EVOLUTION OF BUILDING TECHNOLOGY IN EARLY ANDHRADESA

(Upto the Fourteenth Century A.D.)

**A Thesis submitted to the University of Hyderabad
for the Degree of Doctor of Philosophy
in the Department of History
School of Social Sciences**

By

E. SIVA NAGI REDDY

**December, 1994
HYDERABAD**

DEPARTMENT OF HISTORY

SCHOOL OF SOCIAL SCIENCES

UNIVERSITY OF HYDERABAD

HYDERABAD

This is to certify that I, **E. SIVA NAGI REDDY,** have carried out the research embodied in the present thesis for the full period prescribed under Ph.D. ordinances of the University of Hyderabad.

I declare to the best of my knowledge that no part of this thesis was earlier submitted for the award of research degree to any other University.

Date: 31.12.94

31.12.94

(E. SIVA NAGI REDDY)

Enrolment No. OS5019

Aloka Parasher 31.12.94

(Dr. ALOKA PARASHER-SEN)
Thesis Supervisor

(Prof. T.R. SHARMA)
Head of the Department
Head, Dept. of History

31/12/94

2-1-95

(Prof. S. NAGARAJU)
Dean of the School

CONTENTS

Acknowledgements

I am grateful to Dr. Aloka Parasher-Sen, for suggesting this interesting research topic and for inspiring me. Her invaluable guidance and encouragement helped me throughout the course of my study. Without her constant, dynamic and diligent supervision, it is doubtful whether this study could ever have been completed.

Grateful thanks are due to Dr. V.V.Krishna Sastry, formerly Director of State Department of Archaeology and Museums Hyderabad for permitting me to undertake this research work. He was very kind enough to spare his valuable time **for** discussions on the problems of research in the initial stage of this research.

It gives me immense pleasure to express my gratitude to Sri N.R.V.Prasad, present Director, Archaeology and Museums Hyderabad for kindly permitting me to utilise departmental material and for his continuous encouragement during the course of the present research. I extend my sincere thanks to Sarvasri B.Satyanarayana Singh, Archaeological Engineer, Dr. Mukunda Rao, Chief Epigraphical Officer, Dr. N.S.Ramachandra Murthy, G.Krishnam Raju, M.A.Quaiyum, Asst. Directors of Department of Archaeology and Museums, Hyderabad for their valuable suggestions and cooperation. I specially thank Dr. B.Subrahmanyam, Research and Training Officer, who has always been with me and helped me in many ways during the completion of the present work.

I would like to place on record my sincere thanks to various Heads of the Department of History in the University and particularly Prof. S.Nagaraju, Prof. T.R.Sharma, Prof. V.Ramakrishna and Prof. Iswar Prakash Gupta, Department of History who have always supported my work in a very cordial manner and for their unfailing cooperation, help and kindness.

I am no less grateful to Prof. R.S.Sharma, Prof. K.M.Shrimali, Prof. V.K.Thakur, Prof. A.V.Narasimha Murthy, Dr. I.K.Sarma, Prof. K.Krishna Murthy and Dr. P.V.P.Sastry for their valuable suggestions on the work during my association with them at various seminars and conferences. I can't forget my training with traditional gurus, Shilpakalanidhis Sri T.Ramamurthy, Thiru S.K.Achari, S.M.Ganapati & Prof. V.Ganapati who laid the foundations for my understanding the traditional methods of building technology.

I thank my colleagues Sarvasri P.Vengal Reddy, K.Raghunath, N.Mallikarjuna Rao, R.V.Devika Rani, S.Brahmanandam, T.V.Chetty, D.Indumati Devi, K.Padmanabha and V.Yellaiah for their help and cooperation during my research work. I also thank my fellow scholars, Mrs.Y.Tejaswini and Mrs. K.S.Shobha and my friends B. Parvathala Reddy, D.V.S.Prasad who helped me in proof-reading the final versions of the thesis.

My special thanks are due to Mrs.M.Varalakshmi, Gazetted Librarian, Dept. of Archaeology and Museums, Hyderabad and the staff of IGM Library, University of Hyderabad for providing me excellent library facilities. I also express my great regards to M/s. Perfect Dataflow Systems, Chaitanyapuri, Hyderabad for data inputting of the entire thesis and giving it its present form.

My special thanks are due to my family members Mr & Mrs. K.Rama Prasada Reddy, Venkat Reddy, Suneetha, Saritha and Priyamvada for helping me in one way or the other in doing this research work.

An invaluable debt to be placed on record is that to my wife Mrs. E.Rajyalaxmi, for relieving me from household botherations and for her understanding, support and affection.

Finally, I thank all the people, who are directly or indirectly involved in bringing up this piece of work.

Hyderabad
Date: 31.12.94

E. Siva Nagi Reddy

Transliteration Table

English	Deva-nagari	Telugu	English	Deva-nagari	Telugu
a	अ	అ	ṭh	ठ	ఠ
ā	आ	ఆ	ḍ	ड	డ
i	इ	ఇ	ḍh	ढ	ఢ
ī	ई	ఈ	ṇ	ण	ణ
u	उ	ఉ	t	त	త
ū	ऊ	ఊ	th	थ	థ
e	ए	ఎ	d	द	ద
ai	ऐ	ఐ	dh	ध	ధ
o	ओ	ఒ	n	न	న
ou	औ	ఔ	p	प	ప
ṛ	ऋ	ఋ	ph	फ	ఫ
k	क	క	b	ब	బ
kh	ख	ఖ	bh	भ	భ
g	ग	గ	m	म	మ
gh	घ	ఘ	y	य	య
ṅ	ङ	ఙ	r	र	ర
c	च	చ	l	ल	ల
ch	छ	ఛ	v	व	వ
j	ज	జ	h	ह	హ
jh	झ	ఝ	ś	श	శ
ñ	ञ	ఞ	s	स	స
ṭ	ट	ట	sh	क्ष	క్ష

anusvara - ṁ   Visarga : - h

No diacritical marks have been used while describing the names of districts, towns and villages which have already become acceptable in modern English. However, these have been used to indicate ancient names of places, persons and in case of technical words in Sanskrit and other Indian languages.

ABBREVIATIONS

ABORI	Annals of the Bhandarkar Oriental Research Institute
AI	Ancient India
APJA	Andhra Pradesh Journal of Archaeology
ARADN	Annual Report of the Archaeology Department of the Nizam's Dominions
ARAP	Annual Report of the Archaeology and Museums. Andhra Pradesh
A RASI	Annual Report of Archaeological Survey of India
ARASWI	Annual Report of the Archaeological Survey of Western India
AREAP	Annual Report of Epigraphy. Andhra Pradesh
AREASI	Annual Report of Epigraphy. Archaeological Survey of India
BDCRI	Bulletin of the Deccan College and Post-Graduate Research Institute
BIIHM	Bulletin of the Indian Institute of History of Medicine
CSSH	Comparative Studies in Society and History
EA	Epigraphia Andhrica
EC	Epigraphia Indica
GOS	Gaekwad Oriental Series
HAS	Hyderabad Archaeological Series
HE	Human Ecology
IA	Indian Antiquary
IAR	Indian Archaeology-A Review
IESHR	Indian Economic and Social History Review
IHQ	Indian Historical Quarterly
IHR	Indian Historical Review
JAHRS	Journal of Andhra Historical Research Society
JASB	Journal of Asiatic Society of Bengal
JESHO	Journal of Economic and Social History of the Orient
JESI	Journal of Epigraphical Society of India

JHAS	Journal of Hyderabad Archaeological Society
JHGS	Journal of Hyderabad Geological Society
JIH	Journal of Indian History
JISOA	Journal of Indian Society of Oriental Art
JOI	Journal of Oriental Institute
JRAI	Journal of Royal Asiatic Society of Great Britain and Ireland
JRAS	Journal of Royal Asiatic Society
LL	Luders List
MAS	Modern Asia Studies
MASI	Memoirs of Archaeological Survey of India
ND	Numismatic Digest
NDI	Nellore District Inscriptions
PAPHC	Proceedings of the Andhra Pradesh History Congress
PAPS	Proceedings of American Philosophical Society
PIHC	Proceedings of Indian History Congress
PISHC	Proceedings of South Indian History Congress
QJMS	Quarterly Journal of Mythic Society
QHRS	Quarterly Historical Research Studies
SAS	South Asian Studies
SBB	Sacred Books of the Buddhists
SBE	Sacred Books of the East
SIH	Studies in History
SII	South Indian Inscriptions
SVUOJ	Sri Venkateswara University Oriental Journal
TC	Technology and Culture
TI	Telangana Inscriptions
TLSB	Transactions of Literacy Society of Bombay
TRAS	Transactions of Royal Asiatic Society
UHAI	Urban History Association of India
VKP	Vivekananda Kendra Patrika
WA	World Archaeology

LIST OF MAPS

LIST OF FIGURES

LIST OF FIGURES

(Acknowledgements)

LIST OF PLATES

Acknowledgements

Photo Courtesy: Plates I to IX and XI to XVI Sri N.R.V. Prasad, Director, Department of Archaeology and Museums, Gunfoundry, Hyderabad, A.P.; Plate No. X: Dr. N.S. Ramachandra Murthy, Asst, Director, Dept. of Archaeology & Museums, Hyderabad and Reproduced from N.C. Ghosh, Satanikota Excavations. 1977-80, Delhi, 1988, Fig.29

LIST OF CHARTS

INTRODUCTION

INTRODUCTION

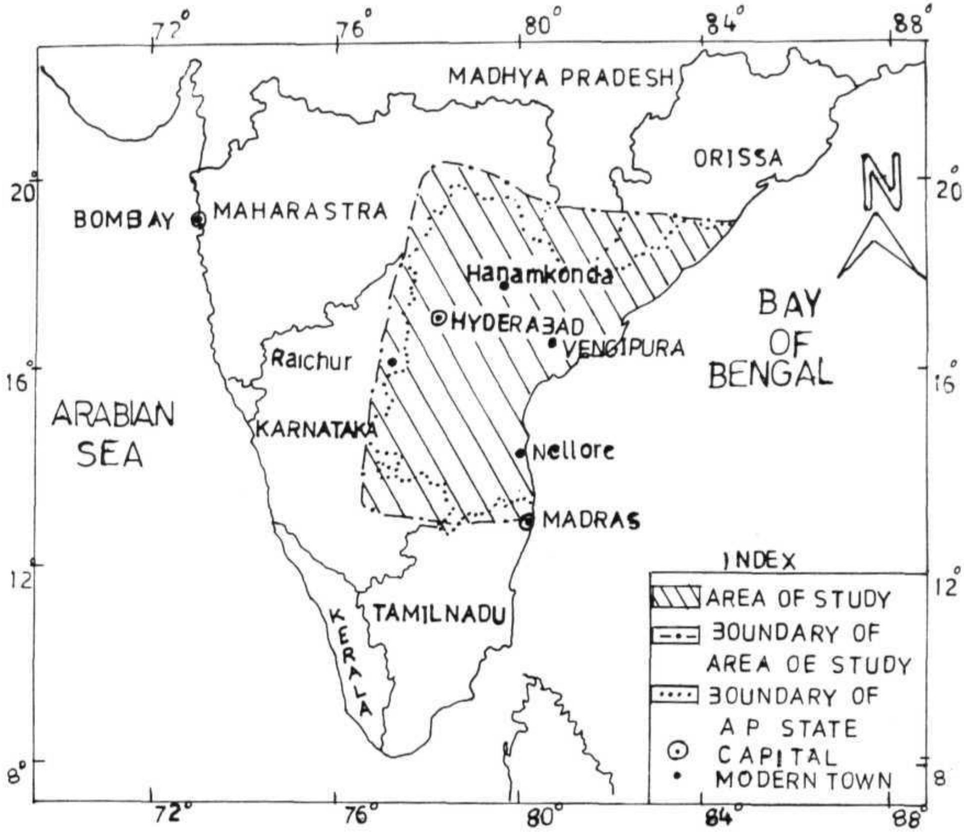
The history and culture of ancient Andhradesa has been studied by several scholars dealing, often in a compartmentalized manner, mainly with its political, religious, artistic, literary and to some extent, its socio-economic aspects. In our opinion, monumental art must be seen as an expression of political and economic power and therefore, its study can highlight this interaction. Further, this can best be done by focussing on a study of technical skills and materials needed for construction. Whereas the elite in society has the resources for making monumental buildings, the construction work however, as is well-known, is done by various groups of artisans and skilled and unskilled labour. A study of the evolution of building technology has been a much neglected aspect of study in the writings on ancient Andhradesa. By focussing on this aspect in the dissertation, we hope to not only fill in this lacunae, but also suggest that the history of any region would be enriched by locating the evolution of technical skills in their particular material and ideological setting. The extant buildings we highlight upon are infact a testimony to the fund of scientific and technical knowledge that was developed and nurtured in ancient Indian society. This is often assumed to have existed but never fully discussed in relation to the evolution of building technology. Our submission is that these material remains, we today proudly display as the collective heritage of our country, were rooted in an intellectual framework that viewed technology as part of a system of thought interlinked to universal urges and not merely as mechanics of covering physical spaces.

People desire buildings not just for individual use and protection but also because they represent their ideological ethos and their social, ceremonial and community life. In other words, they want these buildings to be more than a functional fulfilment. Man seeks the expression of his aspirations in 'Monumentality'. This desire to create buildings, which are not purely meant for utility, are left as records for the future generations. This has always been felt in all ages and as an outcome of which we see all over the world some of the most beautiful buildings built in different eras.[1] In pre-modern societies such 'Monumentality' is almost invariably inter-twined with the religious ethos of the people and therefore, to see the material from the cultural as separate entities is well nigh impossible.[2] These buildings naturally also reflect the social and political power of their patrons. They further reflect the economic resources that were necessary to build them, and last but not least, the availability of technologies known to some specialised groups of people involved in their construction. The survival of some buildings pertinently reflects the superior materials and technologies that were used to build them. It must be mentioned at the outset that we do not merely want to study the exceptional and monumental buildings though these are the large majority of surviving historical monuments.

The proposed dissertation entitled, Evolution of Building Technology in Early Andhradesa is selected with a view to take up an analytical study of various technical skills involved in the construction of both simple and sophisticated dwellings. It is found necessary to attempt a thorough study of not only the details of different types of buildings but also materials used to build them like wood, stone, rock, brick, lime, iron objects, tiles, etc. To analyse the technology at the disposal of society at large, the empirical information on such public monuments like stupas. chaityas, vihāras, temples, house structures, dams, and fortifications for the various centuries has been placed in the context of broad phases of historical change and continuity. In early historic and early medieval times, the region of our study, namely Andhradesa, can be best understood in its broadest sense to be larger than the present day linguistic boundaries of the state of Andhra Pradesh [Map I].

To set the introductory agenda for our discussion we first proceed to amplify the meanings of various terms and concepts that confront us both in the Western and Indian intellectual traditions. In the words of Alfred Lokta 'Evolution' can be understood as 'history of a system undergoing irreversible changes'.[3] Similarly, in the English language, a 'building' is that what is built and the term is also used to cover the practical activities necessary for erection and maintenance of the structure that is thus made for shelter or use of a human being.[4] The term 'technology' is a combination of the Greek terms 'tekhne', and 'logos'. From its very inception and use in the Greek language it meant a discourse on the arts, both fine and applied. The root 'tekhne' infact denoted 'an art or craft'. According to Raymond Williams it was only in the nineteenth century that "technology became fully specialized to the 'practical arts' .... The newly specialized sense of science and scientist opened the way to a familiar modern distinction between knowledge (science) and its practical application (technology)".[5] Thus science and technology, though closely associated concepts, began to be seen throughout the course of Modern history as separate, with technology being used in an almost residual sense. Science began to be oriented towards the expansion of knowledge and

MAP I



AREA *OF* STUDY:ANPHRADESA

the understanding of both natural and social systems. The concept of technology has today come to be commonly understood as a human activity consisting of the application of the processes, procedures, methods of science to evolve patterns of organisation oriented towards making things. In the tradition of the social science disciplines, technology is often defined as "the means or activity by which man seeks to change or manipulate his environment". Thus according to Anthropologist Walter Goldschmidt, technology is the "learned means by which man utilises the environment to satisfy his animal wants".[6] In this sense technology, in its broad meaning, connotes all practical activities, viz., hunting, gathering, agriculture, animal husbandry, mining and manufacturing, construction, transportation, etc. that man acquired gradually since time immemorial. One of the most persistent themes in the social sciences, history and humanities has been to study the impact of technology and technological change on all aspects of social life.[7] The role of technology can be considered central to the history of man. In fact it would be correct to say that social and economic, cultural and political systems in all periods of history are permeated by technology.[8] Each society practices its own technology and this production is greatly influenced by the kind of culture, economy and material setting that it is located in.

It is suggested by scholars that to compensate for the relatively poor biological equipment, nature gave man an efficient hand and a fertile brain with which he produced technology. A human has the ability to use language because he has a brain capable of self examination. According to Henig, "the human brain is the only organ on earth that is aware of itself".[9]

Technology is in fact man's extra corporal organ and it is a cultural phenomenon. The larger area of the human brain that controls the hand, controls a truely marvellous mechanism. Bernard Campbell[10] has a delightful description of the hand in shaping technology when he writes: "not needing our hands for support, we have been able to use them for more complicated and more creative tasks. With twenty five joints and fifty eight distinctly different motions, the human hand represents one of the most advanced mechanism produced by nature. The hand itself may be a marvellous tool but it is used to full value only when it manipulates still other tools. . . . Humans are not only the only animals that employ tools, but they are the only ones that do so to any extent and with any consistency". Campbell also suggests that the larger brain size enhanced the capability for attention, span and memory. It is in the context of the memorizing of social traditions of tool making that the cultural traits of a particular people emerged. This greater capacity for memory facilitated the culmination of knowledge within specific world views that were then transmitted to tool making and tool using in equally varied ways.[11] Humans have thus not only complemented the life-sustaining conditions through the development of technology that has made environments habitable for their kind,[12] but have also enriched human society by providing a multiplicity to technological traditions. It would be thus appropriate to suggest that technology was developed and adapted by society in order to solve specific problems or to satisfy specific social needs. The various components of society, the economy, the production system, the culture and so on all interact with technology. Scholars like Tavis[13] write, "technology imposes its own nature and logic on society so that there is almost one-to-one correspondence between patterns of technical organisation and patterns of social organisation."

The interaction between technology and society has a long history indicating that man has used his tools at work from primitive times. Ever since then the various stages he reached in his evolution marks the level of his knowledge about methods and materials of construction, the effect of climate on it, the state of society and the development of his aesthetic sense. Every successive stage shows his never-ending search for better forms and materials of construction to fulfill his social and spiritual aspirations. It is important to emphasize that technology is dynamic and open ended. The greater physiological ability for tool using, combined with the nature of tool using itself, gave rise to new and imporved tools. These imporvements in tools and tool use then fed back to give further selective advantage to those members of the population with improved capabilities for tool using. For example, the colossal monuments of Egypt express the social conditions of the country under the Pharoahs. Without the forced labour of a vast population of slaves and captives such massive structures would have been impossible to build. It also points to the availability of, and access to certain materials of construction and the surplus wealth necessary for its purchase. On the other hand, absence of stone in Babylonia, of around the same period, led to the development in brick construction, which resulted in the evolution of arches and vaults as a necessity instead of the use of simple trabeated constructions.

As suggested by Thomas R. De Gregory[14] it is difficult to understand the history of architecture and architectural achievement without comprehending the history of construction technologies and materials. As has been stated above, language and technology were the two attributes that set human beings apart from animals. All over the world from Palaeolithic times onwards the parallel growth of social and technological progress is possible to trace. However, it is only from the Neolithic times that we obtain evidence that, 1n the social group or tribe, the technologist finds a special position. The medicine man, the potter, the weaver, the arms maker and so on were considered technicians. Buildings in this period were probably made by the community as a whole. Man's discovery of his abilities led to explorations, acquisition and a development of an increase of skills,[15] which, further expanded through a remarkable continuity of efforts throughout the various phases of Civilization to produce new and better products and systems for use. It led to a discovery and invention of materials and devices for newly perceived needs. Artistic perceptions gradually came to be influenced by technological innovations. Technologists in most pre-modern societies sought to combine functional usefulness with what was considered beautiful.[16] With this begins a long relationship between art and technology. The artist experimenting in various mediums, experiences on his own and he 1s comparatively free, but the architect, on the other hand, is closely linked with society. The expression of the latter's art depends upon the state of social development and upon the environment in a way which is far more intimate than in any other form of art. This is one reason why we find that in different regions, the forms of buildings have taken different shapes. The nature of buildings and their survival depends on climate, their functions and the use they have been put to and finally, the state of technological growth.[17]

In our country, there has been development in building technology in consonance with its ideological world view, with the spirit of the times and in consonance with the environmment and local background. India, from time immemorial, has seen the construction of a variety of spaces such as living spaces, defence spaces, burial spaces and religious spaces. Though India has its own problems in the conservation of buildings due to its tropical climate, the earliest evidence of a rich repetoire of technical skills goes back to 3000 B.C. The buildings constructed at the different sites of the Harappan civilization were mainly oriented with their sides towards the cardinal points. The walls of private and public buildings were constructed with a pronounced batter. The bond adopted for construction of walls was the same as the modern English bond.[18] There were market halls, offices, palaces, religious buildings and also bathing establishments and each city was divided into different wards for protective purposes. The builders of these cities were well-skilled in town planning. The systematic way in which buildings of the Harappan civilization were made lead us to infer that technicians were controlled by some form of ruling authority.[19] Alternatively, it can be suggested that political power tended to gravitate towards technological elites.[20]

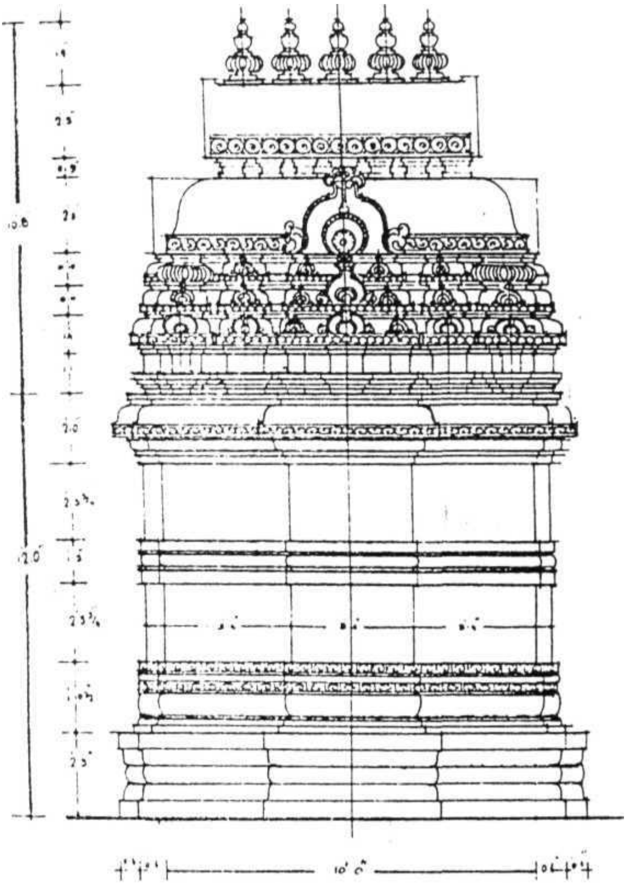
The geological conditions on a sub-continental scale afforded excellent variety of building materials for later Indian builders to pursue their skills. Further, the intellectual and spiritual advancement of the people can also be seen reflected in the types of building found throughout Indian civilization. These ideas were formulated, transmitted and shaped into form by a specialised group of people called <u>Silpins</u> or <u>Sthapatis</u> in south India and <u>Viswakarmas</u> and <u>Sompuras</u> in north India. The <u>Silpins</u> can be defined as technologists trained within the framework of an ideology deep rooted in metaphysical linkages. An attempt to understand and appreciate the ethos, values and skills of these people responsible for making both simple and sophisticated buildings such as dwellings, stupas. temples, forts and other public utility structures is the next focus of attention in this introduction.

The roots of the indigeneous science[21] of building in India has been explained as the centre of the consciousness of an individual and its relationship with the Universal being. The resultant Union in the form of objects experienced at that level are then understood to take physical form in the material world to be processed and shaped in a variety of ways through an unique spiritual technology.[22]

Under colonial rule, the study of the traditional Vāstuśāstra suffered a set back. It was neglected because of the absence of patronage and support needed to continue the practice of the indigenous science of building technology. More fundamentally, there was a conflict with modern science and technology that was introduced in India by the colonial masters. As a result these traditional skills and their application for the construction of monumental buildings came to a near stand still. However, some aspects of this technology continued with local support. For instance, in the princely States patronage for such artisans was not completely absent. In south India, in particular, architects still retained and received the training based on the Sāstras, since this was confined to their family members through oral transmission. After India got independence there was an urge which was aroused to uphold the age-old tradition of Vāstu-śilpa that embodied the ancient civilisation's spiritual values. Consequently, the Government of India and the State Government of Tamil Nadu in particular, began to promote vocational education and started separate institutions for imparting training in the indigeneous architectural and technological traditions. Thus came into being the Government College of Architecture and Sculpture in 1957 at Mamallapuram in Tamil Nadu. Following the same pattern, the Tirumala Tirupati Devasthanam also started in 1960 an institute called the Sri Venkateswara Institute for Traditional Sculpture and Architecture at Tirupati in Andhra Pradesh. These two institutes became committed to the aim of spreading and popularising traditional techniques and skills. They have been able to produce an alumini of skilled and trained persons at present engaged in constructing several new temples in India and abroad **[Figures 1** & **2]** and also in renovating the ancient temples, in accordance with the principles laid down in the Silpaśāstras.

I wish to locate myself among these trainees. I received training at Tirupati between 1973-77 and this has had a significant impact on my professional activities ever since. It was during the early 1970's that an impetus was simultaneously provided for the resurgence of the traditional skills initiated by the Government of Andhra Pradesh, in connection with the salvage archaeological operations. A prominent aspect of this operation involved the transplantation of ancient temples by way of first dismantling them, then transporting them to elevated places and finally, leading to their reconstruction. This became a necessity because otherwise they would have been submerged as a result of the building of the Srisailam Hydro-Electric Dam that had been taken up across the river Krishna. Fortunately, I have been in association with these rescue operations, **right** from the inception of this project and have had the opportunity of documenting the nature of building technology that was employed by the traditional architects, particularly in building temples, mandapas, gopuras

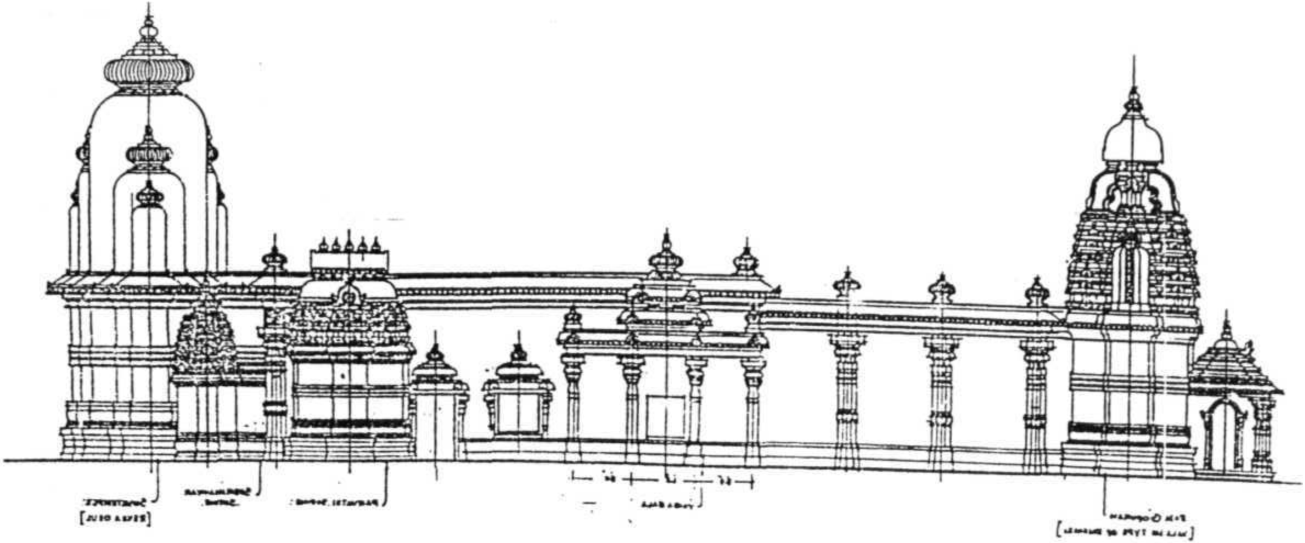
FIGURE 1



The Hindu Temple of Creator Chicago, Lemont, Illinois, U.S.A.
DESIGN OF SRI GANESHA/SHIVA/DURGA TEMPLE

Design of a modern Hindu Temple at Chicago

(Reproduced from Vastupurusha, Vol.1, No.3, October, 1993, Madras, Front Cover)



NORTH SIDE ELEVATION

The Hindu Temple of Greater Chicago, Lemont, Illinois, U.S.A.
DESIGN OF SRI GANESHA SHIVA DURGA TEMPLE

(under construction)

Designed and Executed by : V.GANAPATI STHAPATI & ASSOCIATES

Northern side elevation of a modern Hindu Temple at Chicago

(Reproduced from Vastupurusha, Vol.I, No.3 October, 1993, Madras, Back Cover) and compound walls from their foundations to the roof level and above.

My training as a Sthapati, coupled with the experience I got in the salvage operations in the Krishna-Tungabhadra valley, enabled me to look into the ethos and values of the technological and architectural traditions of early India in general, and south India in particular. To further understand the importance of the spiritual background of the traditional architects and appreciate their values, I personally made it a point to contact some living experts engaged in practising the age-old tradition, among whom, mention must be made of the renowned Sthapati 'Padmasri' S.M.Ganapati, formerly Chief Sthapati of the Government of Andhra Pradesh, and Professor V.Ganapati, formerly Principal, Government College of Architecture and Sculpture, Mamallapuram, besides my mentors, Silpakalānidhis S.K. Achari and T.Ramamurthy, both Sthapatis at Tirupati. These meetings enriched my knowledge about indigeneous building technologies and I was also able to collect a plethora of information concerning the methods, the education, and training as envisaged in the Vastu Silpa traditions preserved in several palm leaf manuscripts handed over to them by their ancestors. This revealed that minute precision was the hallmark of the traditional architects and those who were still practising the same techniques inherited from their ancestors continued to lay emphasis on it. Another aspect of their world view that had not changed, was their aesthetic value system and the ethos in which they worked. A well-known Vastu-Vedic scholar, V.Ganapati Sthapati observes that the western scholars who have studied the architecture of India sympathetically sensed a kind of divine ambience in the built-in spaces related to the ancient achievements in art, architecture and town planning.[23] However, he opines that few attempts have been made to expound the inner nature and spirit behind this art form or lay bare the hidden sources of inspiration of the traditional art and architecture. In his opinion, any creative urge emanating from the inner being must be seen as a result of experience of Rasa which then turns out into artistic expression in a variety of forms.[24] Most western and modern Indian scholars, on the other hand, could understand and appreciate it only in terms of its symbolic representations at a superficial level and see parallels of it in Indian philosophy and religion.

Thus, for instance, about the form and origin of the Brahmanical temple, early literature provides us with the perspective that this infact originated from the human body. The Chāndōgyōpanisad propounds that the human body has to be conceived as the temple of Brahma.[25] The Skandōpanisad[26] further specifies: dehōdevālayam proktah jīvo deva sanatanah and suggests that the assimilation of the external with internal and the synthesis of macrocosm and microcosm was important which led to the identification of the individual soul with the Universal soul. Stella Kramrisch was one of the first scholars who elaborated on these aspects in her writings, namely, that in the shape of the Garbhagrha, the sanctum of the temple, the innermost macrocosmic and microcosmic conception can be seen to be conjoined.[27]

Jyothindra Jain 1s also of the view that it is due to the embodiment of some of the cosmological and mythological ideas and that the traditional Indian architect's practice was inspired by his beliefs so that the two interacted with each other. On the other hand, the traditional Indian dwellings of the countryside, it is suggested by him, represent a whole universe, packed with beliefs and ritual practices, which become a symbolic replica of the cosmic structure of spaces representing the worlds of men, Gods and ancestors.[28] The traditional architect had borne this in mind while drawing the plan of dwellings of the Chatussala variety.[29] Here, in the centre was an open space symbolized by ākāśa which was then surrounded by living rooms. R.Nagaswamy commenting on the origin of the temple seeks to explain that in order to establish an apparent relationship between the formless akasa and the human mind, the temple as an architectural framework was brought into being by the ancient technologists.[30] More emphatically scholars like, V.S.Agrawala opine that the stupa and Prasada were developed from an identical religious consciousness and that both were symbolic representation of the manifest cosmos and unmanifest divine.[31] These modern scholarly writings have based their deductions on the ancient literary traditions, which are quite explicit in their understanding of the links between physical and metaphysical space.

Most of the treatises on Indian śilpa and vastu are said to have been written or compiled by the saints or Rsis. whose experience was based on the realization of the Individual and the Universal spirit and this is said to have had a great impact on their creative behaviour. The creative feelings of not only Rsis, who are attributed to be the authors of these texts, but also of the practicing Silpins had to activate the centre of their inner space which was also the primal creative centre called ākāśa or atman. The primary pattern of this centre was configured as a square, which was then supposed to turn into an octagon and finally, into a circle. All these basic geometrical forms emanated from, and were manifestations of, primal energy. The outer space was called as paramākāśa which was finally transformed into the objects of the universe.[32] Makim Malville thus sees the temple as an affirmation of the co-evolution of inner space and outer space.[33]

In the ancient texts the atman was symbolically represented in a square, dynamism in an octagon and execessive dynamism 1n a circle. These basic patterns of form were in turn supposed to represent satva. raiasa and tamasa elements called the triqunās and these were applied in the plans of the temples.[34] The physical drawing of the vāstupurusamandala on which the plan of the temple was drawn and constructed was thus symbolic of the metaphysical doctrine of an all pervading cosmic principle. Scholars like D.N.Sukla elaborate on the vāstupurusamandala as one consisting of three parts; vastu. purusa and mandala and these three terms are said to define the cosmological, the metaphysical and the architectural implications, respectively. Stella Kramrisch[35] further elaborates this philosophy of vāstubrahma. in the words: "purusa. cosmic man, the origin and source of existence (apara prakrti) 1s to be His substance as its material cause (upadāna). This is how He was known in the world, the manifested aspect of Himself, the para-prakrti. beyond existence, the avyayapurusa. the immutable one (uttamapurusa). The plan makes the site of the building in his image which is his form."

Thus it can be suggested that the monuments that follow the ritual architectural patterns have been erected by the architects patronised by different religious sects, to replicate the cosmos in these physical structures. Both Brahmanical and Buddhist philosophy and religion influenced the plan and execution of these buildings.

In the Buddhist tradition, the architects, called as the Navakammika. represented the Buddhist thought of the cosmos 1n stupas which were in the shape of a circle, that depicted the Buddhist philosophy of the world.[36]

In the Mahavamsa[37] a dialogue between a King and architect is worth-mentioning here. When Duttagami, in the 2nd Century B.C. inquired of the architect as to what shape the stupa was to take, the latter replied that it should symbolize, a golden bowl which could be filled with water. He further informed that when water fell on the surface of the earth, a great bubble rose in the shape of a half globe of crystal. This semi-circular bubble shaped stupa became the symbol of the unreal nature of the world and also symbolised the cosmos.

The Indian art and architectural traditions were thus bound by the injunctions of code, custom and spiritual concepts. The artists and architects had full liberty to generate creativity in their works by highlighting its spiritual quality, to give sublimity so that an eternity was echoed. In many cases they succeeded in expressing their ideas through architectural media which enhanced their appeal 1n a manner that contributed to the enrichment of the outer forms of life in relation to the inner growth of the mind.[38] This meant that ancient Indian technologists and architects found value 1n looking at the functional aspects of their activity, as also in simultaneously emphasizing its fundamental relationship to the Universal essence of Atman and Brahman.[39] Madhu Khanna writing on the revelation of form 1n the creative process says that the Silpaśāstras clearly articulated the psychological techniques of aesthetic vision that formed a foundation of all creative endeavour. Thus she elaborates that ancient India had developed the technical discipline of

Yoga in which the practice of dhyāna or meditation played a central role. Yogaśāstra explained a psychological process of drawing into oneself the dynamics or the logos which controlled the Universe and this was part of the curriculum which also inspired the Sthapati with his creative skill, wherein ethics and aesthetics were synthesized and applied to building structures. Further, V.Ganapati Sthapati goes to the extent of saying, "that if a part of the energy space is enclosed by a four walled structure it is called building and this building becomes a living organism".[41]

It is also felt essential to emphasize that the symbolism of various materials used to particularly make religious structures, was equally embedded in various conceptual moorings. For instance, earth, clay, wood, brick and stone, the basic substances used for erecting the temple and their structures, were regarded as Prakrti 1n the Indian concept.[42] Clay was the first material used in building simple structures during proto-historic times, though, in its exclusive use as a material, its life was short. It was prolifically used for walls, floors and as an essential binding material during all periods. People believed that they lived 1n utter closeness with mother earth in a deep sense and therefore continued the use of mud and clay. The external coolness of space was also experienced by the occupants in the interior, without the use of any artificial contrivances, to condition the atmosphere, inside the clay or mud built-in space.[43] Wood was also a prime material used for construction. In the Vedic texts this was significantly regarded as Brahman as noted in the Taittirīya Brāhmana.[44] According to the Skambha hymn of the Atharva Veda, wood was considered a substance of the principal essence of the three worlds. The tree was worshipped as a God of Gods,[45] and commonly used as a substance to make images of deities, pillars for monumental structures and for beams, roofs of dwellings and temples. Stone was also regarded as part of Prakrti, since it was extracted from the mother earth.[46]

Bricks were solid masonry units made of burnt clay. Since the clay had a plasticity when mixed with water, the clay particles fused together when subjected to high temperatures. In the Indian context, the brick made of clay was regarded as sacred. In the Satapatha Brāhmana[47] it is mentioned that the brick which had four corners infact represented the four cornered earth. The TaittirTya Saṁhitā[48] identified the brick with Goddess earth. Bricks were also distinguished as male, female and neuter.[49] However, highly sophisticated brick technology was already known to the builders of the Harappan civilization that had ushered 1n the first urbanisation in India. The technology was conspicuously absent during early Vedic period but was re-introduced in a big way for building structures from the later Vedic times.[50]

The source material for the study of Evolution of Building Technology in Early Andhradeśa, comprises of primarily archaeological data supplemented by information from literary works and inscriptions. We found it extremely necessary to explain the extant monuments and other data on structures revealed from archaeological excavations, in the light of the existing literary information available on building technology. Recent archaeological excavations and explorations conducted by the State Department of Archaeology and Museums, Archaeological Survey of India, Birla Archaeological and Cultural Research Institute, and several Universities have brought to light valuable data pertaining to various technological aspects of different types of buildings. Some of this, has hitherto not been used and it is possible to take this opportunity to study and interpret, at first hand, this material, since much of my professional duties in State Department of Archaeology, Government of Andhra Pradesh are related to identifying these remains in a systematic manner.

The inscriptions, engraved mostly on copper plates and stone slabs have been primarily used to provide information about the political, social, religious and economic aspects of the history of the region. They have also helped in a considerable way to corroborate data on different types of buildings and the materials and tools used to build them. Most importantly, we have used them to describe the various social groups involved in building activity like Silpins. Sthapatis and so on. Literature for the various phases of study was found useful, as it not only provided prescriptive norms, on the basis of which various buildings and structures were built, but was most forthcoming on understanding the spirit and ethos behind the early notions of building technology. Such references have been found from early times, such as from Vedic literature, Buddhist literature, the Dharmaśāstras. the Arthaśāstra. Purānic and Epic literature, the Silpa and Agama texts and contemporary Telugu literature. Thus, an attempt has been made to utilise and assess all the information contained in various types of sources for the present study.

Nonetheless, it would be true to say that the dissertation has been primarily dependent on empirical data available from archaeology. Based on explorations and excavations conducted by various agencies, a list of sites (arranged in alphabetic order) and their location has been prepared by us as Appendix to this dissertation. Relevant data on individual buildings from these sites forms the core of our empirical information which is discussed fully in the various chapters of this dissertation. For ready reference, the chronological sequence of the material remains found at each of these sites is indicated 1n this list in terms of the four broad periods delineated by us. The sub-region in which they are located has also been indicated. This inclination towards archaeological sources has been determined by the nature of data on technology revealed by each of the different types of sources listed above. For instance, it would be pertinent to point out in this regard that no single literary text describes a known extant monument in early Andhradesa. Further, though relevant and near contemporary texts discuss elements of building technology known at that time, they do so primarily from a prescriptive point of view, by advising <u>si loins</u> and <u>sthapatis</u> on how they should progress in their works. Further, it must be emphasized that, the work undertaken by me in the last decade of the transplantation of temples in Andhra Pradesh offered me valuable data on the ancient techniques of laying foundations, knowledge of building materials used, quarrying and dressing techniques, methods of water-proofing and other such constructional details pertaining to the religious structures of early historic, early medieval and medieval times. The fruits of excavation work carried out at many sites have thus been laid bare by us. In the presentation of our data, we have gone beyond the existing rudimentary method of simply putting monuments into typological and classificatory categories so as to avoid discussing and analyzing only architectural styles. In each of the following chapters, our **focus has been to go behind the buildings and emphasize on an evolution of the possible techniques and materials used to** build them. In fact, descriptions of the outward facade of different types of buildings find minimal place in our discussions.

Though physical space occupied by building structures will form the main bulk of our discussions and descriptions in the dissertation, we shall begin with amplifying the background to this study in **Chapter I** called **'The Context'.** This chapter is also divided into spaces at a different level, namely, **I.1:Interpretative Space**, **I.2:Geographical Space** and **I.3:Historical Space.** In the first of these we note that existing writings on building technology of early Andhradesa are sparse. Even those at an all-India level are few. Thus, this section is basically a survey of the overcrowding of interpretative spaces by empirical studies on the architecture of mainly monumental buildings like stūpas and temples under various shades of detail and angle. This can be contrasted with a consistent lack of interest in describing other types of old structures like simple dwellings or even large structures like forts. Part of our discussion in this section also focusses on the methodological paradigm initiated by scholars, who first started studying Indian monuments under the protection of colonial rule during the eighteenth and nineteenth centuries. Our discussions in this context have suggested that this method hardly changed, as successive generations of scholars have continued to apply it to reveal new data for the various cultural regions of the Indian sub-continent. The modern methods of observation, documentation and description thus gave new meanings to the monument that had been commemorated and built centuries ago. The human imagination enshrined in these monuments could only be retrieved when scholars turned to the literary accounts, which constituted the ideological layer of the past. Scholars who used these accounts during the early twentieth century gave an interpretative dimension to the structure within a prescriptive dimension.

The latter half of this century has seen a keen scholarly interest 1n giving importance to these literary accounts, as they give explicit evidence of the views that the ancient Indians had about building technology. Such studies are few when compared to the continually increasing space of those efforts that emphasize on documentary and conservatory aspects of monument description. Our own effort in this dissertation is to relate the empirical data, got from the study of extant buildings and archaeology and explain its relationship to the knowledge on technology that they represent in an area of Indian civilization which is most prolifically dotted by old structures, buildings and monuments. This would necessarily mean looking at the prescriptive textual dimensions of our sources as well.

In the section on I.2:Geographical Space, it has been felt necessary to elaborate on the intimate relation that structures have to their immediate locale. In the earlier zest for documentation of different types of buildings, archaeologists, historians, and architects tended to overlook the variations in geographical space, that infact, to some extent, determined the location and construction of monuments in conducive ecological niches. The geographical context of most historical studies in post-independent India is almost naturally taken to be the present day linguistic boundaries of the respective states of the Indian union. This is done largely as a convenient mode of addressing questions of regional identity and its historical roots. Our attempt at defining the geographical space in this dissertation has deviated from this rigid classification, keeping in mind the basic premise that administrative and political boundaries change in time. Therefore, Andhradesa must be defined as a broad geo-political and socio-linguistic entity that can best be elaborated upon by taking prime geographical boundaries, as determinants to be ultimately linked up with a broad cultural definition of Andhradesa. In this sub-section we thus necessarily focus on the changing definitions of Andhradesa from ancient literary and inscriptional records followed by a delineation of the physical space in terms of four geographical sub-regions. These sub-regions have been used by us throughout the dissertation as a sort of physical stage, to elaborate upon the various experiments in building technology that were enacted on it.

The last sub-section [I.3] of Chapter I on Historical space sets the chronological scope of our discussions in terms of the socio-economic and politico-ideological dimensions of change. Thus, whereas hitherto scholars have defined monumental structures within the purview of either dynastic appelations, or, religious affiliations, we have sought to move away from such classifications for the purpose of the current discussions on building technology. Technological changes, we argue, have to be perceived in terms of broader levels of historical change. In this section therefore, we explain the four major periods of historical change and how recent interpretations of history have configured them. These discussions form a critical background to the presentation of details on building technology.

In the main body of the thesis **[Chapter II to V],** the evolution of building technology has been focussed upon 1n a thematic way, isolating each type of building under separate chapter heads, which 1s then put into a chronological framework within each chapter. The themes of the technological survey have been understood by us as those covering public or secular spaces [Chapter II] to include ordinary structures of habitation and those for common community use [Chapter II.1] and irrigation related structures [Chapter II.2]. This is followed by areas of building activity, which allude to political space [Chapter III] indicated by forts and other defence structures and to burial space [Chapter IV] available through remanants of funerary structures. Finally, the religious space [Chapter V] has been divided by us into that defined by the evolution of different techniques and material used to build these monumental structures. There is no simple chronological transition in this regard. Rock-cut technology [Chapter V.1] thus co-exists in some areas with brick technology [Chapter V.2]. Similarly, brick use for temple constructions co-exists with stone technology [Chapter V.3]. Nonetheless, each of these emerges to dominate the religious space of the early historic, early medieval and medieval times respectively.

We close the dissertation with a chapter on details of the various social groups [Chapter VI] that laboured to conceive, plan and execute these constructions. Thus, rather than concluding with the physical remains of the building we emphasize on the human 'facade'. In literal terms they are today absent but the extant building itself enshrines the imagination, knowledge and technical skill that was transmitted by these people to make the building possible in the first place.

Before we conclude the introductory remarks a brief outline of the method and format of data presentation 1s given herewith. Though in each of the Chapters [II-V] on physical space, the types of buildings have been separated for description and discussion, within each of these, it is intended to highlight aspects of technological evolution in terms of the criteria set forth 1n the several **Charts [I-VII]** accompanying each chapter. It is important to mention at the outset that the format of description is done neither sitewise nor, **buildingwise.** Rather, this is done 1n terms of the various individual elements that went into constituting each type of building and in relationship to the material used to construct each of these segments. This has the advantage of enhancing the evolutionary pattern at a micro level and, at the same time, not ignoring the small and fragmentary pieces of evidence that emerge, especially for the earlier periods of our study. It is well-known that those buildings that survive in their most complete form are the ones that have the largest amount of resources available to use the best and most durable materials for construction. Such survivals are known to us from most periods of history but it would be erroneous to imply that the level of technological growth applied to these structures, was also applied to all other types of buildings in the past. It is for this fundamental reason that built-in spaces have been studied by us not necessarily as monolithic structures but as parts of such edifices which, 1n some cases, may not have survived in their full form today.

Adopting the above method has meant that for charting out the empirical information in each chapter, care had to be taken to emphasize the elements of variability, available for each type of building. At the same time, there were certain points of commonality which linked the charted information across chapters. We detail these **highlights** so as to explain further the format of the presentation of our data.

First and foremost, a maximum of four charts accompany each chapter, namely, on the basis of the four Periods that they represent. These are numbered with Roman numerals indicating each type of building and with alphabets accompanying them indicating the period which is being represented. The pattern of charting information is as follows:

Chart I A - D	...	Habitation and Public Utility Structures
Chart II B - D	...	Irrigation Structures
Chart III B - D	...	Defence Structures
Chart IV A	...	Funerary Structures
Chart V B - D	...	Rock-cut Monuments
Chart VI B - D	...	Brick Monuments
Chart VII B - D	...	Stone Monuments

Except for habitation and funerary structures, information on other types of buildings for Period I is absent and therefore, the chart numbering itself indicates that they begin from Period II, i.e., with the letter 'B'. On the other hand, there are no funerary structures for Periods II-IV and therefore, there is a solitary chart representing information for Period I marked with the alphabet 'A'. Further the magnitude of data on religious buildings has meant that the type of material used for different religious buildings, be put into separate charts. However, care has been taken within this format, to indicate the religious affiliation which gave rise to the form and shape a building took, depending on the individual needs of worship. Each chapter is also accompanied by a set of four maps illustrating the distribution of diferent types of buildings in each Period and each sub-region. These enable an 'At a Glance' concentrated in some areas and some periods and not in others.

The main thrust of the various chapters while describing and interpreting the data from the charts, has been to emphasize the elements of variability 1n the ways different building materials were used, to improve the efficacy, stability and longevity of the relevant building structures. Chapter II which 1s a discussion on the built-in areas of secular space presents the greatest variability and therefore, in this context our intention has been to elucidate the evolution of building technology of dwellings, their appendages and places of public utility [Chapter II.1] in terms of primarily their plans and existence of post-holes, their foundations and floors and finally, their walls and roofs. In the section on irrigation related structures [Chapter II.2], this 1s done in terms of each different type of irrigation facility, from tanks and wells on the one hand, to canals, drain channels and sluices on the other. This is intended to highlight the most efficient methods of water control, water conservation and water management.

In Chapter III the charts enable us to describe not only the different types of forts and their plans but the additional facilities each of them had developed over a period of historical time. A vast corpus of existing knowledge on the strategic qualities of different types of fort construction was already available to the builders from literary accounts. Thus, the charts help 1n identifying the multiplicity of styles available to the political elites of early Andhradesa which does not necessarily indicate preference to one kind over the other. Similarly, in Chapter IV the variability of funerary structures can best be highlighted through the charts in terms of pit burial, cist burial, rock-cut burial, dolmen and menhirs. It is intended to discuss the evolution of each type of funerary structure and the way each of these was improved upon to make the burial remains as safely gaurded as possible.

The **Chapter V** on religious space is divided in such a way so as to enable us to look at the evolution of technology within each type of material used, rather than in terms of structures located in the same period but using different materials. In this case too the evolution of technology is not intended to highlight it only in terms of the total structure like chaitva. stūpa, vihāra, cell, mandapa but also in terms of the different parts like foundations, floors, walls, beams, roofs, vimānas and so on. The plotting of the information 1n the respective charts to each section of this chapter on Rock-cut Monuments **[Chapter V.1].** Brick Monuments [Chapter V.2] and Stone Monuments **[Chapter V.3]** has significantly facilitated an analysis of the fact that different types of religious monuments with their respective affiliations, adopted more than one material to construct. At the same time, in terms of an evolution of the building materials used ultimately, a strong preference for stone had emerged probably because it ensured the greatest durability.

This brings us to the final point of elaboration pertaining to the data presented in the charts. It has been consciously attempted to depict the material used in each type of segment that went into making the different forms of buildings. The results of this depiction at once brings to the forefront, the elements of commonality across chapters and across the various charts. While describing this in each of the chapters delineated by us above, we emphasize in the concluding part of each of them, the extent to which the use of one material gave way to another. It is also our considered intention to highlight repeatedly that certain time-tested techniques, with a few important innovations from time to time, continued to be used for all types of buildings and by all sections of people. This is, for instance, particularly relevant for identifying how collective skills on such fundamental aspects as laying foundations, plastering walls or even organizing domestic and public spaces was started, across sub-regions, across periods and across different types of buildings undertaken for our study.

We move to look at the human element that was necessarily involved in the construction of buildings 1n Chapter VI. The data for this chapter has been heavily dependent on literature of a pan-Indian nature and inscriptions which are locally available. These details reflect on aspects of building technology from a different angle and we highlight them in terms of the various kinds of skilled professions known, their mode of socio-economic organization, their status and subsistence in society to finally reflect on how knowledge and tools known to them was transmitted to other regions and over generations. The conclusions of the thesis are framed against the background of a recapitulation of the major issues dealt with. It is hoped that the maps accompanying the various chapters defining the area of study, its physiographic, geological and cultural identity will enhance the presentation of the written material. Similarly, photographic illustrations and figure drawings also accompany the different chapters which essentially emphasize on the important issues of technological acheivement, change and innovation. A comprehensive Bibliography has been prepared, based on the different types of sources used to write this thesis.

FOOTNOTES

1. A.P.Kanvinde (ed.), Seminar on Architecture. Lalithkala Academy, Delhi, 1959, p.54.

2. Frank Perlin, 'The Material and the Cultural: An Attempt to Transcend the Present Impasse', Modern Asian Studies. vol.22,(2), 1988, pp.383-416.

3. A.J.Lokta, Elements of Mathematical Biology. New York, 1956, p.29.

4. Encyclopaedia Britannica. vol.3, p.452.

5. Raymond Williams, Keywords: A Vocabulary of Culture and Society. (Rev.edn.), 1983, p.315.

6. W.Goldschmidt, Man's Way: A Prepare to the Understanding of Human Society. New York, 1967, p.110.

7. International Encyclopaedia of the Social Sciences. vol.15-17. New York, 1972, p.572.

8. David Elliot and Ruth Elliot, The Control of Technology. London, 1976, pp.3-4.

9. R.M.Henig, 'Where Surgery meets the Soul', The Washington Post. Book World. 13, no.16, 1983.

10. G.Bernard Campbell, Human Kind Emerging. Bostal, 1982, p.47.

11. Ibid. p.48.

12. Thomas R. De Gregory, A Theory of Technology. Ames, Iowa, 1985. p.7.

13. I.Tavis, Society and Technology. Harvard University Project no.6, 1970, p.1.

14. Thomas R. De Gregory, Op. Cit., 1985, p.71.

15. V.G.Childe, What Happened in History?. (Rp edn.), 1967, p.77 writes "the thousand years or so immediately preceding 3000 B.C. were perhaps more fertile in fruitful inventions and discoveries than any period in human history prior to 16th century A.D." In his earlier book Man Makes Himself. Mentor Books, 1955, pp.87-112, he elaborated on the technological inventions of these thousand years before 3000 B.C. Prominent among these were Man's attempt to harness the force of oxen and of wind, invent the plough, the wheeled cart, the sail boat and solar calender and above all, discovering the chemical processes of melting copper ores.

16. B.D.Nag Choudhary, Technology and Society. Simla, 1979, p.5.

17. A.P.Kanvinde (ed.), *Op. Cit.*, 1959, p.80.

18. *Ibid*. p.87.

19. *Ibid*. p.89.

20. John G. Gunnel, 'The Technocratic Stage and the Theory of Technology', *Technology and Culture*. vol.23, 1982, p.327.

21. When some foreigners who were impressed by Indian technology posed a pertinent question about 'Science' in India to V. Ganapati Sthapati which reads: "How could a technology of your kind do such marvels without a science?, the Sthapati replied: "The uniqueness of our sciences is that they are spirit centric. Not only our architecture, sculpture and town planning but also all other sciences that had flowered 1n this subcontinent are spirit based. One would be surprised to hear that the Indian Mathematics itself is spirit centric, not cerebral or empirical." See *Vasthu Purusha*. vol.1(3), 1993, p.4.

22. V.Ganapati Sthapati, *Synthesis of Science and Spirituality in Vastu Silpa Tradition*. Madras, 1993, p. 12.

23. *Ibid*. p.9.

24. *Ibid*. p.21.

25. *Chāndōgyōpanisad*. 5.1.1.

26. Referred to in D.N. Sukla, *Silpa Śāstram*. Varanasi, 1969, p.262.

27. S.Kramrisch, 'Space in Indian Cosmogony and in Architecture', in Kapila Vatsyayan (ed.), *Concepts of Space Ancient and Modern*. Delhi, 1991, p.104.

28. Jyothiandra Jain, 'Parallel Structures', in Kapila Vastyayan (ed.), *Op. Cit.*. 1991, p.341.

29. T.G.Gill, 'Architectural Expressions', 1n A.P. Kanvinde (ed.), *Op. Cit.*. 1959, p.28.

30. R.Nagaswamy, 'The Brihadesvara as Paramākāśa', in Kapila Vatsyayan (ed.), *Op. Cit.* , 1991, p.299.

31. V.S.Agrawala, *Studies in Indian Art*. Varanasi, 1965, p.122. Also see John Irwin, 'The Axial Symbolism of the Early Stupa an Exegesis', in A.L. Dallapiccolo (ed.), *The Stūpa--its Religious. Historical and Architecutral Significance*. Wiesbaden, 1980, pp.12-28.

32. S.Kramrisch, *Op. Cit.*, 1991, p.104.

33. J.MacKim Malville, 'Astrophysics, Cosmology and the Interiror space of Indian Myths and Temples', in Kapila Vatsyayan (ed.). Op. Cit.. 1991, p.128.

34. V.Ganapati Sthapati, Vāstupurusha, vol.3, no.1, October 1993, p.6.

35. Stella Kramrisch, The Hindu Temple, vol.1, Calcutta, 1991 (Reprint), p.21.

36. A.Seneviratna, 'The Ritualisation of Space in Buddhist Architecture in Sri Lanka', in Kapila Vatsyayan (ed.). Op. Cit.. 1991, p.365.

37. T.W.Gieger (Tr.), Mahāvaṁśa, London, 1960, Ch.XXX, 12-13.

38. V.S.Agrawala, Op. Cit.. 1965, p.3.

39. Ibid, p.257.

40. Madhu Khanna, 'Art and Meditation', in B.N.Saraswati, S.C.Mallik and Madhu Khanna (eds.), Art the Integral Vision (A Volume of Essays in Felicitation of Kapila Vatsyayan), Delhi, 1992, p.136.

41. V.Ganapati Sthapati, The Scale. Madras, 1993, p.5.

42. Stella Kramrisch, Op. Cit. , 1977 (Rp), p.119.

43. V.Ganapati Sthapati, Op. Cit. , 1994 , p.4.

44. TaittirTva Brahmana. 118.96.

45. Bhavisya Purāna, Ch.XXXI, 33.

46. Stella Kramrisch, Op. Cit., 1977, p.119.

47. Satapatha Brahmana. V1.1.2.2.9.

48. Taittirīya Saṁhitā, VI.2.9.4.

49. Īśānaśivagurudevapaddhati, 1.c.677-70; Mayamata, Ch.XII.105.

50. Debiprasad Chattopadhyaya, History of Science and Technology in Ancient India. Calcutta, 1986, p.110.

CHAPTER I: THE CONTEXT

1.1 INTERPRETATIVE SPACE

CHAPTER I THE CONTEXT

I.1 INTERPRETATIVE SPACE

Hitherto, adequate stress on the evolution of the technological aspects involved in the construction of the buildings of different periods has received little attention by scholars. However, it must be stated that descriptions of monuments, their line drawings and measurements have been done in some of the earliest writings, authored by pioneers in the field of archaeology in India. It is necessary to begin the present description of the subject with a review of the works done by earlier scholars even though these do not emphasize on aspects of technology. For convenience of the present study, they have been divided and described as those written in the pre-Independent period and those after it. This division has been primarily made on the basis of the differences in the methodological approaches and the dominant issues, tackled by the scholars writing on monuments of historical importance. During the pre-Independent period preliminary studies were published mainly in the Annual Reports of the Archaeological Survey of India. Today, this kind of literature is indispensable, as it gives valuable information regarding the structural remains of ancient Andhradesa and lays the empirical foundation for all types of historical research. Since there are no known 'Indian' or indigenous accounts about surviving buildings and their descriptions, these surveys were infact the first constructions of knowledge about particular ancient buildings and can be considered as the beginnings of a new awareness in India to document ancient remains. The pioneering archaeologists, both excavators and conservationists, collected and wrote about the archaeological artefact and structure with an exactitude nurtured by scientific positivism. This became such a powerful method of analysis that future generations of scholars on Indian art studies could not shed it off. In the post-independent period though these methodological paradigms continued, it can be seen that a greater emphasis was given to an interpretation of the remains found in various regional contexts. Further, emphasis on the use of ancient literary texts to understand concepts in Indian architecture and identifying major technological achievements in this regard also began to be increasingly written about. We next turn to outline these broad trends in the writings on buildings of different types.

The study of buildings in pre-independent India fall into three broad groups: 1. the traveller's perceptions and brief notings, 2. the administrator's zeal for precision and imperial state's early initiative, and 3. writings of both Indian and Western scholars, inspired by the early discoveries and their attempts to interpret. These early writings taken together primarily focussed on describing the status of the building, its period and dynastic affiliation. They did not give much stress on discussing the methods of construction, materials used in construction and the techniques employed in the execution of the building studied by them. A major trend that emerged from the 18th century onwards was to look at the archaeological site as a whole, rather than at only the individual building. There was no clear cut method 1n this regard to study the evolution of the technology used to construct the different buildings located at these sites. However, architectural styles were vividly described. Infact, most of these early scholars did not think that study of technology was central to any analysis of the buildings that they described. It was apparently accepted as a tacit factor which must have existed to produce the monumental art and architecture.

It can be said that the first European notices of the extant ancient monuments of India are found in the writings of travellers and scholars from the sixteenth century onwards a trend that continued upto the middle of the eighteenth century. It has been suggested that these records constitute the first group of archaeological writings on India[1]. In the beginning most of the observations and studies by these observers were limited to ancient monuments on the West coast of India. The study of Indian architecture was an offshoot of these observations on monuments that were recorded by the European travellers. They reveal the contemporary European attitude to Indian architecture and sculpture which has been summarised in Partha Mitter's work Much Maligned Monsters[2]. The travellers however, recorded their observations in great detail and often over burdened it with personal opinion. For instance, Dan Joaode Castra[3] came to India in 1538 A.D. and his attitude was one of unabashed admiration for Elephanta and Kanheri. His study for the first time offers an understanding of the plan and measurements of these caves. John Huighen Van Linchotien, a Dutchman, published his work on India in 1596 A.D. which was later translated into English in 1598 A.D. It was mainly a description of temples and images. Pietro Delia Valle travelled to India between 1623-1625 A.D. and also refers to temples on the West coast of India, for which some plans of temples have been given.[4] The seventeenth century European travellers continue to describe the magnitude, of the ancient monuments, in particular, the famous Sun temple of Konark and the Jagannath temple of Puri.[5]

The same tradition continued well into the 18th century. Towards the middle of this century, however, systematic scholarly attitude towards the monuments began, which marked a significant historiographical turn in the study of early Indian monuments. South Indian temples figure in the writings of the French scholars like Le Gentil la Galasiere and Pierre Sonnerat. Le Gentle who came to India in 1760 A.D., toured South India and studied temples near Pondicherry and the South Indian gopura styles.[6] South Indian gopuras were also studied by Pierre Sonnerat, who toured India in 1774 A.D. He further described the famous temples at Tirupati, Srirangam and Kancheepuram.[7] Francis Leguet referred to some places in the south and observed the form of South Indian temples in 1776 A.D.[8] Colonel Colin Mackenzie,[9] a military engineer who was renowned to be a specialist in the siege of forts, organised the Survey of India as its first Director General from 1783 A.D. onwards. He visited almost every place of historic interest in Peninsular India and in the process prepared 2630 measured drawings and 78 plans all laid to scale. He also prepared the first plans and drawings of the great stupa at Amaravati, which are still unsurpassed for accuracy and finish.[10] Writers like Mackenzie had both a scientific idea and a benign interest in reproducing the art and architecture of ancient India to be preserved for posterity. For the Deccan and South India his work is invaluable, as, it for the first time, described the historical geography of the region.

The foundation of the Asiatic Society was a land-mark in the history of studying antiquities, arts, architecture and literature of ancient India in a systematic manner. On the 15th of January, 1784 Sir William Jones founded the society in Calcutta. Till the middle of the 18th century observations on a few accessible monuments had been made. To some extent these surveys helped 1n understanding the historical geography of the region where the monuments were located. In this regard there was great emphasis on the discussion of classical sources as a possible aid to locate ancient sites. The European travellers knew most of the ancient monuments for India as a whole by the 18th century. During the 18th century interest in aspects of Indian technology also began, since the historical origins of India, in their manifold dimensions came to be a matter of considerable theoretical interest to western scholarship. Thus, in this regard, writings on the origin of iron technology emerged in a significant way. The iron-smelting procedures in different parts of South India in particular, were discussed 1n detail to conclude that the indigenous and unique methods of metallurgy were well-known in India from ancient times.[11] There was another aspect of the writings of the mid-eighteenth century, namely, the tendency to compare the Indian monuments in style and aesthetic appeal to those of Greece and Rome. Nieubuhr's writings around 1786 show this tendency.[12]

At another level the relationship between India and the Western world was sought by showing the linguistic affiliation of Sanskrit with European languages like Greek and Latin. William Jones and several of his contemporaries were proponents of this view and for Indian studies in general, this had a great impact because, it tried to integrate Indian history within the contemporary notion of universal history. From now on this began to be done within various interpretative spaces. The earliest of these are today encapsuled by the term 'Orientalist Discourse' which has brought to the forefront the realization that Orientalism had generated authoritative and essentialized statements about India's texts, monuments and institutional practices. They helped in creating a knowledge about India which was seen as the opposite of rational Europe's norms and practices.[13] However, from our point of view what 1s important to emphasize is that extant monuments now began to be placed 1n new contexts for analysis overriding the existing contextual and textual frame works that they had been originally built in. It can be observed that this new theoretical exercise was done at a time when the nature of British rule in India was undergoing a change from being a trader to a territorial ruler. The documentation and reporting on Indian monuments during the latter half of the eighteenth century, was thus done more precisely and accurately than the earlier attempts. At this stage this was mainly done by Western scholars.

The nineteenth century had important implications for the British in India as their rule became stabilised. The listing of momuments with scientific precision began in earnest.[14] Buildings, arts etc. were important cultural manifestations and to map them and understand them, was in a sense, to show a superiority over the conquered people. James Princep who was the Secretary of the Asiatic Society of India located in Calcutta, wrote about his attitude towards field research in the words, "what the learned world demands of us in India is to be quite certain of our data, to place the monumental record before them exactly as 1t now exists, and to reinterpret it faithfully and literally".[15] Though the monuments and antiquities did not earn any revenue, the official interest in exploring, studying and publishing on them was the need of the times. Indian reality could now only be percieved in terms of how the administrative document described it so that colonial rulers could appropriately use it to know and understand the 'alien' Indian culture and society which they had colonised. From 1830 A.D. onwards specific archaeological writings on a variety of subjects are noted increased. Apart from descriptions of the observations on monuments, individual sites were also excavated and reported on. Accurate and precise description of monuments began to appear in the context of marked archaeological sites. One must underline that in contrast to the earlier writings, there was a conscious attempt to achieve accuracy on the documentation of ancient Indian monuments by the middle of the 19th century. This had a natural extension in that a new methodology of writing emerged during this period, wherein technical details were incorporated in these writings of the administrator scholars. The ideological frame work of knowledge within which this was done was totally alien to the society that produced the monuments being studied. However, as the descriptions below indicate these were not only done by Western scholars but Indian scholars too began to adopt the same methods of documentation.

William Erskine wrote a paper 'observations on the remains of the Buddhists in India' in the third volume of the Literary Society of Bombay in 1823 which included a detailed account of major Buddhist remains known to that period.[16] Colonel James Tod in 1830 tried to explain the origin of the Indian Rock-cut caves. He was the first scholar to cite a reference to the Silpa Sastram. i.e., the indigenous texts on ancient technology and crafts. According to him, "The architecture and sculpture of India present a wide and interesting field for research, and much valuable information on these subjects may be expected from the translations of the Silpa Sastram. which is said to contain the principles of them and of other arts and sciences of the Hindus".[17] From this statement it can be gleaned that such knowledge was not readily available to western scholars though they were keen to use it and link it to their observations on the existing monuments. It is significant to note that an Indian Judge, Ramraz had in 1834 written a theoretical paper on Indian architecture. Ramraz's essay was announced as marking a significant step in writing about the history of the science of architecture in India.[18] Ramraz had drawn Information from contemporary workmen in temples and the priests inorder to be able to explain the famous Silpa text, the Mānasara. To make the meaning of the text clear, he further utilised 48 plates of neatly made and lithographed drawings of temples.

James Fergusson,[19] (1808-1886) was inspired by Ramraz's essay though he was one of the most important scholars who used the tools of modern scientific methods to study Indian monuments. He began to write on the monuments after he had travelled extensively and conducted what can be called a one man architectural survey. He spent months at particular monuments and took extensive notes on them while simultaneously sketching them. His drawing plans are astonishing for their accuracy. Fergusson in 1843, presented a paper on the Rock-cut temples of India at the Royal Asiatic Society which resulted in the Government passing orders for a systematic preservation, drawing and copying of antiquities. Later in 1845, he published his first work, Rock-cut Temples of India with the explicit aim of attempting to bring architecture within the domain of the sciences. His Hand Book of Architecture was published in 1855 which is considered as the first illustrated history of Indian buildings and monuments. His most quoted work today 1s History of Indian and Eastern Architecture which consists of a description of the architecture of famous

Buddhist monuments and that of the Dravidian and Chalukyan styles of temples. With all his emphasis on scientific precision, Fergusson however, made no attempt to focus on the technological skills involved in the construction of these buildings. The post-mutiny period gained momentum for the listing and systematization of details on buildings to understand their outward manifestations.

Alexander Cunningham, basically a military surveyor and engineer who was a close associate of Princep, stressed the need of a systematic archaeological investigation at Government initiative. This culminated in the establishment of the Archaeological Survey of India in 1861 under his charge. The 23 volumes of his reports were published from 1863-67 which are now considered as indispensable source materials for the students of Indian architecture.[20] Cunningham's own particular contribution to the study of Indian architecture was his work on the temples of the Gupta period, in which he, for the fist time, traced the broad outlines of the evolutionary hypothesis of temple building. The newly established Archaeological Survey of India, however, left out of its scope a whole range of monuments and sites in South India during this period. Since Cunningham's primary concern became the topograpical details of various archaeological sites, the latter half of the nineteenth century, saw a neglect of studies on Indian architecture especially in the context of South India. In fact the earliest architectural surveys were limited to Western India and the Central Deccan because of their accessibility and also due to the fact that they had been reported by earlier scholars through their perfunctory notings and observations.

A hallmark of these early reports of the Archaeological Survey of India was that, they were purely administrative 1n nature, only highlighting the form of the architecture. This can be contrasted with the reports of the later administrators of the survey, who wrote scholarly reports touching on the aesthetic values of the building and its art, duly incorporating the traditional literary references to them as well.

A greater stress on building activity of ancient South India and the Deccan rather than on only a study of its temples, is noticed in the writings of Burgess. One can also suggest that with his taking over the Directorship of the Archaeological Survey of India, a concerted effort at the documentation of different styles of architecture began. Burgess came to India as a Professor of Mathematics in 1855 and subsequently got interested in the study of Indian architecture. In 1874 he was appointed as Archaeological Surveyor and Reporter to the Government for Western India. During this phase he published his Report on the Antiquities of Belgam and Kaladgi Districts in 1874; Report OQ the Antiquities of Kathiawad and Kachch in 1876, and Antiquities of Bidar and Aurangabad Districts in 1878. In 1880 Burgess published, jointly with Fergusson, a monumental work on the Cave Temples of India and in 1881 he was appointed as Architectural Surveyor and Reporter for South India. His tenure as Director General of Archaeological Survey of India was marked by several important architectural surveys, which resulted 1n the publication of volumes entitled 'New Imperial Series' by the Archaeological Survey of India.[21] In this regard Burgess wrote two important monongraphs, namely, Notes on the Amaravati Stupa and The Buddhist Stupas of Amaravati and Jaggayyapet.[22] which were published in 1882 and 1887 respectively. In 1884, Alexander Rea[23] followed suit and published South Indian Buddhist

Antiquities which included a discussion on the stupas of Bhattiprolu, Gudivada and Ghantasala and other ancient sites in the Krishna District of the then Madras Presidency. This work 1s significant because it included important notes on the methods used for dome constructions of the stupas. He also published a monograph on Chalukyan Architecture in 1896 with plans and drawings of the temples. Robert Sewell's[24] List fif Antiquarian Remains *in* the Madras Presidency published in 1882 and Lists of Inscriptions and Sketches of Dynasties of South India in 1884 are other important works of the later half of the nineteenth century, focussing on individual monuments of South India. In this regard 1t must be mentioned here that these also happened to be the first detailed studies of monuments of ancient Andhradesa.

Alexander Rea's 'Excavations at Amaravati' was published in the Annual Report of the Archaeological Survey of India for 1905-06. This was an important one being the first excavation report of Amaravati, unveiling many important technical details of the stupa located here. It was only after this excavations, that he was able to reconstruct the plan of the stupa along with drawings of the gateways. He also made notes of Jaina structures at Danavulapadu and some temples of the early medieval period at Pedamudiyam in the same report. The Buddhist remains at Sankaram were studied by him next and published in the report of 1907-08. These remains included details of a rock-cut stuoa, caves, and brick built monasteries, which were all dated to between the 6th-7th century A.D. In the succeeding year Rea surveyed the monastic complex at Ramathirtham hill in Visakhapatnam district. The early 20th century was thus marked by inventing or reporting on new monuments in specific regional contexts.

Most of the writers like Rea followed the earlier pattern of writing their reports and also gave plans of the monuments visited by them. Though there were no major theoretical shifts 1n interpretation, the early twentieth century was marked by a tremendous increase 1n knowledge about different types of monuments. Some of the sketches and line drawings of this period became indispensable for a comparative study of new discoveries made later in the century.

As a policy matter of surveying ancient remains and monuments at a regional and local level, different States of British India began to establish their own Departments of Archaeology. The Hyderabad Archaeological Department was constituted in 1914 to study the ancient monuments and sites in the former Nizam's Dominions. Since its inception, a large number of temples, Buddhist sites have been systematically studied and described 1n detail in the Annual Reports[26] of the Department. The first report was published in 1916. Yazdani as the Director of the Department, surveyed the monuments of the Nizam's Dominions and offered remarks on their architectural features. In particular, he surveyed and studied the temples at Pillalamarri, Palampet, Warangal, Ditchpally, Nagulapadu, Alampur and so on. Principal forts in the Dominions like Elegandal, Warangal and Koyalkonda were also studied, with the details on such aspects as trenches, trap doors, draw bridges, ramparts, walls, gates, bastions, cellars and secret passages. However, like other surveyors of the time, he did not discuss aspects of the technological skills involved 1n making either temples or, fort buildings.

G.Jouveau-Dubreuil's contribution to the study of Indian architecture, particularly in south India is most significant. He combined the first hand knowledge of the actual monuments and living traditions of the Silpins by subjecting these to a logical and systematic application of an appropriate methodology. This study was published as a History of Dravidian Architecture[27] in 1917. It excelled previous achievements from a stylistic point of view, by thus interpreting every aspect of Indian Architecture. The concern to understand indigenous techniques gained momentum around this period with a good number of important texts bearing on architecture being brought to light, edited and published. Among these, the Īśānaśiva Gurudevapadhati published from Trivandrum between 1920-24, the Silparatna also from Trivandrum in 1922, the Samarangana Sutradhara from Baroda in 1923, the Mānasōllāsa from Mysore in 1926 and the Vastuvidva from Trivandrum in 1940 are significant to mention as they facilitated researchers to understand the relevant terminology of architecture within the Indian tradition. They had another far reaching impact in that it opened the door to appreciating Indian technological achievements along with appealing to the aesthetic sensibilities of the art that went along with the building.

According to Pramod Chandra,[28] "many of the short comings of the scholarship of Indian temple architecture such as the failure to explore Indian sources and understand the inner meaning of the monuments, the purely literary studies of the silpa texts, without reference to the surviving monuments of its living practitioners, the study of style conceived only in terms of the development of ornamental motifs and without a grounding in architectural or religious history, were all largely overcome 1n the works of Ananda Coomaraswamy". Coomaraswamy's endeavours have been credited with re-establishing the study of Indian art and architecture on a new basis. The 1920's saw a great spurt of writings by Nationalist scholars in various fields of ancient Indian History. This was not unrelated to the contemporary concerns of the anti-colonial struggle. One of these was to show that India as a nation in the making had had a glorious past and its intellectual achievements had to be documented. It was realised that the study of ancient buildings had not been neglected per se by the Orientalists but that they had simply been projected as inert passive objects of study, being thus regarded as lacking in dynamism. Indian art historians like Coomaraswamy who wrote between the 1920's and 30's thus injected these studies with a spirit that gave value to the indigenous wisdom. This they did by consciously focussing on local literary sources as central to their interpretation of buildings. They incorporated in their writings the aesthetic values that highlighted the inward manifestations of the Indian buildings and thus provided their own meanings to defining the cultural achievements of an ancient civilization. Coomaraswamy's writings on Indian architecture reflect this characteristic yearning to know the conceptual framework and the multifarious manifestations of Indian architecture through the ages. His first important work was History of Indian and Indonesian Art which was published in 1927. His Early Indian Architecture was published in 1930 which is indeed a master piece.[29] We find in it a brilliant discussion on the Prasada based on the evidence of literary sources and on early Indian sculptural examples, which were integrated to the architectural form, for the first time. In another context he described the various parts and components of the palace, the walls, gateways, different quarters and apartments, pillars, windows, etc. like a professisonal architect. He further examined the material employed 1n the construction of the multistoried prasadas and the development of gavaksha or the arched window which was a characteristic feature of Indian architecture. Thus one can conclude that an important feature of Coomaraswamy's interpretations of Indian architecture was his profuse citations from ancient Indian literature to arrive at appropriate explanations of the buildings, different structures and their components and an elucidation of many obscure architectural terms.[30]

Coomaraswamy's work left an inedilible mark on writings of later scholars. His work also opened up avenues for serious research on the Silpa texts. The ethos of his work in portraying the essence of ancient Indian buildings was carried forward by Stella Kramrisch. Her authoritative work on the meaning and symbolism of the Hindu Temple[31] in two volumes, was published in 1946. This contains valuable information on the principles and methods of construction of temples with direct focus on South India. Her scholarly endeavours took pains to describe all aspects of temple building from the selection of site to laying of its foundations, the spatial organisation of temple layout, the construction of the upapītha, adhistāna and other aspects of the superstructure. In giving these details, she heavily depended on ancient Silpa texts which were utilised so as to supplement her views on the description of extant temples. From our point of view it is pertinent to note that her work is one of the first to embody discussions on technical details of building temple complexes and information on building materials and bye-laws necessary to build structures which thus enable us to have a wholistic view of the inter-relationship between architecture and technology. Necessary details for the latter and the terminology used for 1t was brought out in a systematic way by P.K.Acharya. His, An Encyclopaedia of Hindu

[32]

Architecture was also published in 1946 and provided detailed notes on the temple building activity according to the ancient Manasara Silpa Sastra. This was supplemented by making drawings to illustrate the relevant terminology used to describe various facets of temple building. This ranged from soil testing before executing the building to plastering which ultimately lent finishing touches to the building. Principles laid down in connection with the construction of other types of buildings such as common dwellings, palaces, roads and defence structures have also been elaborated upon and critically discussed. What is significant from our point of view is that aspects of building technology such as procurement of materials for construction, dressing of stone, erection, joining of beams, providing roofs have been fully explained based on information provided by the Manasara.

Just before Independence many scholars in their writings lay emphasis on the use of literary sources. H.D.Sankalia,[33] in an article entitled 'Regional and Dynastic Study of South Indian Monuments' published in 1941 was primarily concerned with methodological questions and heavily dependant on Dubreuil's work on A History of Dravidian Architecture published earlier. Sankalia's basic aim was to develop a more comprehensive classification of South Indian monuments on a regional level, since the dynastic knowledge about them was often incomplete. Percy Brown's[34] first volume on Indian Architecture was mainly a compilation from previous work but with its numerous photographs and drawings it became a useful text book on Indian Architecture for a study of both Buddhist and Hindu monuments. His focus, like other scholars before him, was primarily on religious buildings.

The early twentieth century was also significant from the point of view of an increase in archaeological excavations. Excavations were carried out at Alluru and Gummadidurru in the Krishna district and at Nagarjunakonda in Guntur district between 1926-27 by M.H.Khureshi.[35] Later, between 1928-29, and between 1929-30, fulfledged excavations were conducted at the same site by A.H.Longhurst[36] revealing the existence of three monasteries, sixteen temples and small stupas. This is an important excavation, which laid bare a good number of ancient buildings which had served different purposes. For a study of early historic building technology, the materials brought to light from these excavations are indispensable. However, the Archaeological Survey of India over a period of time became more interested in the investigation of pre and proto-historic sites. This tendency limited the scope and progress of the study of Indian architecture for several years. It has been observed that during the pre-independent period most of the northern and western Indian monuments had been surveyed by the Archaeological Survey of India with some initial attempts at incorporating south Indian monuments into the survey. Andhradesa, the present region under study was still marginally documented.

In the post-independent period, a shift is noticed in the study of monuments and this is now done mainly by Indian writers. By and large they followed the methodology laid down in the scholarly works of the colonial period. However, monuments and buildings began to be studied in a thematic way, with focus of study being either Brahmanical temples or Buddhist structures or, 1n some rare cases, forts. Secular namely, ordinary structures of a non-religious nature were hardly taken up for critical study, in separate monographs. A significant tendency in the post-independent period has been the focus to study monuments 1n a regional context.

A brief survey of works done on the Brahmanical temple architecture shows that there was a great emphasis on this theme of study in the post-independent period and this 1s seen to continue even today. The Archaeological Survey of India too launched an Architectural Survey of Indian temples with Krishnadeva and K.R.Srinivasan incharge of North and South India, respectively. This was intended to conduct a detailed survey of regional styles in architecture and to distinguish their similarities and variations. We list below some of these descriptive studies pertaining to Andhradesa. P.Sreenivasachar[37] of the Hyderabad Archaeological Department published a small book, The Ramappa and Other Temples at Palampet. in 1953 in which he described the location, history and salient features of temples and sculptures of Palampet, which had been constructed during the Kakatiya times. Ground plan of the main temple and some illustrations of temples and sculptures were also included in this work. Like many other works for the different regions of India, it lacks any details on the techniques used for the construction of the temple building activity of the Kakatiyas. K.V.Soundararajan[38] published his monumental work on the Architecture of the Early Hindu Temples in 1965. This was followed by two other works, namely, Indian Temple Styles in 1982 and Early Kalinga Art and Architecture in 1984. In the first one, the Brahmanical temples at Nagarjunakonda, the rock-cut caves at Vijayawada and Bhairavakonda and the temples at important places like Chejarla, Alampur, etc. were studied with their plan, elevation and measurements. His Indian Temple Styles subsequently became a standard text on the Indian temple as

1t encapsulated neatly classified temple styles and described salient features of the architecture developed during various centuries with some of the typical examples. It was however, in his work on Early Kalinga Art and Architecture that he made an attempt to study the building materials used for building activity and, to some extent, the mechanics of temple construction.[39] On the other hand, M.Rama Rao's Select Kakatiya Temples in 1962, Early Chalukyan Temples of Andhradesa in 1964, and M.Radhakrishna Sarma's[40] Temples of Telingana published in 1972 focussed mainly on describing the form of architecture and did not at all mention the technology that lay behind these monumental edifices. These microlevel studies were valuable since they tapped an hitherto unknown material about the extant temples in the different sub-regions of Andhradesa, but they hardly differed from each other, 1n their mode of presentation and analysis of the new data. Such a method became typical of temple based studies and continues to be a standard format, identified for topics of research in the various universities of Andhra Pradesh.[41]

At the same time we continue to note an interest in the publication of many Silpa texts.[42] Some of these like Aparājita Prichcha. Viśvakarma Vastu Sastra. Pramāna Mañjari and Tantra Samuchchaya affected the study of art history, as they provided information on hitherto unknown details, extremely valuable for preparing technical reports on the extant monumental buildings. The appearance of these publications by Sompura[43] and others have strongly influenced our current understanding of the traditional methods of temple construction and the terminology used for doing so. For instance, Bruno Dagen's critical edition of the Mayamata[44] gives a comparative study of temple architecture. It is a useful work for scholars to acquaint themselves with the terminology used in the methods of construction with special reference to South Indian temples. Chapter XII of this book exclusively deals with techniques on which the foundations of the temples were made. Sompura 1n an article entitled 'The Vastuvidya of Viśwakarma'[45] presents briefly the terminology which was used for the construction methods of temples in the past. Details discussed begin with the laying of the foundations of temples to the construction of the vimānas. The prescriptions of the texts comply with the methods probably used for construction of the medieval temples. The Kakatiya temples 1n particular, most certainly, used some of these works on ancient architecture.

From the 1970's onwards a trend emerged wherein some scholars began to write about the technology of buildings but still considered it as peripheral to the overall discussions on ancient styles of architecture and their characteristics. The thrust of these writings did create scope for a change in the existing methodological framework. The new perspective focussed on technological aspects such as methods and skills used for construction, the invention of new materials needed for building activity and a study of the shapes and patterns of buildings. Despite these relevant concerns to understand the evolution of ancient building technology, many articles and books on temple architecture continued to appear prolifically. We highlight some of the important ones in this regard and then finally, narrow down on those exclusively dealing with ancient building technology.

H.Sarkar,[46] in an article 'A Study of Adhistanas in Early Temples of Andhradeśa', traces the origin of the adhiṣṭāna or the basement of the temple to differentiate the individual types employed in the rock-cut and structural temples of early medieval temples in Andhra Pradesh. However, barring the description of the decorative elements he does not mention the technical aspects of how these basements were made and how important they were to the building as a whole. R.Subrahmanyam's article 'Brahmanical Structures at Nagarjunakonda',[47] on the other hand, provides information regarding the Brahmanical temples constructed during the 3rd century A.D. along with a discussion on materials used to make them and the development of plans and engineering skills of the period. I.K.Sarma, in his book, The Development of Early Saivite Art and Architecture.[48] traces the origin of Saivite architecture from the 4th century B.C. onwards in Andhradesa. This book is based on the available archaeological sources gleaned from the excavations conducted at Amaravati and Gudimallam. He goes on to discuss major developments on this theme during the Sātavāhana, Ikshvaku and Vishnukundin periods. His major conclusions are on specifying the evolutionary hypothesis of how structural buildings of the Brahmanical faith in the Krishna Valley emerged during the early historic period. However, technology involved in temple building, does not form a topic of discussion in this study either.

Rajendra Prasad in his work Chālukyan Temples of Andhradeśa[49] shifts the focus to the early medieval period but similarly aims at only giving full details of the temple forms built during the time of the Chalukyas of Badami in Andhradesa. An architectural survey of the temples at Alampur, Kudavelli, Panyam, Mahanandi, Satyavolu and Kadamarakalva has been done with a view to evaluate the art and architecture exemplified in terms of the evolution of the history of what he calls Chalukyan Architecture. A brief description is however, given on the material used in temple construction. Gopal Reddy[50] on the other hand, in his book, The Ghanpur Group of Temples while giving much descriptive architectural details also classifies the Kakatiya monuments. These are put into Ekakūta, Dwikūta, Trikuta and Mandapa varieties. He further discusses the spatial organisation of the temples, their plinths, basements, walls, roof and super structure but does not explain the techniques employed to achieve aspects of temple building nor, does he have a discussion on the building materials used to construct them. Encyclopaedia fif Indian Temple Architecture[51] edited by Michael W.Meister and M.A.Dhaky is basically a Series which systematised, in two volumes, a discussion of the styles of temple buildings in terms of those found in lower Drāvidadeśa and those in Upper Drāvidadeśa. They initiated for the first time, a focus on the Deccan by emphasizing a Deccano-Drāvida mode of Drāvida Architecture, which, they saw had survived from as early as the 1st century A.D. to the 10th century A.D. In these volumes the temple building activity of Andhradesa was done dynasty-wise including discussion on the Satavahanas, Ikshvakus, Vishnukundin, Eastern Chalukyas, Telugu Chōḍas, and Nolambas of Hemavati by two of the most prolific writers on the subject, namely, K.R.Srinivasan and K.V.Soundararajan. The important features of temple architecture noticed at the major temple sites of Rangapur, Kudali Sangamesvaram, Veerapuram, Nagarjunakonda, Pondugula, Biccavolu, Chebrolu, Draksharama, Amaravati, Samalkota, Bhimavaram, Papanasi and Somasila have been highlighted. Plans, Adhistana mouldings, plinth cuttings have been elaborately discussed. Except for a clear exposition of the stylistic affiliations of the temples to the different dynasties no indepth analysis of the evolution of technical details over historical time in early Andhradesa was visible in this work.

A good number of studies on buildings of Buddhist affiliation were also published during this period. Important among them were R.Subrahmanyam's[52] Salihundam A Buddhist Site in Andhra Pradesh; H.Sarkar's[53] Studies in Early Buddhist Architecture of India: Waheed Khan's[54] A Monograph on the Early Buddhist Stupa at Kesanapalli: Debala Mitra's[55] Buddhist Monuments, and I.K.Sarma's[56] Early Buddhist Monuments and Brahmi Inscriptions of Andhradesa. Like the aforementioned studies on Brahmanical temples, these reveal descriptive details on the Buddhist structures such as stupas, chaityas and viharas of Andhradesa illustrating them with plans, elevations and sectional drawings, besides furnishing details on their measurements. It goes without saying that these works too do not deal with the skills involved in the planning and construction of Buddhist buildings. A recent work which focusses on engineering skills, building materials and methods employed in the construction of the Buddhist structures at Thotlakonda has been made available in the form of a report by Krishna Sastry, et al.[57]

In reviewing the historiographical literature of the post-independent period, it has been noticed by us that though the largest number of works were on different types of religious buildings, the study of defence buildings received some attention. N.S.Ramachandra Murthy's unpublished thesis, Forts in Ancient and Medieval Andhra: A Study[58] is an unique attempt on the defence architecture of Andhra Pradesh. He has traced the origins of the defence system from the proto-historic times and sought to discuss their development during the early historic and medieval times in Andhradesa. Select forts such as Dhulikatta, Keesaragutta, Bhongir, Warangal and Gandikota have been thoroughly documented for the first time.

He has added literary references to understand the concept, lay-out and development of the fortifications. However, stress on how an evolution of defence building took place from period to period in early Andhradesa is lacking.

T.V.G.Sastry's work on the Veerapuram Excavations[59] adds new data to the concept of early fortifications by describing those at Veerapuram in Kurnool district. Krishna Sastry[60] has similarly described the new data on early forts noticed by him at Kotilingala and Dhulikatta during the course of his excavations there. The standard method in these works is to describe the physical features of these forts, such as bastions, gates, guard-rooms and moats. Margabandhu[61] in his broader classification of architecture elaborates upon select forts and fortifications of Andhradesa under a chapter called 'Defence Architecture'. Amaravati, Dhulikatta, Satanikota and Nagarjunakonda figure in this connection. Ramamohan Rao[62] studied the fortifications of Nagarjunakonda, Keesaragutta, Nelakondapalli, etc. and R.Subrahmanyam[63] has exclusively studied the plan, elevation and building materials used at the fort at Nagarjunakonda which he defines as a Sthala and Giri Durga. Civilian architecture in the fortifications has also been studied in his article 'Secular Remains at Nagarjunakonda'. N.C.Ghosh[64] in the Satanikota Excavations: 1976-80 has brought to light new data on the early historic fortification at Satanikota. The important feature described here is an unique rock-cut moat around the fortification with a draw bridge on the moat not reported earlier from any other site. Recently, Ramakrishna Rao[65] has also discovered an unique rock-cut fort datable to between the 8th-9th centuries A.D. provided with rock-cut gate and guard-rooms at Gandharikota in Adilabad district. Though the above works deal with the defence buildings of the early and medieval periods and reveal interesting information, the pattern of studying the evolution of building technology of the defence building is yet to be taken up.

In comparision with religious and defence structures, we find that separate monographs on habitations and public utility structures is rare. Those scholars that have drawn our attention to these do so by making a few contextual references to them 1n their works. Allchin's The Rise of Civilization in India and Pakistan[66] describes town planning and types of individual dwellings in proto-historic India as a whole and discusses some technical aspects such as brick making, quarrying of stone and its transportation, sanitary arrangements and metal technology. This work differs from the other general works which usually confine themselves to only a description of the buildings in a superficial manner. Kulkarni in an article, 'Engineering in Ancient India'[67] has attempted to trace references from Vedic and post-Vedic literature to explain the building of forts, bridges, roads and irrigation structures while also describing skilled workers like masons, smiths, etc. He does not, however cite any surviving structures to correlate his discussion of the literary evidences.

Pertaining to Āndhradeśa in particular Allchin in his, Utnoor Excavations[68] describes pit-dwelling activity as revealed through this excavation. In this regard he writes a small note on the construction of wooden cattle-pens. Amita Ray's, The Villages, Towns and Secular Buildings in Ancient India.[69] is the first systematic work on data discussing different types of dwellings from the Vedic period onwards. This work is based on literary, archaeological and ethnographic sources. She has traced the origins of village architecture and also discussed the development of towns and other secular structures, supported by the evidence of the sculptural reliefs from Amaravati and other places. She has succeeded 1n connecting the early house plans to the proto-types of what the present day tribes of the Krishna Valley and coastal areas of the Andhra Pradesh live in. R.Subrahmanyam's contributions on the Nagarjunakonda excavations were published as Nagarjunakonda-I (1954-60)[70] in 1975 embodying the results of the excavations at the site pertaining to various phases of habitation. Dwellings such as pit-dwellings and houses made of stone have been discussed here at length. Amita Ray's other work Life and Art of Early Andhradesa[71] also discusses settlement patterns, buildings and monuments. Rural house types, and city buildings are both elaborated upon and building materials used with special reference to Amaravati and Nagarjunakonda have been detailed. Besides laying emphasis on town planning and country planning, she critically evaluates different surviving proto-type structures 1n Andhradesa. Krishna Sastry's The Proto and Early Historical Cultures of Andhra Pradesh[72] 1s a work mainly dealing with the proto-historic cultures of Northern Telangana. He traces the development of settlement patterns and discusses the house types of the Neolithic and Megalithic periods. This book also discusses aspects of civil buildings during the urban phase of early Andhradesa, giving details on building materials, drains, wells, roads and residential buildings from pre-Satavahana to the Vishnukundin times. Margabandhu[73] in his book has a chapter on civil architecture. He describes the different buildings used by individuals as well as royal palaces, buildings of public utility and irrigational works with examples from Dhulikatta, Amaravati and Nagarjunakonda as noted from the excavations conducted at these sites. Ghosh's Excavations at Satanikota 1977-80.[74] 1s also an excavation report which provides information on civilian structures and building materials used such as tiles, bricks, iron nails, etc. of the Satavahana period in Andhradesa. R.Subrahmanyam's article, 'Secular Remains at Nagarjunakonda'[75] elaborates the secular structures found here such as public buildings, roads and amphitheatre. Krishna Murthy's book Early Indian Secular Architecture[76] emphasises on the architectural patterns in early India with reference to select sites on the basis of literary evidence.

The review of the above works leads us to conclude that the authors like Allchins and Krishna Murthy inform us about ordinary housing patterns and dwellings at an all India level. Krishna Murthy's attempt in citing literary references to such structures, however, lacks corroboration of the material with archaeological data available in plenty both at the all India and regional levels. Margabandhu's survey on the other hand, deals with such descriptions in the Deccan context whereas Krishna Sastry narrows the spatial scope even further to deal primarily with Telangana. Subrahmanyam and Ghosh, as excavators of the sites reported the extant archaeological remains pertaining to different types of utility structures as noticed at Nagarjunakonda and Satanikota, respectively. Amita Ray's works provide ample information on habitation buildings, beginning from hutments to sophisticated buildings of the proto and early historical periods, in early Andhradesa. She uses contemporary classical literature to understand the bye-laws for making such buildings. An important aspect of her work is that she has successfully corroborated the archaeological data with the literary references and has also connected the ancient house types with those of the present day tribes of Andhra Pradesh. Her studies are however mainly focussed up to the early historical times. A comprehensive study on the evolution of building technology of simple housing structures from proto-historic to medieval times in the context of Andhradesa is left unresearched.

These works have interestingly used such terms as 'secular', 'civil' to club different types of buildings which do not fall into the category of religious buildings. Basically they have culled information from archaeology, on simple structures and ordinary housing patterns. In this sense, these are valuable studies but it has been noticed by us that such studies are only available for the proto and early historical environment. None of the aforementioned works delve into the early medieval or later medieval period to continue their concern with identifying the building technology of ordinary public utility structures. It can ofcourse be reasoned out that empirical data on this subject is lacking for these later periods. In this context, it is interesting to note that Jyothindra Jain[77] in a recent article called 'Parallel Structures' explains the spatial organisation of the traditional dwellings in to kitchen, bedroom, living room, pen-place and courtyard that have continued to be built throughout history in a same manner. In his study on the Rathva and Bhilai tribes of Gujarat and Madhya Pradesh and the Savaras and Kondhs of Orissa, he postulates that the method used for constructions also seem to have remained unchanged. Jain observes that the symbolic replica of the cosmic structure as understood at the tribal level was equally important to them as its functional and utilitarian aspects. These simple structures were usually built in wood and reeds, supported by a central pole and often supporting poles on the periphery with ridge pieces on the horizontal frame. D.R.Raju in his work, The Stone Age Hunter-Gatherers (an

Ethnographic Study of Cuddapah District)[78] also tells us about the means and methods of building simple and temporary structures 1n vegetable material by the semi-nomadic tribes of Andhra Pradesh called the Yanadis. This work, in explaining the simple building technology of the tribals on a regional level, does valuable documentation on the subject.

The discussions above reveal that though they do dwell on the technological aspects of simple building structures they do so as marginal to their larger concerns of describing layouts and types of buildings. This leads us on to the final focus of a review of the works that explicitly discuss the technological aspects of architectural edifices. This pertinently brings to the forefront, the fact that the existing interpretations have only highlighted the technological aspects of monumental buildings, particularly temples. It can be noticed that such a trend was the natural culmination of a concentrated effort to read textual material pertaining to temple architecture rather than simply describing existing temple structure. Such endeavours had therefore revealed a plethora of information on techniques and technological skills. Most of these interpretations are found in books and articles published in the past few years.

In a discussion of articles and books exclusively dealing with building technology, we necessarily have to focus on India as a whole. There are no studies of this kind in the context of Āndhradeśa. Andhreas Valwashen's Living Architecture: India[79] begins his work with an understanding of the origin of the Hindu temple and its evolution leading to dynastic variations in style. At the end of this description he supplies valuable information regarding such technological aspects as the transportation of huge stones and their erection with the help of scaffolding and earthen ramparts. This book also gives a clear idea about the engineering and technical skills involved in temple building of South India. Kirit Mankodi in an article, 'Scholar Emperor and a Funerary Temple, Eleventh Century Bhojpur'[80], mentions the details of the construction of the Bhojpur Temple. Evidence of planning involved in such a work is found in draftsman's diagrams engraved on the rock. He identifies an earthen ramp laid between the stone quarry and the temple for carrying the slabs. Some light 1s also thrown on the qualifications of an architect and matters related to the mechanics and the organisation of the temple construction during the medieval times based on the Samarāṅgana Sutradhara which was written by Bhoja.

Alice Boner and Sadasiv Rath Sarma[81] are said to have identified a plam-leaf manuscript called the Bavachakada. which, according to them details as to how one of the greatest undertakings in the history of Indian temple building, i.e., the Sun Temple at Konark, was constructed around 1250 A.D. It provides interesting information about how the work progressed, the organisation of labour and their relationship with the patrons, and the administrators and artisans connected with the execution of the work. It further discusses the qualifications of the architects and sculptors, building materials and the methods of quarrying, transporting, lifting of huge stone blocks and scaffolding arrangements have also been published in the work. It is equally interesting to note that the above work has been considered a forgery according to some scholars. K.S.Behera,[82] is one of the many scholars who has questioned the authenticity of the manuscript and after testing the historical value of the manuscript by cross-evidence, argues that the reliability of the text should not be taken for granted. Besides, many statements of the manuscript consulted by Alice Boner and others, such as the survey of the temple, the name of the Sutradhara who constructed the temple are also contradicted by M.H.Chakravarti, in his study based on another literary source on the Konark temple called the **Mādala Pañji.**[83] After careful and critical scrutiny, K.S.Behera suggests that the manuscript published by Alice Boner and others belongs to the 20th century.[84] On the other hand, a few scholars like Christopher **Tadgel,** while writing on the temples of Orissa in his work A History of Architecture in India.[85] appreciates the work of Boner and others. He says "Alice Boner, New Light has shown that the temple at Konark took twenty years to build and was finished for concentration on Surya's birthday in 1258 A.D."[86] **This** statement reveals that Tadgel had relied upon the work carried out by Boner and others. Tadgel does not seem to have been aware of the rejoinder putforth by K.S.Behera in this regard.

Tadgel's above work is a new approach on the evolution of Indian architecture. Technological aspects such as the foundations of temple structures and the building materials used, load bearing and distribution, trebeated system of arranging the beams, alongwith other engineering feats of the ancient architects are described. Gerald Colas[87] in his article, 'Some Remarks about the Construction of the Temple according to Marichi **Samhita'** discusses different aspects of temple construction such as selection of site, methods of soil testing, laying of foundation and basement and the hearthing materials to be used. **This** 1s an unique attempt at studying a medieval Sanskrit text, to unveil many mysteries of the traditional techniques in temple building. He 1s among the first few writers who has delved into such details and also gives descriptions of ancient bye-laws needed for temple building at every level. The qualifications of the architects and skilled persons are some of the other aspects thoroughly discussed.

In the context of studies on South India, Parabrahma Sastry's The Kakatiyas of Warangal.[88] though primarily a study of the political history of the Kakatiyas, gives significant citations from epigraphic sources to aspects of temple construction. He thus informs us about how the selection of stones was done for the Kakatiya monuments, their dressing, the joinry techniques and its development and finally, on the skills of the architects. In an article 'Tamil Temple Architecture and Art' Soundara Rajan[89] focusses on the techniques of temple construction in general and explains several features such as the extraction of stone from quarry by 'blocking technique' and its transportation to the site to be finally dressed at the site before the erection of the temple. In 1991, the Regional Engineering College, Warangal,[90] in collaboration with the Archaeological Survey, conducted a survey of the geological, geo-physical and geo-technical studies at places like the Thousand Pillared Temple at Hanamkonda, the Keerthi Tōranās at Warangal fort and the Ramappa Temple at Palampet in Warangal District, to identify details on how the foundations of these structures were made and evaluate their performance in relation to the total structure. The survey found certain technical flaws and suggested some remedial measures like grouting and the construction of retaining walls, around the temples with deep foundations. It also suggested that total reconstruction of certain temples could be taken up. These survey reports interestingly, do not throw much light on the

methodology and technology that was originally in practice at the time when Kakatiyas built these temples. 'Materials and Techniques of the Kakatiya Temples'[91] an article by Siva Nagi Reddy and Subrahmanyam is the first of its kind, in which, they have studied the Kakatiya monuments from the technical point of view, keeping the style of Kakatiya buildings in mind. The building materials and tools used has been discussed to show how the huge and massive slabs used for pillars, beams and roof slabs were quarried, transported, dressed, lifted and arranged in position. It is also pointed out why in the first course of the foundation and basement, sand or earth was used to serve as cushion bed for foundation of these temples. In this paper, both literary and epigraphic references have also been used to corroborate the existing evidences from the standing monuments in evaluating the engineering skills and building technology of the Kakatiya period. Norms for temple construction as laid down in the Mānasāra, the Mayamata, the Marīchi Saṁhita and the Vastuvidva have been used to corroborate it with the archaeological data.

A few works which describe the techniques of rock-cutting in the building of ancient monuments have been taken up by scholars from the early 1970's. An attempt to explain the process of rock-cutting is made by O.C.Kail with reference to the caves of northern India in his work published in 1971 as The Cave Temples of India.[92] In the following year, Vidya Dehejia's study appeared as Rock-Cut Temples of India[93] in 1972, in which, she explained the technical aspects of rock-cut temples of India in general. Her other work gives a clear idea about how rock was hewn into caves and how façades and mandapas in early historical times were made in **Western and Central Deccan, with** special reference to Ajanta and Ellora. **The method of drawing** or **marking on the rock before** starting the excavation in required sizes and shapes by the craftsmen with the help of variety of tools and training of the artistis are thoroughly discussed in her work Looking Again at Indian Art.[94] Subsequently, similar studies on rock-cut architecture were carried out by several scholars. These include, S.Nagaraju's Buddhist Architecture of Western India.[95] S.P.Gupta's The Roots of Indian Art.[96] R.P.Mohapatra's, Udayagiri and Khandagiri Caves.[97] all published in 1981. Among the scholars mentioned above, Vidya Deheja and S.P.Gupta discuss the rock-cutting process of some Buddhist caves in Andhradesa, especially the ones at Guntupalli.

Among exclusive studies on Andhradesa, I.K.Sarma's, Studies in Early Buddhist Monuments and Brahmi Inscriptions fif Andhradesa.[98] provides some technical details on rock-cut technology, based on his observations of a few unfinished caves at Guntupalli and cut-out monoliths at Rampa Errampalem. The rock-cut caves discovered at Gopalapatnam for the first time by us, this year offer a few clues to assess that how the cells were cut into, the type of tools used for the purpose etc. These have been dealtwith in an unpublished report entilted 'A Report on the Discovery of a few Rock-cut Cells around Gopalapatnam near Tuni, Visakhapatnam District' based on our survey conducted in April, 1994.[99] However, the study of evolution of rock-cut technology in Andhradesa as a whole still remains unattempted.

The study of the buildings 1n the pre-independent period outlined by us above has therefore revealed that knowledge about them increased with the widening of interpretative spaces. From the brief notings of the travellers' accounts to detailed reports of the administrators along with their zeal for precision, ultimately culminated in scholars looking beyond the buildings to the cultural ethos that inspired the building construction in the first place. Thus, it has been noted by us that those monuments which were observed by the travellers were described only from the outward architectural point of view. This was followed by scientific exactitude being introduced for doing the same thing with the backing of the colonial state. Finally, scholarly insights found it necessary to describe the monumentality of buildings as initiated earlier within the purview of literary sources so that they could be understood much more comprehensively. It can further be concluded that during the earliest phase of writing on buildings, technological skills involved in their construction, were not identified for analysis and discussion. Later, however, the initiative by administrators resulted in an allusion to these skills being made to a limited extent. However, it was only during the later half of the 18th century and during the 19th century that diffusion of ideas had resulted in great interest in comparing the skills and monumentality of the buildings found in India to those of the classic western type, found in the ancient Greek buildings. This became a standard marker of comparision. Technical details while describing buildings were an integral part of those writings using literary data. Above all, the works of the pre-independent period provide first hand information of the details on the dynastic affiliations of monumental structures since the focus in this period was mainly on big buildings like temples and stupas. Further, most of these early writings looked at the buildings only in terms of their aesthetic and artistic form and were not concerned with understanding what went behind the making of these buildings, from a technological point of view. The empirical foundations that they laid for later studies cannot, however, be denied.

In the post-independent period scholars lost sight of writing on archaeological sites as a whole whereas there was a proliferation in the writings about individual religious buildings particularly temples. Indian scholars tried to replicate the methodological framework. They had inherited, especially in terms of the documentation of new buildings surveyed by the Archaeological Survey of India. From the 1970's onwards the interpretative space shifted to a study of buildings on a regional scale. Simultaneously, the earlier pre-independence interest of writing on Buddhist and Brahmanical monuments increased. In these, studies too, the focus was on the description of the outward facade, its decorative and stylistic details and its religious and dynastic affiliations. This gradually led to a tendency of describing the individual buildings alongwith a brief discussion on the materials used to build them. The engineering skills needed for construction, were however, dealt with only in a perfunctory manner.

The above survey of scholarly works gives us an idea that very few scholars attempted an understanding of the evolution of building technology on a broad scale, covering different types of buildings. Those who have taken a keen interest in this direction have done so in the context of looking at the various discussions of temple construction as literary texts provided valuable data on this subject. There were however, two other areas of technological interest which covered the interpretative space in the last few years. The first was the interest shown by scholars to understand the house patterns of dwelling, especially 1n the proto and early historic times. The other was a keenness to understand rock-cut technology as developed in early historic times.

In reviewing these works we concluded that in the particular context of Andhradesa no major writings have dwelt on understanding the evolution of building technology not only in terms of different types of buildings but also in terms of being spread over a long span of historical time. The proposed dissertation hopes to fill in this gap and lay the empirical foundations for other studies in the future.

FOOTNOTES

1. D.K.Chakravarti, 'Ideas and Discoveries in Indian Archaeology: Till the Middle of the Nineteenth Century', IHR, Vol.V, no.1-2, 1978-79, p.96.

2. P.Mitter, Much Maligned Monsters. Oxford, 1977.

3. Ibid. p.327.

4. D.K.Chakravarti, Op. Cit.. 1978-79, p.96.

5. Simon Digby and J.C.Harle, 'When did the Sun Temple Fall Down', SAS. Vol.1, 1987, pp.1-17.

6. D.K.Chakravarti, A History of Indian Archaeology. Delhi, 1988, p.13.

7. Ibid. p.13.

8. Ibid, p.14.

9. W.C.Mackenzie, C.C.Mackenzie - First Surveyor General of India. London, 1952, p.110.

10. S.Roy, The Storv of Indian Archaeology. Delhi, 1961, p.18.

11. D.K.Chakravarti, 'The Beginning of Iron in India', Antiquity. Vol.L, 1976, pp.114-124.

12. D.K.Chakravarti, Op. Cit.. 1978-79, pp.101-102; Though he graded the Indian Art to be higher than that of Egypt, it did not come up to the standard of Classical Greek or Roman Art.

13. Discussed at length in Ronald Inden, 'Orientalist Constructions of India', MAS, Vol.20, no.3, 1986, pp.401-406.

14. It is pointed out that this was done for most fields of Indian study as a professional medium to represent India in neat scientific packages. See Gyan Prakash, 'Post Orientalist Histories of the Third World: Perspectives from Indian Historiography', CSSH. Vol.32, no.2, 1990, pp.356-387.

15. J.Princep, 'On the Edicts of Pr1yadas1 of Ashoka', JASB. Vol.7, 1838, pp.219-220.

16. William Erskine, 'Account of the Cave Temples of Elephanta', TLSB. Vol.1, 1819, pp.190-250.

17. James Tod, 'Remarks on Certain Sculptures in the Cave Temples of Ellora', IRAS, Vol.11, pp.328-329.

18. Captain Harkness's Preface to Ramraz's Essays on the Architecture of the Hindus. London, 1834, p.iii.

19. Pramod Chandra, The Study of Indian Architecture. Varanasi, 1975, p.2.

20. Ibid, p.10.

21. See Marshall's introduction to ARASI: 1902-03. Delhi, Reprint 1970, p.2.

22. J.Burgess, Notes on Amaravati Stupa. Madras, 1882; The Buddhist Stupas of Amaravati and Jaggayyapeta. London, 1887.

23. A.Rea, South Indian Buddhist Antiquities. Madras, 1894; Chalukyan Architecture. Madras, 1896.

24. R.Sewell, Lists of Antiquarian Remains in the Presidency of Madras. Madras, 1882; Lists of Inscriptions and Sketches of Dynasties of South India. Madras, 1884.

25. A.Rea, 'Excavations at Amaravati', ASIAR: 1905-06. 1909, pp.116-119; 'Buried Jaina Remains at Danavulapadu', ASIAR: 1905-06, pp.120-127; 'Ancient Village site at Peddamudiyam', Ibid, pp.128-130; 'A Buddhist Monastery on Ramathirtham Hills, Vizagapatnam district', Ibid for 1910-11, pp.70-80.

26. See Annual Report of the Department of Archaeology in HEH The Nizam's Dominions, from 1914 onwards which are available with the Department of Archaeology and Museums, Government of Andhra Pradesh, Hyderabad.

27. J.Dubreuil, Dravidian Architecture. Madras, 1917.

28. Pramod Chandra, Op. Cit. 1975, p.27.

29. This essay was first published in Eastern Art. Vol.11 and III in 1931. Now available in the form of a monograph (Delhi, 1977). Also see his 'Symbolism of Dome', IHQ, Vol.XIV, 1938, pp.1-56; 'Indian Architectural Terms', JAOS. Vol.XLVIII, 1928.

30. K.V.Raman, 'Coomaraswamy on Early Indian Architecture' in, K.K.Dasgupta (ed.), Ananda Coomaraswamy- A Centenary Volume, Calcutta, 1981, p.49.

31. S.Kramrisch, The Hindu Temple, 2 Vols., Calcutta, 1946.

32. P.K.Acharya, An Encyclopaedia of Hindu Architecture. Manasara Series, Vol.VII, London, 1946.

33. H.D.Sankalia, 'Regional and Dynastic Study of South Indian Monuments', ABORI, Vol.XXI, 1941, pp.213-228.

34. Percy Brown, Indian Architecture (Buddhist and Hindu), vol.1, Bombay, 1948.

35. M.H.Khureishi, 'Trial Excavations at Alluru, Gummadidurru and Nagarjunakonda', ASIAR: 1926-27. pp.5-10.

36. A.H.Longhurst, 'Excavations at Nagarjunakonda', ASIAR: 1927-28. 1931, pp.43-121; Ibid. 1928-29, 1933, pp.110-104; Ibid. 1929-30, 1935, pp.144-151.

37. P.Srinivasachar, The Ramappa and Other Temples at Palampet. Hyderabad, 1953.

38. K.V.Soundara Rajan, Architecture of the Early Hindu Temples of Andhra Pradesh. Hyderabad, 1965; Indian Temple Styles. Delhi, 1982 and Early Kalinga Art and Architecture. Delhi, 1984.

39. M.Rama Rao, Select Kakatiya Temples. Tirupati, 1962; Early Chālukyan Temples of Andhradesa. Hyderabad, 1964; Temples of Kalinga. Tirupati, 1965.

40. M.Radhakrishna Sarma, Temples of Telingana. Hyderabad, 1972.

41. For instance, out of 61 topics registered for Ph.D. and M.Phil degrees in Andhra University, Waltair upto 1987, there are seven topics on the study of Temple architecture, e.g., K.Sundaram's The Simhachalam Temple. B.Mastanaiah's The Temples of Mukhalingam. S.Nageswara Rao's Temples of Bikkavolu. etc. In Nagarjuna University, Guntur, there are also seven topics on temple architecture e.g., Srisailam Temple Art & Architecture. G.Kamalakar's Temples of Renadu. etc. For more details on the topics of other universities in the State, see PAPHC. 11th Session, 1987, Appendix II 'Research Topics in the Universities of Andhra Pradesh'.

42. Aparajitaprccha. Baroda, 1956; Viśwakarma Vastu Sastra, Tanjore, 1958; Tantra Samuchchaya. N.V.Mallayya (ed.), Trivandrum, 1958.

43. P.O.Sompura, Prāsādamañjari. Palitana, 1965.

44. Bruno Dagens, Mayamata. Pondicherry, 1970.

45. P.O.Sompura, 'The Vastu Vidya of Viswakarma' in, Pramod Chandra (ed.), Op. Cit.. 1975.

46. H.Sarkar, 'A Study of the Adhistanas in Early Temples of Andhra Pradesh', JAHRS. Vol.XXXV, 1975-76, pp.317-320, pl.63.

47. R.Subrahmanyam, 'Brahmanical Structures at Nagarjunakonda', Itihas. Vol.VIII, 1981, pp.1-13.

48. I.K.Sarma, The Development of Early Saiva Art and Architecture. Delhi, 1982.

49. B.Rajendra Prasad, Chalukyan Temples of Andhradesa. Delhi, 1983.

50. Y.Gopala Reddy, The Ghanpur Group of Temples. Hyderabad, 1985.

51. M.W.Miester and M.A.Dhaky (eds.), Encyclopaedia of Indian Temple Architecture (Lower Dravidadesa), Varanasi, 1986.

52. R.Subrahmanyam, Salihundam: A Buddhist Site in Andhra Pradesh. Hyderabad, 1964.

53. H.Sarkar, Studies in Early Buddhist Architecture of India. Delhi, 1966.

54. A.Waheed Khan, A Monograph on the Early Buddhist Stupa at Kesanapalli. Hyderabad, 1969.

55. Debala Mitra, Buddhist Monuments. Calcutta, 1971.

56. I.K.Sarma, Early Buddhist Monuments and Brahmi Inscriptions of Andhradesa. Nagpur, 1986.

57. V.V.Krishna Sastry, et al, Thotlakonda (A Buddhist Site in Andhra Pradesh). Hyderabad, 1992.

58. N.S.Ramachandra Murthy, Forts in Ancient and Medieval Andhra: A Study. Ph.D. Thesis (unpublished), Karnataka University, Dharwar, 1981.

59. T.V.G.Sastry, et al, Veerapuram: A Type Site in Krishna Valley. Hyderabad, 1984.

60. V.V.Krishna Sastry, The Proto and Early Historical Cultures of Andhra Pradesh. Hyderabad, 1983.

61. C.Margabandhu, The Archaeology of the Satavahana Kshatrapa Times. Delhi, 1986.

62. K.Rama Mohan Rao, Early History of Andhrades'a from the fall of the Satavahanas to the rise of Eastern Chālukyas. Ph.D. Thesis (unpublished), Karnataka University, Dharwar, 1981.

63. R.Subrahmanyam, 'Secular Remains at Nagarjunakonda', JAHRS. Vol.XXXVIII, pt.IV, pp.1-42.

64. N.C.Ghosh, Satanikota Excavations: 1977-80. Delhi, 1986.

65. N.Ramakrishna Rao, 'Explorations around Gandharikota', ARAP: 1990-91. (cyclostyled), pp.11-16.

66. B.R.Allchin, The Rise of Civilization in India and Pakistan. New Delhi, 1983.

67. R.P.Kulkarni, 'Engineering in Ancient India', VKP, Vol.12, no.1, Madras, 1983.

68. F.R.Allchin, Utnoor Excavations. Hyderabad, 1961.

69. Amita Ray, The Villages, Towns and Secular Buildings in Ancient India. Calcutta, 1964.

70. R.Subrahmanyam, Nagarjunakonda-I (1954-60). Delhi, 1975.

71. Amita Ray, Life and Art fif Early Andhradesa. Delhi, 1983.

72. V.V.Krishna Sastry, Op. Cit. • 1983.

73. C.Margabandhu, Op. Cit.. 1986.

74. N.C.Ghosh, Op. Cit.. 1988.

75. R.Subrahmanyam, Op. Cit.. 1987.

76. K.Krishna Murthy, Early Indian Secular Architecture. Delhi, 1987.

77. Jyothindra Jain, 'Parallel Structures' in Kapila Vatsyayan (ed.), The Concept of Space Ancient and Modern. Delhi, 1991, pp.344-354.

78. D.R.Raju, Stoneage Hunter-Gatherers (An Ethnographic Study of Cuddapah District). Poona, 1989.

79. Andreas Volwashen, Living Architecture - India. Calcutta, 1969.

80. Kirit Mankodi, 'Scholar Emperor and Funerary Temple Eleventh Century Bhojpur', MARG, Vol. XXXIII, no. 2, 1990, pp.

81. Alice Boner, S.R.Sarma, New Light on Sun Temple of Konark. Varanasi, 1972.

82. K.S.Behera, 'Palm-Leaf Manuscript on the Architecture of Konark Temple', ABORI. Vol.LVII, pts.I-IV, pp.176-180.

83. M.H.Chakravarti, 'Mādala Panji', JASB. Vol.IV, no.2, NS, p.322. Appendix.

84. K.S.Behera, Op. Cit.. 1978, p.180.

85. Christopher Tadgel, A History of Architecture in India. Delhi, 1990, p.351.

86. Ibid. p.351, see foot note no.51.

87. Gerald Colas, 'Some Remarks about the Construction of the Temple according to Marīchi Saṁhita', SVUOJ. Vols.XXI-XXII, pts.1-4, pp.43-50.

88. P.V.P.Sastry, The Kākativas of Warangal. Hyderabad, 1978, pp.300-303.

89. K.V.Soundara Rajan, 'Tamil Temple Architecture and Art', Marg. Vol.XXXIII, no.2, 1990, p.16.

90. M.Pandu Ranga Rao and others, Geotechnical Appraisal and Evaluation of Kakatiya Monuments. Warangal, 1991 (cyclostyled).

91. E.Siva Nagi Reddy and B.Subrahmanyam, 'Material and Techniques of Kakatiya Temples' a Paper presented at a National Seminar on The Kakatiya Art & Architecture, held at Telugu University, Srisailam Campus, Nov.17-19, 1991, (typed 27p.).

92. O.C.Kail, The Cave Temples of India, London, 1971.

93. Vidya Dehejia, Rock-Cut Temples of India. London, 1972.

94. Vidya Dehejia, Looking Again at Indian Art. Delhi, 1978.

95. S.Nagaraju, Buddhist Architecture of Western India. Delhi, 1981.

96. S.P.Gupta, The Roots of Indian Art. Delhi, 1981.

97. R.P.Mohapatra, Udavagiri and Khandagiri Caves. Delhi, 1981.

98. I.K.Sarma, Op. Cit.. 1986.

99. E.Siva Nagi Reddy, 'A Report on the Discovery of a few Rock-cut Cells around Gopalapatnam near Tuni, Visakhapatnam District' (typed). Available with the Dept. of Archaeology and Museums, Hyderabad, 1994.

1.2 GEOGRAPHICAL SPACE

\2 GEOGRAPHICAL SPACE

For any writing of regional history the definition of the geographical space is an important dimension. However, these geographical spaces of the past must necessarily be highlighted in the context of the historical and cultural landscapes that give meaning to it from time to time. In one sense vivid images of ancient geographical spaces can only be understood either, when historical texts tell us about them or, when monuments located in particular localities indicate to us ancient landscape patterning. Though historians and archaeologists have for quite sometime been aware of the importance of geography for the study of past cultures and events, it is only recently that theoretical and conceptual approaches of how this should be done have emerged in publications pertaining to different countries.[1] In the particular context of our study of building technology, the archaeological potential of indentifying past human occupation and activity has been fully exploited. This has been done by way of mapping historic structures at a regional level which preserve certain essential features of ancient environments. In explaining the importance of 'applied historical geography', Denecke informs us that one of the best ways of doing this is with the help of conservationists of old buildings and architects, who can document them in the best possible way. These structures then manifest themselves as a "visible past" and "represent human activity and thought from the past".[2] More importantly, he informs us that historical geographers must appreciate that all kinds of past structures are "integerated parts of ancient landscape" and therefore, in his opinion such endeavours, i.e., "Research on past landscapes and vanished places of former human occupation then becomes an obligation of landscape conservation and of preservation and restoration of field monuments".[3]

The attempt in the following pages of this chapter is to define the region of study with the help of ancient literary sources, inscriptions and more recent documents like gazetteers and census reports. Most significantly, it is attempted to locate the extant monuments against the geographical background of four sub-regions delineated by us. Whereas historical change is perceivable 1n the nature and variety of monuments that dot the cultural landscape from time to time, geographical change is directly less perceivable but is implicit in surviving structures of old centres of towns or villages. This historico-geographical survey of early Andhradesa has been plotted by us in the maps accompanying the various chapters of this dissertation **[Maps** I to **XI].**[4] We would like to emphasize at the outset that though definitions of Andhrades'a as a political and administrative entity have been many and ever contestable, the boundaries of its geo-cultural identity have been changing only to be more integerative and incorporative as far as it has been possible to do so. The spread of the Telugu language has been taken by us to be an important criteria to define this space. Interestingly, this spread coincides with certain delimiting geographical boundaries which, in some directions, are more severe than in others. Nonetheless, if these are firm, at the same time flexible, geo-cultural boundaries that have enabled us to identify the area of our study, rather than the contestable political boundaries, which, in any case, have always been changing and defy a stable definition for the period of our study which covers a long span of time from the earliest habitations in the region upto the 14th century A.D.

Based on archaeological sources it can be suggested that Andhradesa has seen continuous human habitation since pre-historic times and the antiquity of terms Andhra/Andhradesa can be gleaned from literary and epigraphical sources. The term Andhra to denote race or people has been found recorded in some of the earliest literary works known on the Indian sub-continent. The earliest reference to the term Andhra is the name of tribe and this is made in the Aitareya Brāhmana.[5] This speaks of them as the exiled sons of Visvamitra who were considered outside the pale of civilised life. The same Brahmana[6] counts the Andhras to be socially parallel to other tribes such as the Pundras, Sabaras, Pulindas, etc. Of these, it is suggested, that the Sabaras can be identified with the present day Sabaras of the Visakhapatnam-Srikakulam tract.[7] The term Andhra to denote a race is also mentioned in the Sāṅkhyāyana-Srauta Sutra.[8] Among some of the later historical works, Megasthanese motions that the Andhra were a seperate race.[9] Even to this day there is an aboriginal tribe known by the name 'Andh' in the Adilabad district of Andhra Pradesh which is believed to be an off-shoot of an ancient race.[10] Gopalachari[11] emphatically affirms that the country Andhrades'a derived its name from the people called the Andhras, whom he has defined as a tribal group most of whom, according to him, had settled down in the valleys of the Godavari and the Krishna. Thus, the name Andhra is commonly established in an ethnological sense; a name derived from an autochthnous tribe called Andhras.[12]

Early Buddhist literature contains many references to the Andhras and their country. The Suttanipāta story of Bavari mentions Assaka as an

Andhra janapada.[13] In some of the Buddhist texts, the Andhakas are mentioned along with the Mundakas, Kalakas and Cinas.[14] The Kumbha and Samkicca Jatakas. refer to the Andhakas as well as to Andhra country and to an Andhra city.[15] The Bhīmasena and the Serivani.ia Jatakas describe the Bodhisatva's journey to Andhradesa.[16] Bhandarkar suggests that Andhapura, mentioned in the Serivani.ia Jataka is to be placed on the river Televaha, identical with the modern Telugu or Telingiri, a tributary of the Mahanadi in the Eastern Deccan.[17] In the Suttanipāta the land of domicile of the Andhakas is identified on the banks of the Godavari and it was referred to as Andhakaratta.

In the classical accounts of the Greeks too the Andhras as a people have been mentioned. Megasthanese[18] noted that the Andhras were second only to the Mauryas in military might, having possessed 30 fortified cities with an army which consisted of 2000 elephants, 3000 horses and 1,00,000 infantry. Charaka who 1s generally believed to be the court physican of the great Buddhist monarch Kanishka mentions the Andhras.[19] The famous Indian epics also refer to the Andhras as a people. For instance, in the Mahabharata.[20] it is said that Sahadeva, the younger brother of the Pāṇḍavas, conquered the Pāṅdyas, Drāviḍas, Udaras, Keralas and the Andhras. It also speaks of the Andhras and Odhras as neighbours of each other.[21] The Prakrit work, Kuvalavamāla of Udyotana Suri refers to the Andhras and their language.[22] The Mārkandeya Purana mentions the Andhras as a southern people.[23]

Andhra country too finds frequent mention in the ancient texts. According to a Buddhist tradition, the Andhra country had rich and fertile soil.[24] Varahamihira has mentioned the Andhra country as situated towards the south of the Vidarbha, Videha and Chedi countries.[25] Hieun Tsang[26] in the 7th century A.D. refers to Andhra as An-To-Lo, which was said to be situated to the south of Kosala within a distance of 900 li. Jayamangala, the commentator of the Kama Sūtra, locates the Andhra country to the south of the Narmada and to the east of Karnata Vishaya within Daksinapatha.[27] Dandin in his Daśakumāracharitra speaks of the country as lying to the south, west of Kalinga and calls the capital of Vengi as Andhra nagari.[28] The name Andhra as a river has been mentioned in the Bhāgavata Purana[29] which is datable to roughly between the 8th and 9th centuries A.D. Yadava Prakasa's Vaijayanthi located the Andhra country in Eastern India.[30] The Pratāparudriyam of Vidyanatha describes that the land surrounded by Srisailam, Draksarama and Kalesvaram was known as Trilingadeśa.[31] Kumarilabhatta,[32] the commentator of Jaimini's Pūrvamīmāmsa Sutras written during the 8th century A.D., refers to the Andhra-Dravida Bhasha. A Jaina work, Jinavijaya in reference to Kumarila says, that he was an Andhra, born in village called Jayamangala, situated on the border land of Utkala and Andhra countries.[33] The Anargharaghava mentions that the river Godavari passes through the country of Andhra and its chief deity is Mahadeva Bhimesvara. The Saktisangama Tantra draws the distinction between the Andhra country and another land which it calls Tailanga deśa.[34] It has to be noted that the author of this work for the first time separates Andhra from Telangana and also from Kalinga. At the same time, the work refers to Andhradesa as the country which stretches from Jagannatha (Puri) to the shrine of Bramarambika of Srisailam.[35]

Inscriptions also provide considerable information on the term Andhra and its various connotations as a people, a language and as a country.

Among the epigraphs, the earliest is their mention in the Asokan Rock Edict XIII, which refers to Andhras along with the Bhojakas, the Pitinikas and the Pulindas.[36] The next record that refers to Andhras are the Mayidavolu plates of Pallava Sivaskandavarma[37] dated to the 4th century A.D. It mentions the tract of Andhrapatha and its capital Dharanikota which is considered identical with the modern Dharanikota, near Amaravati in the Guntur district of Andhra Pradesh. In the Haraha inscription[38] of the Maukhari King Kumara Gupta III (554 A.D.), a certain lord of Andhras is said to have given the Maukhari King great trouble by his thousands of three-fold rutting elephants. The identification of the Andhradhipati of the inscription is with a King of the Vishnukundin period and the Kingdom was known then as Andhra according to D.C.Sircar.[39] In the Jaunpur inscription of Isvara Varman, the Maukhari King refers to a victory over the Andhras on behalf of Isvara Varman.[40] In the Eastern Chālukyan records, the name Andhra has been applied to a wide region bounded on four sides by the Eastern Ocean, the Kalahasthi hill, the Mahendra mountain and Srisailam.[41] The Udayendiram Plates of Vikramāditya II also mention the land lying to the west of Andhrapatha.[42]

The Indian Meseum Plates of the 9th year of Narayana Paladeva of the Pala dynasty refers to Āndhra Vaishayika Śakva Bhikshu Sthavira Dharmamitra,[43] who erected an image of the Buddha. It is stated in one of the inscriptions of the Velanāḍu chief Gonkaraja, that Andhradesa consisted of fifty lakhs of villages.[44] Velanāṭi Kulottunga Rajendra Chola II in his records called himself, the general and vassal of Rajaraja II, the Chālukya-Chola emperor, and has also mentioned that he received from him the Andhra country bounded on the four sides by the Eastern Ocean, the

Kalahasthi hill, the Mahendra mountain and Srisailam.[45] In an inscription of the Vakataka King Harisena[46] there is mention of his conquest of the Kalinga and Andhra countries. The patron god whose temple was built at Srikakulam was called Andhra-Visnu, either, because his worshippers were the Andhras and their empire is said to have extended upto the banks of river Krishna with their capital at Dhanyakataka or because a mythical personage of that name was said to be the progenitor of the Andhra King.[47] A record dated to 1192 A.D. in the tenth year of Kulottunga Chola II issued by Velanāṭi Gonka at Draksarama, mentions the king as the supreme Lord of Andhras.[48] In a 13th century inscription, Hanumakonda is described as the "ornament of the Andhra country".[49]

Throughout the early historic and early medieval period we notice a change in the meaning of the term 'Andhra', initially as a name of people or tribe. The name as a suffix to a country developed later and the extent and limits of this country also underwent change from time to time. Most often inscriptions referred to the political boundaries of Andhra country 1n relationship to the Kings that ruled over this territory. The above references clearly show the familiarity of the Andhra people and country to contemporary writers, located every where in India and to political chiefs in their inscriptions through the centuries. The broad geo-cultural as well as territorial delineation of Andhra country however, has not been specified in many of these early sources. We next turn to examine this aspect from the medieval period onwards as sources are relatively more specific from the 14th century onwards. The references discussed below for the medieval period, for the first time, bring out clearly the question of the relationship between Telangana and Andhra.

By 14th century A.D., the name Andhrakhandamandala came to be restricted to the territory that extended from the Gautaminadi to the border of Kalinga.[50] In the Srirangam Plates dated to 1358 A.D., it is stated that the Telinga country is bounded 1n the north by Kanyakubja, on the west by Maharastra, on the east by Kalinga and on the south by Pandyaka and there is also a reference to the emperor of the Kakatiyas in these Plates.[51] Kakatiya Rudra's realm was called Tillanga in the Vratha Khanda of Hemadri. He also mentions the term Andhra as applying to the same country when he refers to Queen Rudramba, the daughter of Ganapatideva.[52] In an inscription of Mudukidare[53] from south Kanara dated to 1429 A.D., it is stated that Devaraya II of Vijayanagara, besides vanquishing a large and powerful body of Muslim cavalry, destroyed the elephant forces of the Gajapati and the vast army of the King of the Andhras.[54] The Andhra King of the above inscription has been identified with the Velama ruler of Rachakonda. It is however, in an inscription of the 16th century A.D., that the two names of the kingdom are combined in the expression, Andhra-Trilinga-Madhyama country.[55]

The earliest form of the name Telangana is perhaps Trilinga corresponding to the Trilingon of the classial writer Ptolemy and Trilinga of the Purle Plates of the Ganga King Indra Varma dated to 647 A.D. A Kurgod inscription of the later part of the 12th century A.D. had the form Telunga. Amir Khusro has reference to Tilung and Abul Fazl to the term Tilingāna.[56]

It is only very recent history, when the Andhra and Telangana regions highlight their identity in absolute terms. Thevenot, a 17th century traveller notes that Telangana was the principal province of the Deccan and its boundaries reached as far as the Portuguese lands towards Goa and Bijapur. It was bordered on the east by the kingdom of Golconda, on the west by the provinces of Baglana and Bijapur, on the north by the Balaghat range and on the south by the Vijayanagar empire.[57] After the collapse of the Vijayanagar empire and the gradual decline of the Bahmani kingdom, with the exception of certain parts of southern Andhra, the entire Andhra region was under the Qutub Shahi rule.[58] From 1687 A.D., Golconda became one of the provinces of the vast Mughal empire.[59] The kingdom of Golconda included the districts of Kaulas, Elgandal, Medak, Warangal, Muhammadnagar, Bhongir, Nalgonda, Khammammet, Koilkonda, Devarakonda, Ghanpur, Pangal, Eluru, Rajahmundry and Srikakulam, including Kondavidu and Kondapalli. The Golconda province of the Mughal empire comprised of the land between the two rivers, Godavari and Krishna, and a small territory to the south of river Krishna upto the Gundlakamma rivulet. The fall of Golconda ushered in a new dynasty of rulers called the Asaf Jahis[60] who ruled over the districts of Nalgonda, Pangal, Elgandal, Warangal, Kondapalli, Eluru, Machilipatnam, Rajahmundry, Chicacole, Guntur, Nizampatnam, Khammammet, Bhongir, Medak, Ghanpur, Koilkonda, Ramgir, Molangur. The above districts comprise the then Andhradesa, exactly the land between the two rivers Krishna and Godavari, in addition to Chicacole on the north-eastern border of present day Andhra Pradesh. The British East India Company concluded an agreement with the Nizam in 1765 A.D., in which the Circars of Srikakulam, Rajahmundry, Eluru, Mustafanagar and Murtujanagar, except the Guntur Circar were given to the Nizam's government. Later on, the authority in the Guntur Circar was transferred to the East India Company in September 1788.[61] In 1800 A.D., the Nizam of Hyderabad ceded the districts of Cuddapah, Kurnool, Bellary and Anantapur to the British. These districts were called the ceded districts of the present day Rayalaseema region of Andhra Pradesh. Subsequently, the British occupied the Nellore and Chittoor districts defeating the Karnataka Nawab. However, it was only by 1815 that the British succeeded in restoring their order into the coastal districts[62] of present day Andhra Pradesh by incorporating them under their rule.

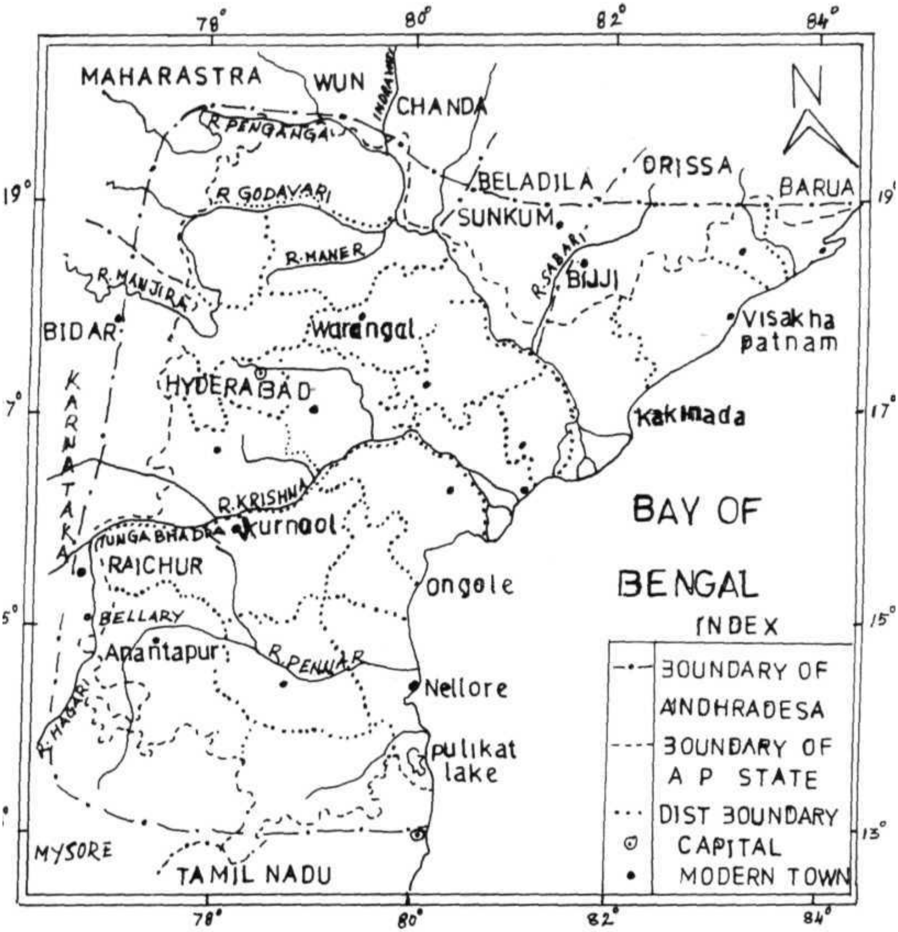
The Andhras at the time of independence thought that the exit of the Britishers would facilitate the early formation of the Telugu speaking areas as a separate State but this was delayed. The agitation for a seperate Andhra province therefore took a long time but as early as 1913, a resolution had been passed by the Andhra Mahasabha demanding a separate province. In the meanwhile, due to the policy of Sardar Patel, a democratic government was introduced in the dominions of the Nizam in 1952 and this kindled the hopes in the hearts of Telugu people that a full-fledged Telugu speaking State would certainly materialise in the near future. Sri Potti Sriramulu (1901-1952 A.D.) took up a fast unto death for the achievement of the formation of such a separate State. The Union government responded to the peoples' demand, and the Andhra State was constituted by separation of the undisputed Telugu speaking territories of 11 districts and 2 taluks from the Madras State in 1953. Later, as a result of the decision of the Union Government on the report of the States Reorganisation Commission on 1st November, 1956,[63] the State of Andhra Pradesh, which comprises the Andhra area of the Andhra State and Telangana area of the Hyderabad State was inaugurated by Jawaharlal Nehru, the Prime Minister of India.[64]

The recent historical changes in the formation of the present day state of Andhra Pradesh can be contrasted with the situation of this region in medieval times. It can be noted for instance, that the term Andhradesa during the post-Kākatiyan period was applied to the region around the present-day Godavari, Krishna and Guntur districts, whereas the term Telangana was applied for the Telugu speaking area of the northern part of the State, bordering Maharashtra. The State in its present form was never entirely ruled by a single monarch nor, had it come under the sway of a single dynasty but was ruled simultaneously by more than one ruler from different centres. The above study leads us to conclude that the term Andhra, over a historical time had different connotations alluding to either a general term for a people, or a specific tribe, or yet again to a territory or language from the different sources dealt with above. The territorial and administrative division of Andhra, underwent many changes at the hands of various political powers and we can notice that there was instability even 1n terms used to describe the administrative boundaries of Andhradesa from time to time. A broad political definition coinciding with a cultural indentity of the region emerged gradually, and can be gleaned from inscriptional sources of Andhra till about the 13th century A.D. Thus a regional identity of the Telugu speaking people in a full-fledged manner emerged from the medieval period onwards.

Against the above background of the changing definitions of Andhradesa in the indigenous literary and inscriptional sources, we may observe the definitions given by Campbell and Grierson for the Telugu speaking areas at the turn of the 19th century. In 1898 A.D.,Campbell[65] defined the Andhradesa, in terms of the limits of the Telugu language. Sir George Grierson[66] of the Linguistic Survey of India also gave importance to this factor and defined Andhradesa as follows: "The Telugu country is bounded towards the east by the Bay of Bengal from Barua in the Ganjam district in the north to near Madras in the south. From Barua, the frontier line goes westwards through Ganjam to the eastern ghats and then southwards, crosses the Sabari on the Sunkam and Bijji taluks in the State of Bastar, and thence runs along the range of Bela Dilla to the Indravati, it follows this river to its confluence with the Godavari and then runs through Chanda cutting off the southern part of that district and further eastwards including sourthern border of the district of Wun. It then runs southwards to the Manjira and thence farther southwards towards Bidar where the Telugus meet the Kanarese. The frontier line between the two forms of speech then runs almost due south through the dominions of the Nizam. The Telugu country further occupies the north-eastern edge of Bellary and greater eastern corner of Mysore. Through North Arcot and Chingleput the border line then runs back to the sea" [Map II].

This description has given a broad geographical location of the country known from its linguistic affiliation to the Telugu language. It therefore, includes those areas of bilinguism within its purview, which does not exactly coincide with the present day linguistic boundaries of the State of Andhra Pradesh. Infact, it is larger than it. The above definition broadly helps us to undersand the cultural formation of this region in border zones where two languages co-exist. These cultural boundaries are very different from the political or administrative ones described in the earlier sources and as noted above these have been changing from time to time. Cultural boundaries too change but they are closer to the geographic delineations of regions and sub-regions which are

MAP II



LINGUISTIC IDENTITY OF ANDHRADESA

(A 19TH CENTURY DEFINITION)

rooted in a particular specificity and we turn to examine this next. It may also be noted that geographical changes take place at a slower pace when compared to any historical, political and administrative change that a region undergoes.

It is necessary to study the physical setting of ancient Andhradesa to suggest that the geographical background had changed at the slowest pace and therefore, this is the most appropriate way to describe the cultural delineation of ancient Andhradesa. History is influenced to a larger extent by its geographical features since man has conditioned his life and subsistence pattern by exploiting nature. The influence of geography can be seen not only in economic prosperity but also in the political and military spheres. The communication systems of any region of any period had a great influence of the geography of that particular area. According to B.Subba Rao,[67] the cultural development in space and time was controlled by the geographical features of the regions and the relative effectiveness of its barriers, physical and human. E.W.Gilbert[68] also opines that, "Geography is the art of recognising and describing the personality of regions". In a brilliant analysis of the relationship between Indian History and Geography, Richards[69] has indicated that the main transcontinental communication system was based on the geographic factors of the region. Subba Rao[70] further rightly observes: "the horizontal expansion of the cultures has to some extent been retarted by the geographic and factors of a particular region". The technological attainments of a society, from time to time, are also determined by the interaction of geographical factors, with the level of material existence which, in turn, shapes the economic structure of that society.[71] A proper understanding of any particular region demands the knowledge of its cultural traits in addition to its geographical extent.

The geographical limits of ancient Andhradesa naturally include the present day boundaries of the State of Andhra Pradesh but, in the particular context of this study, embedded as it is, in an ancient and early medieval period, the contiguous regions bordering the State have also to be taken into account. In other words, we have not adhered to a rigid boundary, for making ancient Andhradesa coincide with the modern State boundaries. This is a must because to understand the broad parameters of the development of building technology, those in the adjacent States of Karnataka, Maharashtra, Madhya Pradesh, Orissa and Tamil Nadu cannot be lost sight of. Buildings located especially in the border regions of various present day linguistic States, have features which are similar to each other and this calls for a comparative study. The study of building technology in Andhradesa has to be therefore, projected against the salient geographical features of the land we undertake to describe phsiographically which must include the border regions cutting across present day State boundaries of Andhra Pradesh.

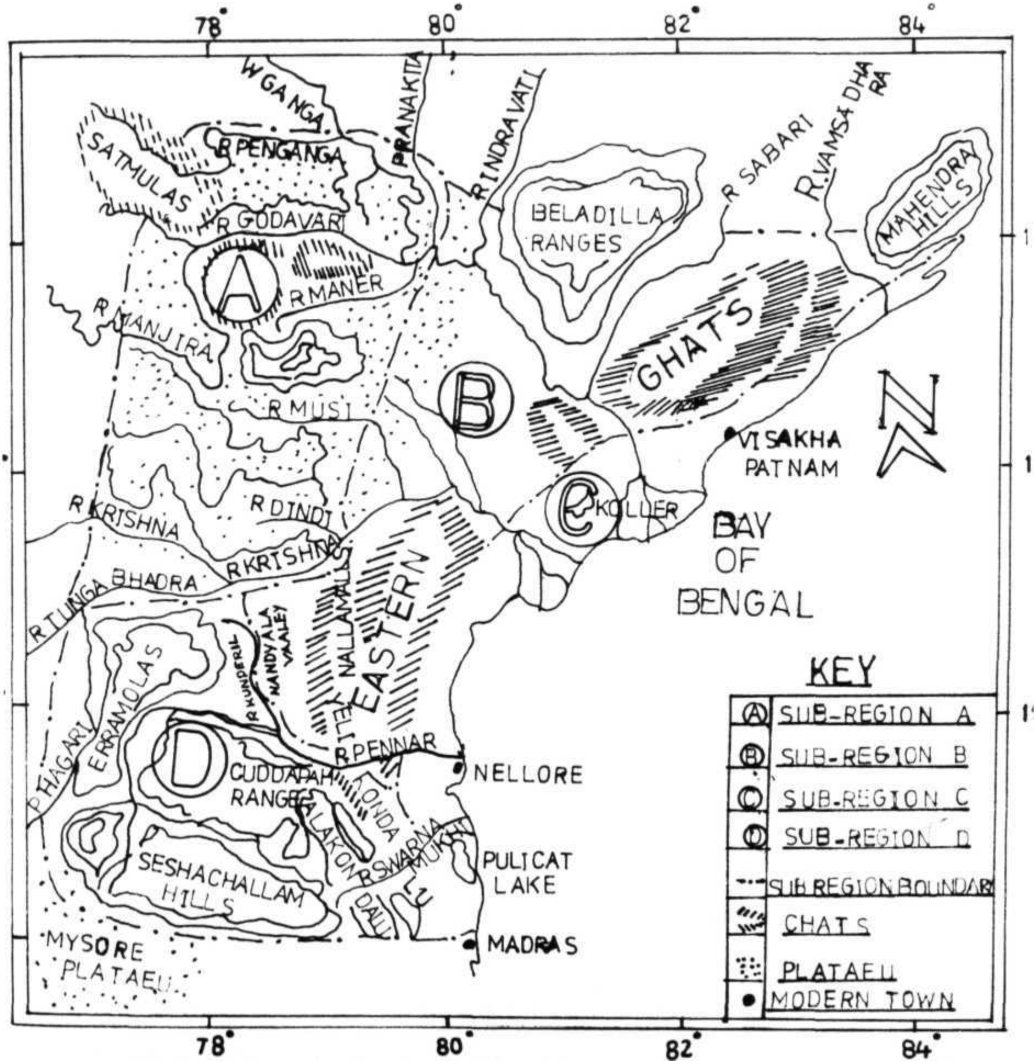
Since the present day State of Andhra Pradesh is essentially part of our definition of ancient Andhradesa, a brief topography of the State is furnished below for convenient reference. Andhra Pradesh, a State of the Indian Union, lies between 12^o 46' and 19^o 54' north latitudes and 76^o and 84^o 46' east longitudes. Excluding the natural nautical boundaries of the Bay of Bengal on the east, the State is bound by the States of Maharastra on the north, Madhya Pradesh and Orissa on the north-east, Karnataka on the west and Tamil Nadu on the south. The State has an area of 2,76,754 sq.km.

forming 8.4% of the total land of the country, with a coastal line of 970 kms.[72] Topographically, the State has three geo-political regions, viz., Coastal Andhra, Telangana and Rayalaseema. Coastal Andhra consists of the present day districts of Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore. The Telangana area situated on the north-western part of the plateau is composed of the modern districts delineated as Adilabad, Nizamabad, Karimnagar, Medak, Hyderabad, Rangareddy, Warangal, Khammam, Nalgonda and Mahboobnagar. The Rayalaseema area on the south-western part of the State consists of the districts of Anantapur, Kurnool, Cuddapah and Chittoor.[73]

To make the physical configuration of Andhradesa far more inclusive we must recognise that it presents varied geographical regions with their attendant historical and cultural peculiarities. As a Working outline, we draw upon Grierson's definition[74] of the cutlural limits where the Telugu language had existed at the turn of the last century to begin to delineate this geographical region. We have divided the area, with its heterogenity into four sub-regions. The rationale for our sub-regional demarcation lies in the fact that there are geographical and topographical differences and variations within the broader region of Andhradesa. The four sub-regions denoted as A, B, C and D in the accompanying maps [Map III] have been defined in the following way:

Sub-region A on the north side is bordered by the river Penganga from the Satmula range and continues upto the meeting point of the river Wainganga and from there onwards it is called as the river Pranahita. The eastern border line falls on the river Pranahita which crosses the river

MAP III



DELINEATION,. OF SUB REGIONS AMD PHYSIOGRAPHY OF ANDHRADESA

Godavari and then runs along the river Maner which further continues crossing the rivers Paler, Aler, Musi, where it turns in the southward direction and proceeds further crossing the river Halia until the point where another river Dindi meets the Krishna and takes the line along the river Tungabhadra until the river Hagari meets it and finally, the western border starts from the merging point of the Hagari and passes northwards crossing the rivers Manjira and Godavari upto the Penganga [Demarcated on Map III].

Sub-region B: The northern boundary of this sub-region starts from the Pranahita river, crosses the river Indravati, further runs eastwards along its course touching the Bela Dilla ranges and then moves towards the east, crossing the rivers Langulya, Vamsadhara and Nagavali into the Eastern Ghats and then to the sea coast. Its eastern limit starts from the Mahendra hills on the east which takes a southward direction all long the eastern ghats on their western side crossing the rivers Godavari, Krishna and Pennar upto the river Swarnamukhi in the south. The southern border of this sub-region takes its line from the meeting place of the rivers Krishna and Tungabhadra, then goes towards the south along the Kunderu river course cutting across the Nandyala valley and then towards the east by the Pennar river, upto the Velingondalu ranges which again take a southward direction upto the Swarnamukhi river and finally, the western border falls exactly on the eastern border of sub-region A described above [Demarcated on Map III].

The western border line of sub-region C falls on the eastern border of sub-region B described above and the coast line forms its eastern boundary. The southern limit of this sub-region starts from the Veligondalu ranges, crosses river Swarnamukhi and further extends upto the sea on the east.

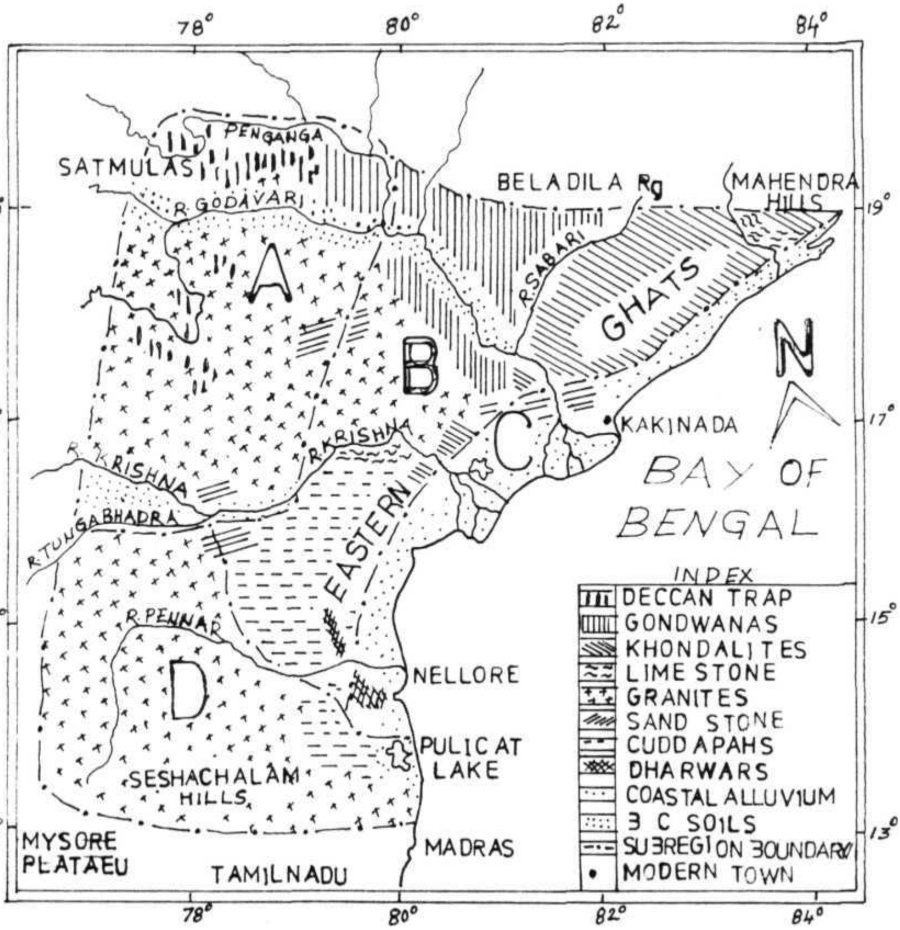
Sub-region D: The northern boundary of this sub-region falls on the southern boundary of the sub-region A which follows the river Tungabhadra upto its confluence with the river Krishna, then takes a slope towards south-eastern direction following the Kunderu and Pennar rivers upto the western side of the Eastern Ghats, where 1t turns towards the south ultimately on the northern side of the Pulicat lake. The eastern border becomes the coast line between the Pulicat lake and the mouth of the Swarnamukhi river. The southern boundary of this sub-region tallies with that of the southern border of Grierson's definition of Andhradesa defined above. The western limit of sub-region D starts from the confluence of the river Hagari with Tungabhadra on the north, which cuts across the north-eastern portion of the Mysore plateau.

Sub-region A broadly lies to the south of the river Penganga and north of the river Tungabhadra and this includes the western and northern Telangana area of the present day districts of Adilabad, Nizambad, Karimnagar, Medak, western part of Warangal, Hyderabad, Rangareddy, Mahboobnagar and parts of Nalgonda. The contiguous regions of the neighbouring States are southern parts of Nanded, Yavatmal and Chandrapur districts of Maharashtra, the eastern parts of the districts of Bidar, Gulbarga, Raichur, Bellary, Chitradurg, the northern parts of Tumkur and Kolar districts of Karnataka, and the northern parts of North Arcot and Chingleput districts of Tamil Nadu. In terms of geology sub-region A [Map IV] is composed mainly of granitic rocks that differ markedly from the basaltic rocks of the Maharashtra region. The Peninsular gneissic complex is widely distributed. The Gondwana rock belt of 60 km width is found adjacent to the river Godavari and Pranahita in this sub-region. Major geological formations occupied are Archaeans, Deccan traps and laterites. The granites are the predominant rocks in the southern and eastern parts of this sub-region. The Deccan Trap which originated during the Mesozoic and Kenozoic eras has got a few extensions in the western and northern parts of the Telangana region. The formation has to be seen in the context of the physiography of the Deccan Plateau as a whole. The Telangana peneplain covers a major part of Hyderabad, Rangareddy and Nalgonda districts along with a few adjoining stretches in Mahboobnagar and Medak districts.[75]

There occurs in this sub-region, an eastward projected table land, namely, the Hyderabad plateau, conspicuous by its imposing position with laterite and lava deposits. The Cuddapah sediments occur along the northern bank of the river Krishna. A laterite cap is seen developed over the trap in the Anantagiri hill area of Hyderabad and Rangareddy districts and in the Chinnamarur area of Mahboobnagar district. The sub-region is drained by the major river Godavari with its tributaries, Penganga, Wardha, Pranahita, Manjira and Maneru in the north and the river Krishna and Tungabhadra and its tributaries, the Bhima, Musi and Dindi in the south. Almost all the area has rugged and heavy undulating topography and most of the prevailing soil is reddish brown to brownish red sandy loam known as Chalkas.[76] These are stated to have developed under severe leaching conditions and they are almost free of soluble bases and plant food elements. Thus the area is generally poor in plant nutrient reserves. The other soils are mostly found in low valleys. The soils vary very much in colour, depth and physical and chemical properties from area to area. There are many patches of black soil, both deep and light, dispersed throughout the sub-region. These are generally encountered as narrow strips and at places, wider patches are also met with in Adilabad, Nizamabad and Karimnagar districts and in the Krishna-Tungabhadra doab area. The alluvial soils are met with along some parts of the course of the river Godavari.

Sub-region B includes the southern part of the Chandrapur district of the Maharashtra State; Bastar district of the Madhya Pradesh State; Koraput and Ganjam districts of the Orissa State; and parts of Warangal, Nalgonda, entire Khammam district, the western half of the districts of Srikakulam, Vizianagaram, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore districts and the eastern parts of the Kurnool and Cuddapah districts of Andhra Pradesh. This sub-region is drained by the rivers, Vamsadhara, Nagavali, Godavari, Wyra, Krishna, Gundlakamma and Pennar. In terms of geology [Map IV], the major formation of this sub-region consists of the Archaeans, which include the charconite series and the granites. Lower pre-cambrians consisting of Khondalites are most extensive formations along the eastern boundary of this sub-region, particularly in Srikakulam, Vizianagaram and Visakhaptanam districts. Dharwars are the oldest rocks belonging to the pre-cambrian period, consisting of schists which are highly metamorphosed occuring 1n the Nellore, Prakasam and Guntur districts. The lower Gondwana rocks consisting of shales and sand stones occur mostly in the costal area in between the rivers Godavari and Krishna. Tertiary formations, also called the Rajahmundry sand stones, belong to the Miocene-Pliestocene period and are found on the eastern border of this sub-region, especially in the East and West Godavari districts and are considered very useful as building materials. The relief of the sub-region consists of the Eastern Ghats on the eastern border which are a continuous

MAP IV



GEOLOGICAL FORMATIONS OF ANDHRADESA

chain of hills spreading from north to south. They separate the coastal plains of the east from the plateau which lies to the west of the sub-region. The river Krishna and Godavari flow through the gaps of these hills. The uplands of the coast **forming part** of the eastern ghats reach an elevation of 3000-6500 ft. Beyond the Krishna lies the Cuddapah range of hills. This region forms a great crescent, the heart of it being the wide Nandyal valley drained by the Kunderu river, a tributary of the Pennar. The eastern limb of the Kunderu basin is formed by the parallel ranges of the Nallamalai and Velikonda hills, separated by a longitudinal valley drained by the Sagileru stream which joins the Pennar. The sub-region consists of peneplains developed on the gnessic plateau which covers the Kurnool, Nalgonda and Warangal districts. The general feature everywhere is that of graded valleys and isolated hills or groups of hills breaking the monotony of the plains. The soils of this sub-region are red soils. Red soils can not retain the moisture for long, which is necessary for continuous cultivation. Black cotton soil patches are scattered here and there in the Telangana area. These are residual soils which are brown, black or red, pebbly and porous and are found mostly in the dry districts of Kurnool, Srikakulam and Nellore. The vegetation includes moist deciduous types of forest which contain teak, maddi and yepi in the agency tracts of Visakhpatnam, Srikakulam, Vizianagaram and East Godavari districts.

The sub-region C is nothing but the coastal plain east of the Eastern Ghats starting right from the **Srikakulam** district in the north to the Nellore district in the south. **Regarding** the soils of this sub-region, the coastal alluvium stretches as a belt throughout the length of the coast, excepting for a short interruption of few kilometers near Visakhapatnam in the north. In places where the Eastern Ghats approach the sea, only a comparatively narrow sandy tract remains. The costal alluvium is generally not rich in plant nutrients and organic matter. These soils are usually of sand and sandy loam. Here, we also see soil known as deltaic alluvium [Map IV]. This is to be met with in the double delta of the rivers. Godavari and Krishna extending over hundreds of kilometres around the lake Kolleru. The deltaic alluvium is mostly with plant nutrients. Therefore, this micro region becomes the most fertile part of Andhradesa. This is an area of high agricultural productivity based on triple cropping pattern which has throughout history, always supported a dense population. In the costal belt the Krishna-Godavari alluvial expanse is occasionally marked by rich mango groves, swamps and clusters of tall palm trees, big and small Lagoons and low sand dunes near the sea. This alluvial expanse constitutes the agricultural nucleus of the region.[77] Further up the coast in the Srikakulam-Visakhaptnam region, there is an occurrence of outcrop rocks which come close to the sea. The valley floors of this region are constituted of black soil, which grade upwards into poorer red soil.[78] In the extreme south, along the coast, that is in the Nellore region, a narrow belt of alluvium intervenes between the rugged interior and the sea. However, generally speaking Nellore region is a poor land.[79]

The chief river basins of this sub-region, the Godavari, Krishna and Pennar, have however, been penetrated and exploited by large scale agricultural communities, driving the earlier inhabitants with a more primitive economy into the forested mountains.

Depending upon the way physiographic formations of this region are perceived and their consequent impact on the political, economic and social structure from time to time, various geographical entities have been classified by scholars under different headings. One such is the terminology given to us by B.Subbarao and known as 'nuclear' regions or 'areas of attractions', areas of 'relative isolation' and 'areas of isolation'.[80] Regions with vast tracts of fertile lands which have direct impact on the development of civilization, have been defined by him as the 'nuclear areas' or 'areas of attraction'. Sub-region C is one such area. These areas, according to Subbarao are to be called "the areas of attractions".[81] The core area of periodic and persistent political power was the Telugu speaking deltaic area of Godavari river centered around Rajahmundry.[82] The lower valleys of the rivers Krishna and Godavari falling within the gnessic-metamorphic zones supported wide spread pre and proto historic settlements.[83] On the other hand, the more wooden upper reaches of the Godavari were first exploited by widely distributed Chalcolithic communities. Gradually the centre of political power and economic acitivity shifted to the less fertile tracts of the interior, i.e., from Andhra to Telangana during the 11th-12th centuries A.D. and afterwards.[84]

Sub-region D can be identified with parts of the modern districts of Kurnool, Cuddapah and the entire districts of Anantapur and Chittoor. This sub-region also occupies the eastern parts of Bellary and Chitaldurg districts of the Karnataka State on the western border of the sub-region. The northern parts of Tumkur and Kolar districts also form the sourthern border of the sub-region in addition to parts of Dharmapuri, North Arcot and Chingelput districts of Tamil Nadu. The Western part of this sub-region has a long belt of peneplains chiefly developed on the gneissic rocks with common levels between 300-600 metres. More than three-fourths of the area is occupied by Archaeans belonging to Dharwarian system [Map IV]. The Dharwar formations chiefly consist of the schists. The Cuddapah systems comprising of quartzite and shales are found in huge hill masses. The spread of the Nallamalais starting in Kurnool district, a section of Eastern Ghats, end in the Cuddapah district of this sub-region. The Seshachalam and Palakondalu ranges occupy Anantapur and Cuddapah districts. Numerous workable deposits of barytes and asbestos occur along the Papaghni river in Cuddapah district. The sub-region is drained by the river Pennar which is joined by the Kumudvati, Jayamangali, Chitravati, Papaghni, Sagileru, Swarnamukhi, Kaundinya, Arni, Bahuda, Kalyani and Kusasthali. Black cotton and red loamy soils occur in this sub-region. Black cotton soil, mostly occurs in patches along the river course. Residual soils of the lateritic type, vary from dark reddish to brown or black and these also occur in the sub-region. The bulk of dry deciduous forest, tropical thorn forests and the scrub jungles are confined to the outer edges of hill slopes in Cuddapah, Chittoor and Anantapur districts.

The above sub-regional divisions facilitate us to make a comparative study of the various ancient buildings located in them and the reasons why specific building materials have been found prolific in a particular sub-region and found absent in other sub-regions. It is also possible to study the buildings in terms of how they were influenced by technological skills prevalent in adjoining zones. For example, the buildings in the north-eastern parts of sub-regions B and C were prominently influenced by the skills in the Kalinga region and in the western and northern parts of sub-regions A and D by the skills in the areas ruled by Western Chalukyas in northern Karnataka. Similarly, in the southern parts of sub-regions C and D, the influence of the technical skills prevalent in the Pallava-Chola ruled Tamil Nadu areas was rampant and in the sub-region C the styles and skills of the Chalukya-Chola ruled areas of Karnataka and Tamil Nadu were predominant. Many kinds of forces, external and internal, have influenced the political formation of the region under study. The geographical features as argued by Subbarao[85] and Manzoor Alam[86] have always been determinant factors in this regard.

The continental and maritime location of Andhradesa has been one of the most important factors that has shaped its destiny. Unlike the Konkan on the western side of the Peninsula, the eastern coastal plains with easy access to the plateau, had a fertile hinterland. This is because the Eastern Ghats were neither too high, nor so continuous as the Western Ghats, and communications were easy across them. The mouths of the East Coast rivers have always served as locations for important ports upto the modern age. This facilitated the develoment of ancient Andhra as a maritime country. From an early period the Andhra people navigated the seas and their bold sea faring exploits carried them to distant parts of world.[87] The double delta of the Godavari and Krishna made the traders, along with their religious Bhikshus from north and south, gather here in ancient times.[88] The ports at Dharanikota and Nagarjunakonda are the best examples of their order. The epigraphs of the Satavahanas and Iskvakus refer to a good number of such ports and **market centres.**[89] The Indo-Roman trade helped the rearing of a chain of coastal port-towns and these must have inspired the growth of a number of inland market towns.[90] Sarkar[91] is of the opinion that many Buddhist centres were found to be along the trade-routes and situated close to places of commercial intercourse. Most of these occupied the major part of the so-called 'area of attraction' in early Andhra as delineated by Subbarao's definition. As trade and religion drew people from all parts of India to Andhradesa from early times, close contacts naturally brought about cultural assimilation which became a characteristic feature of Telugu culture during the medieval times as well. It can be said in general that the pattern of Indian culture that evolved here was the result of a creative synthesis between the north and south.[92]

It is necessary to identify the location of some of the important building structures right from proto-historic times onwards that had an impact on certain geological and geographical factors, in determining the shape and nature of these buildings. Some of the pit dwellings of the Neolithic period have been reported from sub-regions A and B. This is so because the region during the Neolithic times may have had dense forests with wild animals and in order to protect themselves from the predators and also to withstand the then climatic conditions this type of pit dwelling was evolved. Pit dwellings have been noticed at the sites of Utnoor in sub-region A; Veerapuram and Nagarjunakonda in sub-region B [Chart I A]. Megalithic burials of various types have been reported from almost all sub-regions as tabulated in **Chart** IV A. All types of burials such as cairn circles, stone circles, cists, pit circles, dolmens and menhirs have been noticed in sub-regions A, B and D **[Chart** IV A]. These primarily needed the use of different types of stone for building, which were found in easy accessibility of most of these burial sites. It 1s true to say that Menhirs and monolith stones used in Dolmens, are more common in the Plateau region. For instance, a unique type of rock cut burial has only been reported from Jonnawada 1n sub-region C. Burials with cruciforms have also been reported from sub-regions C and D. It is singificant to note that in sub-region C however, no structural burials have been found for this period, probably because of its location on the sandy coast.

The Early historic period in Andhradesa is marked by such buildings, viz., religion-related structures like Buddhist stupas. chaitvas. viharas. Brahmanical temples, and habitational buildings and irrigation structures and finally, defence buildings like forts, ramparts, etc. All these indicate that there was a greater exploitation of the environment for rich agricultural settlements to emerge. It was only because of this development that surplus, needed for expenditure to execute these building structures, could have been met with. The Buddhist Stūpas and monastic buildings have been found at a good number of sites as tabulated in [Chart VI B] Maximum number of Buddhist establishments are found located in sub-region C, this being an 'area of attraction' and well-connected to trade routes leading to other parts of India. The locational tie between Buddhism and the political-merchant complex is apparent in the period from 2nd century B.C. to the 1st century A.D. During this time[93] there was a spread of Buddhism, from central India to the Krishna Basin. The three-fold union of Buddhism, trade and empire continued into the following centuries of Christian era[94] and this further saw an increase in monastic sites in the Krishna delta of sub-region C. In sub-regions B and C a sudden jump in the number of Buddhist centres has been noticed during the Ikshvaku times, whereas, in sub-region D, only a single Buddhist centre at Nandalur has been reported because this area was a semi-arid zone and not conducive for agricultural expansion. It was also not congenial for trade activity. This region falls into the category of a 'area of isolation' as defined by Subbarao. On the other hand, sub-region B falls under the category of 'area of relative isolation' which constitutes a few pockets of fertile areas and was more amenable as a region of trans-continental communication and trade. This had only an indirect impact on the development of Buddhist buildings in this sub-region as they emerged on important trade routes connecting eastern Deccan with the western Deccan. Therefore, a greater number of centres have been found in this sub-region when compared to sub-region D. Subbarao[95] in defining the regions of 'isolation' and 'relative isolation' has pointed out that these were not fertile zones like the 'nuclear' areas but the latter was important because it was a crucial region of communication and migration connecting economically well-developed zones.

Brahmanical brick temples have been noticed in various sub-regions as tabulated in **Chart VI B.** However, it has been noticed that they have not been prolifically distributed, as the religious structures of the Buddhist affiliation during the early historic period. This structural feature is in turn indicative of the fact that economic development went hand in hand with the relization that the surplus thus generated had to be controlled and channelized for distribution. Thus early State formation was first seen in the rise of localities emerging as small centres of political control. This is the reason why so many defence structures are found located even in sub-region A which is an area of 'relative isolation'. Sub-region D has not reported any defence buildings of the early historic period partly because it was an area of 'isolation' without either large tracts of alluyial soil, or port towns facilitating as outlets of trade, as in the case of sub-region C. This sub-region was a peripheral area under the rule of dynasties like the Mauryas and Sātavāhanas.

The growing prosperity of the early historic period is found reflected through a number of buildings such as houses, shops, roads, cisterns which have been found located at sites as tabulated in Chart I B. From the early medieval period onwards no structural remains of this type have been reported in terms of archaeological remains. However, existing epigraphs and comtemporary literature do give considerable data on building technology of this period. They also describe housing patterns and material used to construct. It is interesting to note that for the same period, i.e., from early medieval times onwards evidence of structural temples increases manifold. The great spurt in temple building activity at the local and sub-regional levels in Early Medieval and Medieval periods, i.e., Periods III and IV, is pertinently indicative of the expansion of the agrarian base into areas which had not been habited in the early historic times [Charts VI C & 0; VII C & D]. It is also relevant to note that much of the agrarian surplus went into the hands of local elites, who in turn supported the building and maintenance of temples. Such large structural remains also involved the exploitation of natural resources like different types of stone and wood. It is noticed that apart from the earliest stages, a major tendency arose to build temples in stone in preference to the use of brick.

The occurrence of several buildings of specific nature only in a particular sub-region and their absence in other sub-regions may be explained due to geographic, economic, political and ideological factors. Of these, the availability of suitable building materials like stone, lime, sand, fine clay and wood which determines the shape of buildings is also important to emphasize upon in the present context. For example, alluvial and black cotton soils of sub-region A, B and C were more preferred to make fine bricks than the gritty and morrum soils found in the semi-arid area of sub-region D. Therefore, subregion D has a very few structural remains in all periods of history. Likewise, the main building material for the early structural temples in these sub-regions was red sand stone brought from Satanikota. The architects of the later Chalukyas, Chālukya-Chola and the Kakatiyas used the locally available stones such as granite, sand stone, basalt, shale and khondalite in addition to brick for various buildings in the different sub-regions. Sub-region C 1n particular, with the fertile alluvial soils and port towns and well-connected hinterland by both land and water ways, prompted the ruling elites to raise magnificent buildings. Apart from a sound economic background the ideological beliefs of both kings and laymen influenced the style of buildings. The rock-cut structures of the early historical period were said to be excavated on lines suggested by the taste of the donors coupled with skill and creativity of the artisans.

Geological considerations certainly played a great role in the location of various buildings, especially monumental ones. The quantum of economic surplus of a society in different historical periods, also determined the nature and number of buildings that were erected. S.J.Knudson[96] suggests that geographical features directly influence the material cultures of a society and thus technology, with the interaction of geographic factors, produces the economic structures. The study of the Evolution of Building Technology in Early Andhradesa in different sub-regions of Andhradesa, has been taken up in the light of the geographical variations of these localities. This enables us to postulate an analysis of building technology, which was intrinsically related to the way the geographical context determined the given socio-economic formation of different periods in early Andhra history. We shall focus on some of these aspects in the next section of this chapter. The present study of building technology thus generates an interesting relationship with past geographical spaces that enables us locate possible old landscapes in the visible present.

FOOTNOTES

1. A significant publication that has helped us to clarify some of our ideas on the subject is Period and Place. Research Method in Historical Geography, Alan R.H.Beker and Mark Billinge (eds.), Cambridge University Press, Cambridge, 1982.

2. D.Denecke, 'Applied Historical Geography and Geographies of the Past: Historico-Geographical Change and Regional Processes in History', in Alan R.H.Baker and Mark Billinge (eds.), Op. Cit.. 1982, p.134.

3. Ibid. p.134.

4. It is a common practice for Departments of Archaeology to compile selective inventories of ancient monuments and buildings but these are hardly ever placed in their geographical context.

5. Aitareya Brāhmana. VII. 8.

6. Ibid. VII. 8, 92.

7. D.R.Pratap, Tribes of Andhra Pradesh. Hyderabad, 1975, p.5.

8. Sankhvavana Srauta Sūtras: XV.

9. IA, vol.VI, p.339.

10. This aboriginal tribe lives in the border areas of Adilabad, Nanded and Berar on the banks of the river Penganga according to W.Grierson. See preface to C.V.F.Haimendorf's Chenchus Aboriginal Tribes of Hyderabad. London, 1942, p.ii.

11. K.Gopalachary, The Early History of the Andhra Country. Madras, 1976, p.25.

12. S.J.Mangalam, Historical Geography and Toponomy of Andhra Pradesh. Delhi, 1986, p.3.

13. Referred to in Nalinaksha Dutt, Early Monastic Buddhism. Calcutta, 1941, p.125.

14. B.C.Law, Geography of Early Buddhism. Calcutta, 1973, p.22.

15. E.B.Cowell, Jātakas. vol.1., no.12, 80., Cambridge, 1895-1907.

16. Ibid. I, no.12 and 203.

17. R.G.Bhandarkar, The Age of Imperial Unity, vol.11, Bombay, pp.194-95.

18. J.McCrindle, Ancient India. Delhi, 1926, p.140.

19. Charaka Samhita: Indriasthāna-29; also referred in B.S.L.Hanumantha Rao, 'Sources of Andhra History', in S.P.Sen (ed.), Sources of History of India, vol.1, Calcutta, 1978, p.97.

20. Mahabharata: Sabha Parva, II.37-73.

21. Ibid. III.188.35; Ramayana IV.41 refers to them as Jati.

22. The Geographical Encyclopaedia of Ancient and Medieval India. Varanasi, 1967, p.23.

23. Markandeya Purāna, LVII, 48-49.

24. Nalinaksha Dutt, Op. Cit.. 1941, pp.120-125.

25. Brhat Samhita: Ch.16 Sloka 11.

26. S.Beal, Buddhist Records of the Western World, vol.11, pp.217-218.

27. Kama Sutram with Jayamangala Vyākhyāna. Banaras, 1929, p.112 (Karnāta Vishayāt Purvena Andhra Vişhayah), see T.P.Adinarayana (ed.), Vatsayayana's Kama Sutra. Madras, p.126.

28. Daśakumāra Charitra. III.9.

29. Bhagavata Purāna. V.19, 51.17.

30. D.C.Sircar, Studies in Geography of Ancient and Medieval India. Delhi, 1971, p.38.

31. Pratāparudriyam, Madras, 1950, p.177.

32. K.Raghavacharyulu, 'The Term Andhra and Early References there to' JAHRS. vol.X, 1936-37, p.114.

33. Anargharāghava. Act VII. 113.

34. IC, July, 1941.

35. G.Yazdani, The Early History of the Deccan, parts I-VI, London, 1960, p.27.

36. £1, vol.XXV, p.

37. Ibid. vol.VI, p.86.

38. Ibid. vol.XIV, p.110 ff.

39. D.C.Sircar, Op. Cit.. 1971, p.168.

40. CII, vol.III, p.230.

41. EI, vol.IV, p.43 also see Y.Gopala Reddy, 'The Territorial Division of Kakatiyan Age' .JAHRS. vol.XXXV, p.397; and O.C.Ganguly, The Eastern Chalukyas of Vengi. Calcutta, 1960, p.137.

42. EI, vol. III, p.76.

43. B.C.Law, Historical Geography of Ancient India. Delhi, 1976, p.140.

44. K.Eswaradutt, Historical Geography of Ancient Andhra. Hyderabad, 1962.

45. B.V.Krishna Rao, History of the Eastern Chalukyas of Vengi. Hyderabad, 1973, p.519; EI, vol.IV, p.43.

46. JAHRS. vol.X, 1937, p.115.

47. SII, vol.IV, no.1171.

48. JAHRS. 1914, p.137.

49. £1, vol.IV, p.85.

50. Ibid. p.358.

51. Ibid. vol.XIV, p.80.

52. G.Yazdani (ed.), Op. Cit.. 1960, p.29.

53. R.Subrahmanyam, The Suryavamsi Gajapatis of Orissa. Waltair, 1957, pp.24-25.

54. SII, vol.VII, no.202.

55. R.Sewell, Historical Inscriptions of South India. Madras, 1872, p.265.

56. G.Yazdani (ed.), Op. Cit. 1960, p.290.

57. J.P.Guha (ed.), India in Seventeenth Century. New Delhi, 1976, p.137.

58. H.K.Sherwani, History of the Qutub Shahi Dynasty. Delhi, 1974, p.493.

59. J.F.Richards, Mughal Administration in Golconda. Oxford, 1975, p.1, Map.1.

60. Yaqub Ali, Hayathi-Usmani. Hyderabad, 1936, p.56.

61. A.V.Kotireddy, History of Modern Andhra. Hyderabad, 1986, (RP), pp.46-47.

62. A.Ramesh Chaudhary, Andhra Pradesh. New Delhi, 1979, p.40.

63. Report of the States Reorganisation Commision. 1955.

64. M.Somasekhara Sarma (ed.), Telugu Culture. Madras, 1960, p.10.

65. C.Campbell, Specimens of languages of India including those of aboriginal tribes of Bengal, the Central Provinces and the Eastern Frontier. 1874.

66. G.A.Grierson, Linguistic Survey of India. Vol.IV, Delhi, 1967 (Reprinted from the first edition, 1903), p.296; 577.

67. B.Subba Rao, The Personality of India. Baroda, 1958, p.20.

68. E.W. Gilbert, 'Geography and Regionalism', in Taylor Griffith (ed.), Geography in the Twentieth Century. London, 1953, p.346.

69. F.J.Richards, 'Geographic factors in Indian Archaeology', IA, Vol.LXII, 1932, p.20.

70. B.Subba Rao, Op. Cit. , 1958, p.2.

71. S.J.Knudson, Culture in Retrospect. Chicago, 1978, pp.67-69.

72. M.Somasekhara Sarma, Op. Cit. , 1960, p.9.

73. Andhra Pradesh Year Book for 1988. Data News Features, Hyderabad, 1989, pp.1-5.

74. G.A.Grierson, Op. Cit., 1967, (RP), p.296.

75. O.H.K.Spate and A.T.A.Learmouth, India and Pakistan: A general and regional geography. 3rd (edn), Great Britain, 1967, pp.733-38.

76. Techno-Economic Survey of Andhra Pradesh. National Council of Applied Economic Research, New Delhi, 1962, p.25.

77. O.H.K.Spate and A.T.A.Learmouth, Op. Cit., 1967, p.733.

78. Ibid, p.734.

79. Ibid. 1967, p.738.

80. B.Subba Rao, Op.Cit., 1958, pp.88-141.

81. Ibid, p.12.

82. David Sopher, in R.R.Platt (ed.), India: A Compendium. New York, 1962, p.162.

83. B.Subba Rao, Op. Cit., 1958, p.21.

84. A.B.Mukherjee, 'Successors of Cultural Landscapes in Telangana Reddi Villages', IGJ, Vol.39, 1964, pp.42-58.

85. B.Subba Rao, 'The Geographic Factors in Andhra History and Archaeology, BDCRI, 1948, pp.168-171.

86. Manzoor Alam, 'The Historic Deccan: A Geographical Appraisal', in V.K.Bawa (ed.), Aspects of Deccan History. Hyderabad, 1975, pp.16-27.

87. Referred to G.Yazdani (ed.), Op. Cit., 1960, p.140.

88. B.S.L.Hanumantha Rao, Religion in Andhra. Hyderabad, (RP), 1993, pp.69-70.

89. C.Sivarama Murthy, Amaravati Sculpture in Madras Government Museum. Madras, 1942, Ins.nos.5,16,45,87,103 & 126.

90. Amita Ray, 'Beginning of Urbanisation in Andhradesa', in J.S.Grewal and Indu Banga (eds.), Studies in Urban History, Amritsar, 1978, pp.29-42.

91. H.Sarkar, 'Emergence of Urban Centres in Early Historical Andhradesa', in B.M.Pande and B.D.Chattopadhyaya (eds.), Archaeology and History. Delhi, 1987, p.632.

92. M.Somasekhara Sarma, Op. Cit., 1960, p.9.

93. James Hietzman, 'Early Buddhism Trade and Empire, in K.A.R. Kennedy and G.L.Posshel (ed.), Studies 1n Archaeology and Palaeoanthropology of South Asia. AIIS, 1984, pp.121-131.

94. M.N.Deshpande, 'The Rock-cut Caves of Pitalkhora in the Deccan, AI, no.15, pp.66-93.

95. B.Subba Rao, Op. Cit. , 1958, pp.85-140 (summarised).

96. S.J.Knudson, Op. Cit., 1978, pp.67-69.

1.3 HISTORICAL SPACE

1.3 HISTORICAL SPACE

The above delineated geographical space thus becomes for us an appropriate background to now focus on historical space which must necessarily be done in terms of time or, more simply, within a chronological frame work. Hitherto studies on monuments, which have primarily been done on identifying styles of temple architecture, have used the political chronology of the rise and fall of dynasties as a convenient way to understand the long process of the development of these styles. Thus writes Champakalakshmi: "the commonly used method is its periodization under dynastic appellation. . . . . .This division has a fortuitous coincidence with the major changes that occurred in architectural evolution"[1] (emphasis added). It must be mentioned that her writings in this regard were focussed on Tamil Nadu and such a conclusion may not be applicable to all cultural sub-regions of the sub-continent. However, more pertinently, in the present dissertation we are concerned with delineating the historical space of a large variety of buildings from simple dwelling structures and public buildings to monumental structures like forts and temples. Therefore, to visualise change in the evolution of building technology only in terms of transition in political periods of governance would not be a wholly appropriate frame work.

The Annale School of French Historians[2] had succinctly explained to us that political changes envisage the most visible and fast moving elements of change which are easily identifiable as they are often documented clearly in literature and inscriptions. Significantly, economic and social change is said to take place at a slower pace and is also less easily discerniable and recognizable. In other words, it must always be analyzed on the strength of a given broad range of trends. Historians do not necessarily agree on how this change should be divided as the criteria for doing so would differ in the respective methodological perspective adopted by them. In this sense historical space and time continually change because the emphasis on interpretations of history lend it different chronological frame works. Further, in any case, it has come to be generally considered that history is an on going dialogue between the present and the past[3] in which the emphasis is not on what actually happened in the past but an account of what happened in the past.

Recent researches on the ancient and early medieval periods of history pertaining to the Indian sub-continent as a whole, have made us sensitive to understand historical space and time at a broader level, incorporating several elements of change in the society at large. We have thus moved away from simple historical representations of the political and military acheivements of kings and their nobles or, of the history of religion and monuments, affiliated to the myriad faiths and belief systems that India gave birth to. For our current research on the history of technology, therefore, it has become necessary for us to look at the rise of local cultures and kingdoms and their prosperity and decline in an integrated way to define historical time both in terms of changes in the nature of polity and the attendant social and economic changes.[4]

The whole period of the present study, i.e., from the proto-historic to the medieval times (roughly from the second millennium B.C. to about the middle of the fourteenth century A.D.) has been divided by us into four periods for convenience of historical analysis. They are named as Period I, Period II, Period III and Period IV. Among them Period I basically deals with the proto-historic period, its chronological frame ranging from the second millenium B.C. to the third century B.C. This is followed by Period II which can be identified as the early historic phase from about the fourth century B.C. to the third century A.D. The next period, i.e., Period III is defined as the early medieval phase ranging from about the fourth century A.D. to the ninth century A.D. and Period IV, is considered by us as the beginning of the medieval phase proper from about the tenth century A.D. We terminate our study around the fourteenth century A.D.

Each of these periods do not sharply differentiate the stages of technological growth and development but they do enable us to reflect on the new elements that were added to the already known skills and techniques known to a particular period. In India, the continuity of technological skills is a hall mark which has something to do with the corporate nature of the organizations known to the people who were involved in protecting and transmitting these skills. However, what is significant in the adoption of the above scheme of periodization is that both the types of buildings found in each period and the skills inherent in their construction, can be related to the changes that took place in the polity, economy and ideology of the times.

It is to elaborate on some of these ideas, that before embarking on a discussion of the evolution of building technology with respect to habitation, irrigation, defence, funerary and religious structures, it was felt necessary to dwell upon the nature of state, society, economy and ideology of each period of our study, beginning from Period I to Period IV. It is pertinent to do so because, for instance, the nature of state and polity had a great impact on the forms and types of different defence structures that were built from time to time. Likewise, the nature of society, economy and ideology are closely related to each other and influenced in shaping the different types of habitational, irrigation and religious structures repectively, and the technological improvements made from time to time.

Further, within the periodization envisaged by us above, the dynastic changes at the level of not only the major families has been taken into account but, side by side, also the activities of chiefs of the smaller localities have been considered. In the following pages we primarily focus attention on the interpretative dimensions pertaining to: (a) transition from pre-state to State society, (b) issues associated with the characterization of early historical society, particularly the historical environment in which Buddhism flourished, and (c) the economic and ideological aspects of transition to the early medieval and medieval periods. Each of these aspects emphasize on recent interpretations of the historical space. They particularly lay stress on the periods of transition and also help us to highlight those elements which are necessary for a background to detail the evolution of building technology pertaining to the different types of structures taken up for discussion in the subsequent chapters.

We begin with a brief description of the origin of social stratification in a pre-state society as this is a necessary background for understanding the rise of early State. Differentiation in stages of a tribal society in terms of band, ranked society or chiefdom and stratified society have been discussed at length by Morton Fried.[5] Service defines a band as "an association more or less residential, of nuclear families, ordinarily numbering 30-100 people allying it with one or a few other bands".[6] Service's views of a tribe are that it is an association of a much larger number of kinship segments which are each composed of families.[7] In the view of Sanders and Morino a tribe has a common culture, languages and territory.[8] Sahlins emphasizes that tribes live in perpetual state of warfare.[9] The development of simple headship or leadership in a tribe was strengthened by being in conflict with other tribes. These conflicts increased with compound headship along with larger antagonism of race with race.[10] These scholars therefore suggest that differentiation emerged in this society by which there first arose a temporary military head. Initiated by conflict with adjacent societies it naturally happened that his political power increased as military activity continued. Thus, the simple leadership in the band stage led to the emergence of a ranked society.[11] According to Fried, a ranked society grew out of an earlier egalitarian society without the conscious awareness of the members of the society in which it occurred and he is further of the opinion that later a stratified society and the state emerged in much the same way.[12]

The late neolithic society has often been described as a ranked society. A distinctive feature of ranking society is the employment of all individuals in labour tasks on the basis of their age and sex.[13] Warfare increases in a ranked society over that in an egalitarian society and increases still more in a stratified society, over that in a ranked society and crests after the appearance of the state.[14] In primitive society no one possesses a **special** military technology but all members use ordinary tools and the weapons of the hunt when they fight men. The evolution of warfare and military statuses during the earliest breakthroughs to a more complex form of society was followed by, and was dependent upon, developments in technology, economic organisation and other non-military aspects of social organisation.[15]

The social organisation of the chalcolithic phase reflects an adaptation to the environment. Agriculture brought large communities together for creating new subsistence patterns. This meant that a division of labour was necessary for efficient farming and craft specialisation. Irrigation was also developed and this helped the incipient redistributive economy. It emphasised the need of a centralised autority for the control of water or for storing of the surplus. On the characterisation of ranked societies in the Western Deccan, Dhavalikar explains that increased accumulation of surplus clearly must have resulted in the formation of a ruling elite separated from specialised craftsmen and tillers of land.[16] These developed chalcolithic societies have been considered by him as ranked societies since there had emerged in them the importance of the control of surplus by a few as corroborated by the existence of public buildings such as fortifications and irrigation structures along with granaries as noticed at both Diamabad[17] and Inamgoan.[18]

The economy of the neolithic phase in Andhradesa is characterised by besides hunting, a mixed economy of agro-pastoral production. Excavations conducted at Chinnamarur and Chagatur in sub-region A, Veerapuram and Gandlur in sub-region B and Hulikal in sub-region D indicate the domestication of cattle, sheep and goat from the early levels of neolithic occupation.[19] Cattlepens which have been reported from Utnoor[20] in sub-region A also attest to the above. Incipient cultivation must probably have begun with the help of hoe and digging sticks. The occurrence of corn-crushers, mealing stones, mortars and pestle from Hulikal, Veerapuram, Chagatur, Chinnamarur and Ieej indicate a primitive agriculture and a subsistence economy.[21] The recovery of copper toe rings, bangles from Chinnamarur[22] in sub-region A and Palakonda[23] in sub-region B respectively and unique discovery of a copper antennae sword from Guttikonda[24] in sub-region B speak of the economic status of a few groups in society who could own these luxury goods.

The simple subsistence level of these early societies meant a limited amount of agricultural surplus and therefore, during this early period we do not have evidence of monumental buildings. Simple structures were taken up for construction even by the ruling elite. Neolithic technology however, developed and proliferated from the use of stone to the expanding use of clay for various constructional purposes. The knowledge of wood, reeds and other such material as rice husk for building simple habitations become icreasingly evident in the archaeological record.

During the Megalithic phase, there was a significant change in the protohistoric society of early Andhradesa with the introduction of iron. During this period both domestic and sepulchral buildings emerged and the use of non-perishable materials like hard stone began to appear. Agriculture along with domestication of animals and hunting formed the main basis of the economy of the people during these times. Agriculture is attested to by the discovery of iron sickles, ploughshares, etc. from the burial sites.

The burials provide an example of structures which were large in size and the constructions were made to meet practical needs. All of these structures testify to the ability of powerful individuals or chiefs to engage skilled people, to own material resources as well as control a large amount of ordinary labour. Bruce Trigger[25] is of the opinion that monumental architecture is an expression, in a public and ordinary manner, of the ability of an authority to control materials, specialised skills and labour required to create such structures. Major megalithic monuments could have only been built by some centralised and coordinated society, of the kind which, Renfrew[26] has called as a chiefdom society. E.R.Service[27] has discussed at length that the chiefdoms were particularly distinguished from tribes by the presence of centres which coordinated economic, social and religious activities. That specialisation of crafts grew in the megalithic chiefdom society are implicit in the monuments. In fact they could only have been erected with an organisation in an integrated society which had centres that were able to coordinate social, religious a well as economic acitivity. This involved pooling of individual skills in large cooperative endeavours, organisation and deployment of public labour for building its monuments and above all, collecting resources to do so. The chief in such a society was the seniormost descendant of the tribe's ancestors or the ancestor's gods. The chief was considered to be in the best position to influence the latter and thus, he along with the religious specialists, became the managers of the cult and responsible for its well being and prosperity. This ritual status according to Shereen Ratnagar[28] enabled the chief to transcend his immediate kinship/obligation and gave him authority to command non-kin labour as well.

The important aspect of the material culture of the megalithic phase was the intensification in the exploitation of iron deposits. The megalithic people generally preferred habitation on hilly sites, near some perennial water sources, since stone for building megalithic burials was an absolute necessity. Importantly, these plateau areas and hilly tracts were also rich in iron ore.[29] The level of iron technology attained by megalithians can be discussed by the range of tools found in their burials which indicate the use of these for a variety of crafts based on material requirements. The amount of objects found in this media is fairly large implying the availability of raw materials. These are particularly pertaining to agricultural implements such as axes, hoes, ploughshares, coulters and objects of offence like swords, daggers, lanceheads, arrowheads, tridents and long śūlās and apparatus for carpentry and quarrying work like chisels, crowbars, etc. Scholars like S.B.Deo opine that the level of craftsmanship reflected in the manufacture of metal objects and beads suggests that the megalithic people maintained a specialist group of artisans who catered to the needs of the community in respect of basic and luxury requirements.[30] Agriculture was one of the forms of subsistence in the economy of the society which has been attested by the existence of sickles, and plough coulter[31] in the excavated material. Iron strapped hatchets have been recovered at Pochampad,[32] while the prong of a hay fork or ploughing implement was found in a cairn burial at Hashmatpet.[33] The discovery of pulses at Serupalli,[34] rice and pulses at Veerapuram[35] from megalithic levels suggests that these people were primarily agriculturists.[36] At Gajjalakond[37] in sub-region B, decayed grains were found in pots from megalithic burials. The association of irrigational tanks with the megaliths, as has been noticed at Budigepalli[38] in sub-region A, also indicates the possibility of a megalithic culture having a strong agricultural bias.

The megalithic economy and society is also reflected in the recovery of ornaments in precious metals like gold, silver, copper and bronze alongwith ivory. Nearly 35 gold beads have been reported from the cairn XIV at Nagarjunakonda[39] in sub-region B. Golden bangles and objects have been recovered from megalithic burials at Janampet and Polichetty Cheruvugadda[40] in sub-region B and Kadambapur[41] in sub-region A. Along with gold, silver was also recovered in the shape of studs and spacing beads from Nagarjunakonda.[42] At Karapakala[43] in sub-region A, a bronze bell with a bone tongue was noticed 1n a pit circle. Copper rings/hands for tying round the neck of the cattle have been reported from Raigir[44] in sub-region A. Recovery of an ivory comb from a burial at Pochampadu[45] in sub-region A further speaks of the craft specialisation and economic well-being of the megalithic society.

The study of the building technology during megalithic has to be discussed not only in the broader socio-economic context but 1n the ideological context as well. It has to be stated that the ideological context cannot be seen as different from the forms of polity and control mechanism that each society asserted either, through coercive force or, spiritual conquering. We know a considerable amount about the megalithic ideology especially their religious beliefs as this firmly led to the erection of huge monuments like dolmens, menhirs, etc., for the dead. An aspect of ancestral worship 1s evident in these different types of burial practices. Thus in a sense the ground was prepared in the megalithic period for the rise of institutional religion during the early historical period.

In this connection we felt 1t necessary to have a brief description on the origins of religious trends in human society. These were responsible for leaving a great legacy of monumental building known atleast from the late phase of protohistoric period, i.e., Period I, corresponding to the Megalithic phase in Andhradesa. The noted British anthropologist Edward Burnett Tylor, who has often been called the father of anthropology, has presented a hypothesis of the evolutionary development of religion, beginning with simple animism and belief in spiritual beings and then proceeding finally to monotheism. He has interpreted it as a cognitive attempt on the part of prehistoric man to explain the differences between life and death, sleep and wakefulness and states of unconsciousness and normality.[46] According to Edward Norbeck,[47] religion is also regarded as the creation of man that has arisen by whatever psychological processes, from man's experiences of daily life and serves him various functions. The concept of life after death was responsible for the emergence of primitive religion which is evident through the disposal of the dead right from the prehistoric times. During the Palaeolithic times dead were buried in caves. In course of time the late Neolithic peasants developed their economy which led them to erect some tombs for the dead. During the megalithic period, tombs continued to be built, but on a larger scale by people inspired by a certain faith. The forms of these tombs varied from simple pit burials to the erection of Menhirs and Dolmens by cutting monolith stones from local quarries to be transported and erected on the burials.[48]

It has been pointed out by the scholars that in an ethnographic present, there are parallel instances of the practices of live Megalithism in India among the 'Savara', 'Gadaba' and 'Valmiki' tribes, while they celebrate their respective mortury funerals like 'Gaur', 'Kudamala' and 'Akkara'. In these ceremonies they arrange stone slabs or monolithic menhirs, dolmens and stone circles respectively.[49] The Kurumbas of North Arcot district erect small dolmens even today.[50] The Chota Nagas construct little dolmens to cover the pots containing the skulls of their dead. Khasis in Assam and Mundas in Chota Nagapur region are also said to erect menhirs on their burials.[51] It was during the Megalithic period that the worship, veneration and commemoration of the dead expanded on large scale. A wide variety of megalithic memorials indicating forms of religious behaviour intermingled with the way of life of the Megalithic folk. However, these memorials in the shape of different burials known as the megalithic monuments, not only speak of their belief in after life, but also suggest the essential commitment of the megalithic folk involved in expending of finances, labour and energy required for installations of monuments in memory of their dead. With this overall description on the pre-state society, economy and ideology of Period I we now turn to discuss state formation and the nature of society, economy and ideology of Period II and assess how the building construction of this period could be related to these changes.

As mentioned in the earliest extant literature of India the Rig Vedic society was essentially a pastoral one. Leadership 1n this situation required the ability to protect not only the herd since cattle were the chief form of wealth, but also one's clan and to defend its claim to ownership of cattle and control over the grazing ground. Hence, we have the synonyms of Gopa. Gōpati and Janasya Gopati for the word rāja.[52] A group of clans consituted a Jana and the territory where they settled was referred to as the Janapada. In the post Vedic times peasants produced much more than they needed for their subsistence. This created conditions for the rise and upkeep of large territorial states called Mahājanapadas. Once the tribal traits of equality had disappeared completely by later Vedic times, in due course, there emerged a social stratification based on class and Varna. This has been considered as the first pre-requisite for the rise of State in early India.

53

In the view of Thapar, the basic unit in such a system was the extended family based on a three or four generation lineage controlled by the eldest male who represented it on both ritual and political occasions. She focusses on data from the Vedic texts to explain that a nuclear unit in a lineage society was the Kula. the family and a group of such families made Grama or village which was a large unit than the Kula by smaller than a Vis.[54] Before the emergence of full-fledged State, Ganasangha chiefships were known in north India as metioned by Pānini[55] Once the State had emerged it had an obligation to defend its citizens and its territory, impying an identification of its citizenship over others and a monopoly over the use of force.[56] For scholars like R.S.Sharma, the ancient Indian state acted as a functional and structural power entity. It is well understood that State must be defined as a collection of specialized agencies and institutions, both formal and non-formal, which help in maintaining an order of stratification. Stratification has been viewed as a precondition for the emergence of the state since stratified groups became involved in internal conflicts, resulting in the evolution of a powerful elite. Thus according to Fried, the State is a complex amalgam of institutions by means of which the power of the society is organised on the basis of superiority in kinship.[58] The state is also explained as the product of a particular social condition, whereby society is divided into opposed social classes which produces a central organisation of political authority within its midst.[59] Magadha in north India witnessed the first state formation with Ajatasatru as its king and Rajagriha the first capital which was later shifted to Pataliputra.

In north India the breakup of old tribal units during the 6th century B.C. saw the emergence of the first territorial states which led to the growth of certain places as seats of political authority. With the growing complexity of the administrative set-up large number of royal officers were appointed.[60] This process was rather late in the Deccan and south India. Sudershan Seneviratne views the emergence of a stratified society in which the producer was subordinated by the elite with the rise of the Satavahana power.[61] Prior to this period, writing in the context of Andhra and Kalinga, he visualises and refers to "Chiefdoms" wherein the expansion of settlements from the highland peripheral areas to deltaic plains show a transformation from a pastoral-cum-subsistence economy to a primarily agricultural one in the technique of production.[62] The Sangam texts for south India pertaining to TamilaKam also reveal simple segmentary tribes living as decentralised autonomous communities 1n small dispersed settlements. It is generally suggested that simple segmentary tribal states emerge into a lineage society and these are defined as a corporate group of unilinial kin with a formalized system of authority.[63]

Seneviratne, further opines that "the process of secondary state formation in Kalinga and Andhra was an outcome when the autochthonous forces combined with consequences resulting from a period of political subordination to the metropolitan states of Mauryas and the Sātavāhanas".[64] The process of state formation in Andhra and Kalinga was thus understood by him to be one of a rapid progress from a ranked society to a stratified one with the consolidation of the ruling power through their direct access to surplus production and its distribution. His study aims at focussing on the dynamics of socio-political transformation in Andhra and Kalinga in pre-Sātavāhana times and visualises this as a congenial background for the development of early state characterized by the profusion of iron-age settlements, demographic expansion, social groups representing new and complex subsistence patterns and the rise of the elements of leadership.[65]

The period between the third century B.C. to the third century A.D. is important for the study of the processes that led to the transformation of the pre-state situation to that of early state in Andhradesa. Mauryan intrusion into the Deccan during the 3rd century B.C. is well documented giving a spatial dimension to the extent of the Mauryan influence.[66] The Second, Fifth and Eighth rock edicts of Asoka refer to the tribal people of the Deccan. A Rock edict at Eerragudi in Kurnool and a minor rock edict at Rajulamandagiri attest to Asokan rule in Andhradesa.[67] The black and red ware found at Amaravati is said to have graffiti marks similar to the Asokan Brahmi.[68] The small Brahmi inscription found at Malekonda in Prakasam district, according to I.K.Sarma, also suggests the Mauryan

influence.[69] Besides, Mauryan punchmarked coins from Amaravati, Peddabankur and Kondapur reveal that Mauryan influence had been widely felt in the area.

Maharathi coins have been reported from Veerapuram suggesting that the Maharathis might have been prominent here since the Mauryan rule.[70] According to the excavators of Veerapuram, "the stratigraphic sequence of Maharathi coinage of Veerapuram over the Mauryan level suggests the independence of the Maharathis for the first time after Asoka".[71] The Kondapur coins of the Mahisha dynasty attest to the evidence of the local rulers with Swasthika marks and who had Mahāsenāpathi titles.[72] It can be suggested that Mauryan political authority had co-existed with the small independently insulated localities in the Deccan. In the opinion of I.K.Sarma, "Andhras, like the Rathikas and Bhojakas formed an integral part of the Asokan empire and had subordinate status. Small independent principalities must have cropped up after the downfall of the Mauryan empire and the notable among them were the Satavahanas".[73] After the downfall of the Mauryas, no kings with dynastic appelation or an extent of territorial authority like the Mauryas are known from Andhradesa for more than two centuries.[74] One KubTrakaraja occurs on a relic casket found at Bhattiprolu.[75] One Raja Asoka of the first century B.C. occurs in a record found at Salihundam.[76] One Sōmakarāja occurs in an inscription recently discovered on a hillock in the outskirts of Vaddamanu near Amaravati[77] in 2nd century B.C. characters. One A1ra Manasada in the Velpuru epigraph[78] and Aira Sirisakasada on some coins preserved in the Amaravati museum are some more examples which mention chiefs who exercised political authority in the Krishna valley during the pre-Satavahana period. One Sirisada, the Lord of the territory of Kalinga and Mahisaka, possessing the title

Mahameghavahana, occurs in the pillar records found at Guntupalli datable to the 1st century B.C.[79]

In the Telangana part of Andhradesa some coins issued by Kings such as Gobhadha, Samagōpa, Kamvaya and Narana have been discovered in the Karimnagar district and these have been ascribed to the pre-Sātavāhana period.[80] According to B.D.Chattopadhayaya,[81] these kings ruled some Janapada like localities and he further observes that a kind of proto-state formation existed before the rise of a Pan-Deccan empire of the Satavahanas. In the opinion of P.V.P.Sastry in pre-Sātavāhana times there existed only a kind of Ganarajya under the name Andhras or Andhrajātiyas, a term applied to an ethnic people and also to a political unit.[82] It can be said that among the small kingdoms that had cropped up notable were the Satavahanas, the earliest indigenous regional rulers of the Deccan who established an empire ruled from about the 1st century B.C. to the 3rd cnetury A.D. The political rise of the Sātavāhanas as a royal house has been taken to be the first manifestaton of the traits of civilization though the pre-Mauryan cultural and material traits continued along in archaeological terms.[83] In the light of the above discussion the growth in the political authority of this dynasty can be highlighted keeping in mind the various sub-regions which we have delineated for Andhradesa.

The Satavahanas established their control first over the central and western Deccan and this then gradually spread to Krishna-Godavari valley.[84] Here it must be stated that though their origin is shrouded in uncertainty, recent archaeological evidence tends to suggest that the early Satavahana chiefs belonged to the Kotilingala region. These kings began to weild superior authority as is indicated by the high sounding titles, they began to acquire. Paithan and Dhanyakataka were their earlier and later capital cities respectively. Early defence buildings and fortifications of the period have been noticed at Kotilingala and Dhulikatta in sub-region A, at Dharanikota in sub-region C and at Satanikota in sub-region D and this gives credence to the fact that the Satavahanas attached great imporatance to military control in order to dominate the destinies of various communities in Andhra for more than three centuries. By the 3rd century A.D. the fall of the Satavahanas from political power resulted in the dismemberment of the empire into a number of smaller principalities occupied by several so-called feudatories. Among the main successors of the Satavahanas were the Ikshvakus who, under the leadership of Chantamula I (220-240 A.D.), exercised authority over the fertile area around the Krishna valley in the present day Guntur, Nalgonda, Krishna and some parts of Prakasam districts. There were in all, four members in the dynasty who ruled for 75 years with Vijayapuri as their capital. The excavations at Nagarjunakonda[85] have revealed that the city was surrounded by a rampart wall and had a moat with palaces, bathing ghats, houses, roads, soakpits and water channels inside. In an over view of the transition from pre-state to state society in Andhradesa 1t can be said that sub-region A witnessed the rise of pre-Satavahana kings under the dynastic names of Mahisha as attested by the Kondapur and Peddabankur coins; sub-region B witnessed the rule of minor dynasties like Raja Sōmaka and Sirisada as mentioned in the epigraphs of Vaddamanu and Velpuru; sub-region C was under the petty chiefs like Raja KubTraka, Asoka and also under Mahameghavahana, the Lord of Kalinga and Mahisaka dynasty as recorded 1n the Bhattiprolu, Salihundam and Guntupalli inscriptions. Prior to their rule and sometimes contemparaneous to it some parts of all sub-regions were under the influence of the Mauryas. Later Satavahana rule had co-existed with the rule of minor chiefs in some sub-regions and this was followed by Ikshvākus gaining supramacy in sub-region B after the decline of the Sātavāhanas.

It can be clearly explained that Period II was represented by a well-stratified society which was a fullfledged state society with a sound economic basis and which could support significant religious institutions of the time like those of Buddhism. Writing within the Marxist methodological framework, K.Satyanarayana[86] says that agriculture was the main occupation during the Satavahana period and irrigation facilities were provided to promote agriculture. He also adds that trade guilds played an important part in the life of the community.[87] Groups like the Gahapatis and Kutumbikas which are mentioned in the inscriptions are largely seen to have derived their wealth from agricultural acitivities.[88] At the same time, the fourfold division of the society based on varna seems to have been propagated by the Satavahana rulers. Further, the Brahmins occupied a place of prominence in the society.[89]

Technological and economic changes were significant during this period and evolved in stages to reflect the increasing prosperity of early historic society. This can best provide the broad chronological parameters within which monumental buildings in particular were constructed since these required large amounts of financial and material support. The gradual change in the economic and social conditions of Period I in Andhradesa, had an impact in moulding the economy and social structure of period II.[90] Agriculture was the main stay of the economy and it has been argued that the state took interest in the extension of agriculture and in imporving the irrigation facilities.[91] It was iron technology that provided the necessary tools for cultivation of crops, trade and commerce, arts and crafts, mining and metallurgy.[92] The existence of an expanded agrarian economy was clearly visible in the proliferation of early historic settlements with evidence of money circulation and craft production and an organised local merchant group.[93] Many early historic settlements were of the village type being located along the alluvial banks of the major rivers. The agricultural surplus as well as technological developments gave impetus to the rise of urban centres in the period which resulted in the growth of systematic building acitivity of all kind. The early historic settlements in Andhradesa survived from about the 3rd century B.C. to 3rd century A.D.

Further, with an increased agricultural surplus and specialised craft production there were trade contacts within the sub-continent as also with foreign countries. These settlements were well-connected by inland and coastal trade routes. A significant trade route from Ter went southwards to the Hyderabad-Medak region via Akkanpally in Nalgonda distrct where a large hoard of Roman coins of the 1st century A.D. has been found. The same route was also said to have continued via Nagarjunakonda, Goli, Rentala, Kesanapalli and Amaravati all on the southern bank of the river Krishna, to reach the sea-coast.[94] Trade and urban centres were connected to a system of navigation at port towns for ships to land and facilitate communications. At Dharanikota we have the evidence of an inland port where a navigational channel connected to the river Krishna is datable to between 400-100 B.C. and this strongly suggests a brisk trade in early Andhradesa.[95] Occurrence of quite a good number of Roman coins associated with indigenous coinage at Amaravati, Peddabankur, Dhulikatta, Ghantasala, Veerapuram, Thotlakonda and Bavikonda, is a clear testimony to maritime trade contacts with western countries during the early historic period in Āndhradeśa.[96] It can be said that trade transactions gained an ascendancy under the Satavahanas as the potential of the Mediterranian market came to be fully realised.[97] Thus Period II was marked by an agrarian expansion, with considerable surplus production and craft specialisation, growth of trade and money circulation. All this had an impact on the nature of the settlements which became increasingly urban in character with a sound economic background.

Regarding the ideology of the period, the rulers and administrators had an interest in Brahmanism and Bhāgavathism, though Buddhism clearly flourished during this period. The Naneghat inscription of Naganika gives a long list of Vedic sacrifices performed by her husband Satakarni I in the 2nd century B.C.[98] It has been suggested that the early Satavahanas were devoted to Saivism. This is deduced on the basis of the Siva Lingas found at Gudimallam and Amaravati.[99] Besides, early Saivite brick temples have been noticed in the Krishna-Tungabhadra valley datable to the 1st-2nd centuries A.D. At Nagarjunakonda, Saivite temples have been unearthed during the course of excavations datable to the 3rd century A.D.[100] The Astabhuja Nārāyaṇa temple at Nagarjunakonda also indicates that Vaishnavism was favoured during the period. However, more importantly Buddhist establishments flourished during this period and can be seen at Amaravati, Bhattiprolu, Dhulikatta, Chandavaram, Thotlakonda and Bavikonda. Buddhism continued to be a popular religion till the 3rd century A.D. A good number of <u>stupas</u>. <u>viharas</u> and other monastic establishments have been unearthed at Nagarjunakonda.[101]

The growth and spread of Buddhist ideology has been seen as the result of the changes that took place in the socio-economic spheres during Period II. In this connection, Max Weber has argued that "Buddhism presents itself as a product of the time of urban development or urban kingship and the city nobles".[102] The religious establishments could not have been raised, reared up and maintained without the active patronage or support of the <u>Gahapatis</u>.[103] Period II represents an increase in the number of settlements both on the coast and on the plateau.[104] The proliferation of the Buddhist monastic establishments along with a growth of urban centres was a very important feature of this period which was directly related to the economy of the period. The kings extended their patronage to the Buddhist establishments for the consolidation of several economic activities. Sites like Amaravati, Bhattiprolu and Ghantasala were thus patronized as mentioned in the inscriptions available from these sites. This shows that the Satavahanas tried to retain their economic hold on these places and effectively used their patronage of both Buddhist and Brahmanical religious ideologies to buttress their power over different sub-regions of the Deccan. A large cross section of society also actively indulged in gift making activities to the Buddhist establishments and this indicates that, along with the royal patronage, Buddhism particularly enjoyed popular patronage.

According to Amita Ray,[105] improved communication routes, mining operations, money economy, establishment of a Provincial seat of administration and introduction of Buddhism, all these together must have created a social situation which provided a good base for the growth of urban centres. It is further suggested that the services of the artisan and the merchant communities to Buddhism was more important than those of the royal patrons.[106] Most of the epigraphs from **Amaravati** record the gifts by merchants,[107] artisans[108] besides Upasakas and Upasikas.[109] Many of the Buddhist sites occupied a major part of southeastern Deccan called by Subbarao as an 'area of nuclear attraction'[110] constituting the deltas of Krishna and Godavari rivers and the fertile coastal belt.

We next take a look at different aspects of Buddhism and its spread in early historic Andhradesa and also on the origins of the stupa and vihara structures in India. According to the early Buddhist tradition, Buddhism entered Andhradesa during the life time of Lord Buddha itself. A later Buddhist text, the Kathāvatthu,[111] deals with the Andhras who played a prominent role in the third Buddhist Council. In addition to literature, some archaeological sources also provide information regarding the popularity of Buddhism during the 4th-3rd centuries B.C. in Andhardesa. Recent digs at the Mahastupa at Amaravati[112] have yielded Northern) Black Polished ware datable to the 4th century B.C. Discovery of a fragmentary pillar inscription of Asoka at Amaravati[113] along with a few upright pillars of the granite railing with Mauryan polish attest that an early Buddhist stupa here may have been built by Asoka Maurya. The eighth rock edict of Asoka further mentions that the Andhras were within the Rajya Vishaya of the Mauryas and following the Dhamma.[114]

Andhradesa, however, **significantly** became the home of different Buddhist schools and sects and they developed their own set of religious practices. All the sects more or less agree in believing that one may attain merit by erecting, decorating and worshipping the chaitvas or stupas and hence the building of stupas and viharas gained momentum right from the 4th century B.C. in Andhradesa. This ideological intent was perhaps also responsible for the active participation of different strata in the society in raising Buddhist monuments. This came to be indicated in a plethora of evidence. The Buddhist buildings constructed during this period were mainly stupas. chaityas. viharas. podhis and silamantapas.

The conceptual essence behind the origin of building the stupa in the Buddhist religion is important to emphasize. The word stupa means 'to praise', 'to worship' or 'to heap',[115] in funerary association and was thus primarily a mound containing ashes and charred remains of the dead. Some of the Buddhist texts mention the erection of a stupa over fire embers known as Angara Sthupa.[116] In the Su.iatha Jataka.[117] there is a reference to the erection of a Mattika-Sthūpa enshrining the relics of Sujatha's grand father. Stupa was also related to the ritualistic and commemorative aspects of social life. The Stūpavādana[118] describes the commemorative aspect of stupa. We have earliest epigraphical reference to a stupa from the Asokan pillar edict of Nigalisagar[119] which mentions the reconstruction of a stupa. The Buddha himself approved the construction of Stupas on his corporeal remains. As an answer to a question, the Buddha replied "Ananda, that his remains should receive the honours of a universal monarch by stupas being erected over them at crossing of four major highways".[120] According to Buddha four kinds of men were worthy of a Stupa. a Tathagata, a Pratyeka Buddha, a disciple of Tathagata and a Universal monarch.[121] It is intersting to note that the practice of raising stupas at burial places has also been mentioned in Satapatha Brāhmana[122] dated to around 800-700 B.C. We get references to stūpas in the Aśwalayana Grhya Sutra[123] and subsequent literature like the Arthasastra[124] and the Manusmrti[125]

V.V.Krishna Sastry[126] is of the opinion that the concept of a Buddhist stupa might have originated from the Aryan twin funerary practices of burning and burying the dead. K.Krishna Murthy is further of the opinion that the stupas were orginally known to the Brahmanical faith and this idea was subsequently appropriated by the Buddhists with all their appendages.[127]

According to Debala Mitra[128] the Buddhist stupas can be classified into four categories viz., SarTraka. Paribhogika. Uddesika and Votive ones. SarTraka stupas signify those erected over the corporeal relics of the Buddha and his disciples. The Paribhogika stupas were built over the objects used by the Buddha. The Uddesika was commemorative of Buddha's life including the places of his birth, previous births and associated with his visits. Votive stupas were small 1n size and were erected at sacred places of the Buddhists by pious pilgrims to attain religious merit.

Like the stupa. the vihara. a place of residence of the Buddhist monks must also be seen primarily as a religious structure built by the affluent who financially supported the Buddhist sangha. Vihara structures occupied a prominent place in Buddhist settlements as residential areas with all the building appendages required for a healthy habitation. In the beginning, it is said in Buddhist texts that the monks stayed here and there in the forest, at the root of trees, on the hill side, in glens, on mountains, in cemetary areas, in the open air and on heaps of straw.[129] On the request of the monks, the Buddha allowed them to spend the entire rainy season known as Varshavasa at one place. This gradually led the monks to have permanent habitations such as rock-cut and brick built dwellings called the viharas. A place where several viharas were clustered together was called a Sangharama.[130] During the life time of the Buddha itself since the Buddha was regarded as a teacher of Dharma, his followers began to invite him to their places for his discourses and accordingly, they had to provide some arrangements for his stay in the gardens known as aramas. Bimbisara, the king of Magadha was the first to offer a garden Veluvana for the stay of the Buddha.[131] Ananda Pindada, a merchant invited the Buddha, to Sravasthi and on his request the people built some rest houses for the stay of the master and his disciples on the way to Sravasthi.[132] Ananda Pindada also built dwelling rooms provided with fireplaces along with a gandhakuti intended for Buddha's stay in the Jetavana.[133] A setti of Rajagriha happended to see some bhikkus coming hither and thither from the woods and he took pity on them and offered to build dwellings for them, but the bhikkus refused saying that the Buddha did not agree with this. On the request of the bhikkus the Buddha accepted the building of sixty dwelling places at Rajagriha for use of the sangha of the four directions.[134] Then Buddha delivered a discourse, allowing them five kinds of abodes, viz., vihara, addayoga, prasada, hammiya and guha as Varshavasa retreats.[135]

Building constructions of monuments in Period II were therefore, substantially determined by the support, the followers of Buddhism gave to them. The urban environment of the period fostered trade and commerce and this meant that the merchant community was quite prosperous. These groups were also ardent supporters of Buddhism.

Period III in Andhradesa was distinguished by the formation of new regional kingdoms called 'segmentary' by some scholars and 'feudal' by others. But the majority of scholars continue to characterize these as centralized empires. These were those of the Brihatpalāyanas, Sālankāyanas and Anandagotrins Vishnukundins, and other smaller 'chiefs' ruling in various localities of early medieval Andhradesa. During the second stage of period III, beginning around the 7th century A.D., there was the rise of regional kingdoms in the Deccan as a whole such as those of the Western Chalukyas, the Eastern Gangas, and the Rāsṭrakūṭas who ruled over certain areas of medieval Andhra as well.

The Ananda Gotrins ruled over the Guntur region.[136] The Salankayanas ruled over the Vengi region around the 4th-5th centuries A.D. Recent archaeological operations have revealed the existence of an earthen rampart at Pedavegi.[137] The Vishnukundins rose to power in the 5th century A.D. Based on the provenance of their records, their authority may be said to have extended upto Kalinga in the north, the Guntur district was the sourthern limit of their power and besides the coastal districts a major part of Telangāna formed their kingdom.

The next important epoch in political history of Andhradesa begins with the Chalukyas of Badami who ruled from about the 6th to the 8th century A.D. Their activity in Andhradesa was confined to its western part known as Chālukya vishaya,[138] i.e., the present day Rayalaseema region comprising Anantapur, Kurnool, Cuddapah districts and the Mahaboobnagar district of Telangana as evidenced by the location of their inscriptions. Pulakesin II (610-642 A.D.) was the first ruler who brought this region under the sway of the Chalukyas.

Pulakesin II after his conquest of the eastern Deccan, appointed his younger brother Kubja Vishnuvardhana as his Viceroy. He became the founder member of a seperate line of the dynasty that broke away from the main dynasty and came to be known as the eastern Chalukyas of Vengi. They ruled the entire coastal tract of Andhradesa from 624 A.D. to 1026 A.D. Their kingdom comprised the area between the Mahendra mountains in Kalinga and the Maneru river in the present day Nellore district and its western boundary ran along the eastern ghats.

The Rastrakutas of Malkhed, the sucessors of the Chālukyas of Badami continued to rule over the present day Rayalaseema and Telangāna regions with their feudatories, viz., the Vemulavada and Mudugonda branches of the Chalukyas. The early Medieval period has been considered as one of transition, with fundamental changes having occurred in the social, economic, political and ideological spheres and these marked a significant turn in the change from an ancient economy.[139] These structural transformations which have often been termed 'feudal' in character have been considered as an outcome of the system of land grants which had prevailed almost all over the Indian sub-continent during the period.

According to Kulke[140] the process of the territorially segmented development had entered its formative phase with the fifth century A.O. when donations of villages to brahmins became frequent and this is applicable to a similar tendency which began in Andhradesa also. This phenomenon was fully developed during 7th century A.D. when the inscriptions bear evidence of a steadily increasing number of these principalities. From this period onwards, the kings of the loosely structured regional kingdoms, in the absence of a centralised bureaucracy, tried with their traditional patrimonial power, to counter balance the feudal forces by ritual means achieved through royal patronage of places of pilgrimages, encouraging large scale settlements of Brahmins and construction of new temples.[141] Temples were built for increasing religious merit of the persons responsible for construction.[142]

Kulke[143] also holds that the early medieval Hindu Kingdoms tried to integrate the locally powerful groups through the adoption of the religious cults of various indigenous tribes which enabled the medieval state systems to survive with an expansive social and ideological base. The agraharas being the nucleus of agricultural expansion had a tremendous socio-economic impact by bringing the aborginals of the neighbouring forests of hill tracts into closer contact with centres of civilised life and gradually absorbing them into the different strata of the society. In the context of medieval Andhradesa this has been elaborately discussed by B.S.L.Hanumantha Rao.[144] Though there was a relative decline in trade and industry during the period 4th century A.D. to 6th century A.D., which coincided with the issue of land grants to brahmins and resulted in the expansion of the agrarian base. An expansion in agriculture led to an increase in rural settlements[145] and there were a concomitant decline in different types of urban centres between 500-1000 A.D.

It has been systematically researched on the basis of archaeological sources that most of the early historic towns which began to disintegrate from the close of the 3rd century A.D., finally disappeared towards the close of the 5th century A.D.[146] In Andhradesa, desertion of towns is said to have taken place at several sites such as Kotilingala, Dhulikatta, Peddabankur and Polakonda in sub-region A; Veerapuram, Yeleswaram, Nagarjunakonda in sub-region B; Dharanikota and Kesarapalli in sub-region C; and Satanikota and Nandalur in sub-region D. In early Andhradesa, therefore, urban occupation of the early historic period lasted upto the 3rd-4th centuries A.D. only. The nature of decline was similar and all the sites have revealed a lack of ordinary habitations and public utility buildings after this date. The probable causes for the decay, decline and desertion of towns and market centres has been elaborately discussed by R.S.Sharma. As the main proponent of the urban decay theory for this period, he holds that the fall of stable empires, decline of long distance trade, foreign invasions, the kali crisis of social upheaval and widespread unrest caused the decay and desertions of towns during the 3rd-6th centuries A.D.[147]

Some attempts have been made for understanding the process of urban growth and the nature of urbanisation during the early medieval period as well for various regions of India in general, and for south India in particular. In the absence of significant archaeological sources for the study of urban decay and revival of urban centres during the early medieval and medieval periods, B.D.Chattopadhyaya[148] suggests epigraphy as a probable source to undersand the nature of early medieval settlements which emerge as urban in character. He emphasizes however, that these are different from urban centres[149] of the early historical times since this period is marked by an absence of structural remains and indigenous currency in large parts of south India.[150]

In contrast to Chattopadhyaya's view, for the same period, but in the context of western India and based on numismatic data, K.M.Shrimali explains that the cash nexus under the Silaharas was marked by limited use of money despite the revival of trade, spurt in agricultural activities, growing tendency of urbanisation and multiplication of exchange centres in western India between the 9th and 13th centuries A.D.[151] Similar studies have been made to understand the nature of urban growth in the early medieval period for other regions of India. For example, V.K.Thakur's study[152] for the eastern part of India shows that urban centres in this period were only centres of political and religious consumption without any organic links with the agrarian hinterland. Like Shrimali and Thakur, R.N.Nandi also works within the Marxist framework and in broad terms, agrees with R.S.Sharma's hypothesis of a decline in urban centres between the 3rd and 9th centuries A.D. In fact his study[153] shows how there was a migration away from towns in this period and therefore, new methods of ritual patron-client relations had to emerge in the early medieval period which gradually came to revolve around a temple centre. However, unlike Shrimali and Thakur, his study on Karnataka[154] argues that because of agrarian expansion from roughly around the 6th century A.D. due to the land grant economy, there was a gradual improvement in irrigation techniques and knowledge of crops and this naturally created an increase in agricultural surplus. This in turn is said to have led to a re-emergence of market economy and towns in early medieval Karnataka after the 10th century A.D.[155]

Similarly, for Tamil Nadu, Champakalakshmi's writings[156] show **that** **there** was a pattern of urban growth from Pallava-Pāṇḍya to Chola times in early medieval south India but this urbanisation in her opinion was necessarily different from the early historic urbanisation. She does concede that the latter declines because of the decrease in overseas trade.[157] It must however, be stated that no comprehensive work has been done with reference to the decay and growth of towns in Andhrades'a for the early medieval period which covers aspects of analysis that are related to the growth of rural settlements and the particular nature of the land grant economy of the period. Increase in temple centred market towns and especially after the 10th century, the revival of trade and currency along with emergence of cities in medieval Andhradesa can be suggested on the basis of T.Venkateswara Rao's premilinary study which deals with some aspects of village assemblies, medieval market centres and other such information.[158]

In the transition from the ancient to the early medieval period therefore, scholars generally agree that there was a decline of early historic urban centres. However, there is a difference of opinion on what caused this decline. While the above cited Marxist scholars view it in terms of primarily economic forces like decline in trade, etc., there is an approach that looks at more specific internal reasons for this abandonment of towns and urban spaces. At a general level, one of the earliest scholars who wrote about this was K.A.Nilakanta Sastry who suggested that the burning down of villages with their standing crops and the indiscriminate slaughter of households including that of the Brahmins was a recurring feature of feudal warfare during the early medieval times.[159] The Brhatsamhita, a sixth century A.D. text, has also enumerated drought, scarcity, invasions and shifts in river courses as the reasons for desertion and destruction of towns in the early medieval period.[160] The accounts of the foreign travellers further attest to the desertion of towns. The Chinese traveller, Hieun-Tsang had reported that he could not approach the monasteries at Dhanyakataka because these monasteries had already been deserted by this time. In excavating one of the famous towns of early historic Andhra, Yazdani attributed the decline of Buddhist religion as powerful reason for the desertion of the site of Kondapur.[162] Many of the above reasons are in fact, interconnected. For instance, decline in trade meant that the merchant groups that patronised and supported Buddhism financially were adversely **affected** and therefore, the religion could not thrive as it had done earlier. From our point of view this had serious implications for funding building constructions on a large scale which was now not available.

R.N.Nandi suggests that the burning of towns by the invading Kings could have been another cause for the decay of prosperous urban centres.[163] The destruction of towns in his opinion would mean complete snapping of the administrative links between the town and the country. He further elaborates that earlier priests had depended on towns for their dana and were patronised by urban elites. As a result of these changes they now had to turn to a new rural elite for the same patronage. This was linked to their being given remuneration in land by kings of all early medieval dynasties.[164]

The desertion resulted in the migration of artisans and urban elites to small village settlements during the period. The early medieval Agnipurāna[165] says that even a group of five families and the headman could constitute a village. T.Venkateswara Rao, in his survey of Andhradesa gives information on four kinds of villages, viz., Racha Ullu, Nayamkara, Brahmadeva and Devadeva villages and these villages were grouped and organised into Nadus.[166] To determine the nature and types of settlements in early medieval period, when archaeological data is absent, B.D.Chattopadhyaya[167] proposes a method which is dependant on the contemporary perceptions contained in the inscriptions. In these inscriptions references to villages and other settlements are made in the context of land grants. He also says that the use of the terms grama, on the one hand, and pura and nagara on the other, in the epigraphs denote two kinds of settlements, viz., rural and urban. A similar attempt in identifying the types of settlements in early medieval Andhradesa based on Vishnukundins records is made by J.Krishna Prasad Babu.[168] According to his study almost all the Vishnukundin records mention grama and village settlements, whereas very few refer to the pura and nagara settlements.[169]

The period between the 5th and 9th centuries A.D. in Andhradesa witnessed the expansion of large scale agricultural operations which formed the basis for the growth of temple towns in the succeeding centuries.[170] However, some scholars suggest that during the early medieval period it is the temple that emerged as a legitimator of political power and an instrument of peasant subordination and surplus accumulation.[171] Many scholars have discussed the growth of temple centred settlements that sprang up particularly around agrahara or brahmadeya grants and in due course became market towns.[172] In her study on Tamil Nadu, Champakalakshmi explains how the temple as the institutional base for socio-economic and political integration, assumes great significance from the period the 7th to 10th century A:D.[173] She further says that the temples as sacred pilgrimage centres receiving money endowments which led to the trade and urban development in the subsequent period.[174]

From the 7th century A.D. onwards in Andhradesa too some temple towns became important religious and pilgrimage centres. Around them evolved huge urban complexes and subsequently other settlements also rose around them. During the early medieval period, a few of the decaying towns were transformed into TTrthakshetras or holy centres situated on sacred river banks where important rituals had to be performed.[175] In the Visnusmrti[176] it is mentioned that performing Sraddha ritual and dana at these centres was meritorious. The early Puranas also agree with this view.[177] In Andhradesa, Srisailam known as Sriparvata,[178] Alampur[179] and Tripurantakam[180], were the famous TTrthakshetras during the early medieval period. some more holy places of local importance included were the Pañchārāmas, Chebrolu, Pithapuram and Vijayawada.[181] Most of these centres grew up as market centres with urban settlements.

Between the 4th-5th centuries A.D. Buddhism lost its ground and became practically extinct in Andhradeśa by the end of the Vishnukundin period. Most of the rulers started donation of land and agraharas to Brahmins. Many agriculturists who were engaged in tilling the land of these gifted lands became loyal to the Brahmanical religion.[182] The process of the acculturation of local tribal cults into the main stream of Brahmanism was a complicated process and took a considerable time to manifest itself in various forms of sectarian worship in medieval Andhradesa.[183] Śaivism was the predominant system of belief during this period and many Saivite temples were built all over Āndhradeśa during the period.[184] V.K.Thakur[185] points that the temple building activity was aided by the emergence of certain religious beliefs and this, in a way, tended to provide the very ideological sustenance to the feudal system itself. The Pāsupatas were the earliest of the Saivite sects in Andhradesa and were popular during the

7th-8th centuries A.D. and from the 9th centuries A.D. onwards the Pasupatas were replaced by the Kālamukhas.[186]

The Anandagotrins followed Saivism and constructed an apsidal temple at Chejarla.[187] The Salankayanas claimed that they were the devotees of Chitrarathaswamy, i.e., Surya and constructed a Chitrarathaswamy temple at Vengipura. Recent archaeological operations here have also revealed the existence of a Buddhist Stūpa at Vengipura.[188] The Vishnukundins were called Parama Māheśvaras but they patronised Buddhism too. Govinda varma[189] embellished all the quarters of his kingdom by constructing temples, stupas, monasteries, halls, drinking houses, ponds, wells and gardens. Madhava Varman II patronised the Brahmanical order and constructed several temples.[190] The archaeological excavations at Keesaragutta have brought to light a good number of brick temples, palace, residential buildings surrounded by a huge fortification of the Vishnukundin period.[191] Some scholars believe that the rock-cut caves at Vijayawada were excavated by the Vishnukundins.[192] Buddhism disappeared from this period as Brahmanical religion gained momentum and flourished on a large scale henceforth.

The early Chalukyan rulers favoured Vaishnavism until the time of Vikaramāditya, though they were tolerant to Saivism and Jainism as well. The Pāsupata cult of Saivism was dominant in this aspect. All the nine Nava Brahma temples at Alampur are dedicated to Siva. Sakta and Harihara cults also received due attention during the period. Temples in the Rāsṭrakūṭa style were constructed during this period as seen at Kudali Sangamesvaram,[193] Kadamara Kaluva, Mahanandi, Panyam and Satyavolu. Temples constructed in Kadambanagara style, i.e., in stepped pyramidal order of the period are also located at Panchalingala, Maramunagala, Somasila, etc. The Rashtrakuta temples in Andhradesa are seen at Alampur, Tandrapadu, Sangameswaram, Mallesvaram, Miyapur and Veldurti.[194] In these temples the proliferation of subsidiary shrines indicates the incorporation of lesser deities at the local level.

In political terms, Period IV witnessed the rule of the Chalukyas of Kalyani, the Eastern Gangas, the Chālukya-Cholas and the Kakatiyas of Warangal. The Kakatiyas were a major medieval power in Andhradesa who ruled over it from the middle of the 11th century to the first quarter of the 14th century A.D. Beginning as the Commanders of the Rāstrakūtas in the Koravi region, they slowly rose to imperial position, under the Chalukyas of Kalyana.[195] The Kakatiya government was a monarchy.[196] C.V.Ramachandra Rao analyzes the Kakatiya state to describe it as a metropolitan state which maintained relationships between central, intermediate and peripheral zones. He also argues that this metropolitan state maintained segmentary units of power within the intermediate and peripheral zones.[197] M.Krishna Kumari, following the methodological framework of German scholars like Kulke, opines that with the development of popular Bhakti cult and increase in number of temple festivals which blend the religious ideologies of the elite with those of the masses, the temples became the centres of continuous integration of territories was operated during the medieval period in Āndhradeśa.[198]

Between the 10th and 11th centuries A.D., the Brahmanical temple emerged as a landlord on a large scale. This phenomenon went hand in hand with the spread of the bhakti cult and the temples supported by local bases of power became centres of this devotional ideology. Besides the royal members, the lesser Chiefs also made grants mostly to the temples. By providing patronage to such institutions, the state system could effectively establish its hold over society. Thus "the contributive potential of the temple in the legitimisation of a political power based on social differentiation is clearly discernible with active participation of the agencies of political power with the creation and promotion of a network of temple centred monastic groups".[200]

Besides, urban activity also began to be centred around the Brahmanical temples which became the main focus of the commercial activities for the cluster of villages around it.[201] Politically and economically highly developed nuclear areas yielded sufficient surplus crop for the establishment and the maintenance of a sub-regional power.[202]

Apart from Kulke, several other scholars have tried to characterize medieval Indian polity. Nuclear areas of sub-regional power as conceived by Burton Stein[203] in south Indian context, has been applied to the Kakatiyas of Andhradesa since they superimposed their imperial power on various small kingdoms of the Malyala, Viriyala, the Koṇḍapaḍumaṭi, the Kanduru Cholas, the Cherakus, the Chalukyas of Vemulavāḍa and the Telugu Chōdas of Nellore. In this context, a regional kingdom based on an amalgamation of the already highly developed nuclear areas with their own cultural and socio-political loyalties was described by Burton Stein as a 'multicentered system of power'.[204] Kulke[205] agrees that the nuclear areas were regarded as an integral part of a continuous process of political development.

James Heitzman[206] sees a rapid decrease in the penetration of all aspects of royal influences with an increasing distance from the centre of the polity in medieval south India. This is based on his study of state formation in south India with special reference to the Cholas. He further explains that south India during this period was dotted with the landscape of fertile agricultural zones that encouraged ritual manifestations of authority.[207] Studying ritual polity and economy in medieval south India, Heitzman argues that by donating to learned brahmins or to temples, the donors protected dharma, in the manner of a king and thus legitimately shared political power.[208]

The social structure of the Period IV was ideologically permeated by the concept Varna.[209] The Brāhmins occupied a foremost place in the society. They held lucrative posts under the government. However, there were significant changes in the ordering of society. The Ksatriyas had lost their past glory and Sudra rulers also came to power for the first time. The Kakatiyas were sudras.[210] This implies that all warrior groups were not assimilated into the category of the Kṣatriya varna. The ruling Sudras enjoyed power or status in the society whereas on the other hand, the Sūdras who belonged to the lower strata of society acted as agricultural labourers.[211]

In the economy of this period, the organisation of functional groups such as the Panchanamvaru, weavers, etc. of the society as a viable economic institutin is a significant development.[212] The guilds of the period traded in different kinds of agricultural products and other commodities and had a wide network connected with religious-cum-commerical centres like Alampur, Tripurantakam, Krishnapatnam, Pedaganjam, Motupalli, and Warangal. The Kakatiya Ganapatideva revived the sea-borne trade of Andhradesa as indicated by the Motupalli inscription known as Abhayasasana of 1245 A.D.[213] The Venetian traveller Marco Polo visited the port of Motupalli during the closing years of Rudramadevi's reign. Besides Motupalli, Krishnapatnam, Chinaganjam, Nellore and Divi also played a very important role in fostering the sea-borne trade.[214] With regard to the craft organisation of the period, mention should be made of the Panchanamvaru[215] or Pañchāli comprising of goldsmiths, blacksmiths, carpenters, braziers and stone cutters. This guild received royal patronage and the economic stability prompted the building of temples in large numbers.

It was the desire to spread a certain religious ideology that also prompted the activity of temple building during Period IV. As mentioned earlier this period covered the rule of the Eastern Chalukyas, the Eastern Gangas and the Kakatiyas. The Eastern Chālukya temples of the period, with a distinct style, are seen at Draksharama, Samalkot, Bhimavaram, Amaravati and Chebrolu.[216] The Eastern Gangas had also constructed temples in their kingdom as noticed at Mukhalingam, Jayati, Narayanavaram, Galavelli, Arasavelli and Simhachalam in their own distinctive style. The religious scene of Andhradesa from about 1000 A.D. to the 14th century A.D. was as momentous as that in the contiguous Karnataka region. The growth of the Kālāmukha centres, viz., Amaravati, Alampur, Srisailam, Tumbalam, Nadendla, Vijayawada, Hanumakonda and Pushpagiri,[217] Vaishnavism spread very slowly and Ramanuja's contribution accelerated the growth of this religion in Andhradesa. Jainism was also in a flourshing state. The rule of the Kakatiya kings saw innumerable temples being built not only by them but also their subordinate officers all over Āndhradeśa. The rise of new religious movements of devotionalism and the general prosperity in the economic conditions of the period was concomitant with a stable political order.[218] That a great amount of public money went into temple building and their maintenance during this period is mentioned prolifically in the contemporary literature. The Pratapa Charitra[219] mentions that the Kakatiya king Prataparudra spent every year one crore of coins for the upkeep and the grandeur of the temples of Ekaśilānagara, besides spending another three crores for the maintenance of Saiva and Vaishnava temples situated inside and outside Andhradeśa. The Siddheswara Charitam[220] states that, this monarch set apart 2000 villages, besides the amount mentioned above, for the various expenses of the temples. Saivite temples were predominant in numerical strength during this period. For example, the Pratapa Charitra[221] gives the number of temples situated in the city of Warangal during Prataparudra's time as temples dedicated to Siva being 5500 and to Vishnu being 1300. These numbers however, seem to be an exaggeration but they do indicate the popularity of the former vis-a-vis the latter.

Saivism was the predominant faith during the Kakatiya period. Viśveśvara Śivāchārya was the religious Guru of Ganapatideva. Vaishnavism also received equal patronage of the rulers.[222] The Kakatiyas took a special interest in building temples which are distributed throughout the length and breadth of the kingdom. The 1000 Pillared Temple at Hanumakonda constructed during the time of Rudradeva in 1162-63 A.D.[223] was a land mark in the evolution of the Kākatiyan style of architecture. The climax of the Kakatiyan style of architecture is seen at the Ramappa temple at Palampet constructed by Recherla Rudra, the Commander-in-Chief of Ganapatideva. Other important temples are Ramanujapur, Katakshapur, Jakaram, Nagulapadu, Nidikonda, Nagunuru and Tripurantakam.[224] All these temples were able to acquire funds mainly from the munificient gifts made by the pious donor which included kings, Queens, subordinate officers, noble and corporate bodies such as guilds of merchant and artisan communities and private individuals both rich and poor.[225]

In an overview of the above discussions on historical space it would be appropriate to highlight the significance of each of the dimensions of interpreting historical change that we have focussed upon. First and foremost, understanding the transition from pre-state to state society provides us the essential background to explain the importance of small kin-based forms of social organization as a precursor to the socially complex and stratified relations during early historical times. This went hand in hand with the growth of a more integrated economic system which was absolutely necessary for the generation of enough surplus wealth in society. Further, the accumulation of political power in the hand of organized ruling elites enabled this to be galvanized in such a way that resources could be effectively used by urban elites. These changes were ultimately linked to, and manifested in, far-reaching ideological implications for society in early Āndhradeśa. The institutionally unorganized, but focussed, belief patterns of groups responsible for the megalithic culture gave way to a full-fledged movement of Buddhism flourshing in many parts of the Deccan. Thus, whereas socio-political forces of organisation have a considerable bearing on understanding the particular nature of monumental defence structures, the growth of Buddhism dotted the landscape of early Andhradesa with the first monumental religious buildings. On the other hand, 1n terms of the ordinary housing structures and the material used to build them, there is a remarkable continuity from proto-historic times indicative of the fact that some of the community based skills gained in strength and were collectively transmitted over generations.

A major shift in the economic modes of surplus appropriation takes place during early medieval times and the social groups involved in this process, as well as the institutional base of the new ideology, gives vent to the rise of a new socio-political structure of governance. Some of these interesting changes lay the foundation for the new character of the medieval state in Andhradesa. Thus, our discussion on Period III and IV above must be seen together. These have primarily highlighted the possible interpretative angle on the basis of which it is possible to understand the tremendous growth of temple building activity. Agrarian growth during this period also had a great impact on increase in irrigation related structures and improving upon their techniques. What is however, particularly significant in the context of these two periods (III and IV) is that there were powerful local organisational bases to distribute the resources like village assemblies, the temple, trade and merchant guilds and so on. Further, it was crucial to focus on recent interpretations of the integerative forces that led to state organisation as the old images of centralized empires in the medieval context are fast waning in historical writings. By far the most relevant historical interpretations, particularly for Period III, have been those pertaining to the recent debates about the decline on the one hand, and growth on the other, of urban centres which we have focussed upon in our discussions above. They gain relevance primarily because archaeological data for ordinary housing structures and dwellings is lacking for these two periods. This necessarily raises the question of the nature of early medieval settlements particularly in the context of the growth of temple centred agrarian settlements. Housing patterns and dwellings in such an environment must be located as being almost permanently around these major temple settlements. In our assessment therefore, to explain the total context of historical space we have tried to highlight the key areas of recent historical interpretation on facets of the relationship between the economy and ideology with socio-political developments for the various periods under study.

FOOTNOTES

1. R.Champakalakshmi, 'The Dravida Style of Architecture: A Historical Perspective', Indian Horizons. Vol.XXXI, no.2, 1982, p.7. For instance she delineates these as Pallava-Pandya, Chola, Later Pandya and Vijayanagara.

2. F.Braudel, On History (Trans. Sarah Mathews), Chicago, 1980, Essay I.

3. E.H.Carr, What is History? Penguin Books, 1964 (Rp.edition 1985), pp.20-30. Carr's famous answer to the question 'What is history?' "is that it is a continuous process of interaction between the historian and his facts, an unending dialogue between the present and past" (p.20).

4. For a most recent discussion on understanding the transition from one historical period to another see B.D.Chattopadhyaya, The Making of Early Medeival India. OUP, 1993, Introduction, pp.3-14.

5. M.H.Fried, Evolution of Political Society. New York, 1967, pp.10-22.

6. E.R.Service, Primitive Social Organisation: An Evolutionary Perspective. New York, 1962, p.110.

7. Ibid, p.111.

8. E.T.Sanders and J.Morino, New World Prehistory. Prentice Hall, 1970, p.6.

9. M.D.Sahlins, Tribesmen. Prentice Hall, 1968, p.7.

10. H.Spencer, The Principles of Sociology. Vol.1, New York, 1896, p.523.

11. Ibid, p.524.

12. M.H.Fried, OP. Cit.. 1967, p.183.

13. Ibid, p.105.

14. M.H.Fried, 'Warfare, Military Organisation and the Evolution of Society', Anthropoiogica. 3, pp.134-147.

15. M.H.Fried, Op. Cit. . 1967, p.105.

16. M.K.Dhavalikar, 'Cultural Ecology of the Chalcolithic Maharashtra', in S.B.Deo and K.Paddayya (eds), Recent Advances in Indian Archaeology. Poona, 1983, p.141.

17. Ibid. p.142.

18. Ibid. p.143.

19. B.Subrahmanyam, Protohistoric and Early Historical Cultures of the Mahboobnagar Region. Ph.D. Thesis (unpublished), University of Mysore, 1986, p.102.

20. F.R.Allchin, Utnoor Excavations. Hyderabad, 1961, pp.11-17.

21. B.Subrahmanyam, Op. Cit. 1986, p.107.

22. Ibid. pp.127-128, pl.XXIV.

23. V.V.Krishna Sastry, The Proto and Early Historic Cultures of Andhra Pradesh. Hyderabad, 1983, p.45.

24. E.Siva Nagi Reddy and B.Subrahmanyam, 'A Copper Antennae Sword from Protohistoric Andhra: A Study', PAPHC 16th Session, Karimnagar, 1992, pp.20-22.

25. B.G.Trigger, 'Monumental Architecture: A Thermo-Dynamic Explanation of Symbolic Behaviour', WA, vol.22, no.2, pp.119-131.

26. C.Renfrew, Approaches to Social Archaeology. London, 1984, p.220.

27. E.R.Service, Op. Cit., 1962, p.143.

28. Shereen Ratnagar, Enquiries into the Political Organisation of Harappan Society. Pune, 1991, p.13.

29. A.Sundara, Early Chamber Tombs of South India. Delhi, 1975, p.1.

30. S.B.Deo, 'Some Aspects of Megalithic Technology', in Madhu: Recent Researches in Indian Archaeology and Art History. (M.N.Deshpande Festscreift), Delhi, 1981, p.33.

31. M.K.Dhavalikar, 'A Plough Coulter from Brahmagiri, India', Antiquity. vol.XLII, 1968, pp.137-138.

32. S.B.Deo, Problems of South Indian Megaliths. Dharwar, 1973, p.18.

33. M.L.Nigam, Excavation Report of two Megalithic Burials at Hashmathpet. Hyderabad, Hyderabad, 1978, p.6.

34. B.Subrahmanyam, Op. Cit.. 1986, p.247.

35. T.V.G.Sastry, Brief Results of the Excavations at Veerapuram. Hyderabad, 1981, p.23.

36. On the otherhand, based on his researches of the megalith sites in the Vidharba region of Maharashtra, Deo suggests that their economy was mainly based on pastoralism. See K.Paddayya and S.B.Deo (eds.), OP. Cit. Poona, 1983, p.77.

37. A.H.Longhurst, Annual Report of Archaeological Department. Southern Circle for 1914-15. Madras, 1916, pp.54-59.

38. V.V.Krishna Sastry, Op. Cit.. 1983, p.79.

39. R.Subrahmanyam, Nagarjunakonda (1954-60) Vol.1, Delhi, 1975, p.194.

40. K.M.Ahmad, 'Preliminary Excavations at Pre-historic Sites near Janampet', ARADN. 1940-41, p.13.

41. V.V.Krishna Sastry, Op. Cit.. 1983, p.99.

42. R.Subrahmanyam, Op. Cit., 1975, p.179.

43. B.Subrahmanyam, Op. Cit. 1986, p.246, pl.XLVIII.

44. E.H.Hunt, 'Hyderabad Cairn Burials and their Significance', JRAI. vol.54, 1924, pp.140-156.

45. E.Siva Nagi Reddy and B.Subrahmanyam, 'Combs 1n Proto and Early Historic Andhra: A study', PIHC, 51st Session. Calcutta, 1991, pp.822-826.

46. E.B.Tylor, Primitive Culture. New York (3rd Edn), 1857, p.5.

47. Norbeck Edward, 'Anthropological Views of Religion', in J.C.Fever et al (eds.), Religion in Philosophical and Cultural Perspective. New Delhi, 1971, p.419.

48. J.Meringer, History of Religion: The Gods of the Prehistoric Man (Eng. tr.), London, 1960, p.159.

49. S.K.Rao, 'Use of Ethnography in South Indian Megalithic Studies', Eastern Anthropologist. vol.44, no.2, pp.44-50.

50. Bride Surgeon General, 'Archaeology', JRAS. vol.XXI, 1887, p.694.

51. J.H.Hutton, 'Nagachank Ornaments of South Indian Affinities', Man. vol.XXVI, 1926, p.223.

52. R.Thapar, From Lineage to State. Bombay,, 1984, p.19.

53. Ibid. p.10.

54. Ibid, p.47.

55. Panini. IV. 2-31, VI. 2-34.

56. R.S.Sharma, 'Origin of the State in India', D.D.Kosambi Memorial Lectures. Delhi, 1987, p.2.

57. R.Thapar, Op. Cit., p.12.

58. M.H.Fried, Op. Cit., 1967, p.229.

59. J.M.Classen and P.Skalnik (eds.), The Early State: Theories and Hypothesis. The Hague, 1981, p.3.

60. A.Ghosh, The City in Early Historic India. Simla, 1973, p.35.

61. S.Seneviratne, 'Kalinga and Andhra: The Process of Secondary State Formation', IHR, vol.VII, no.1-2, 1980-81, p.54.

62. Ibid, p.54.

63. Middleton and D.Tait, Tribes without Rulers. London, 1964, p.23.

64. S.Seneviratne, Op. Cit. 1980-81, p.54.

65. Ibid, p.54.

66. Vimala Begley, 'From Iron Age to Early Historical in South Indian Archaeology', Jerome Jacobson (ed.), Studies in the Archaeology of India and Pakistan. New Delhi, 1986, p.301.

67. D.C.Sircar, Inscriptions of Asoka. New Delhi, 1975 (3rd Edn), p.32.

68. I.K.Sarma, 'C14 Dates, NBP ware and Early Historical Archaeology of Peninsular India', JIH, vol.41, pt.1, pp.49-59.

69. I.K.Sarma, Studies in Early Buddhist Monuments and Brahmi Inscriptions of Āndhradeśa. Nagpur, 1986, p.

70. T.V.G.Sastry, et al, Veerapuram: A Type Site for Cultural Study in the Krishna Valley. Hyderabad, 1984, p.98.

71. Ibid, pp.98-99.

72. G.Yazdani, 'Excavations at Kondapur: An Andhra Town (c.200 B.C.-200 A.D.)', ABORI, vol.VII, pt.vii, 1941, p.177.

73. I.K.Sarma, Coinage of the Satavahana Empire, Delhi, 1980, p.126.

74. P.V.P.Sastry, 'Political System in Early Coastal Andhra', D.Handa (ed.), Ajayasri: Prof. A.M.Shastry Felicitation Volume. Delhi, 1989, pp.71-74.

75. £1, vol.XXXI, pp.87-88.

76. Ibid. pp.328-329.

77. T.V.G.Sastry, Vaddamanu Excavations. Hyderabad, 1983, p.16.

78. EI, vol.XXXII, p.86.

79. R.Subrahmanyam, Guntupalli Brahmi Inscription of Kharavela. Hyderabad, 1968, p.3.

80. ND, vol.11, no.1, p.10 ff and Ibid, vol.III, no.2, pp.17 ff.

81. B.D.Chattopadhyaya, 'Transition to the Early Historical Phase in the Deccan: A Note', in B.M.Pande,, B.D.Chattopadhyaya (eds), Archaeology and History, vol.11, Delhi, 1987, pp.727-732.

82. P.V.P.Sastry, Op. Cit.. 1989, p.72.

83. D.D.Kosambi, An Introduction to the Study of Indian History. Bombay, 1985 (RP), p.242.

84. Aloka Parasher, 'Social Strucutre and Economy of Settlements in the Central Deccan (200 B.C.-A.D.200)', in Indu Banga (ed.), The City in Indian History. Delhi, 1991, p.46.

85. R.Subrahmanyam, 'Secular Remains at Nagarjunakonda', JAHRS. vol.XXXVIII, pt.iv, Hyderabad, 1987, pp.1-42.

86. K.Satyanarayana, A Study of the History and Culture of the Andhras. Vol.1, Delhi, 1975, p.132.

87. Ibid. p.154.

88. B.S.L.Hanumantha Rao, 'Formation of Social Groups in Andhra', PAPHC. 13th Session, Srisailam, 1989, p.9.

89. Y.Gopala Reddy, A Comprehensive History of Andhra. Hyderabad, 1990, p.16.

90. I.K.Sarma, 'Historical Archaeology of Ancient Andhra in the Light of Recent Excavations at Amaravati, Nagarjunakonda and Pedavegi', in A.Ray and S.Mukherjee (eds.), Historical Archaeology of India. Delhi, 1990, p.110.

91. D.C.Sircar, Select Inscriptions. vol.1, Calcutta, 1970, p.161; Gathasaptasati. 490; and £1, vol.VIII, Ins.no.15, pp.59-96.

92. Vibha Tripathi, 'Impact of Metal Technology on Economic Development', in A.Ray and S.Mukherjee (eds.), Op. Cit.. 1990, p.195.

93. Aloka Parasher, 'Mechanism of Trade and Historical Change in the Mid-Godavari Valley' c.200 B.C.-A.D.200', PAPHC. 10th Session, Guntur, 1986, pp.26-33.

94. H.P.Ray, Monastery and Guild. Delhi, 1986, p.70.

95. H.Sarkar, 'Emergence of Urban Centres in Early Historical Andhradesa', in B.M.Pande and B.D.Chattopadhyaya (eds.), Op. Cit.. 1987, pp.631-641; Also see K.Raghavachari, 'Dharanikota and its Western Contacts', QRHS. vol.XII, 1972-73, pp.167-70.

96. V.V.Krishna Sastry, Roman Gold Coins Recent Discoveries in Andhra Pradesh. Hyderabad, 1992, pp.3-4.

97. H.P.Ray, OP. Cit.. 1986, p.158.

98. ARASWI. vol.V, p.60 ff.

99. I.K.Sarma, The Development of Early Saiva Art and Architecture. Delhi, 1982, pp.76-77.

100. R.Subrahmanyam, 'The Brahmanical Structures at Nagarjunakonda', *Itihas*, vol.VIII, no.1, Hyderabad, 1981, pp.13-27.

101. H.Sarkar, *Studies in Early Buddhist Architecture of India*. Delhi, 1966, pp.1-25; Also see Jitendra Das, *The Buddhist Architecture in Andhradesa*, Delhi, 1993, pp.18-19.

102. M.Weber, *The Religion of India*. Glencoe, 1958, p.204.

103. Amita Ray, 'Beginnings of Urbanisation in Early Andhradesa', in J.S.Grewal and Indu Banga (eds.), *Studies in Urban History*. Amritsar, 1978, pp.40-41.

104. H.P.Ray, *Op. Cit.*, 1986, p.31, 52.

105. Amita Ray, *Op. Cit.*. 1978, p.35.

106. B.S.L.Hanumantha Rao, *Op. Cit.*. 1993, p.69.

107. *Luders List* no.1229.

108. *Ibid*, no.1247.

109. *Ibid*, no.1303

110. B.Subba Rao, *The Personality of India*. Baroda, 1958, p.12, 21.

111. Rhys Davids and S.Zan Aung, *The Points of Controversy*. Oxford, 1915, p.10.

112. IAE, 1973-74, p.4.

113. £1, vol.XXV, p.40.

114. *Ibid*. p.40.

115. Priyabala Shah, 'Aiduka', *JOI*, vol.1, 1951-52, Baroda, p.271.

116. *Digha Nikaya*, II, p.164.

117. B.Barua, *Barhut III*. Calcutta, 1937, pp.9-11; *Sujatha Jataka*. F.No.352.

118. Saratchandra Das (ed.), 'Stupavadana', *Journal and Text of the Buddhist Society of India*. vol.11, pt.1, p.15.

119. D.C.Sircar, *Select Inscriptions*, vol.1. Calcutta, 1942, p.71.

120. T.W.Rhys Davids, 'Buddhist Suttas', *SBE*, vol. XV, Oxford, 1881, p.93; *Mahapari nibhana sutta*, VI.52.

121. Susheela Pant, *The Origin and Development of Stupa Architecture in India*. Varanasi, 1976, p.46.

122. P.V.Kane, *History of Dharma Sastras*, vol.VI, Poona, 1953, p.247.

123. Aswalayana Grhya Sūtra, Bk.I, 12-13;

124. Arthasastra. Bk.III, 18.

125. Manusmrti, X.50.

126. V.V.Krishna Sastry, et al, Thotlakonda (A Buddhist site in A.P.), Hyderabad, 1992, p.19.

127. K.Krishna Murthy, Mirrors of Indian Culture. Delhi, 1982, p.144.

128. D.Mitra, Buddhist Monuments. Calcutta, 1971, p.21.

129. I.B.Horner (tr), 'Cullavagga', SBB, vol.XX, London, 1952, p.204.

130. S.Beal, Buddhist Records of the Western World. (2nd Edn), Delhi, 1983, p.218.

131. Mahāvagga. I.22.18.

132. I.B.Horner (tr), Op. Cit.. 1952, p.187.

133. Ibid, p.188.

134. Ibid, pp.157-160.

135. Ibid, pp.159-160.

136. T.V.G.Sastry, 'A Bhumija Temple from Chaityagriha at Cejarla', Itihas, vol.III, no.1, Hyderabad, 1978, p.19.

137. I.K.Sarma, 'New Light on Vengipura: Excavations at the Ancient Historical City of Andhradesa', Puratattva. no.17, Delhi, 1988, pp.15-21.

138. N.Ramesan, Copper Plate Inscriptions of Andhra Pradesh. Government Museum. Vol.1, Hyderabad, 1962, pp.42-43.

139. Y.Tejaswini, 'Social Groups and Economic Change 7th-13th century A.D.', in Aloka Parasher-Sen (ed.), Social and Economic History of the Deccan Some Interpretations. Delhi, 1993, p.158.

140. H.Kulke, 'Royal Temple Policy and the Structure of Medieval Hindu Kingdoms, in A.Eschmann et al (eds.), The Cult of Jagannatha and the Regional Traditions of Orissa. Delhi, 1978, p.127.

141. Ibid, p.132.

142. Brhatsamhita. LV.2.

143. H.Kulke, 'Fragmentation and Segmentation Versus Integration Reflection on the Concepts of Indian Feudalism and the Segmentary State in Indian History', Studies in History. vol.V, no.2, 1982, p.21.

144. B.S.L.Hanumantha Rao, Op. Cit., 1989, p.9.

145. Y.Tejaswini, Op. Cit.. 1993, p.161.

146. R.S.Sharma, Urban Decay in India, Delhi, 1987, pp.132-141; pp.87-100; Also see, V.K.Thakur, Urbanisation in Ancient India. Delhi, 1981, pp.261-320.

147. R.S.Sharma, Op. Cit.. 1987, pp.132-139; 167-183.

148. B.D.Chattopadhyaya, 'Urban Centres in Early Medieval India: An Overview', in S.Bhattacharya and Romila Thapar (eds.), Situating Indian History. Delhi, 1986, pp.8-33.

149. Ibid, p.15.

150. B.D.Chattopadhyaya, Coins and Currency System in South India. AD 225-1300. Delhi, 1977, p.118.

151. K.M.Shrimali, 'Cash, Nexus on Western Coast A.D.850-1250: A study of Silaharas', in A.K.Jha (ed.), Coinage Trade and Economy. Nasik, 1991, pp.178-193.

152. V.K.Thakur, 'Trade and Towns in Early Medieval Bengal' (c.A.D.600-1200), JESHO. vol.XX, pt.II, June 1987, pp.196-220.

153. R.N.Nandi, Social Roots of Religion in Ancient India. New Delhi, 1986, pp.18-26.

154. R.N.Nandi, 'Growth of Rural Economy in Early India' Presidential Address, PIHC. 44th Session, 1984, Annamalainagar, pp.1-72.

155. O.P.Prasad, 'Trade in the Growth of Towns: A Case Study of Karnataka (600-1200), PIHC. 40th Session, Bombay, 1980, p.154.

156. R.Champakalakshmi, 'Urban Process in Early Medieval Tamil Nadu', Occasional Paper Series no.3, Urban History Association of India, Amritsar, 1990, pp.1-17 and idem, 'Urbanisation in Medieval Tamil Nadu', in, S.Bhattacharya and R.Thapar (eds.), Op. Cit.. 1986, pp.34-76.

157. Idem, 'Growth of Urban Centres in South India: Kudamukkupalaiyarai, the Twin City of the Cholas', in Studies in History. vol.21, 1979, pp.1-29.

158. T.Venkateswara Rao, Local Bodies in Medieval Andhra. Hyderabad. 1987, pp.77-79.

159. K.A.N.Sastry, A History of South India. Madras, 1947, p.958.

160. Brhatsaṁhita. Ch.XV.42; XIX.7; XLVI.36, 41, 47, 55.

161. T.Watters, in T.Rhys Davids and S.W.Bushells (eds.), On Yuan Chwangs Travels in India. Vol.1, London, 1904-05, p.168.

162. G.Yazdani, OP. Cit.• 1941, p.182.

163. R.N.Nandi, Op. Cit., 1986, p.22.

164. R.S.Sharma, Indian Feudalism, c.300-1200 A.D., Delhi, 1980 (RP), pp.110-126.

165. Agnipurāna, 165.11.

166. T.Venkateswara Rao, Op. Cit.. 1987, p.77.

167. B.D.Chattopadhyaya, Op. Cit.. 1986, pp.17-18.

168. J.Krishna Prasad Babu, Socio-Economic Conditions in the Deccan 4th-7th Century A.D. from Vishnukundins Records. M.Phil Dissertation, University of Hyderabad, 1989. (unpublished), Also see, J.Krishna Prasad Babu, 'Social and Economic Change (AD 400-700)', in Aloka Parasher-Sen (ed.), Op. Cit.. 1993, pp.115-134.

169. Ibid, pp.73-78.

170. R.Champakalakshmi, Op. Cit.. 1982, p.1.

171. According to D.N.Jha, in his analysis on 'Temples as Landed Magnets in Early Medieval South India', the grants of lands and villages to temples during this period gave rise to an expansion of temple personnel who were paid in kind or through allotments of land which resulted in the growth of feudal land tenures. He also argues that the endowment of land and village to temples weakened the central authority. See D.N.Jha, 'Temples as Landed Magnets in Early South India (c.A.D.700-1300), in, R.S.Sharma & V.Jha (eds.), Indian Society: Historical Probings. Delhi, 1974, pp.202-216.

172. R.N.Nandi, Op. Cit.. 1984, p.14.

173. R.Champakalakshmi, Op. Cit.. 1986, p.38.

174. Ibid. p.38.

175. R.N.Nandi, OP. Cit.. 1986, pp.46-54.

176. Visnusmrti, Ch. LXXV.

177. R.C.Hazra, Studies in the Puranic Records. Delhi, 1975, Ch.IV.

178. M.Rama Rao, says that Srisailam was an important Tirthakshetra during the 7th-8th centuries A.D, See his 'Temples of Srisailam', JAHRS, vol.XXVI, pp.103-104.

179. See Gurajala Inscription, EI, vol.XXVII, p.23 ff.

180. TI, vol.11, pp.21,23,26,30.

181. B.S.L.Hanumantha Rao, Op. Cit.. 1993 (RP), p.230.

182. B.S.L.Hanumantha Rao, Op. Cit., 1989, p.9.

183. M.L.K.Murthy, 'Environment, Royal Policy and Social Formation in the Eastern Ghats, South India, A.D.1000-1500', Presidential Address, Indian History Congress. 53rd Session, Warangal, 1993, pp.10-19.

184. B.S.L.Hanumantha Rao, Op. Cit., 1993, pp.311-312.

185. V.K.Thakur, 'Feudal Content of the Pala Art: A Framework for Enquiry', PIHC. 48th Session, Goa, 1987, p.104.

186. B.Narasimha Rao, 'Kalamukhas in A.P. upto 10th century A.D.', PAPHC. 3rd Session, Vijayawada, 1978, pp.29-31.

187. T.V.G.Sastry, Op. Cit.. 1978, p.19.

188. I.K.Sarma, Op. Cit.. 1988, pp.15-21.

189. S.Sankaranarayana, 'Two Vishnukundin Charters from Tummalagudem', EA, vol.11, Hyderabad, 1974, pp.4-20.

190. N.Venkataramanayya, Vishnukundinulu (Telugu). Hyderabad, 1975, p.27.

191. V.V.Krishna Sastry, 'Keesara- A Capital of Vishnukundins?' APJA. Vol.1, no.1, Hyderabad, 1970, p.101.

192. K.Rama Mohana Rao, Early History of the Andhradesa from the fall of the Satavahanas to rise of Eastern Chālukyas. Ph.D. Thesis, Karnatak University, Dharwar, 1981 (unpublished).

193. N.Ramesan, Op. Cit. . 1962, pp.42-43.

194. B.Rajendra Prasad, Art of South India: Andhra Pradesh. Delhi, 1980, pp.131-135.

195. P.V.P.Sastry, The Kakatiyas of Warangal. Hyderabad, 1978, p.45.

196. P.V.P.Sastry, Op. Cit.. 1978, p.179.

197. C.V.Ramachandra Rao, 'The Kakatiya Polity, Economy and Society', PAPHC. 14th Session, Warangal, 1990, p.61.

198. M.Krishna Kumari, 'An Analysis of the Political Structure in Medieval Andhra Kingdoms', PAPHC. 12th Session, Anakapalle, 1988, p.75.

199. Y.Tejaswini, Op. Cit.. 1993, p.162.

200. Ashok Settar, 'Aspects of Agricultural Expansion in Early Medieval Southern Karnataka', in K.Veerathappa (ed.), Studies in Karnataka in History and Culture. Vol.11, PKHC. Mysore, 1987, p.15.

201. Y.Tejaswini, Op. Cit., 1993, p.163.

202. H.Kulke, Op. Cit.. 1978, p.131.

203. B.Stein, 'Integration of the Agrarian System of South India', in R.E.Frykenberg (ed.), Land Control and Social Structure in Indian History. Delhi, 1969, pp.175-216.

204. Ibid, p.185.

205. H.Kulke, Op. Cit. . 1978, p.127.

206. J.Heitzman, 'State Formation in South India, 850-1280', IESHR. vol.24, 1, 1987, p.59.

207. Ibid. p.61.

208. J.Heitzman, 'Ritual Polity and Economy: The Transactional Network of an Imperial Temple in Medieval South India', JESHO. vol.XXXIV, 1991, pp.25-26.

209. P.V.P.Sastry, Op. Cit.. 1978, p.270.

210. Y.Gopala Reddy, Op. Cit. • 1990, p.54.

211. Ibid, p.54.

212. R.Narasimha Rao, Corporate Life in Medieval Andhradesa, Hyderabad, 1967, p.15.

213. £1, vol.XII, pp.18-19.

214. P.V.P.Sastry, OP. Cit.. 1978, p.257.

215. N.Mukunda Rao. 'Pañchānamvāru-Pañchāli', Itihas. vol. XVIII, no.2, 1993, pp.35-42.

216. M.Rama Rao, Eastern Chalukyan Temples of Andhradesa. Hyderabad, 1964, pp.10-29.

217. B.S.L.Hanumantha Rao, Op. Cit.. 1993, pp.254-299.

218. R.Soma Reddy, Hindu and Muslim Religious Institutions of Andhradesa 1300-1600. Madras, 1984, p.17.

219. K.Laxmi Ranjanam (ed.), Pratapa Charitra. Tanuku, 1969, p.40.

220. Idem, Siddheswara Charitra. Hyderabad, 1969, pp.154-155.

221. K.Laxmi Ranjanam (ed.), Op. Cit.. 1969, pp.xxvii-xxviii.

222. P.V.P.Sastry, Op. Cit.. 1978, pp.271-281.

223. Ibid, p.300.

224. Ibid. p.301.

225. R.Soma Reddy, Op. Cit.. 1984, p.95.

CHAPTER II: SECULAR SPACE

II. 1 HABITATION AND PUBLIC UTILITY STRUCTURES

CHAPTER II SECULAR SPACE

II.1 HABITATION AND PUBLIC UTILITY STRUCTURES

The term 'Secular' is used in the present context to simply convey the meaning of that "not involving or belonging to religion".[1] In this sense all those buildings used for non-religious functions and purposes have been placed together for discussion. The indigenous texts percieve secular space in terms of dwellings and public utility structures. The early Brahmanical works refer to such structures through terms like griha, nivāsa for ordinary houses, sālāgāras for stored buildings, kostagara for granaries, nishādya for rest houses, gōsāla for cattle penns, setubandha for dam, adhara for reservoir, tataka for tank and kupa for well.[2] On the other hand early Buddhist texts have terms such as nagara for city, arama for garden, nevesana. geha for house, kuti for hut, koṭṭaka for granaries, vissamanasāla for rest house, apana for shop, kīlāgāra for sports hall, tadāga for tank, upadana for wells and niddamana for drains alongwith different types of building in the above category.[3]

The first part of our discussion is highlighting the various technologies used for habitation buildings. These buildings can be defined as any building used by either an individual or by a community for dwelling or other purposes of communal use. They include, besides the dwelling places, their appendages such as hearths, dumping pits, cattlepenns, granaries or silos, enclosures, shops and pathways. These have been noticed in all Periods of our study (I to IV) which includes the Neolithic, Megalithic, Early Historic, Early Medieval and Medieval levels of habitation as excavated at various sites of Andhradeśa.

As a background to the present study it has been noticed that primitive dwellings of the prehistoric and the early proto historic societies as indicated by the archaeological investigations conducted in the Krishna-Tungabhadra,[4] the Manjira and the Godavari Valleys,[5] has revealed that the earliest palaeolithic human habitations, in some natural form or the other, were concentrated on the banks of the rivers, rivulets and forested areas. This was necessary for the purpose of easy collection of food, as hunting and gathering was the main occupation of the period. In regions outside India[6] like England, France, Italy, Germany and Czecoslovakia, where cold was intense due to long periods of ice fall during the palaeolithic period, man had to resort to living in natural caves and take shelter under overhanging rockshelters. However, so far, no caves of the Palaeolithic period have been reported from India. Some evidence of cave dwelling is evident in the finds of remnants of fossils of human teeth in association with the upper palaeolithic tools from the Billasargam[7] caves of limestone formation in the Nandyala basin in sub-region D of our study.

In the next stage, known as the mesolithic, man was still a hunter, but he made some efforts to make semi-permanent habitations especially on the banks of rivers. Recent excavations conducted at Mucchatla Chintamanugavi,[8] in sub-region D have revealed evidence of a prolonged occupation of the limestone caves by men of the mesolithic period. Besides, some open air sites near Belum, also in the same sub-region, have been located. At Muchchatla Chintamanugavi, the excavations have yielded some microliths and bones of domesticated animal, at the lower levels. During the mesolithic period, the hunters and gatherers usually had to scout over an extensive territory, exploiting animal and vegetable resources. Since they were on frequent move, they made their shelters from locally available material.[9] The evidence found at the rock shelters and natural caves at Kethavaram and Bollaram[10] in sub-region D, Durgam and Uppair[11] in sub-region A prove beyond doubt that these caves served as temporary shelters during this period. The walls and ceilings of these shelters have been found painted with red ochre and white coloured pigment depicting hunting scenes mainly of animals and some geometrical designs, suggesting their temporary stay. The presence of several rock shelters at Budigepalli, Kadambapur, Regonda, Kokapeta[12] and Gandharikota in sub-region A and Pandavulagutta in sub-region B[13] in association with microliths, neolithic celts and rock paintings, also indicate the occupation of natural protected areas as the earliest habitations of Āndhradeśa datable to mesolithic times.

The next phase of habitation characterized as the early neolithic, saw a systematic exploitation of flora and fauna and shift in basic subsistence patterns. This led to a tendency to settle more or less permanantly at open air locations and to make seasonal migrations to potential open air sites.[14] This phenomena is clearly observed in Period I of our study, when man attained the knowledge of food production. According to Childe[15] this transition from hunting and gathering to food production can best be described as a 'neolithic revolution'. People began to use ground and polished fine grained stone tools. They sometimes moved from caves and rock shelters to open plains specially to cultivate the nearby alluvial soils on the banks of the rivers and rivulets. They cultivated with their stone hoes, and felled trees with axes and dressed timber with stone chisels and adzes. Binoy Ghosh[16] has proposed three fundamental needs which a human, dwelling served since the dawn of the human society, viz., the need for protection from weather and enemy or wild animals, the need for storing food and tools and the need for free family life. Thus we find that during the neolithic period, people began to live in pits cut into the ground, known in archaeological parlance as pit-dwellings. These have been noticed in many parts of the Indian Subcontinent at Burjahom[17] in Kashmir Valley, Inamgoan[18] in Maharashtra, Piklihal[19] in Karnataka and Paiyampalli[20] in Tamil Nadu. In Andhradesa the pit-dwelling activity has been noticed at Utnoor,[21] Veerapuram,[22] Nagarjunakonda[23] and Gandluru[24] [Chart I A].

After acquiring adequate knowledge in food production, the people had to move to open areas for cultivating fertile lands near river beds. Shelters were made to meet the needs of protection from unfavourable natural climate and to provide comforts which were suitable to varying new environments. With the beginning of settled life in neolithic times, the natural caves became inconvenient since they were located far from the lands that could be potentially used for cultivation. People therefore, moved down to the open air sites where there were no natural caves. It is possible to postulate that in order to suit the environment available in caves, people dug out pits below the ground level.[25] Probably, the cold and windy climate might have also encouraged them to dig pits to use as dwellings. These pit-dwellings not only helped them to be protected from nature but also from predators and enemies from other neighbouring human communities.

As mentioned above pit-dwelling activity in Andhradesa has been noticed at Utnoor in sub-region A and Veerapuram, Nagarjunakonda and Gandluru in sub-region B. The pits at Veerapuram and Nagarjunakonda were cut into the ground[26] whereas, the ones at Utnoor were only half-subterranean.[27] The plans of the pits varied from circular to oblong and oval at Nagarjunakonda and Veerapuram, pot bellied, cylindrical, shallow, bipartite, tripartite and quadripartite at Gandluru. The measurements of these pits also varied both in diameter and depth from 1.1 to 4.80 metres and 1.20 to 2.0 metres respectively. Some pits were provided with roofings supported by wooden posts, as post-holes on the periphery of the pits have been found at Nagarjunakonda. The mouth of the pits were more or less circular at Nagarjunakonda, Veerapuram and Utnoor and at Gandluru they were neatly dressed. The entrances were made from the natural stone outcrops. This phenomena was observed at Nagarjunakonda. At Gandluru, on the other hand, the entrances were arranged and controlled by some sort of closing, as we noticed here two deep cut post-holes meant for wooden posts.[28] The pits were cut into the natural disintegrated shale deposits at Nagarjunakonda and into the calcarious schist at Gandluru. The pits at Veerapuram and Utnoor were dug into the soils. Some pits were used as soakage or refuge deposits as at Gandluru. Other accessories of the pit-dwellings included hearths, fireplaces, and cattlepenns. Cattlepenns with wooden barricades near the pit-dwellings have been reported from Utnoor. The bottom of the pits at Gandluru were expanded to facilitate room for cooking and this is indicated by the existence of hearths here. At Nagarjunakonda, the occurrence of dwelling pits in an alignment and also in clusters suggests the existence of both small and extended family units that lived in them.

To cut the pits into the bed rock the technology used must have employed different types of tools of dolerite like pointed chisels, adzes and celts. The sides of the pits at Gandluru were found smoothened to a neat surface. The floors here were somewhat levelled and sometimes dressed neatly, over which a thin coat of lime and earth mixed layer was applied.[29] It seems that they had felt the inconvenience of dampness on the floors of the pit-dwellings and this was probably the reason that led them to lay **neat** floors of lime and earth.

The early builders opted for only circular or oblong shaped pits since that was the only plan that could be easily excavated as the cutting was in all probability done from inside the pits. Absence of metal tools and with only primitive tools of stone to cut them it was not possible to make shapes with angles at this stage. In order to be protected from the sun and cold, they made some roofings of skin or thatched material supported by wooden posts. All the sites with pit-dwellings have attested the existence of postholes on the periphery of the pits. At Nagarjunakonda, a development in technology can be seen in that the natural rock-boulders were made use of as entrances to the pit-dwellings.

The above discussion reveals that during the early neolithic period people lived in subterranean and deep cut pits into the ground in the shapes which ranged from circular to oval. In all the above mentioned cases, these pit-dwellings were located within the vicinity of water sources. The pits at Veerapuram and Nagarjunakonda were just on the bank of the river Krishna, whereas, at Gandluru they were near the perennial water rivulet called Gundlakamma. The necessity of sufficient accommodation in pits made people expand the size of pits to house four or five people at a time and also to provide space to cook food. Thus fire places and hearths were built within the pits. The pits were provided with steps and the side walls were neatly dressed, the floors were laid with lime plaster and finally, they were all covered by some sort of roofing supported by wooden posts.

In contiguous regions to ancient Andhradeśa the evidence of pit-dwelling activity at Inamgaon in Maharashtra is datable to c.1600-1400 B.C., at Tekkalakota and Sanganakallu in Karnataka,[30] it is datable to 1300 B.C. at Paiyampalli in Tamil Nadu,[31] it is datable to 1100 B.C. These are all later than the evidence found at Utnoor,[32] which is datable to 2100 B.C. The evidence from all the above sites suggests that pit-dwellings tended to be square and rectangular and then gradually changed to being circular and oval. This is in contrast to what is found in Andhradeśa, as here, only the latter type of shapes were preferred. The fact that the early neolithic man had no knowledge of geometrical calculations for making pits, along with his primitive tool kit impeded him to obtain angles more accurately.[33] Similar pit-dwelling activity was also noticed at Paiyampalli[34] in Tamil Nadu where the floors of the pits were rammed with fine earth. The pits here were provided with approaches by raising ramps at the entrances. One of these pits was partitioned by planting a row of stones. The postholes around the periphery further indicate conical thatched roofs.

A change occurred in the plans and shapes of the pit-dwellings from being circular to square or rectangular. The pit-dwelling activity discussed above symbolises the earliest human endeavour in building technology. This entailed either digging or cutting into natural soil while making the natural boulders as entrances. These efforts successfully created an artificial living environment though with minimal facilities. Nonetheless, this enabled man to discard living in natural caves, caverns and rock-shelters. Therefore, it can be looked upon as a land mark in the initial experiments in building technology of habitations in early Andhradesa. However, as proposed by Muller-Wille,[35] based on his theory on duration of early site occupations, it afforded people an opportunity to stay at a site only for some months.

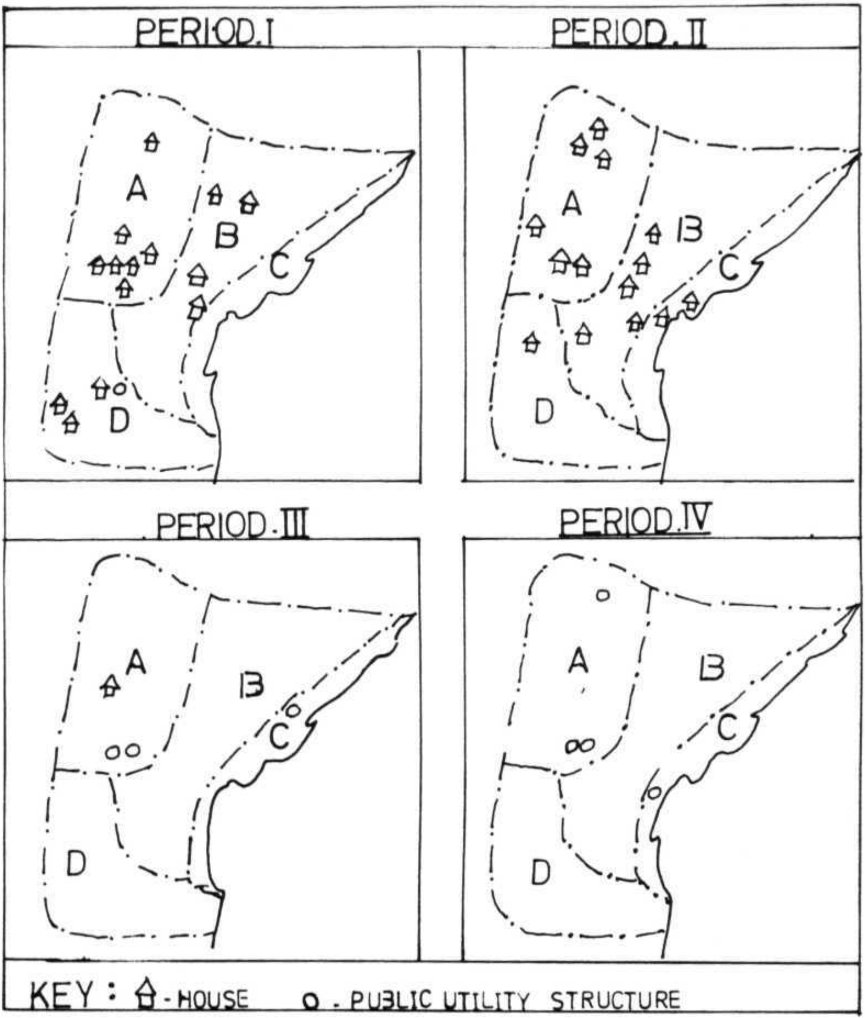
In Period I of our study the evolution of building technology of the early habitation buildings and public utility related structures is effected by new technological discoveries of the neolithic-chalcolithic phase in early Andhradesa. Some new elements such as technique of painting on redware, preparation of parallel sided blades with cristed ridge technique, copper metallurgy, channeled lipped bowls in greyware, and other such material traits got merged into the main stream of the existing early neolithic culture, which came to be defined as the neolithic-chalcolithic culture in the Deccan. These technological innovations changed the very structure of the society. The people discarded living in pit-dwellings and began building houses on hill tops, slopes, as well as on the plains.

This, led to the process of first building houses with perishable material and there is now a concern to build houses above the ground rather than under the ground. In the mature phases of a neolithic-chalcolithic culture, building of houses on the top of the granite hills or, on the levelled surfaces of hills or at the foot of hillocks became common. This has been noticed at Budidapadu in sub-region A, Nagarjunakonda in sub-region B, Palavoy and Ramapuram in sub-region D. The contiguous regions to ancient Āndhradeśa have also been reported with similar activity of building dwellings at Piklihal[36] and Tekkalakota,[37] in the neighbouring state of Karnataka. During the megalithic phase of period I the early farming and pastoral communities introduced the use of iron resulting in a total change in the social setup which unleashed new economic processes that culminated in urbanisation during the early historic period. The intensified exploitation of iron ore and the smelting of iron led to the manufacture of sophisticated tools and these could be fruitfully employed for quarrying and dressing monolith stone. This, in turn, facilitated the people to build structures in stone which is a notable change that occurred during this phase. While this meant that the buildings were constructed with non-perishable materials such as stone, perishable materials like mud, reeds and so on continued to be used side by side for floor, roofings, etc. The introduction of iron technology was linked to the spread of agrarian settlements which also meant that permanent houses became a form of housing desired by most people. However, it has been pointed out by A. Ghosh, "the megalithic builders spent all their masonoic skill on building monuments for the dead but none on providing firm houses for the living. This illustrates the point that mere possession of technology does not lead to its application to all spheres, unless it is encouraged by social institutions which can take advantage of that technology".[38] These iron age settlements were largely concentrated on river banks and sometimes, were located near irrigation tanks which were built as seen at Budigepalli in sub-region A. Though data on dwellings for the megalithic phase is limited, we do find information on associated structures such as platforms, hearths, floors and enclosure walls. Funerary structures of this period are discussed by us separately in Chapter IV.1.

The evolution of building technology in all these phases of Period I can be studied under the classification of: (1) habitation buildings, i.e., dwellings and their appendages such as hearths, cattlepenns, barricades, enclosures and (2) public utility structures such as pathways, though the latter are not found on a large scale. Evidences of house building activity during the neolithic and neolithic-chalcolithic phases, has been reported from Utnoor,[39] Chinnamarur,[40] Hulikal,[41] Budidapadu,[42] and Chagatur[43] in sub-region A; Veerapuram,[44] Nagarjunakonda[45] and Gandluru[46] in sub-region B; at Jami[47] in sub-region C and at Palavoy[48] and Ramapuram[49] in sub-region D. Most of the habitations and house buildings of the megalithic phase were more or less on elevated places or river banks as noticed at Serupalli,[50] Pydigutta,[51] Chinnamarur[52] Peddamarur[53] and Polakonda[54] in sub-region A; Veerapuram[55] and Gandluru[56] in sub-region B and at Ramapuram[57] in sub-region D **[Hap V** and Chart I A].

The houses of the first phase of period I were built of local materials, which played a considerable role in determining the plan and construction of the buildings in geometrical pattern. The houses were either circular, square or rectangular in shape, floors were rammed with earth and morrum and then smeared with cow dung. Sometimes, they were planted with lime on stone chips mixed with earth and laid as a layer. Posts were planted on the periphery of the floor to support the roofs. Enclosures were provided on all the cardinal directions and these varied in each case. Walls were built of mud, wattle and daub. Hearths and fire

MAP-V



DISTRIBUTION OF HABITATION AND PUBLIC UTILITY STRUCTURES PERIOD WISE

CHART I A

Period I: Habitation and Public Utility Structures

S.No	Name of the Site	Sub-region	Type of House Plan	Foundations/ Floors	Post -Holes	Walls	Roofs	Associated Structures	Public Utility Structures
1.	Budidapadu	A	O	-	_/	-	/\	-	-
2.	Chagatur	A	O	...	-	-	-	[ ]	-
3.	Chinnamarur	A	O	⊡ ... ⧄	_/	-	/\	C [ ]	-
4.	Gandaluru	B	U O T	...	_/	⫼	/\	C	-
5.	Hulikal	D	O	⊡	_/	-	/\	-	-
6.	Jami	C	O	-	_/	-	/\	C	-
7.	Nagarjunakonda	B	U T X	-	_/	-	/\	( )	-
8.	Palavoy	D	O T	⊡	_/	-	/\	-	-
9.	Peddabankur	A	O	⧄	_/	-	/\	-	-
10.	Peddamarur	A	O	-	_/	-	/\	-	-
11.	Polakonda	B	O	⊡	_/	-	/\	-	-
12.	Ramapuram	D	O T	⊡ ⧄	_/	-		C *	-
13.	Serupalle	A	O	⧄	_/	-		-	-
14.	Utnoor	A	U T	-	_/	-		( )	-
15.	Veerapuram	B	U O T	-	_/	-		C	-

contd...

Key:

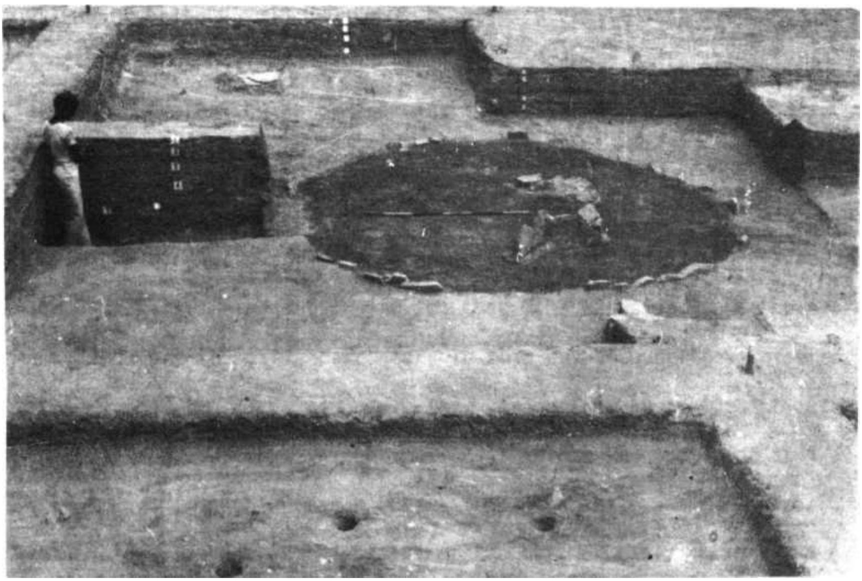
Type of House Plan	Foundations	Walls	Roof	Associated Structures	Public Utility Structures
U Pit-dwelling	Mud	Mud	/ \ Thatch	C Hearth	= Path way
O Circular, Semi circular, Oblong	Concrete	Brick	≈ Tile	Platform	$ Workshop
	... Plastered	Stone	Stone	* Granery	% Wharf
X Square	Stone			# Well	AMT Amplitheatre
T Rectangular	M Rock			@ Drainage	ST Stadium
				( ) Cattle penn	BG Bathing Ghat
				[ ] Compound Wall	RH Rest Houses

places were built inside the houses. Sometimes, houses were arranged in a linear pattern and occassionally, they were clustered. Well laid pathways have been noticed for the first time belonging to neolithic-chalcolithic period. The periphery of the houses was planted with stone slabs as a sort of border. Central posts supporting conical shaped roofs have also been noticed. It is well-known that technology and the availability of raw materials were closely inter-related as they affected the methods of house building.[58] The plans of houses of the neolithic and neolithic-chalcolithic phases on circular plan have been reported from Chinnamarur, Veerapuram, Hulikal, Budidapadu, Jami, Chagatur, Palavoy and Ramapuram [Plate I]. At Chagatur and Gandlur, a semicircular plan of houses was also encountered. Plans of oblong houses have been seen at Veerapuram, Chinnamarur and Ramapuram. The houses constructed on square plan have been reported from Nagarjunakonda only. The rectangular plan was preferred at Utnoor, Nagarjunakonda, Gandlur and Palavoy [Chart I A]. The foregoing information leads us to observe that there was a change in house plans from circular to square and rectangular. It has been suggested that this indicates that gradually the sedentary life of the agro-pastoral communities began to become permanent in nature. In such a situation people preferred square and rectangular structures whereas the earlier communities having to migrate on a seasonal basis were accustomed to the circular plans.

The plans of the houses of the megalithic phase were both circular and rectangular. The circular hutments were noticed at Serupalli [Plate II], Veerapuram, Chinnamarur, Peddamarur and Polakonda. Semi-circular ones were also in existence as noticed at Pydigutta. A lone example with an apsidal

PLATE I

Period I: A circular hut, Neolithic Phase, Hulikal, Sub-region A



Period I: A hutment, Neolithic - Chalcolithic Phase, Chinnamarur, plan has **been** found at Ramapuram. The rectangular plans were found preferred at Veerapuram and Gandluru **[Chart I A]**. In this connection it is appropriate to recall that in the neolithic period too there was a co-existence of all these plans. Scholars like Kent V.Flannery[59] opine that "circular dwellings tend to correlate with nomadic or semi-nomadic societies, rectangular dwellings tend to correlate with fully sedentary societies". Circular or oval hutments are raised even today by the Chenchus of Amrabad-Mannanur valley and circular hutments are used in the coastal areas of Andhra Pradesh.[60] The tribal people pitch up their seasonal camps by way of erecting the posts in a circular fashion. In the coastal area the circular houses were especially preferred so as to withstand the powerful winds of the coasts **[Figure 3]**.

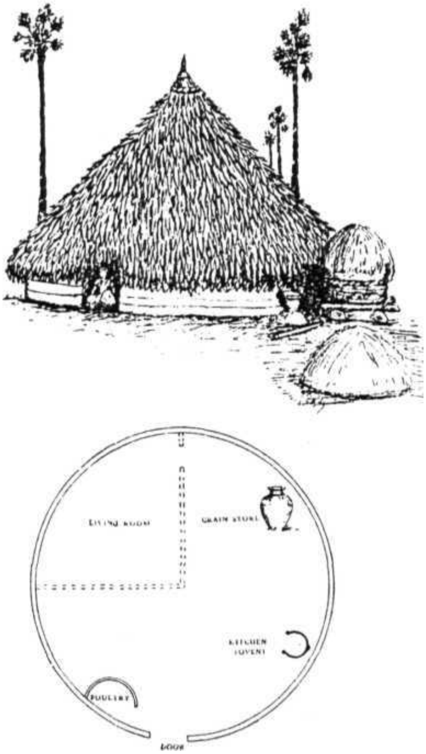
The contiguous regions of ancient Andhradesa also provide important evidence of house building activity which were supported by postholes as noticed at Naikund[61] in Maharashtra, Brahmagiri,[62] Maski[63] and Hallur[64] in Karnataka and Paiyampalli in Tamil Nadu. Wooden posts were usually put into the dug out holes by dressing the bases with stone chisels, but at Chagatur, the posts were driven and erected into the holes cut into the bedrock. The posts were made of wood of the Acasia or Dalbergia species. They were earlier circular in shape but one finds square and rectangular ones as well. The latter implies that the bases of these posts **were** chiselled by the early carpenters in this way because they offered **more** firmness than the circular ones. They varied from 20 to 80 centimetres in diametre and 14 to 36 centimetres in depth as noticed at Palavoy. Interestingly, at Chinnamarur **[Chart I A.3]**, a shale stone of size 75 x 70 centimetres was kept at the centre of the hut, **probably** to serve as a base

FIGURE 3

A TYPICAL CONICAL HUT

IN

VISAKHAPATNAM DISTRICT



A modern hut with conical thatched roof, Visakhapatnam, Sub-region C

(Reproduced from Census of India, 1961, Vol.II, Part IV-A Delhi, 1964, Sketch No.3) for a central pole supporting the frame of a conical roof. The stone at the base must have been put to counter the dampness of the black cotton soil here and to see that the base of this lone post which being the main support to the entire hut, was protected from insects like termites, etc. This also reveals that they learnt from their earlier experience based on observation when building materials, particularly wood must have deteriorated and therefore, precautionary measures had to be taken to rectify this. Thus, technological improvements in the erection of wooden posts has been observed during the megalithic phase. Dwellings at places like Serupalle, Veerapuram and Peddabankur were all supported by wooden posts. An interesting feature to note in this context is two unique postholes at the entrance of a circular hutment at Serupalle. Their base was strengthened by the insertion of quartz pebbles. This was in all probability meant to not only provide additional support for the wooden posts so that they would last long, but they did so without tilting to sides. This feature can be said to have been a significant improvement to the earlier methods of erecting posts, affording a longer duration to withstand wind and other pressures.

No major changes in the types, plans and building materials used for constructing ordinary dwellings during the megalithic phase have been noticed by us. More or less the same types and plans described for the neolithic phase continued with marginal changes in the appendages that were added to the houses. However, a combination of perishable and non-perishable materials such as stone, wattle and daub were used together and these structures were supported by the wooden posts and mud walls. The roofs continued to be made of vegetable materials as was done in Neolithic times. The floors were rammed and sometimes lime plastered. It has been observed by us, that to make stone paved floors, was an innovation of the period. Further, for the first time, houses were enclosed by compound walls. The settlements were still dependent on natural water sources only. Therefore, so far no evidence of using ground water has come to light for megalithic levels of habitation.

The megalithic people in Andhradesa like those in other parts of South India lived in these simple dwellings though evidence of these habitation sites is not very prolific. It must therefore, be stated that despite an economically stable background, coupled with a growth of agricultural settlements and the spread of iron technology, there was no major breakthrough during megalithic times in transfering technological skills of making houses to ordinary people nor did it give rise to major public utility structures.

The walls and the roofs of these dwellings were supported by wooden posts as postholes have been found on the periphery of the floors of the dwellings. Postholes of the neolithic phase have been found at Hulikal [Plate I], Nagarjunakonda, Jami, Palavoy, Ramapuram **[Chart I A],**

The walls of the dwellings of the neolithic, neolithic-chalcolithic and megalithic phases were mostly built of mud. Later, these were perfected by wattle and daub and a further evolution of building technology was observed in building them with non-perishable material such as stone. The walls of the dwellings in the contiguous regions of Karnataka were made of split bamboo mattings, plastered with mud and cowdung, supported at intervals by wooden posts, as seen at Piklihal[65] and Tekkalakota.[66] The periphery of the houses were sometimes planted with shale stones placed vertically to demarcate the circular plan. These probably served the purpose of preventing the unwanted entry of insects. This feature has particularly been noticed at Chinnamarur[67] and Budidapadu.[68] At Ramapuram[69] and Hulikal[70] on the other hand, the stone pieces were erected vertically inside the already dug out shallow channels and care was taken to prevent the entry of snakes by digging snake pits. A further development in this aspect has been noticed at Palavoy,[71] where unhewn granite boulders of considerable size were placed around the floors of the houses. They were collected and brought from nearby areas not only to demarcate but also to protect the house from big predators and human enemies. As a stage in the evolution of human societies when the first ranked and stratified society had emerged it necessarily meant that signs of conflict and warfare had become apparent.[72] Therefore, protection against enemy communities began to emerge in the settlement area. In the last phase, i.e. in the megalithic context, the houses were buttressed with stone slabs. The walls more or less, continued to be built in the same manner as noticed in the neolithic phase. The walls at Polakonda[73] located in sub-region B were made of mud and rubble. This indicates no significant change in the building of walls of the megalithic phase.

The roofs of dwellings were probably made of vegetable material during the neolithic period. The plan of the structure at Chinnamarur which suggests a conical roof, was in all probability made of reed and grass bundles, tied to the top end of the pole to form a cone[74] [Chart I A.3]. The sloppy sides facilitated draining off the rain water beyond the periphery of the mud wall. The early builders took keen interest to protect their mud walls, as which otherwise they would have demanded frequent repairs after the rainy season. This arrangement can be said to be an important achievement of the early building technology. Vitruvius, the famous engineer of Italy who flourished during the early centuries of Christian era, has summed up man's earliest efforts in house construction in the following way. "Some of them began to make roofs of leaves. Others, to dig out caves under the hills, some imitating the nests and constructions of swallows made places into which they might go; out of mud and twigs. Finding then other shelters and inventing new things by their power of thought, they built in time better dwellings. At the beginning, they put up rough spares, interwove them with twigs and finished the walls with mud".[75]

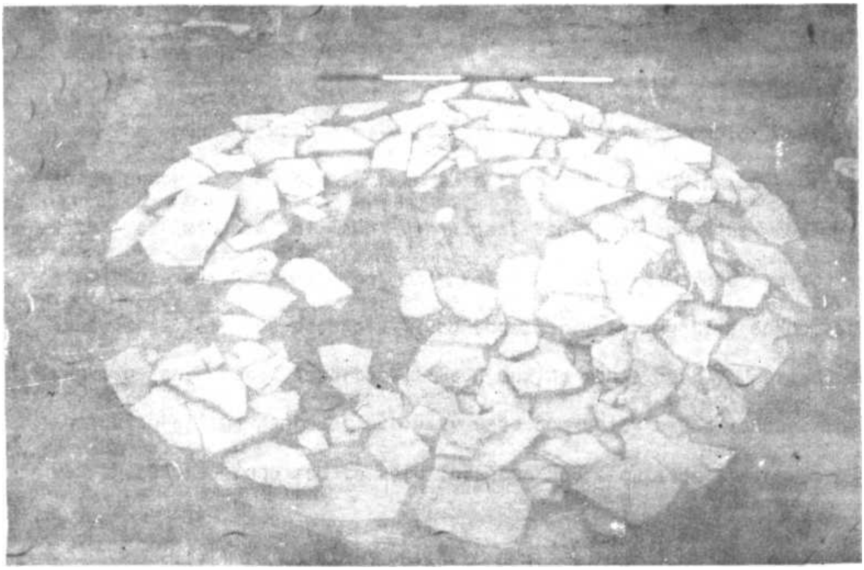
The floors of the houses of the neolithic period were rammed with clay nodules, morrum and occasionally, were plastered with mud and lime concretions. Paved floors with shale stones were also innovated. Floors of rammed earth have been noticed at Chinnamarur,[76] Hulikal[77] and Ramapuram.[78] At the last site, the floors were raised above the surrounding ground level, by digging out earth from outside the hutments. Floors were also rammed on the calcareous nodules and stone chips at the above sites. It was only at Chinnamarur[79] that rubble floors have been encountered. The floors were found plastered with clay at Chagatur.[80] Further a pavement of cut shale stone for floors was noticed at Ramapuram. The areas outside the hutments were also paved similarly, probably to be used as working places for domestic purposes. This arrangement of raising the floor level, levelling the surfaces, paving chips and then ramming after which a pavement was made of shale stone all bespeaks of their knowledge in keeping the floors at a higher level so as to be water proof.

This highlights an aspect of a sound technological achievement of this early period of human habitation.

During megalithic phase, the floors of the dwelling places were rammed and then made up of shale stone chips and plastered with lime stone concretions as found at Chinnamarur.[81] A similar feature was noticed also at Hallur[82] in the neighbouring Karnataka. A further improvement in laying the flooring has been observed at Serupalli[83] **[Plate II]** where cut shale stone slabs were paved in two courses in order to protect the house floor from dampness, since this site was located on sticky black cotton soil. The surface was treated with a thick layer, mixed with shale stone chips and mud, to achieve firmness. This was a well-known practice of those times and in Tamil Nadu. At the site of Paiyampalli,[84] we find that circular houses also had such floors, made of stone chips covered with morrum and plastered with lime.

The neolithic people had some amenities both inside and outside the habitational buildings such as hearths or fire places, facilitating them to cook food and refuge pits to dump the waste which were dug just near the huts. Besides these, some appendages to the dwellings such as cattlepenns or stockades were also built with a simple technology geared to easy access and use. The associated structures, found along with dwellings of the megalithic period include platforms, built for different purposes, and granaries. The public utility related structures of the late neolithic period are rare and we find evidence of only a pathway in the habitational area. Construction of compound walls surrounding a group of houses in

PLATE II



Period I: Circular pattern of hut with stone floor, Megalithic phase Serupalli, Sub-region A megalithic phase was a new aspect of community protecton which was not known earlier.

The hearths were single, double and sometimes complex ones found in large number. Some denote that more than one pot would be kept at a time with a minimum of two varieties, so that cooking could go on simultaneously. This, not only saved a lot of time, but also indicates that large families probably lived together. Saving time on domestic work was in any case important, as, during this early period both the agricultural and pastoral activity used community based labour. The family was therefore, required to work for long hours outside the house.

At Chinnamarur,[85] the hearths were noticed in the south-west direction. They were built with cut shale stones, which were planted vertically to earthen hearths to a height of 36 cms. probably to protect the circular hearths from the gale. This technique was also employed because, with the help of vast experience in making use of the fire, they wanted to conserve the heat and not let it go waste. In another hut at the same site, the hearths were formed by arranging shale stone pieces. At Jami,[86] a double hearth looking like twin basins sunk into the ground has been found. Some more interesting information comes from Ramapuram,[87] where the hearths of burnt clay had a separate fuel chamber and a deep fire place with tripods. It also had a side oven connected by a small tapering hole. Two pots could be kept on this and the cooking done simultaneously. Clay lined hearths and fire places have also been noticed at Gandluru[88] and Veerapuram[89] [Chart I A]. The above information leads us to conclude that the neolithic people had their fire places made of clay lumps in the beginning which were then improved technologically by lining them with stones. Still later, inorder to offer permanancy, the shale slabs were planted to protect the hearth. This also helped to utilise the fire to the maximum extent. Necessity was the prime motive force to bring about these innovations. Their sound knowledge in building technology is also indicated in the expert way in which the fire places were made with single and double hearths, which were provided with separate fire chambers.

Some shallow pits dug outside the houses were meant for dumping the waste and other used material during the neolithic period. This also can be said as an important aspect of the early building technology to keep the habitation areas clean and maintain good sanitary conditions. The chief evidence regarding this aspect comes from Nagarjunakonda[90] and Gandluru,[91], where pits were cut into the ground and these were found during the course of excavations to be containing waste material.

Plans of cattlepenns, denoting the importance of the upkeep and management of domesticated animals come from Utnoor[92] and Nagarjunakonda.[93] At Utnoor in the neolithic settlement, a double line of postholes of 9" in diametre with an interval measurement of 1'-0 to 2'-0 in between two poles has been noticed, indicating a stockade. Occurrence of postholes in front of the stockades implies a verandah or an area used to reinforce struts set at greater interval, denoting some sort of wooden barricade for the small cattlepenns.[94] This type of evidence proves that the neolithic people were masters at not only building dwellings for themselves but also equally responsible for building wooden barricades to facilitate some sort of protection for the cattle from wild animals. They also had to see that they were not let loose to cause damage to the crops which, in a mixed farming economy were also being raised by the people.

Among the prominent associated structures or appendages to the megalithic dwelling units figure platforms which were built both inside and outside the house. They were probably used to keep household objects of daily use and have been noticed in particular at Ramapuram.[95] Granaries, circular and oval shaped, dug to a depth of 10 to 35 cms. and then rammed with white sticky clay, have also been found at Ramapuram. Sometimes, stone slabs have been seen projecting out from the pit, to serve as bases for the thatched bins and these have been recorded at Ramapuram. A very significant and unusual find for this period is the occurrence of mud bricks of size 30 x 17 cms. at Gandluru[96] in the context of a dwelling [Chart I A.4]. This is for the first time that sun-dried bricks have been discovered from a late phase of the megalithic period. The houses built with these bricks were rectangular in plan. In the evolution of building technology the last phase of Period I is thus marked by the discovery of early brick making technology.

Another significant aspect of the building technology of the megalithic phase was the construction of enclosure walls for clusters of houses, inorder to provide security and protect the habitation from wild animals or from enemy clans and tribes. Two examples have come to light from Chagatur and Chinnamarur [Chart I A.2 & I A.3]. The circular wall at Chagatur was 1.5 metres in thickness. They were built using shale stone slabs enclosing the hutments and found to an extant a height of 1.0 metre. The one that enclosed some houses at Chinnamarur was of 1.00 metre in thickness. Scholars like B.Subrahmanyam[97] opine that this sort of building barricades or enclosure walls should be considered important precursors for the construction of fortifications around settlements found common during the succeeding early historic times in Andhradesa.

The concept of building houses in clusters or groups arose during the neolithic-chalcolithic phase as noticed at Ramapuram.[98] Sites like Chinnamarur, Gandlur, Veerapuram, Hulikal and Nagarjunakonda also had a group of hutments within a limited space of the habitation, indicating the formation of a small village dependant mainly on a small scale agricultural and pastoral economy. According to Bhattacharya[99] the Deccan neolithic houses occurred in small clusters of mud and stone at a time when the western group of such settlements had developed into larger ones which he calls chalcolithic urban centres. In his opinion in the southern Decccan this growth might not have been possible, due to lack of contacts with the developed communities with whom economic exchange could have developed on a large scale. The Western group of the chalcolithic and late neolithic settlements on the other hand, had vigorous cultural contacts with well-developed centres in north-western India. Therefore, with a largely village environment of settlements in proto-historic Andhradesa, we do not have much evidence of public utility structures or monumental buildings. In this connection a very interesting and unique evidence comes from Ramapuram.[100] Here, it has been noticed that a pathway was laid to a length of 40 metres in north-south direction, with a varying width of 2.60 to 3.60 metres. For the first time such a pathway has been found belonging to the neolithic-chalcolithic period in Andhradesa. The roadway was laid with central rib and was found sloping to the sides. The total width was paved with rubble stone which served as a soling to the road, quite similar to the modern way of laying roads. The width of 3.60 metres was quite wide probably enabling the movement and crossing over of two carts at a time.

The foregoing part of our discussion on the building technology of the neolithic, neolithic-chalcolithic and megalithic phases of Period I in Andhradesa reveals that the technology used to build 1n the habitation areas was still in its incipient stage. It gradually took shape with some marked developments in identifying appropriate locations and building materials and these further led to improvements. Amenities inside and outside the dwellings proliferated and wooden structures, for purposes of the domestication of cattle, were not lost sight of indicating the emergence of permanent settlements in these early villages. The distribution pattern of sites in all the sub-regions reveals that the neolithic and chalcolithic people inhabited the fertile areas, often called as the 'areas of attraction' lying on the banks of rivers and rivulets, with a potential to expand agricultural production. These early experiences have been passed on through generations so that many features of the circular plans of houses and the nature of building hearths continue to be known to many nomadic and settlement communities of the Deccan and Andhradesa even today.

The houses built as an immediate precursor to Period I were, pit-dwellings made under the ground. This tendency in the late neolithic and neolithic-chalcolithic phase shifted to build over the ground in varied plans with locally available building materials. The walls were mainly of wattle and daub and sometimes of mud. The same was continued in the last phase known as the megalithic. The roofs were laid using primarily vegetable material such as reed and leaves. Use of unhewn boulders of granite and shale stone for flooring, hearths with separate fire chambers, digging pits outside the houses to dump the waste were some of the innovative aspects of the habitation areas of this period. Laying of a pathway facilitating easy walk especially during the rainy season was another innovation of the building technology of these early societies. It is important to note that this primitive and simple technology built houses primarily of perishable materials. There was also only a limited exploitation of natural resources in this context and it was primarily wood, reed and other natural grasses that were effectively put to use.

During the megalithic phase, the gradual use of stone emerges. However, during the proto-historic period as a whole, mud and wattle and daub remained the predominant materials for building houses and other structures. For the first time, in a late megalithic phase, sun-dried bricks were manufactured, which were replaced by burnt bricks in building the habitational and other buildings in the succeeding period, i.e., the early historic in Andhradesa.

The evolution of building technology of the habitation and public utility related structures of Period II of our study in Andhradesa begins with a brief introduction on the socio-economic and, i.e., politico-religious changes that took place in early Andhra during in the transition from the proto-historic. The knowledge in metallurgy and other technological advancements achieved in the last phase of proto-historic times paved the way for the manufacture of metal objects and tools, of various sizes and shapes, on a greater scale during Period II. This easy availability tremendously helped in catering to the needs of the common people in building habitational and public utility related structures, during the early historical times.[101] It has been opined that it was iron technology, rather than changes in the political system, though the latter may also have had its share, which provided the necessary tools for the cultivation of crops and the proliferation of arts and crafts.[102] In the beginning many early historical settlements were not very different from the village settlements of Period I but later, they got transformed into towns. Some of these cities were significantly located along the banks of the major rivers or rivulets and thus provided with alluvial tracts in the vicinity. This led to an increase in agricultural surplus which provided the necessary financial backing for a proliferation of crafts and technological skills. The locale for the latter were the urban centres, which, during this period, were also the major locales for systematic building activity. In this context, Amita Ray has put forth her ideas that improved communication routes, extensive mining operations, the increase in money economy, the establishment of provincial seats of administration and the introduction of Buddhism all created a social situation, which, in turn provided a base for the growth of urban centres in early Āndhradeśa.[103]

In early historic Andhradesa, settlements in the various sub-regions such as Dharanikota, Kotilingala, Satanikota, Veerapuram, Nagarjunakonda were located close to major rivers whereas, the sites like Dhulikatta, Peddabankur, Kondapur and Nelakondapalli were situated in the interior on small rivulets. Some of these were located on important trade routes which meant interlink with developed areas of the region as a whole. A developed town planning has been observed at Dharanikota, Amaravati, Kotilingala, Dhulikatta, and Nagarjunakonda. Some of the early semi-urban settlements **retained** their traditional agrarian nature while the others emerged into well-organised fortified cities.

Against this background it is necessary to highlight different types of habitation buildings to understand the level of technological developments during this period and to delineate the various materials used for construction, from roughly about the 4th century B.C. to the 4th century A.D. The settlement patterns show an expansion and the size of the individual structures also increases with several improved facilities in the dwelling houses when compared to habitation structures in Period I. On the whole, the early historical settlements comprised of well-laid out house plans which included common dwellings, building complexes surrounded by enclosures, water supply and sanitary structures, workshops, roads besides public utility constructions such as an amphitheatre, rest houses and public baths and ghats.

The excavations conducted in Andhra Pradesh have revealed many interesting aspects of building technology of this period. The sculptural representations particularly from Amaravati, and the contemporary literature have also supplied ample information to correlate the factual information with the literary descriptions. The habitational structures, primarily meant for dwellings ranged from simple huts to sophisticated dwellings, along with many associated structures. The walls were made either of wattle and daub, mud, brick, or stone. The roofs were either, thatched or, made with brick and stone paved or tiled. The floors **were** either made of rammed earth, lime plastered, lime concreted or paved **with** brick and shale. The buildings were raised on simple foundations of rubble stones. Water was drawn from wells sunk into the ground. Storage tanks and brick cisterns were also built within the houses. Waste water was taken away by drains both covered and uncovered. To provide smooth spaces for walking and easy transport, a good number of roads intersecting one another and connecting the entire settlement were laid. Public utility structures such as workshops, amphitheatre and public baths were also built during this period. Well-laid out town planning has been observed particularly at Dhulikatta and Nagarjunakonda with almost all amenities available in the cities.

An early Buddhist text, the Milindapanha[104] provides us a clear account of the essential features of building a new town or city. This entailed first and foremost the selection of a good site and ended with laying of roads to ultimately give the habitations and public utility structures a good finish. These textual traditions must have been available to the architects, town planners and engineers of early Andhradesa as many of these ideas are found in cities excavated here. The above cited material is available to us in varying degrees of survival and has been reported from Kotilingala,[105] Dhulikatta,[106] Peddabankur,[107] Kapparaopet,[108] Kondapur,[109] Polakonda,[110] Peddamarur[111] and Kyathur[112] in sub-region A; Veerapuram[113] and Nagarujunakonda[114] in sub-region B; Dharanikota[115] **[Map V]** and **[Chart IB]** and Amaravati[116] in sub-region C; and Satanikota[117] in sub-region D.

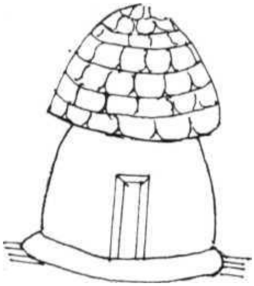
The plans of the different types of dwellings varied from circular to square and rectangular.[118] Circular houses have been reported from Kotilingala, Amaravati and Peddabankur. Rectangular plans have been found at Kotilingala, Kondapur, Satanikota, Peddamarur, Kyathur, Veerapuram and Nagarjunakonda **[Chart IB].** Houses on square plan have been found seen at

Kotilingala, Satanikota, Kapparaopeta and Nagarjunakona.[119] A typical chatuśśāla[120] variety has been noticed at Dhulikatta and Nagarjunakonda.

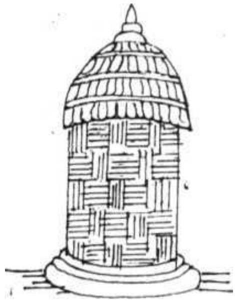
The Amaravati sculptural reliefs provide some information regarding the plans of the contemporary houses. **[Figure** 4] The Mattavindaka. Kavikumāra and Somanassa jataka panels illustrate, for us, circular, square and rectangular huts.[121] Royal buildings of two and three storeed buildings have also been seen provided with doors, windows, balconies, staircases and compound walls.

The architects of the period had selected suitable sites for raising the housing structures for dwelling. Some houses were built directly over the soils and bedrock while some were laid with good foundations below the ground level, which were arranged in such a manner so as to transmit the loads on the structures to the soils below. This was done inorder to prevent unequal levelling of the settlements and also increase the stability of the buildings. The structures at Kondapur[122] and Dharanikota[123] were raised directly on the soil surface and did not have any foundations below the ground level. At Dhulikatta,[124] the houses were built over the well rammed earth since the architects must have observed the instability of settlements laid directly on the soils and thus wanted to provide adequate foundation for the buildings. The foundations for the brick structures below ground level were filled by rubble stones in one or two courses set in mud mortar. Rubble foundations have been noticed at Kotilingala, Dhulikatta, Kapparaopeta, Polakonda, Peddabankur, Kyathur and Nagarjunakonda **[Chart IB].** At Kyathur, the foundations were laid from natural morrum level. At Peddabankur and Satanikota the natural bed rock served both as a foundations and basement to the buildings. The architects selected such a site for building activity keeping in view, the fact that

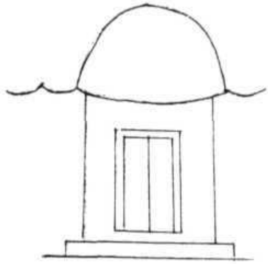
FIGURE 4



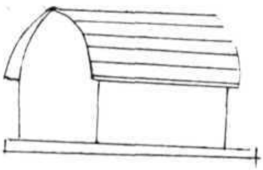
(a) A hut from Kavikumara Jataka



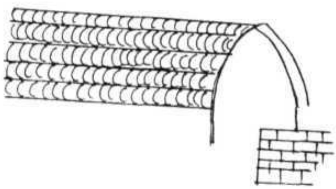
(b) A hut with matted walls



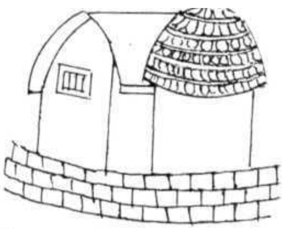
(c) A hut with doors



(d) A Rectangular hut from Kavikumara Jataka



(e) A Parnasala or hut with a thatched roof.



(f) A hut from Mattavindaka Jataka

Sketches of huts from sculptural reliefs on panels found at Amaravati, Sub-region C

(Reproduced from A.Ray, <u>Villages. Towns and Secular Buildings in Ancient India</u>, Calcutta, 1964, Figs. 12, 11, 6, 26, 28 and 10)

CHART I B

Period II: Habitation and Public Utility Structures

S.No	Name of the Site	Sub-region	Type of House Plan	Foundations/ Floors	Post-Holes	Walls	Roofs	Associated Structures	Public Utility Structures
1.	Amaravati	C	O	-	-	-	/ \	●	-
2.	Chandavaram	B	-	-	-	-	-	-	BG
3.	Dharanikota	C	-	-		-	≈	●	⧗
4.	Dhulikatta	A	T Z		-		-	$ ● ⧗ [ ]	$:
5.	Kapparaopet	A	X		-		-		
6.	Kondapur	A	T		-	-	-		$
7.	Kotilingala	A	O T X		-		-	$	⧗
8.	Kyathur	A	T		-		-		-
9.	Majeru	C	-	-	-	-	-	$	-
10.	Nagarjunakonda	B	X T Z				≈	$ ● [ ]	$, AMT, ST, RH, BG
11.	Peddabankur	A	O		-		≈	$ ● [ ]	-
12.	Peddamarur	A	T		-	-		-	-
13.	Polakonda	B	X				-	-	-
14.	Satanikonda	D	T X					⧗	:
15.	Veerapuram	B	T	-	-	-	-	[ ]	-
16.	Eelleswaram	B	-	-	-	-	-	-	BG

Key:

Type of House Plan	Foundations	Walls	Roof	Associated Structures	Public Utility Structures
U Pit-dwelling	Mud	Mud	/ \ Thatch	C Hearth	= Path way
O Circular, Semi circular, Oblong	Concrete	Brick	Tile	Platform	$ Workshop
	Plastered	Stone	Stone	Granery	Wharf
X Square	Stone			Well	AMT Amplitheatre
T Rectangular	Rock			Drainage	ST Stadium
				( ) Cattle penn	BG Bathing Ghat
				[ ] Compound Wall	RH Rest Houses

the rock bed would act as a raft foundation. At Satanikota, the depth of foundations for another building complex was 0.44 metres filled with morrum and small pellets of Kankar. The rammed packing had served as a firm base for the standing walls as the loose gravels were not suitable for carrying the load of the heavy brick wall. The foundations for the buildings were mostly two or three layers of randum rubble stones, set in mud mortar over which the brick or stone walls were constructed as at Nagarjunakonda.[125] The Miliñdapanha cited above clearly mentions that the selection of a suitable site before building the structures of a city was needed and this was heeded to by the contemporary architects of the time.[126]

The walls of the habitation buildings of Period II of our study vary from either being wattle and daub or mud walls to brick and rubble walls. Wattle and daub ones have been reported from the Amaravati[127] excavations. A wall of wattle and daub with mud and white washed called as Sudhamattikalepana has been mentioned in the Buddhist text Cullavagga.[128] Mud walls, by way of piling or placing wet clay clods to form a wall, have been reported from Peddabankur, Kondapur, Kotilingala and Nagarjunakonda [Chart IB]. Postholes have also been noticed on the periphery of walls meant for wooden poles set in mud walls which were needed to support the wooden frames of the thatched roofs.

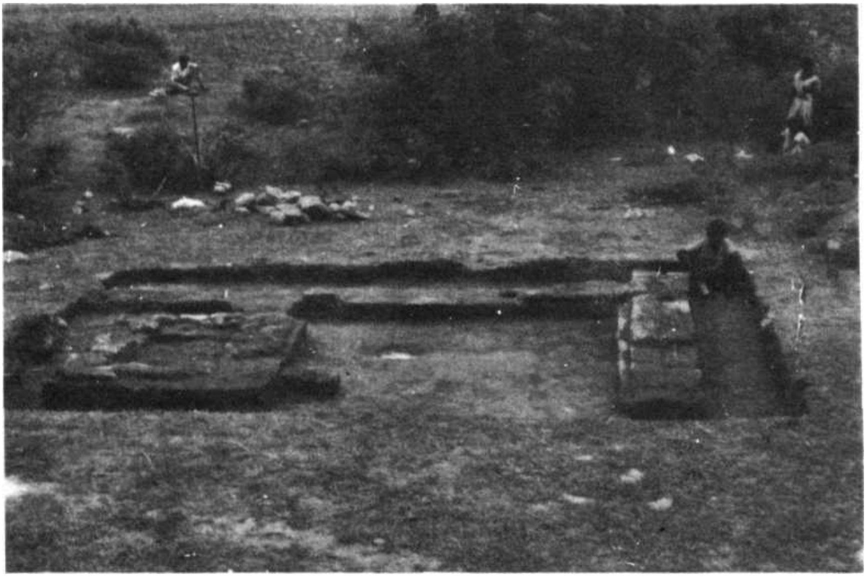
On the other hand, houses built of bricks have been reported from Kotilingala, Dhulikatta, Peddabankur, Polakonda, Kapparaopeta, Satanikota and Nagarjunakonda [Chart IB]. The lower brick course at Polakonda has an offset of 10 cms. wide projected from the wall serving as plinth or Kudyapāda [Plate III]. This arrangement facilitated the walls to diffuse the superimposed load onto the ground of the basement. The thickness of the walls also varied from 0.50 metres to 0.90 metres. At Satanikota and Polakonda, the width was 0.50 and 0.55 metres whereas, at Dhulikatta and Kotilingala the thickness was 0.80 metres. There were non-load bearing partition walls as well meant for the purpose of dividing one room or portion of a room from another. These walls were built with single bricks. The width of the partition walls was 0.40metres at Satanikota. The bricks were laid in two stretchers followed by a header and thus the width of the wall including its mortar came to be about 0.90 metres at Satanikota. The walls formed into square and rectangular rooms, which varied in size from 4.0 x 4.0 metres to 12.0 x 17.0 metres. At Dhulikatta[129] and Nagarjunakonda[130] a typical plan of what can be called as a chatuśśāla was noticed. It had four rectangular halls on the four cardinal directions with a central open courtyard. A slight change in this plan has been seen at Nagarjunakonda.[131] Here a spacious square hall at the centre, had four rooms on four corners and the entire structure was surrounded by a row of five cells on all sides. The other buildings comprised of 1 or 2 rooms with a narrow front, and a verandah. At the rear there was sufficient open space which was perhaps left for the kitchens.[132]

The richmens' houses at Nagarjunakonda were built of brick walls, encased with Cuddapah slabs.[133] This was a development, probably made as a protective course to prevent the walls from dampening. After this, the walls were plastered with lime. Inside the walls, chases were cut and sometimes, postholes was noticed on the top of the walls as at Polakonda,[134] Dharanikota,[135] Satanikota[136] and Nagarjunakonda[137] to receive the wooden frames of the roof. However, the load bearing brick wall can be seen as the most common form of building construction during this period.

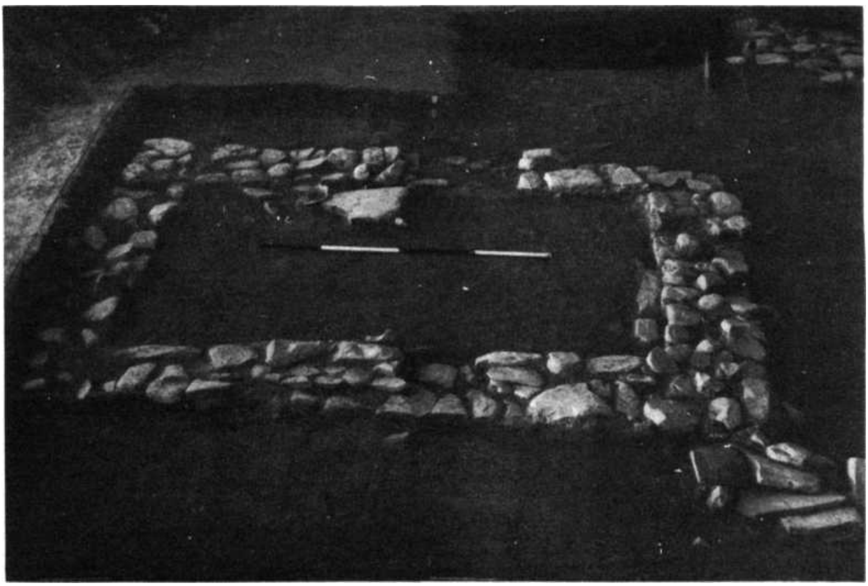
Walls built of rubble or shale stones have also been reported for sites like Kyathur and Nagarjunakonda. At Kyathur,[138] the structures were built of dressed laterite blocks of medium size mixed with cut shale stones and pebbles set in mud mortor [Plate III]. Rubble built houses with 2.0 metres thick wall have been recorded at Nagarjunakonda[139] at site no.13. The change of the medium for these constructions was due to its easy availability at the sites. The walls must have been built with the help of plumb-bobs which carry the perpendicular line to the required height. Terrocotta Plumb-bobs have been recovered from the Eeleswaram excavations.[140] Scaffolding was also necessary for making stone and brick walls. The walls of the houses of the rich and royal people were built to satisfy the functional requirements of stability, strength, durability. They were also more fire and weather resistant than the humbler dwellings which were prone to fire and other accidents and demanded periodical repairs, since they were built of perishable materials.

Mud mortar as a binding material was used to spread horizontally between the various layers of walls. For most of the walls of brick or stone, mud was invariably used as mortar. However, a solitary example of using lime mortar for the construction of a wall has come to light from Satanikota.[141] The engineers had gradually become aware that the potential tensile strength of the individual units of brick work could be developed further by the forces induced or enhanced by a strong mortar at the horizontal bed joints. Hence, they used strong lime mortar at Satanikota. It has been rightly suggested that lime mortar, having the property of the

PLATE III



Period II: Brick walls of a rectangular house, Polakonda, Sub-region B



Period II: Rubble walls of a rectangular house, Kyathur, Sub-region A

ability to spread, and to retain water against the suction of brick, was a process that led to a significant development of bond with the brick and further it was resistant to cracking and rain penetration.[142]

The roofs of the buildings also varied depending on the economic status of the people from simple thatched ones to tiled roofs and their slopes varied from being conical to flat roofs. In case of the houses of the poor, the roofs were invariably of vegetable material whereas, it differed in case of the houses of the rich where they were made of different types of tiles.[143] The Amaravati panels provide us the evidence of different types of roofings. Huts in circular, rectangular and square plans had hemispherical, barrel vaulted and curvilinear roofs respectively as seen from the Kavikumāra, Somanassa and Mattavindaka Jataka panels[144] [Figure 4]. Huts with roofs of palm leaves, Pannaśāla, domical in shape can also be seen from the sculptural panels at Nagarjunakonda[145] and Goli.[146] An attempt in copying a thatched roof in rock cut architecture can be seen at Mahabalipuram in Tamil Nadu during the 7th century A.D.[147]

Different kinds of thatched patterns for roofing have been mentioned clearly in the early Buddhist works.[148] The actual roof, cadana, was to be either thatched with leaves called panna, grass or reed called trna or covered with tiles, called giñjaka and also could be covered with skins. The cottages were said to be made partly of timber, darukutika, reeds, nalāgāra: straw, tīnāgāra, tīnakutika: leaves pannakutika. The roofs were also called Sudhāchadana covered by lime; Istakachadana covered by bricks and Śilāchadana covered by stone.[149]

For thatched roofing, use of long wooden beams fixed to the posts was necessary. On these wooden beams, wooden planks must have been placed, as the spaces between the beams were generally very wide. Reed matting was then laid over the planks and covered with a layer of mud as a water proofing course. In case of conical and hemispherical roofs, the grass bundles were probably placed overlapping the earlier ones and then spread so as to drain out the rain water.[150] This practice of making roofs can still be seen in most of the coastal areas of Andhradeśa.[151] Some houses at Nagarjunakonda had flat slabbed roofs over wooden rafters with proper slope.[152]

Buildings laid with terracotta tiles have also come to light from Dharanikota,[153] in sub-region C, Satanikota[154] in sub-region D, Peddabankur[155] in sub-region A; and Nagarjunakonda[156] in sub-region B. These tiles were double and triple grooved and sometimes, perforated. The tiles were rectangular on plan with rounded corners and a flat upper side. They had three or four channels in the form of grooves. On the undersurface the groove ran lengthwise for receiving the ridge of the adjacent tile. They were kept in position by driving nails into the holes at the breadthwise top into the wooden rafters of the roof.[157] At Nagarjunakonda, the tiles were either fixed by inserting nails in the holes and fixing them into the wooden rafters covering the roof or, to tie them to the rafters with thread or copper wire.[158] The tiles were made very finely, mixed with straw and some lustre was also given. After preparing them in moulds they were well-burnt in the kilns. The kilns of brick and tiles have been unearthed at the University area at the site of Nagarjunakonda.[159]

During this period one can notice that there were no chronological stages in the building of different types of houses. Some buildings were built with sophisticated technology as they were multistoried dwellings and were necessarily provided with all the amenities as seen in the panel sculpture of Amaravati cited above and as indicated by the extant remains found at Nagarjunakonda. On the other hand, huts built of simple technology co-existed side-by-side with these sophisticated buildings. Only a few people in the society had access and control of resources to be able to afford the sophisticated technology.

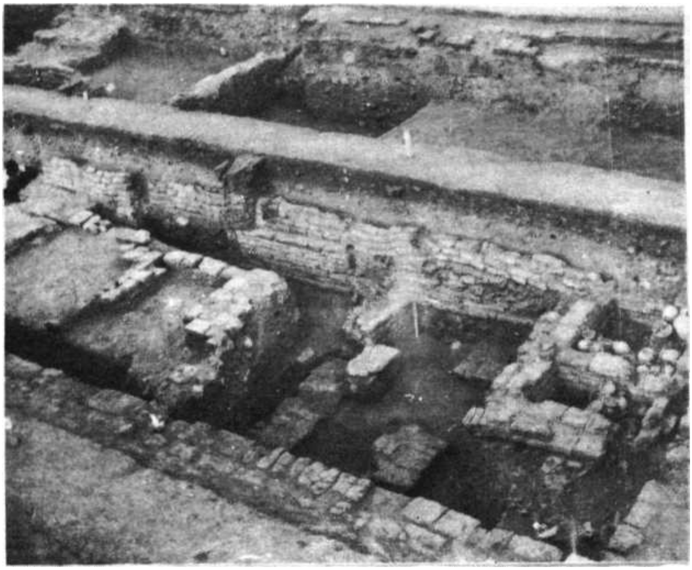
The larger part of society had to employ simple technology for their dwellings using naturally and easily available building materials. Huts of different types have also been portrayed in the contemporary sculptured panels cited above. The archaeological evidence of postholes on the periphery of the huts attest that large numbers of huts were built to house the common people. In the beginning there were huts as noticed at Amaravati, whereas in the succeeding phase comparatively more developed dwellings have been reported from Satanikota, Veerapuram and Nagarjunakonda. Further, in the last phase, i.e., 3rd century A.D., huts are seen built on the debris of the earlier dwellings as seen at Polakonda and Dhulikatta denoting the urban decay at the end of this period.

The houses received light and air through the doors and windows. Windows of three kinds, viz., *vedikāvātāyana*, *jālavātāyana* and *ṣalākavātāyana* [Figure 4] are known to be from the sculptural representational panels of Amaravati and Nagarjunakonda.[160] Providing other amenities which make life easier, also formed part of the planning that went into improving the building technology of the period. Among the amenities, floorings, hearths, granaries, water supply and sanitary arrangements and roads are important to emphasize upon.

The floors were made up of rammed earth, lime plastered and concreted, brick and stone paved. Rammed mud floors have been noticed at Nagarjunakonda[161] where gravel was laid to a depth of 2 to 4 inches thick and plastered with lime. Due to the short span of life of these type of floors, improvements have been seen in the flooring which were laid with brick or, were stone paved. Floors paved with brick have been reported from Peddabankur, Dhulikatta [Plate IV], Kondapur and Nagarjunakonda. Pebble floors have been noticed at Nagarjunakonda only. Stone paved floors have been seen at Satanikota and Nagarjunakonda. To meet long term performance requirement floors were laid with concrete. Lime concrete was laid as flooring at Dhulikatta. Thus we see that there was a gradual development in technology of laying the floors from the earlier simple rammed floors to the making of concrete floors.

Granaries to store food grains were built of bricks on well-laid foundations as seen at Satanikota and Dhulikatta[162] [Plate V]. Partitioned granaries have been found at the latter site. They were built in an inverted funnel or pyramid shape with bricks in receding tiers. The roof was laid with tiles. At Satanikota nails and tiles were recovered by the side of the granaries[163] [Chart I B.14].

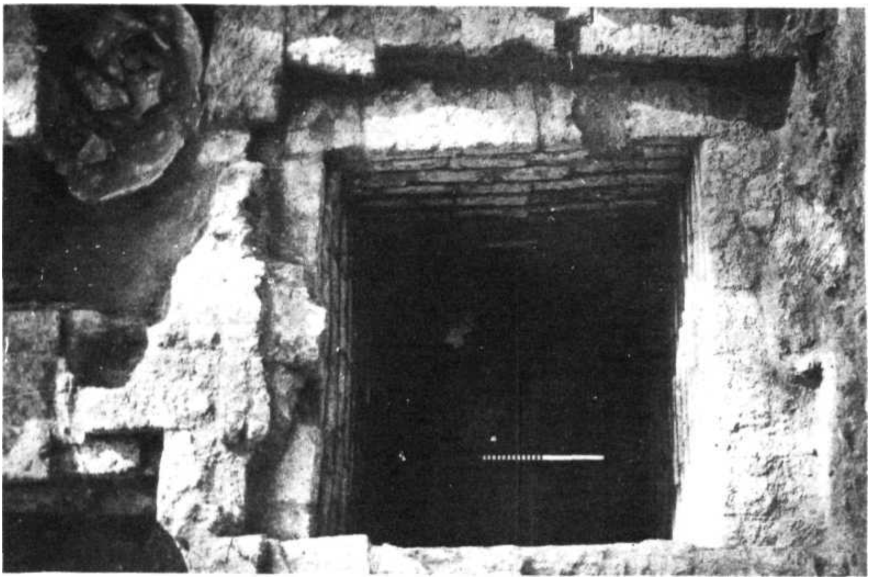
The architecture and technologists of the period took care to see that a good water supply system and sanitary arrangements were made inside the



Period II: A brick house with partition walls, Dhulikatta, Sub-region A

Period II: Brick floor of a house, Dhulikatta, Sub-region A

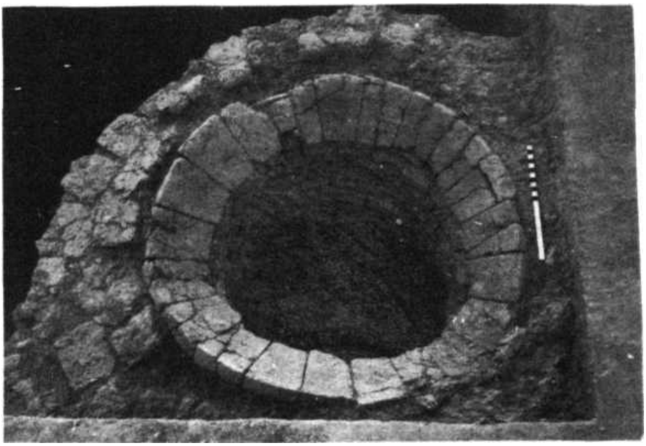
PLATE V



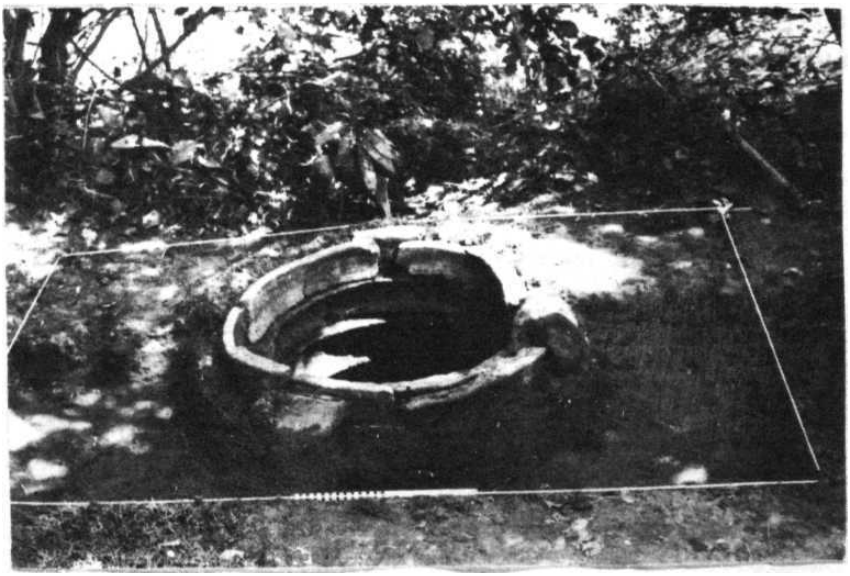
Period II: A brick granary, Dhulikatta, Sub-region A houses. To get clean and healthy water, the people dug wells into the ground. This is an innovation of the period whereas people in Period I purely depended on the natural water sources. To avoid seapage and contamination of the habitation surface, the foundation of these wells was taken right into the virgin soils. In order to make them round at the opening, wedge shaped bricks were used. As mentioned earlier, drawing water from below ground level was an innovation of the people of Period II. Habitations situated on the river banks had naturally used river waters, whereas the habitations away from natural water resources could not depend upon the ground water. The technology of digging well was very significant for early historic society and therefore, even though some of these habitations were situated by the side of the rivers, water for domestic consumption was derived mainly from the wells dug nearby. Wells were sunk into the ground, cased with wedge shaped bricks and sometimes, lined with terracotta rings. Every dwelling had its own well. Wells of big size meant for public uses were also dug. They were provided with steps to access the water. Pavements in brick were made all around the wells. Every care was taken to prevent seapage of water and the sagging down of the foundations. The wells dug into the ground for drawing water have been brought to light in large numbers at Kotilingala,[164] Dhulikatta,[165] Peddabankur[166] and Nagarjunakonda[167] [Chart I B].

The wells at Kotilingala, Peddabankur and Dhulikatta were built of wedge shaped bricks [Plate VI]. At Dhulikatta, a brick well square in plan was exposed. Adjacent to the well was a platform with two postholes evidently for erecting wooden posts to support a pully. Water was drawn by means of a rope tied to a pot or metallic vessel. A unique illustration of

PLATE VI



Period II: A circular well with wedge shaped bricks, Peddabankur, Sub-region A



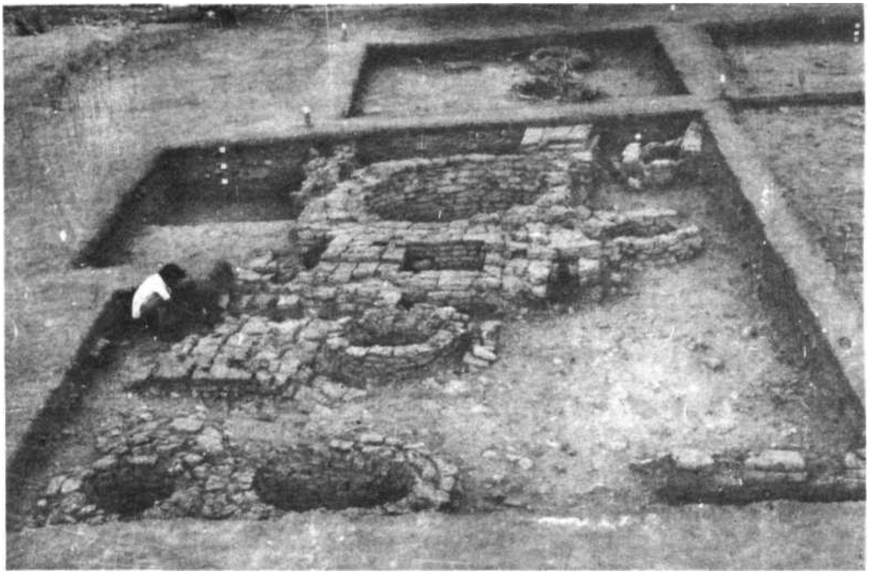
Period II: A well with terracotta rings, Majeru, Sub-region C a brick built well is found represented on a Gandhara sculptural panel, which shows a girl drawing water from the well, by a rope keeping her legs in characteristic pose.[168] An improvement in the technology of building the wells has been noticed at Peddabankur,[169] where a well dug to a depth of 4.10 metres was lined with terracotta rings. Wells lined with terracota rings have also been reported from Majeru[170] [Plate VI] in sub-region C. Though this cannot be a superior technique to lining it with bricks, but it is cheaper than the latter economically. The rings were of convex body, 76 cms. in diametre, 38 cms. high and 25 cms. thick. Altogether 21 rings were used from top to the level of the morrum bed. The earthen strata was cased with rings because there was every possibility of collapse of the walls. These rings went upto hard soil, i.e., to the morrum levels. To ensure safety, the top most course of the terracotta ring well was lined with square bricks. Often the top course of the parapet wall of the well was built with coping stones. This arrangement also reveals their thorough observation in using the wells. These coping bricks facilitated them in preventing the entry of rain water. Hard morrum was rammed all around the well.

The process of excavating the wells around the houses can be explained thus. After the construction of the house was over or when it was in final stages of completion, a suitable place in the compound for digging a well was selected on the advice of the water diviners or with the knowledge of the inhabitants about the local water table. Then a set of three or four persons might have been put to work on the job of digging the well with crowbars, spades and baskets. The earth was dug out and lifted from the well, while digging was in progress and the process continued till the water level was met. The mouth of the well was narrowed with a projection of sufficient width to encase it with bricks. The people were able to prepare wedge shaped bricks, which were best suited in order to get a circular shape. The knowledge of making pottery enabled people to design, and prepare burnt circular earthen rings. The gap between the bricks or rings and the earthen wall was filled with compact earth and rammed. The top portion of the wells was built with parapets as a safety measure. Finally, wooden posts were erected on one side of the well so as to fix a pully, facilitating the drawing of water by means of a rope and a bucket.[172]

At Kotilingala near the wells, platforms, cisterns or tubes and bathrooms were built in brick **[Plate VII].** Open or conceiled drains were also built near the wells, to carry the used water away as at Peddabankur.[173] At Nagarjunakonda,[174] circular, square and rectangular wells were built with stones. The above descriptions of wells lead us to conclude that the people of Period II were careful to consume hygeinic water for drinking purposes and therefore, took great care in seeing that no seapage was allowed into the wells. Well making technology was mastered during this period and remained the same upto the 5th century A.D. barring minor changes. Water cisterns and tanks near the residential areas is being discussed in the next section of this Chapter on Irrigation Structures.

Another important aspect of the building technology in the habitational area during this **period was** the sanitary arrangement that was laid out. The objective was to provide the occupants of the buildings with a safe and healthy environment. The increase in the number of houses in

PLATE VII



Period II: Brick wells and cisterns, Kotilingala, Sub-region A

Period II: A soak-pit with terracotta rings, Peddabankur, Sub-region A many of these urban centres infact demanded that attention be given to the standardisation of hygiene. Thus, drains to carry dirty water away from the living areas were devised. In the early phase of Period II open drains were built as seen at Amaravati[175] databale to about the 3rd century B.C. Since it was observed by the people that uncovered and open drains were unhygienic, they gradually began to build drains which were covered either with brick or stone. These coverings could be removed at anytime in case there was an obstruction in the flow. Drains were also connected to soakage pits as noticed at Peddabankur. Drains inside the houses were often connected to soakage pits. At Dhulikatta was found one such drainage channel which was connected to a soakage pit and it was partitioned into two. Since the earthen canals often collapsed, they were projected by brick constructions. At Peddabankur, a deep pit was cut into the level natural morrum to a depth of 1.90 metres.[176] Here, another drain was connected to a soakpit lined with terracotta rings [Plate VII]. This arrangement reveals that the people had taken utmost care not to allow the drainage to enter into the subsoil as this would spoil the surrounding area.

Drains attached to houses, bathrooms, wells or enclosures have been noticed at Dharanikota, Amaravati in sub-region C, at Kotilingala and Peddabankur in sub-region A and at Nagarjunakonda in sub-region B. The drains connected to soakage pits have been noticed at Peddabankur[177] where a covered drain built in brick was found to a length of 13.30 metres. The side walls had three courses. The bottom ones were paved with brick and covered by a single course of brick. Side vents were provided at varying intervals of 1.70, 2.20 and 2.90 metres to allow excess water to overflow.

It was finally connected to a deep pit. A huge drain connected by small drains has also been noticed at Nagarjunakonda.[178] This was probably the main sewer drain of the city. A drain or sewer which led out of the city has been mentioned in the jātakas as niddhamanamāgga.[179] An enclosure wall at the same site was provided with many outlets of 2'-0 wide and 7" depth at different places, probably to provide a flow for the rain water.[180]

Workshops of blacksmiths, sculptors, potters, bangle and bead makers have been reported from Dhulikatta,[181] Kondapur[182] and Nagarjunakonda.[183] An interesting feature was noticed at Kondapur where a house consisting of an underground chamber ranging in depth from 1.52 to 7.62 metres was found and identified as a workshop area. Occurrence of beads in different shapes and sizes, coin moulds and iron furnace with platform and cisterns reveal that these underground chambers can be considered as some sort of workshop. At Nagarjunakonda, workshops of goldsmiths, ironsmiths, potters and sculptors attached to residential quarters have been brought to light.[184] Availability of moulds of gold jewellery, iron furnace, water cisterns and terracotta pipelines, potters kiln and a good number sculpture showing different stages of carving denote that these were workshop areas which were mostly built in stone.

A hallmark of the building technology of the period was that habitation areas had enclosure walls to provide safety and security. Enclosure walls, rectangular on plan were noticed at Dhulikatta, Peddabankur, Veerapuram and Nagarjunakonda [Chart IIB]. The thickness of the brick walls varied from 0.65 metres to 2.00 metres and they were raised on rubble foundations. At Veerapuram and Nagarjunakonda, enclosures were built in stone and this can be seen as a development in building construction. It is more difficult to build stone walls since the quarried rough stones need to be dressed evenly to suit the plumbline, whereas construction of compound walls with brick was easier because of their premoulded regular shapes. Construction of compound walls has been mentioned in the iatakas[185] and can also be seen in sculptured panels at Amaravati and Nagarjunakonda.[186]

An important aspect of the building technology of Period I was the construction of large public utility structures such as amphitheatres, common baths, resthouses and roads. The amphitheatre and stadium at Nagarjunakonda[187] are an indication of the ability of the people during this period to undertake large scale monumental constructions which were not religious in nature. Both engineering skills and financial support were needed for this. These buildings were built mainly for the leisure pursuits of the elite in society. An oblong stadium with a central arena datable to the 3rd century A.D. was a massive building measuring 300'-0 x 259'-0 in length and width and 15'-0 deep. All around the inner side of the stadium, brick was used with a flight of steps of 2'-0 width. A pavillion was built on its western side. Plain platforms were constructed on all the four sides. Corridors were also provided in the stadium. The central arena was levelled up and kept free from pebbles. Another stadium rectangular in plan, was found with flights of steps on three sides and an entrance on the fourth side. Scholars like K.Krishna Murthy[188] opine that the location of this stadium on the hill slopes and the gallery arrangement speaks of the sound knowledge of the builders in accoustics. The necessity of spacious walls and arena for performing sports activity have been mentioned in the early literature as kīlāgriha.[189]

To execute such buildings it was necessary for the architects to have a pre-conceived plan and first and foremost select a suitable site. Then a big trench was excavated according to the design, and steps were built with landings from the bottom to top in ascending manner. The gaps were duly filled with earth and dressed waste. The flooring and steps were systematically executed so as not to allow their collapse due to erosion.[190]

The excavations at Nagarjunakonda have also brought to light a pillared pavillion attached with a green room.[191] These two structures were enclosed by a compound wall. Rest houses known as visśamanaśāla or punyaśāla[192] were also built at the same time to facilitate the accommodation of the public, visiting Nagarjunakonda which was a significant centre of Buddhist learning. They were built with lime stone pillars and slabbed plain roofs and floors. Keeping in view the fact that the public would be frequently visiting the place, the architects with foresight had the floors made with a mixture of pebble and concrete, over which a smooth plastering was then done. This would prevent their constant repair and maintenance and thereby save finances.

Ghats or bathing places were built with beautifully arranged flights of steps, for easy access and for the use of all the people to take baths on ceremonial occasions. These are prominently in evidence at Nagarjunakonda and Eeleswaram, both sites being situated on either bank of the river Krishna.[193] Recently one more bathing ghat has been brought to light at Chandavaram[194] in sub-region B [Chart IB]. Besides, a common bath built with a well paved platform, water tank, steps and water tub have also been found inside the habitation.[195] Construction of massive structures provided with steps and landings, facilitated the public at large to take baths even when water level in the river fluctuated in some seasons. This is a significant feature in building technology of the period in which the knowledge of the masons was put into practice, in securing the banks with steps especially since they were constantly being washed by the water of the river.

Roads became important to lay out with development of different types of transport during the period. Well-laid and made up surfaces of the roads have been noticed at Dhulikatta, Satanikota and Nagarjunakonda. At the last mentioned site, there were five roads parallel to each other running between the river Krishna and Phirangimotu on the east.[196] Roads were flanked by rubble stones on either side to withstand the lateral thrust produced by the heavy traffic. Side lanes or byeroads were also provided for. These lanes connected the habitational area to the religious and public utility buildings. Unfortunately, hardly any excavation report contains detailed information on how these roads were laid. Literary references[197] of the period mention main streets as rājamāgga, mahāpatha, tōranamāgga, ordinary streets, as veedhi and by-lanes, as antharveedhi. For laying roads the intended paths were first levelled. Then boulders and pebbles were picked up and finally, they were paved with hard morrum to withstand the wheeled transport.

The above information on building technology of the habitation structures and public utility related structures, reveals that two types of building technologies co-existed side-by-side, viz., simple and sophisticated, to suit the needs of both the common and rich people respectively. The archaeological data, literary texts and sculptural panels provide us enough information that the common people had circular houses of wattle and daub covered with thatched roofs whereas, the middle class and rich people had square and rectangular houses built with brick or stone walls and covered with slabs and tiled roofings.

The royal palaces were usually multistoreed with flat roofs having balconies, windows, staircases, doorways and enclosure walls. Workshops were provided with all the necessary appendages such as working platforms, water cisterns and furnaces. The residential quarters were built in both brick and stone and enclosed by compound walls. Workshops were public utility structures primarily limited to use by the artisan and merchant classes, who generally were part of the urban elites. Regarding water supply and sanitary arrangements, *every* housing unit had its own system of dug out wells built with brick or lined with terracotta rings and drainage canals which were also lined and covered by brick. They were appropriately connected to ordinary soakage pits which were sometimes lined with terracotta rings. To enjoy the leisure pursuits, public utility structures such as the amphitheatre, stadium and public baths/ghats and resthouses were built, with permanent building materials. The earthen rammed floors from the earlier period were improved with the use of lime concrete and were also paved with both brick and stone.

The evolution of building technology in this period can thus be summarised in the following manner. The wattle and daub walls of the simple dwelling structures were perfected with a better technology by erecting mud walls and this was then followed by the use of the medium of brick and stone for construction. This offered a better stability to the dwelling structures and a longer duration of their existence. The roofs at the beginning of Period II were thatched ones but over a period of time they too changed and soon brick, stone and tiles became more popular modes of roofing. The former however, continued to exist side-by-side. Tiles, grooved and perforated were manufactured and used for roofings and were fixed to the wooden frames. The technology of brick making was perfected and innovated upon during the period. They were well-burnt and moulded ones in rectangular shape. Wedge shaped bricks to suit the circular periphery of the wells were manufactured for the first time. Brick and stone walls were raised on well-laid foundations, below a ground level according to the nature of soil. Some structures were directly raised on the bed rock. Brick and stone walls were invariably built with mud mortar while lime mortar was used mainly for plastering the walls and floorings.

Upto the 3rd century A.D., the structures were built with brick walls only. However, from the second half of the same century we witness an improvement in technology as the brick walls were strengthened by encasing them with stone slabs. This added a significant amount of stability to the structures and prevented the dampening of the building through the entry of rain water. Houses were provided with front verandahs and partitioned walls, built by a single brick course inside the houses. This reveals the economic aspect of the building technology. Since the partitioned walls were not load bearing components, the architects used only a single course of bricks in order to divide the halls into separate cells. As a safety measure, the houses were enclosed by compound walls. Walk away pathways laid in traditional manner were perfected and improved with well-laid roadways connected to sublanes.

It can further be said that the role of the architects in building technology had been to design buildings that reflected the interests of the public. They became the meeting point between the society and technology. The architects in their enterprises had to have a sound knowledge of the soil mechanics, topography and location, before building the structures. Planning and designing of all types of buildings revealed their organisation of space for different purposes, according to different rules that reflected the needs, values and desires of the people. The architect had to coordinate with other consultants, experts and craftsmen in different fields of building technology. However, he controlled the different aspects of the design and the structural process of arranging for lighting, water supply, sanitation and even accoustics.

Period II thus witnessed important developments in building technology. The evidence for habitation buildings and public utility structures for this period is substantial and enables us to conclude that it reached a watermark by the end of this period in Andhradesa. After this period such information is rare to come by. Some of the above delineated descriptions of ordinary housing patterns and material used to build them are valuable since these traditions continue even today in rural areas. Material evidence of the survival of such techniques in archaeology thus enables us to evaluate their time tested efficacy which the collective experience and knowledge of the people had preserved.

Information on habitation and public utility buildings of Period III and IV is scanty and not forthcoming, because the sites that have been tapped for archaeological excavations have been very few. In this regard it must be mentioned that only future excavations may provide evidence of ordinary housing patterns and public utility structures for Period III. This absence has, at present also to be understood against the background of the debate that is raging among scholars[198] on the nature of urban decline and growth from the early medieval that we have outlined above in Chapter I. Some scholars suggest that urban decay was caused by decline in trade,[199] both internal and external, and the collapse of stable empires and religion.[200] These factors had in the earlier period generated finances which was mainly responsible for the existence of different types of building structures that had been concommitant and prolific with early historic urbanisation.

Despite this general absence, a few sites in Andhradesa have yielded data on habitation buildings and these are discussed below. Excavations conducted at Keesaragutta[201] [Chart I C & I D] in sub-region A have brought to light a complex of residential buildings [Plate VIII] in Triśāla Vasthu pattern, belonging to the 4th-5th centuries A.D. All these structures have been enclosed by a massive wall. Among these, there was a huge brick structure containing five cells prefaced by a common verandah which was provided with a square portico in front and a flight of steps to approach it. Considering the width of the wall, it is likely that this must have been a storeed building. The flat roof might have been covered with terracotta tiles and plastered with lime. It was supported by wooden posts as is indicated by the presence of post-holes. The bricks used measured 46x23x7 cms. Another three celled structure here has also been identified, with a portico and a flight of steps, which ended with a moonstone. The exterior surfaces of the walls were finely plastered with lime. Some houses at this site had rubble basements. The partition walls measured 0.75 metres in thickness. The flooring was brick paved. The excavations conducted in the contiguous region at the site Paunar in the Wardha district of Maharashtra, have also laid bare brick structures, tiles and ring wells, for soakage and well-built houses with excellent foundations belonging to 4th-5th centuries A.D.[202] Amita Ray's[203] study on the 'Urbanisation in Bengal' reveals that from the sixth century A.D. onwards cities grew up in Bengal, with a recognizable urban character, backed by the growth in socioeconomic aspects which accelerated the development in the agrarian base. In this connection she cites two archaeological sites, viz., Pundranagar and Kotivarsha, both of which were fortified and had palace and religious establishments.[204] Keesaragutta is thus one such site of the Period which did not decline as other centres did after the third century A.D.

The above information leads us to conclude that the building technology of Period II was more or less continued into Period III but empirical evidence for this at the moment is limited only in sub-region A from the above mentioned site at Keesaragutta. However, information on habitational and public utility related structures such as dwellings, mathās and hospitals attached to the temples can be described from a few excavations conducted in Andhra Pradesh at some temple sites. Contemporary literature and epigraphical sources have also been used to construct a picture of such habitational structures.

At Alampur in sub-region A, a habitational deposit was noticed by us on the southern side of the present town.[205] Unfortunately, excavations have not been conducted at this early medieval temple town. While dismantling some temples datable to 7th-8th centuries A.D. which were located on the left bank of Tungabadhra river that were threatened by submergence due to the building of Srisailam dam, I observed a deposit of 1.00 metre thick occupation. This layer was of pāti earth mixed with stone and brick bats and abundant pottery pieces resembling examples of the Vishnukundin Period[206] [Chart I C & I D]. Here again, unless fullfledged excavations are done, the true nature of urban settlement in this temple-town will not be possible to delineate. In another case, ruins of early medieval habitation in the shape of fortifications, foundations of residential buildings are still seen at Mukhalingalm.[207] However, because of the modern houses that have arisen over the debris of the above ruins, details are not clearly available regarding the nature of these settlements either. In fact, it would not be an exaggeration to say that most of the early medieval town settlements have been superimposed by subsequent habitations and therefore, have been difficult to excavate.[208] A similar evidence comes from sub-region C at Asanapura, identified as Achalapura, near Yallamanchili in Visakhapatnam district. This has also yielded huge quantities of potshreds and pāṭi earth. Both these pieces of evidence testify to the fact that this town was in existence from the 7th century A.D. onwards. K.Suryanarayana[209] suggests it might have been burnt down by the Eastern Ganga Kings during their invasions. A 7th century inscription of the King Jayasimha-I mentions that he made provision for a dwelling place in Kudivada near Asanapura and this proves beyond doubt that there were dwellings here before its decay.[210]

Therefore, since the empirical evidence from archaeology on habitation buildings is very poor, we can draw upon the contemporary literary works, for India as whole regarding the descriptions of various types of buildings and the possible technology used to build them. The Amarakośa[211] furnishes us information on towns and houses. The Puranas compiled mostly during the early centuries of Christian era and some during the early medieval Period (600-1200 A.D.), deal at length with the subject of building houses. The Matsyapurāna[212] in its Chapters 259 and 260 deals with the descriptions of buildings and their components such as plans, measurements, classification of pavillions, halls, etc. Building materials have also been described in Chapter 257 of the same work. The Brhatsamhita.[213] a text of the 6th century A.D., has descriptions on Vāstuvidya. where some rules have been prescribed for the selection of a site for the proposed building. It is stated that the site was to be soft, even and of sweet odour and taste. It was, on the other hand, not to be hollow from inside. Further, it was good if it abounded in commendable herbs, trees and ores. It also prescribes varying sizes of houses for the different grades of ruling Chiefs and also for members of the four varnas.[214] Some of the houses are described as single storeed while the majority are noted as multistoreed and this, therefore, implies that a sound technology was available to the architects and builders of such big houses. It can thus generally be suggested that house structures of the Period III were mainly multicelled and storeed buildings with front verandahs and built in brick. Floors were rammed and roofs supported by wooden frames and posts supporting the walls. The walls were plastered with lime mortar. The entrances were approached by flights of steps.

For Andhradesa there are inscriptional and literary references which describe public utility buildings such as maṭhās, hospitals and alchemical laboratories. The inscriptions from Alampur describe some of the these in detail. Maṭhās are monastic establishments, separate from the temple, specially built for the residence of religious teachers, who had to impart education. Mathas also served as feeding houses for the students, ascetics and pilgrims. In this connection, the existence of a Saiva matha at Talamanchi in Nellore district which falls in sub-region C, dated to the 7th century A.D., can be cited from the inscription of Chalukya Vikramāditya, wherein he donated some land to his preceptor Sri Meghāchārya for the said purpose.[215]

Another interesting information regarding public utility constructions of the early medieval period is the mention of rasaśāla, i.e., a chemical laboratory which is found at Alampur [Chart I C & I D]. According to I.Sanjiva Rao,[216] the rasaśāla at Alampur was built in accordance with the rules laid down in rasasastra. It is said that metallurgical operations requiring the use of fire, were to be taken up on the south-east quarter, grinding operation on the southern quarter, surgical operations on the south-western quarter, washing operation on the western side, drying up operations on north-western side and finally, alchemical operations were to be taken up on the north-east side. The storage of the raw materials was said to be done in the centre. This description tallies exactly with what has been found in the form of the roandapa like, closed stone building situated on the northern side of the temple at Alampur. At present these structures serve as a Museum. The above literary citation on the construction of the said building pertaining to information on industrial and technical activities is a rare piece of evidence and one of its kind.

The period from the 10th to the 13th centuries A.D. provides the institutional framework for great agrarian expansion and urban growth in the succeeding centuries. However, many scholars have attributed this period with enough economic expansion for rural settlements to be transformed into semi-urban or fulfledged urban settlements.[217] The former grew around Brahmadeyas which were prominently brahmin habitation areas. Revenue from these lands were often offered for the maintenance of the educational institutions and temples.[218] Thus, it is argued in the context of Tamil Nadu, that during this period, due to the developing trade between the town and country, villages which earlier were centres of fairs and markets, now came to be developed as towns. In the context of Andhradesa the Basinikonda epigraph[219] from sub-region D dated to 1050 A.D., states that an assembly of merchants converted the village Siravalli into a town, Pattana.[220] The same inscription mentions it as an erivīrapattana or an inland port and as an important trade centre, so much so that it came to be provided with armed protection. Continuity of settlement and the growing prosperity of villages in some regions of Āndhradeśa has been observed from several epigraphs of the period which speak of urban influence in sub-region D. Another inscription dated to 1187 A.D.[221] records that a number of gavundas (village headmen) who came from nagarisīma (the border of town) with their carts, settled in several rural settlements.

Thus, during Period IV, the study of habitation structures is clearly related to the revival of towns and cities, as found mentioned in the contemporary literature and epigraphs of the 11th to 13th centuries A.D. It has been observed that there was brisk trading activity, and as a result, some coastal port towns such as Kulottunga Chōḍapaṭṭana, identified with modern Visakhapatnam, Cholapāndyapuram, i.e., present Ghantasala and Desivuyyakonda paṭṭana identified with Motupalli,[222] all situated in sub-region C, rose to prominence. Many inscriptions from Mukhalingam, datable between the 8th to the 11th centuries A.D., mention towns and cities such as Simhapura, Dantapura, Draksarama, Dirghasi, Vengi, Vijayapuri, Bhogapuram and Dharmapuram.[223] Further, a text of the 11th century A.D., the Manasollāsa, enumerates important early medieval Andhra urban centres with textile industries located at Podanapura, present day Bodhan, Chirapalli, present day Chirala, and Allikakula, modern Srikakulam.[224] Instances of towns founded by Kings and minsters are also numerous from inscriptions. Jagadala Mummadi, the younger brother of Ganapatideva, claimed to have constructed a town on the banks of a charming lake called Ganapapura in 1245 A.D.[225] All these towns mentioned in inscriptions have to be understood against the background of the re-development of the market economy of towns from the beginning of the 11th century A.D. in many parts of south India. It has further been pointed out that this coincided with a recognizable increase in the circulation of metallic money as indicated by money payments for constructional labour.[226] Regarding the evidence of coined money and its re-emergence in medieval Andhradesa, information can be gleaned from literary, epigraphic and archaeological sources.[227] This kind of urban activity was conducive for the growth of habitation and public utility buildings. However, most late medieval townships remain under continuous occupation. This makes excavation work exceedingly difficult and therefore, there is a dearth of information on such constructions which were a necessity for every day use. Only if these townships had got deserted, as in the case of Hampi,[228] that archaeological information would be available in a substantive and rich manner.

Within Period IV the Kakatiya phase of rule saw a very prosperous regime emerge in medieval Andhradesa. People could exercise power through their assemblies which was more than that exercised by the māndalikas. The village assemblies were called as a aseshapraia. samasthapraja and occassionally aṣṭādaśapraja.[229] Of all these local bodies, a bigger committee called sthalasamava representing all the people of the sthala or group of villages has been importantly mentioned in the epigraphs of the Period.[230] The strong local economy is indicated in one instance by the fact that to donate land to some temples, the early Chiefs of the dynasty had to obtain permission of the village gavundas. the village heads of Sanigaram and Bezavanka,[231] a place situated in sub-region A. Likewise, the māndalikas sought permission of the village assemblies to donate lands and to collect additional dues, as recorded in an inscription found at Taduvai[232] which is located in sub-region B.

This background enables us to describe, based on both literary and epigraphical sources, some of the habitational and public utility buildings for the latter half of Period IV such as dwelling places, maṭhās, satrās. colleges, hospitals roads and highways. There is only a solitary example from an archaeological source that reports public utility buildings from the excavations conducted at Motupalli in sub-region C[233] [Map V]. Inscriptions provide us the terminology used, to refer to buildings and the donations of house sites, called niveśana sthala. to various groups. Literature on the other hand, offers information on the different types of buildings of the period. An epigraph from Sanigaram of 1052 A.D. refers to a donation of 12 house sites.[234] The inscription found at Sirur in sub-region A informs that a mahāsāmanta called Aggalayya made a gift of land, garden and a house to one Siddhantadeva.[235] The Nagulapadu inscription dated to 1303 A.D. refers to a gift of some land for house sites, sthana nivesana.[236] The thousand pillared temple inscription of Hanumakonda dated to 1163 A.D. refers to the fact that Brahmins were living in bhavanas. i.e., storeed buildings.[237] Some inscriptions also provide infromation on the layouts of market centres and cities. At Peruru,[238] a market town in sub-region B, there were separate quarters, i.e., residential buildings for the brahmins, the Telugu and Arava merchants, Gollakāmpulu, Telikis. and local officials. At Nellore, known as Vikramasimhapuri, the capital of the Telugu Chodas there were constructed many quarters belonging to the Brahmins, merchants, artisans, cultivators, weavers, and others.[239]

The Ganapesvaram inscription of Ganapatideva mentions that the different localities of the city were built and developed by Rudra and were named after the Chief towns of the centres he had conquered such as Panugantivada, etc. Further, it states that he peopled these newly developed colonies or satillite towns with the inhabitants of these respective towns conquered thus, making the capital city truly metropolitan and cosmopolitan in nature. An inscription found at Hanumakonda[240] dated to 1170 A.D. refers to the fact that King Rudra burnt the pura of Meḍarāja. From this, it is possible to infer that the houses in the capital town were probably built with perishable materials, such as thatched roofings and wooden frames which must have burnt easily. The Mogulutla[241] inscription of the 13th century refers to Warangal city with saudhas and harmyas, i.e., buildings built by lime mortar and refers to them as storeed ones. The Bayyaram Tank inscription datable to the 13th century A.D. refers to the fact that Mailama built three new towns, viz., Mahadevapura, Bayyaram, and

Dharmavaram, and 1n the last mentioned one she is also said to have built public utility constructions such as hospitals and rest houses (viśramanaśālaṣ).[242]

The Chebrolu inscription of Jayapa Senani, the Commander-in-Chief of Ganapatideva, mentions that after the defeat by Jayapa, the vilāsa harmvas. the luxurious storeed buildings of the Kings, were found ruined and were seen with grass grown on their terraces.[243] In the descriptions of a 13th century inscription called as the Nirosṭhyakāvya,[244] found incised on Ursgutta near Hanumakonda, there are a few references to contemporary buildings such as a storeed building with bed rooms. The same inscription also mentions that the whole of Andhradesa of that period had countless cities which outshone the numerous divine cities. It further goes on to elaborate, with some exaggeration, that the assemblage of numerous damsels with moon like faces, on the top most floor of the houses in the city made it difficult to see the existence of the real moon in the sky.[245] These inscritpional references to cities and the habitation and public utility buildings are corrobrated by descriptions in an important text of the period called Krīdābhirāma.[246] This work portrays the contemporary life of Warangal city with all its details and glory during the first quarter of the 14th century A.D. The text mentions important trade centres like Madisanta, Mailasanta. Akkalawāḍa, some roads and storeed buildings and also hutments. It describes a painting hall of Machaldevi, where paintings of Palnāticharitra were done, on the smooth surface of the walls which were plastered with fine lime.[247] It further informs us that the Warangal city had 300 large and small commercial establishments and shops.[248]

The archaeological sources for Period IV are few but fortunately we have structural remains of some unique buildings identified as a customs house from the site of Motupalli **[Chart** I CS I D], This was a famous port town during the medieval times and excavations were conducted here during the 1971-72 season.[249] These excavations have revealed a huge brick structure, rectangular in plan, constructed of burnt brick in mud-mortar and plastered with lime **[Plate VIII].** The thickness of the wall noted was 50 centimetres, the total length of the building measured 22.20 metres with a width of 5.31 metres. The height of the extant walls was 3.0 metres on the south-western side. All the four walls had off-sets, slightly above the floor level. Four doorways facing each other of the size of 1.07 metres broad, were noticed in the middle of the walls. Long iron hinges of door leaves were also found. Inside the building were two rows of pedestals constructed of brick and lime and provided with rectangular sockets, each with a depth of 20 cms. Wooden pillars might have been kept over these pedestals for supporting the roof which was covered with channelled tiles. A small stack of tiles was found at the floor level, outside the building which measured 24x13x8 centimetres. The site has also yielded Chola coins of Rājarāja and Chinese coins of the early Ming period. The above structural remains give us some idea on public utility buildings and building materials of the medieval period in Andhradesa.[250]

There was no continuous habitation at this site, though it was the rain gullies which were responsible for bringing the remains to light. Initial explorations conducted at this medieval port town further led to systematic excavations. On the other hand, medieval settlements such as at Warangal, Alampur, Vengi, Visakhapatnam, Ghantasala, Hemavati, Kanduru and Vardhamanapuram have been occupied continuously. Therefore, the type and

CHART I C t D

Period III (IV : Hibititioi ud Public Utility Strictures

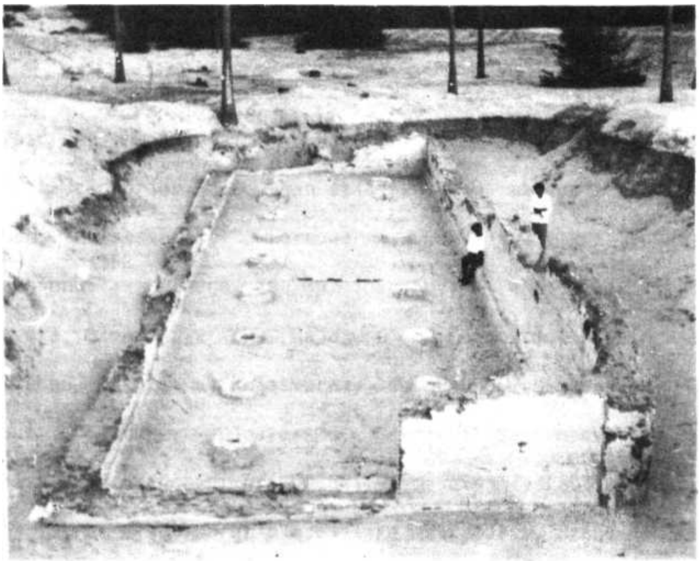
S.No	Name of the Site	Sub-region	Type of House Plan	Foundations/ Floors	Post-Holes	Walls	Roofs	Associated Structures	Public Utility Structures
1.	Alampur	A	T	⧅		⧅	⧅	[ ]	M, CL
2.	Draksharamam	C	T	⧅	-	⧅	⧅	-	H, S, M
3.	Keesaragutta	A	T	⧅	J	⊞	⋀	[ ]	-
4.	Malleswaram	A	T	⧅	-	⧅	⧅	-	M, S
5.	Motupalli	A	T	...	J	⊞	≈	-	CH
6.	Ramathirtham	A	T	⧅	-	⧅	⧅	-	M
7.	Vemulavada	A	T	⧅	-	⧅	⧅	-	M

Key:

Type of House Plan	Foundations	Walls	Roof	Associated Structures	Public Utility Structures
U Pit-dwelling	Mud	Mud	⋀ Thatch	C Hearth	= Path way
O Circular, Semi circular, Oblong	Concrete	⊞ Brick	≈ Tile	Platform	$ Workshop
	... Plastered	⧅ Stone	⧅ Stone	Granary	Wharf
X Square	⧅ Stone			Well	AMT Amplitheatre
T Rectangular	Rock			Drainage	ST Stadium
					M Matha
					CL Chemical laboratory
					H Hospital
					CH Customs house
					S Satra

PLATE VIII

Period III: Rectangular brick house with verandah, Keesaragutta, Sub-region A



Period IV: Brick walls with lime plaster, Customs House, Motupalli, Sub-region C exact nature of settlement of the period is difficult to discern because of later day superimpositions.

Further, on the above mentioned archaeological remains found at Motupalli it can be assessed that the plan of the building and building materials used were similar to those of the buildings in the early historic period. Despite the lack of systematic medieval archaeology the buildings of a public utility are often found attached to extant temples such as mathās, satras, colleges, hospitals and roads. As we shall examine in a subsequent chapter, temple building activity in Period IV was quite prolific and therefore, such constructions that come as appendages to the temple structures are also found in good number. The most common was the matha which played a prominent role in serving as a seat of learning and place of living for the priests and their young students. The Eastern Chalukyan King Amma II granted a village called Tadikonda in 954 A.D. to a Saivite matha designated as a separate dwelling place for monks at Bezewada which was said to have been a three storeed building decorated with pictures and paintings.[251] Ruins of maṭhas built in stone during the 11th-12th centuries A.D. can still we seen at Jalalpuram, Kannekallu, Amarabad, Mallesvaram, Omkareswaram, Udmilla, Laxmanapuram, Velur and Kaluvakolanu.[252] There is an inscription which describes that one Visvesvara Sivacharya the Rajaguru of Ganapatideva, is said to have established maṭhās at Kalesvaram, Ponnuguru, Mantrakuta, Chandravalli, Nandapur, Kommuru, Elesvaramu, Nivrithi Sangamesvaramu and Uttara Somasila.[253] Branches of Golakī matha also established by Visvesvara Sivāchārya were set up at places like Malkapuram, Srisailam, Tadikalapudi and Tripurantakam.[254] Vaishnavites too had mathas and one such is mentioned to have been located at Simhachalam.[255] An epigraph from Pushpagiri dated to 1300 A.D. mentions panchamathas.[256]

Generally, as seen at Mallesvaram and Ramathirtham, situated in sub-region A, the maṭhās were built in stone and were rectangular on plan with a hall on the front side and an ante-chamber at the rear. The religious teacher might have lived in these chambers, whereas the front open hall, closed on three sides, was used as a place of learning and recitation of scriptures by the young students. These mathas as observed at the above two sites, were raised on randum rubble, flat foundations of red sand stone. The stones were joined very closely and their top portions were clamped with iron dowels. These might have been erected by using scaffolding materials as was done for the temple building. Above the walls, the roof was laid with long stone slabs fitted very closely, over which a concrete mixture of lime, stone chips and river rolled pebbles was laid as a water proof course. The floors were laid with neatly dressed slabs. The above information leads us to infer that the building technology of the public utility buildings such as mathas was not essentially different from that used in building temples.

Feeding houses called satras where food was arranged free of cost for saints, students and public on pilgrimage were similarly attached to temples, and likewise, built in stone during Period IV. In this regard we have ample references to them in the epigraphs of the period. satras as appendages to the temples utilised for public purposes have been mentioned in the inscriptions found at Vemulawada,[257] Agasthyesvaram (Malleswaram),[258] Draksharama,[259] Pillalamarri,[260] Peddagarlapadu,[261] Malyala, Juturu[262] and Simhachalam.[263]

A Simhachalam temple inscription dated to 1291 A.D. mentions that the commander of Narasimhadeva, the eastern Ganga King, established a college to provide instructions to the students.[264] Hospitals were also set up as appendages to the temples. The Saidapur and Malkapur inscriptions give information regarding hospitals established at a Jaina basadi and at a Saivite matha, respectively. The Draksharama inscription informs us of the existence of a medical and health centre attached to a local temple. It was also mentioned that a certain Vaidya Suryadeva Pandita and Annaya Vaidyendra, visited this place and made some donations.[265] An inscription from Mandaram registers a gift of two villages by Ganapatideva to Visvesvara Sivacharya who founded a matha, a college, a choultry a maternity hospital and a general hospital.[266] The above references prove the existence of these important structures meant for public ultility which were mostly built of stone because of the permanance of the material. Being attached to primarily religious monumental buildings they have survived intact in contrast to ordinary dwellings which were most probably made of perishable materials like mud, reed, tiles and hay.

Roadways and highways which form part of our discussion on public utility structures, and which facilitated land transport, are found commonly mentioned in the inscriptions of the period. An epigraph from Bodhan of 1056 A.D. mentions different streets of the town as Indranārāyana veedhi, Brahmapuri veedhi, artisans' streets and the street of the dancing girls.[267] A 13th century A.D. literary work called the Andhra Bhashabhushanam[268] of Ketana speaks of a highway connecting the northern region from Ayodhya to Kanchi, running through Warangal and Nellore. There were also routes from Motupalli to Karnataka through Yanamadala, Vinukonda, Tripurantakam, Panyam, Alampur and Raichur.[269] As there was nothing mentioned about the materials used for laying roads we can not assess the level of building technology in relation to road building activity during this period as was done by us for the early historic period.

In an overview, the evolution of building technology of the habitational and public utility structures, i.e., buildings used by individuals or by a community for dwelling or other purposes of communal life, can be assessed from Period I to Period IV in the following manner. During prehistoric times, men had lived in natural caves or caverns. However, his movements to the plains in search of food during the course of his evolution and made him build semipermanent habitations with locally available materials. Natural rock shelters however, continued to be occupied for dwelling purposes. In Andhradesa, during the early phase of neolithic stage we noted interesting constructions for dwellings. These were pits cut into the ground. During the later phase of the same Period, rectangular houses with thatched roofings supported by wooden posts came into existence. During the last phase of Period I, i.e., the Megalithic stage, iron was introduced and people started building their houses with non-perishable materials such as stones. The houses of the neolithic and megalithic stages were circular, square or rectangular in shape. Floors were rammed with earth or morrum, some times, plastered with lime on stone chips. Walls were built of mud, wattle and daub. Hearths and fire places were built inside the houses. The prolific use of stone that could be quarried by use of iron enabled floors to be paved with shale stones. Compared to the rammed floors of the earlier period this was a significant development in the evolutionary process of making good floors.

The associated structures or appendages to the habitation for Period I included cattle pens and refuge pits which were made with a rather simple technology at this stage. We find only one evidence of a pathway which represents the public utility structure of Period I. This comes from Ramapuram belonging to the late neolithic period. Construction of compound walls around houses in the Megalithic period, was a new aspect of community protection which was not known earlier. Single, double or even complex hearths, lined with clay were found inside the habitation. The technology used to build in the habitation area was still in its incipient stage and was primarily done with only perishable materials at first. Though there was a gradual use of stone in the Megalithic context for the first time, sun dried bricks were manufactured as observed at Gandluru.

During Period II called the early historic, roughly around the 4th century B.C. to the 4th century A.D. the settlements show an expansion. The size of structures with several improved facilities in the houses came into being. These settlements were laid out in well planned towns and included, apart from common dwellings, building complexes, enclosure walls, systems of water supply and sanitary structures. Besides, some public utility structures such as an amphitheatre, rest houses, public baths and ghats have also been found. The walls were of wattle and daub, brick and stone and some times, were plastered with lime. Roofs were laid with tiles for the first time. Improvement in covering the floors was observed by covering them with lime plaster or concrete. Walls were raised on simple foundation of rubble stones. Water was, for the first time, drawn from the ground by sinking wells. Waste water was taken away by drains both covered and uncovered.

The plans of houses now changed from circular to square and rectangular. Some houses were built on firm foundations. During Period II some buildings were also built with sophisticated technology as they were multi-storeed dwellings with all the amenities. On the other hand, huts built of simple technology co-existed side by side with these sophisticated buildings. Nonetheless, there was a marked improvement in building technology of this period and we have a variety of buildings known to us not only from archaeological remains still extant, but also from literature and sculptural representation on contemporary buildings.

The limited information on building technology of Period III and IV helps us only to make some general inferences. At the beginning of Period III we have habitational buildings built with brick, lime, wood and tiles as has been seen from the details of the Keesaragutta excavation. The inscriptional and literary evidence suggest beyond doubt that there were buildings of different types used by the common people but due to lack of archaeological evidence the techniques of construction at each stage and in each type of building could not be assessed as was possible to do for Periods I and II. However, we can postulate that some of the dwelling structures must have been built of perishable materials, though the evidence of a considerable number of monumental buildings like temples which were built during this period indicate that permanent and durable building materials were available to the technologists of the periods. In this connection 1t is important to indicate that since resources from land and trade were available mainly to the King and Chiefs and other elites, who were the main patrons of temples, they were in a position to experiment more freely with sophisticated building technology. Further, the technicians and artisans were also under their control. During Period IV, there was a proliferation in the building of monumental structures but the evidence for the houses of the common and poor people is again negligible. Inscriptions and literature do refer to different types of houses and some of them must have been made of perishable materials such as mud walls and thatched roofs, as a thirteenth century text Sukti Muktāvali of Jalhana suggests.[270] This text also alludes to humble dwellings and the harrowing poverty that people lived in. In contrast, it was natural for the public utility buildings such as mathās, colleges and hospitals to be built with stone because of the munificient grants that were available from the landed elites for building and maintaining them.

FOOTNOTES

1. Joyce M.Hawkins, The Oxford Large Print Dictionary. (Based on the Oxford Paper back Dictionary), (third edition), OUP, 1989, p.733.

2. Atharvaveda V.1.11-37; Panini II.1.129: 3.99; IV.4.770; Arthasastra II.1.20.

3. Milinda Panha. 62; Anguttara Nikāya. 1011; Dīgha Nikāya. 1.61; Jataka. I.200, 425 and Vinaya Piṭaka. 3.43.

4. K.V.Soundara Rajn, 'Stone Age Industries near Giddalur, District Kurnool', AI, no.8, p.64.

5. H.D.Sankalia, The Godavary Palaeolithic Industry. Delhi, 1952, p.20.

6. H.D.Sankalia, Aspects of Indian History and Archaeology. Delhi, 1977, p.235.

7. M.L.K.Murthy, 'A Late Pleistocene Cave/site in Southern India', PAPS. vol.118, no.2, 1974, pp.196-230.

8. Ibid. p.198.

9. B.A.LO.Cranstone, 'Environment and Choice in Dwelling and Settlement: An Ethnographical Survey'. in Peter J.Ucko, Ruth Tringham and Dimbleby (eds.), Man Settlement and Urbanism (henceforth MSU), London, 1972, p.487.

10. V.Chandramouli, A Study of Microlithic Culture and Rock Paintings at Kethavaram, Kurnool District. M.Phil Dissertation (unpublished), University of Hyderabad, Hyderabad, 1986, pp.25-40.

11. B.Subrahmanyam, Protohistoric and Early Historic Cultures of Mahboobnagar Region. Ph.D. Thesis (unpublished), University of Mysore, Mysore, 1986, p.3.

12. V.V.Krishna Sastry, The Proto and Early Historical Cultures of Andhra Pradesh. Hyderabad, 1983, p.45.

13. E.Siva Nagi Reddy, 'Recent Discoveries in Painted Rock Shelters of Pre- and Proto-historic Andhra', A paper presented at XVIII Session of A.P.History Congress. Tenali, 8th-9th Jan. 1994, p.2 (cyclostyled).

14. B.K.Thaper, 'Problems of the Neolithic Cultures in India: A Retrospect', Puratattva. no.7, 1974, p.6.

15. V.Gordon Childe, Man Makes Himself. New York, 1951, p.20.

16. Binoy Ghosh, Primitive Indian Architecture. Calcutta, 1953, p.4.

17. R.N.Kaw, 'The Neolithic Cultures of Kashmir', in D.P.Agrawala and D.K.Chakravarthi (eds.), Essays in Indian Protohistory, Delhi, 1979, pp.219-228.

18. M.K.Dhawalikar, H.D.Sankalia, and Z.D.Ansari, Excavations at Inamgoan, vol.1, pt.1, Pune, 1989, p.152.

19. F.R.Allchin, Pikhlihal Excavations. Hyderabad, 1960, pp.19-20.

20. B.Narasimhaiah, Neolithic and Megalithic Cultures in Tamil Nadu, Delhi, 1980, p.80.

21. F.R.Allchin, Utnoor Excavations. Hyderabad, 1961, p.65.

22. T.V.G.Sastry, Brief Results of the Excavations at Veerapuram, Hyderabad, 1981, pp.1-6.

23. R.Subrahmanyam, et al, Nagarjunakonda-I, 1954-60, Delhi, 1975, p.98.

24. ARAP. 1982-83, p.45.

25. J.Hawkes and L.Woolley (eds.), History of Mankind, vol.1, pt.1, UNESCO Series, 1960, p.286.

26. T.V.G.Sastry, Op. Cit.. 1981, p.2; R.Subrahmanyam, et al.

27. F.R.Allchin, Op. Cit.. 1961, p.65.

28. ARAP. 1982-83, p.44.

29. Ibid. p.44.

30. M.S.Nagaraja Rao and K.C.Malhotra, The Stone Age Hill Dwellers of Tekkalakota. Poona, 1965, p.19.

31. B.Narasimhaiah, Op. Cit.. 1980, p.80.

32. F.R.Allchin, OP. Cit.. 1960, pp.19-20.

33. J.Hawkes, Op. Cit.. 1960, p.286.

34. B.Narasimhaiah, Op. Cit.• 1980, pp.80-81.

35. Referred to in Karl, W.Butcher's Environment and Archaeology. Chicago, 1971, p.404. Muller-Wille recognises the following settlement types based on duration of site occupation as ephimeral. Settlements of a few days, 'temporary': settlements of several weeks; 'seasonal'; settlements of several months, duration, 'semi-permanent': settlements of some years duration and 'permanent' settlements lasting for several generations. See, Muller Wille, 'Arten der Menschlischen Siedbug', in Abul Akad, Raunforsch, Landesplan. (Bremen), vol.28, (Mortensen Frestshrift), 1954, pp.141-163.

36. F.R.Allchin, Op. Cit., 1960, pp.19-20.

37. M.S.Nagaraja Rao and K.C.Malhotra, Op. Cit.. 1965, p.19.

38. A.Ghosh, The City in Early Historical India. Simla, 1973, pp.12-13.

39. F.R.Allchin, Op. Cit.. 1961, p.66.

40. V.V.Krishna Sastry, Op. Cit.. 1983, p.126.

41. Ibid. 1983, p.81.

42. B.Subrahmanyam, Op. Cit.. 1986, p.264.

43. ARAP, 1978-79, p.4.

44. T.V.G.Sastry, Op. Cit. . 1981, pp.1-6.

45. R.Subrahmanyam, et al, Op. Cit.. 1975, pp.98-100.

46. ARAP. 1982-83, p.46.

47. O.Ramachandraiah and B.R.Subrahmanyam, 'Jami', JAHRS. vol.XXXV, 1975-76, Hyderabad, 1976, p.373.

48. V.Rami Reddy, The Prehistoric and Protohistoric Cultures of Palvoy. South India, Hyderabad, 1976, p.115.

49. IAR, 1983-84, pp.3-4.

50. B.Subrahmanyam, Op. Cit. . 1986.

51. ARAP. 1977-78, p.4.

52. V.V.Krishna Sastry, Op. Cit.. 1983, p.126.

53. Ibid. 1983, p.132.

54. ARAP. 1974-75, p.25.

55. T.V.G.Sastry, Op. Cit.. 1981, pp.1-6.

56. ARAP. 1982-83, p.45.

57. IAR, 1982-83, pp.3-4.

58. B.A.L.Cranstrone, Op. Cit.. 1972, p.489.

59. Kant, V.Flannery, 'The Origins of the Village as a Settlement Type in Meso-America and the Near-East: A Comparative Study', in Peter J.Ucko, Ruth Tringham, and Dimbleby (eds.). Op. Cit.. 1972, pp.23-53.

60. Amita Ray, Villages Towns and Secular Buildings in Ancient India. Calcutta, 1964, p.93.

61. S.B.Deo, 'Megalithic Problem of the Deccan', in South Asian

Archaeology. Cambridge, 1984, p.222.

62. M.Wheeler, 'Brahmagiri and Chandravalli', AI, no.4, 1947-48, pp.180-310.

63. B.K.Thapar, Op. Cit., 1974, p.6.

64. M.S.Nagaraja Rao, The Protohistoric Cultures of Tungabhadra Valley. Poona, 1971, p.15.

65. F.R.Allchin, OP. Cit., 1960, pp.19-20.

66. M.S.Nagaraja Rao and K.C.Malhotra, OP. Cit., 1965, p.19.

67. V.V.Krishna Sastry, Op. Cit., 1983, pp.126-127.

68. B.Subrahmanyam, Op. Cit., 1986, p.264.

69. JAR, 1983-84, pp.3-4.

70. V.V.Krishna Sastry, Op. Cit., 1983, p.81.

71. V.Rami Reddy, Op. Cit., 1976, pp.114-116.

72. E.R.Service, Origins of State and Civilization: The Process of Cultural Evolution. New York, 1975, pp.47-50.

73. ARAP. 1974-75, p.25.

74. B.Subrahmanyam, Op. Cit., 1986, p.112.

75. Referred to in L.Woolley and J.Hawkes (ed.,) History of Mankind. vol.1, pt.II, London, 1963, p.524.

76. V.V.Krishna Sastry, Op. Cit., 1983, p.126.

77. Ibid, p.81.

78. IAR, 1983-84, pp.3-4.

79. B.Subrahmanyam, Op. Cit., 1986, p.114.

80. ARAP. 1978-79, p.4.

81. B.Subrahmanyam, Op. Cit., 1986, p.113.

82. M.S.Nagaraja Rao, Op. Cit., 1971, p.15.

83. ARAP. 1981-82, p.26, Pl.XII.

84. B.Narasimhaiah, Op. Cit.• 1980, p.86.

85. B.Subrahmanyam, Op. Cit., 1986, p.112.

86. O.Ramachandraiah and B.R.Subrahmanyam, Op. Cit., 1976, pp.373-375.

87. IAR, 1983-84, pp.3-4.

88. ARAP. 1982-83, p.45.

89. T.V.G.Sastry, Op. Cit., 1981, pp.1-6.

90. R.Subrahmanyam, et al, Op. Cit., 1975, pp.98-100.

91. ARAP. 1982-83, pp.45-46.

92. F.R.Allchin, Op. Cit., 1961, p.65.

93. R.Subrahmanyam, et al, Op. Cit.. 1975, p.99.

94. F.R.Allchin, Op. Cit., 1961, pp.64-65.

95. IAR. 1983-84, pp.3-4

96. ARAP. 1978-79, p.4.

97. B.Subrahmanyam, Op.Cit. . 1986, p.267.

98. IAR. 1983-84, pp.3-4.

99. K.K.Bhattacharya, 'Conditions of the Emergence of Agriculture', in B.M.Pande and B.D.Chattopadhyaya (eds.), Archaeology and History. vol.1, Delhi, 1987, pp.11-17.

100. IAR, 1982-83, pp.3-4.

101. I.K.Sarma, 'Historical Archaeology of Ancient Andhra in the light of Recent Excavations at Amaravati, Nagarjunakonda and Pedavegi', in Amita Ray and Samir Mukherjee (eds.). Historical Archaeology of India. Delhi, 1990, p.110.

102. Vibha Tripati, 'Impact of Metal Technology on Economic Development', in Amita Ray, and Samir Mukherjee (eds.), Op. Cit.. 1990, p.195.

103. Amita Ray, 'Beginning of Urbanisation in Early Andhradesa', in J.S.Grewal and Indu Banga (eds.), Studies in Urban History. Amritsar, 1978, p.35. Also see H.Sarkar's 'Emergence of Urban Centres in Early Historical Andhradesa', in B.M.Pande and B.D.Chattopadhyaya (eds.), Op. Cit.. 1987, pp.631-641.

104. In the Milindapanha it is mentioned that 'Just as the architect of a city when he wants to build one, would first search out a pleasant spot of ground, with which no fault can be found, even, with no hills or gullies in it, free from rough ground, and rocks, not open to danger of attack, And then when he has made plain any rough places there may still be on it, he would clear it thoroughly of all sturrups and stakes, and would proceed to build there a city fine and regular, measured out into quarters, with excavated moats and ramparts about it, with stout gate houses and towers, with market places, cross-roads, street-corners, and public squares, with cleanly and even main

roads, with regular lines of open shops, well-provided with parks, gardens, lakes, lotus-ponds and wells, adorned with many kinds of temples of the Gods, free from every fault. And then, when the city stood there in all its glory, he would go away to some other land'. See Miliñda Panha. I-34.

105. V.V.Krishna Sastry, Op. Cit.. 1983, p.126.

106. Ibid. pp.136-138.

107. Ibid. pp.139-143.

108. Ibid. pp.125-126.

109. G.Yazdani, 'Excavations at Kondapur: An Andhra Town (200 B.C.-200 A.D.)', ABORI. vol.XXII, Poona, 1941, pp.171-185; Also see Aloka Parasher, 'Kondapur: A Forgotten City'. PIHC. 44th Session, Annamalinagar, 1954, pp.

110. V.V.Krishna Sastry, OP. Cit., 1983, pp.129-130.

111. B.Subrahmanyam, Op. Cit. . 1986. p.338.

112. Ibid. p.338.

113. T.V.G.Sastry, Op. Cit.. 1981, pp.1-6.

114. R.Subrahmanyam, 'Secular Remains at Nagarjunakonda', JAHRS. vol.38, pt.4, 1987, p.13.

115. I.K.Sarma, PP. Cit.. 1986, p.8.

116. Ibid. p.9.

117. N.C.Ghosh, PP. Cit.. 1986, pp.98-99.

118. It is interesting to note that in the Nasik Inscription it is mentioned that Usavadata gifted quardrangular hermitages, dwellings and shelterhouses, See C.Sivarama Murthy's Amaravati Sculpture in Madras Government Museum. Madras, 1952, p.93.

119. V.V.Krishna Sastry, Pp. Cit.. 1983, pp.136-138.

120. R.Subrahmanyam, Pp. Cit.. 1987, pp.13-15.

121. C.Sivarama Murthy, Pp. Cit., 1977, (RP), PL.XCLII, 2.

122. G.Yazdani, Pp. Cit.. 1941, pp.171-85.

123. I.K.Sarma, Op. Cit.. 1986, p.8.

124. V.V.Krishna Sastry, Pp. cit., 1983, p.137.

125. R.Subrahmanyam, PP. Cit.. p.13-21.

126. Milindapanha, I.34.

127. I.K.Sarma, Op. Cit. , 1986, p.8.

128. Cullavagga, VI.3.11.

129. V.V.Krishna Sastry, Op. Cit. • 1983, p.136.

130. R.Subrahmanyam, Op. Cit.. 1987, p.15.

131. Ibid, p.5.

132. Ibid, p.12.

133. R.Subrahmanyam, Op. Cit., 1987, p.12.

134. V.V.Krishna Sastry, Op. Cit.. 1983, p.130.

135. I.K.Sarma, Op. Cit.. 1986, pp.8-9.

136. N.C.Ghosh, Op. Cit.. 1986, p.94.

137. R.Subrahmanyam, Pp. Cit., 1987, p.12.

138. B.Subrahmanyam, Op. Cit., 1986, p.315.

139. R.Subrahmanyam, Op. Cit.,1987, pp.4-7.

140. A few terracotta plumbobs have been recovered from the Yeleswaram excavations, At present these are under display in Yeleswaram Pavillion, Archaeology and Museums Department, Gunfoundry, Hyderabad. But the excavator A.W.Khan did not mention them in his report which was published as A Monograph on Yeleswaram Excavations. Hyderabad, 1963 (Chapter on Terracottas, See p.45).

141. N.C.Ghosh, Op. Cit. . 1986, p.99.

142. A.W.Hendry, Load Bearing Brick Work Design, Chinchester, 1987, p.31.

143. R.Subrahmanyam, pp. Cit.. 1987, pp.1-21.

144. C.Sivarama Murthy, PP. Cit.. 1977 (RP), Pls.XLIII-1 and XLVIII-2.

145. T.N.Ramachandran, 'Nagarjunakonda', MASI. no.71, Delhi, 1938, Pl.XXX.A.

146. T.N.Ramachandran, Buddhist Sculptures from a Stupa near Goli, Madras, 1929, Pl.VI-F.

147. K.R.Srinivasan, 'The Pallava Architecture of South India', AI, vol.14, 1958, p.129, Pl.XLVIII.

148. Mahāvagga. LXXXVIII, 97; Vinaya, 3.43; Anguttara Nikaya. 101 and Samyuttara Nikaya. 1.61.

149. Cullavagga. Chapter 5 & 6.

150. This is based on my own observations of the construction of thatched huts in coastal area of Andhra Pradesh today.

151. Amita Ray, Villages. Towns and Secular Buildings in Ancient India. Calcutta, 1964, Pl.1-5.

152. R.Subrahmanyam, Op. Cit.. 1987, p.12.

153. IAR, 1964-65, pp.3-4.

154. N.C.Ghosh, Op. Cit. . 1986, pp.98-99.

155. ARAP, 1971-72, p.1.

156. R.Subrahmanyam, Op. Cit.. 1987, p.39.

157. A.Ghosh (ed.), Encylopaedia of Indian Archaeology. vol.1, Delhi, 1989, p.126.

158. R.Subrahmanyam, Op. Cit.. 1987, p.13.

159. Ibid. p.24.

160. K.Krishna Murthy, Early Indiian Secular Architecture. Delhi, 1987, p. 19.

161. R.Subrahmanyam, Op. Cit.. 1987, p.15.

162. V.V.Krishna Sastry, Op. Cit.. 1983, pp.136-138.

163. N.C.Ghosh, Op. Cit. . 1986, pp.98-99.

164. V.V.Krishna Sastry, Op. Cit.. 1983, p.126; ARAP. 1983-84, pp.30-31.

165. V.V.Krishna Sastry, Op. Cit.. 1983, pp.137-138.

166. ARAP. 1970-71, p.1; 1971-72, pp.1-2, 1972-73, p.4; 1974-75, p.1; V.V.Krishna Sastry, Op. Cit.. 1986, pp.139-141.

167. R.Subrahmanyam, Op. Cit... 1987, p.39.

168. H.Ingholt, Gandhara Art in Pakistan. New York, 1957, p.103.

169. ARAP. 1971-72, pp.1-2; and 1972-73, p.4.

170. B.Subrahmanyam, 'Excavations at Majeru, Krishna District', ARAP. 1992-1993 (Cyclostyled), pp.11-15.

171. The process of excavating a well from ground water is based on my observations of such construction work in most of the coastal villages of Andhra Pradesh today.

172. These descriptions are also made based on my field excavation

experience at a good number of sites that I have attended to.

173. In writing these descriptions I have used my own observations based on the excavation reports.

174. R.Subrahmanyam, Op. Cit.. 1987, p.20.

175. I.K.Sarma, Op. Cit.. 1986, pp.8-9.

176. Ibid, pp.211-212.

177. V.V.Krishna Sastry, Op. Cit.. 1983, pp.139-141.

178. R.Subrahmanyam, Op. Cit. . 1987, p.39.

179. E.B.Cowell (ed.), Jataka. vl.I, nos.425, 495.

180. R.Subrahmanyam, Op. Cit., 1987, p.6.

181. V.V.Krishna Sastry, Op. Cit.. 1983, p.138.

182. G.Yazdani, Op. Cit.. 1941, pp.171-185.

183. R.Subrahmanyam, Op. Cit.. 1987, p.16.

184. Ibid, p.23-26.

185. Jataka. IV. 229.

186. K.Krishna Murthy, Op. Cit.. 1987, Fig. X-2.

187. K.Krishna Murthy, 'Early Recreational Architecture', in Sri Ramachandrika (Prof. O.Ramachandraiava. Festschrift). vol.II, Delhi, 1993, pp.257-262.

188. Ibid. p.259.

189. Dhamma Aṭṭakatha, I.269, 270.

190. K.Krishna Murthy, Op. Cit.. 1993, p.260.

191. R.Subrahmanyam, Op. Cit.. 1987, p.20.

192. Jataka. I.200.

193. A.W.Khan, Op. Cit.. 1963, p.24.

194. Personal Communique wiith D.L.N.Sastry, Asst. Director (Excavatiions), Department of Archaeology & Museums, Hyderabad.

195. R.Subrahmanyam, Op. Cit.. 1987, p.5.

196. Amita Ray, OP. Cit.. 1983, p.181.

197. Jataka. I.189, 199, 200; III. 217.

198. An attempt at understanding the process of urban decay and revival of urban centres supported by strong rural agrarian settlements with market economy using epigraphical data, in the absence of substantial archaeological evidence, for the early medieval period has been made by B.D.Chattopadhyaya in his essay on. 'Urban Centres in Early Medieval India: An Overview' in S.Bhattacharya & Romila Thapar (eds.), Situating Indian History. Delhi, 1986, pp.8-33. This can be contrasted with R.S.Sharma's views on the decline and decay of towns after the 3rd century A.D. which he has systematised in his publication, Urban Decay in India. Delhi, 1987. pp.132-141 and 167-183.

199. R.S.Sharma, Op. Cit.. 1987, pp.132-141.

200. G.Yazdani, Op. Cit.. 1941, pp.171-185.

201. ARAP. 1975-76, pp.11-12.

202. IAR, 1966-67, p.27.

203. Amita Ray, 'Urbanisation in Bengal', Presidential Address, IHC, Reprint 48th Session, Goa, 1987, pp.1-48.

204. Ibid. pp.39-40.

205. During a field survey in February 1991, Sri Gadiyaram Ramakrishna Sarma, a wellknown historian of Alampur and myself, observed the same at Alampur.

206. ARAP. 1975-76. pp.11-12.

207. B.N.Sastry, Mukhalingam Devālaya Charitra Sāsanamulu. Hyderabad, 1985, p.29.

208. Settlements known to have existed during the Medieval period such as Warangal, Alampur, Vengi, Kandur, Vardhamanapuram, Amaravati, Kolanupaka are superimposed by later day habitations which have continued to be inhabited till today.

209. K.Suryanarayana, 'Asanapura', PAPHC. 3rd Session, Vijayawada, 1978, p.70.

210. Ibid. p.68.

211. Sivadata (ed.), Amarakosa. Bombay, 1915.

212. Referred in P.K.Acharya, Indian Architecture. Patna, 1979 (RP). p.19.

213. A.M.Sastry, India as. Seen in. the Brhatsaṁhita of Varāhamihira. Varanasi, 1969, p.384.

214. Ibid. p.384.

215. A.Butterworth and V.V.Chetty, A Collection of the Inscriptions of Copper Plates and Stone in the Nellore District. Part I, 1990, (RP),

pp.189-192.

216. I.Sanjiva Rao, 'Rasasiddhas of Alampur', BIIH, vol.XIII, p.40.

217. R.Champaka Lakshmi, 'Urbanisation in South India: The Role of Ideology and Polity', Presidential address, IHC, Reprint, 47th Session, Srinagar, 1986. pp.27-44; R.N.Nandi, Social Roots of Religion in Ancient India. New Delhi, 1986, pp.141-161; Amita Ray, Op. Cit., 1987. pp.31-46.

218. R.Champaka Lakshmi, Urbanisation in Early Medieval Tamil Nadu. Occasional Paper Series no.3, UHAI, Amritsar, 1992, p.6.

219. ARE, 1912, Inscription no.342. Also see K.R.Venkata Ramana Ayyar, 'Medeival Trade, Craft and Merchant Guilds in South India', JIH, vol.XXV, 1947, parts 1-3, p.277.

220. K.R.Han, Trade and State Craft in the Age of Cholas. Delhi, 1980, p.151.

221. ARE, 1912-13, Inscription no.16, p.26.

222. K.Sundaram, Studies in Economic and Social Condition in Medieval Andhra. Machilipatnam, 1968, pp.92-96.

223. B.N.Sastry, Op. Cit., 1985, p.31.

224. Manasollasa, III.6-1017-20.

225. T.Venkateswara Rao, Local Bodies in Medieval Andhra. Hyderabad, 1987, p.101.

226. R.N.Nandi, Op. Cit., 1984, p.50.

227. Nannaya, the writer of the Mahābhārata in Telugu language during 11th century A.D. mentions about the currency that was in circulation as Gadyanas and Gaddelu which were of gold metal. This has been corroborated by epigraphic and numismatic evidences of the period. See S.Dasarathi, 'Numismatic References in Nannaya's Mahabharata'• PAPHC, 10th Session, Guntur, 1986, p.177. A.S.Altekar has reported a gold coin issued by Rajaraja, the Eastern Chālukyan King under whom Nannaya served as a poet laeuret. This information has been referred to in G.Yazdani, Early History of the Deccan, vol.11, London, 1962, p.804. Similarly,, the epigraphs of the period also mention Gadyas, i.e., Gadyanas. See SII, vol.VI, Inscription no.1201. Further, a few gold coins of the Kākatiyas bearing the legend dāyagajakesari were found from Suddala and Tarigoppula both situated in sub-region A.

228. John M.Fritz, George Michell and M.S.Nagaraja Rao, Royal Centre at Vijayanagaram Preliminary Report. Melbourne, 1984. (See Chapter 6. Plat Forms and Palaces: Remains of Secular Buildings, pp.97-121).

229. P.V.P.Sastry, 'Popularity of the Kakatiya Rulers', in S.N. Rao (ed.), Cultural Heritage of the Kakatiyas. Warangal, 1993, p. 15.

230. SII, vol.X, p.495.

231. P.V.P.Sastry (ed.), Inscriptions of Andhra Pradesh Karimnagar District. Hyderabad, 1974, pp.14-15.

232. SIX, vol.X, p.508; ARAP 1973-74, pp.3-4.

233. ARAP. 1973-74, pp.3-4.

234. P.V.P.Sastry (ed.), Op. Cit., 1974, p.38.

235. G.Jawaharlal, 'Aggalayya: The Great Royal Physician of 10th century A.D.', PAPHC. 16th Session, Karimnagar, 1992, p.59.

236. CTI, vol.11, no.30.

237. IA, vol.II. pp.9 ff.

238. T.Venkateswara Rao, Op. Cit.. 1987, p.114.

239. Ibid. p.120.

240. P.V.P.Sastry, Kakatiya Sasana Sāhityam. Hyderabad, 1981, p.20.

241. EA, vol.IV, p.99.

242. P.V.P.Sastry, Op. Cit. 1981, p.43.

243. El, vol.V, p.142 ff.

244. P.V.P.Sastry, Siddhodvaha of Nrsimha. Hyderabad, 1968, pp.9-10.

245. EI- vol.XXXVI, pp.209-218.

246. V.Prabhakara Sastry (ed.), Krīdābhirāmam. Hyderabad, 1960, pp.98-110.

247. Ibid, pp.58-61.

248. C.V.Ramachandra Rao, 'The Kāktiya Polity, Economy and Society: A Few Considerations', PAPHC. 14th Session, Warangal, 1990, pp.59-75.

249. ARAP. 1973-74, pp.3-4.

250. Ibid. p.4.

251. El, vol.XXIII, no.25.

252. B.N.Sastry, Cheraku Vamsa Charitra. Sāsanamulu. Hyderabad, 1989, p.10.

253. SII, vol.X, Inscription no.395.

254. B.S.L.Hanumantha Rao, PP. Cit. 1993, p.303.

255. SII, vol.V, Inscription no.1025.

256. AREAP, for the year 1965. Inscription no.56.

257. P.V.P.Sastry, Op. Cit. . 1974, no.2.

258. II, vol.11, p.183.

259. SII, vol.IV, no.1054.

260. II, vol.1, p.37.

261. ARE for 1929-30, Inscription no.29.

262. T.Venkateswara Rao, Op. Cit.. 1987, p.51.

263. SII, vol.VI, no.904.

264. V.Anuratha, 'Temple as a Social Service Organisation in Medieval India', PAPHC, 3rd Session, Vijayawada, 1978, p.55.

265. R.Hymavathi, 'Medical Facilities under the Kakatiyas', S.N.Rao (ed.), Op. Cit.. 1993, p.77.

266. SII, vol.X, no.395.

267. HAS, no.7, p.55.

268. Surayya and Gopalakrishnaiah (eds.), Ketana's Andhrabhashabhushanam. Tenali, 1953, p.4, v.12.

269. P.S. Kanakadurga, 'Inter State Trade during the Kakatiya period (A.D. 1000-1300), QJMS, vol.LXXVII, pp.17-31.

270. Sukthi Mukthavali of Jalhana, G.O.S.no. LXXXII, 1938.

II.2 IRRIGATION STRUCTURES

II.2 IRRIGATION STRUCTURES

The prosperity of any country depends upon its economy supported by agricultural revenue. To improve agriculture the States resort to artificial means of irrigation for the betterment of the economic standards. The emergence of State with a capacity to set apart huge amounts for the development of technology was one of the factors that led to the building of irrigation structures in early India. Private individuals, certain communities and local lords also helped financially and materially in this regard. In Andhradesa a number of irrigation related structures, originally located in the vicinity of religious structures, were dug and built, after a proper survey and selection of suitable water sources and command area under the guidance of technical experts who managed large number of ordinary labourers. In the following pages an attempt is made to explain the different stages of development in building technology of irrigation structures in Andhradesa beginning from Period I to Period IV of our study.

Irrigation is the artificial application or process of supplying water to crops in countries where the rainfall is insufficient or comes in the wrong season.[1] In modern terms it is understood as a scientific practice which deals with the operation or system of conveyance of water through channels. It is commonly assumed that today irrigation represents a major departure from earlier agricultural practices involving radical changes in techniques.[2] The earliest forms of irrigation were indeed small scale water-spreading techniques involving minimum amounts of investment and labour. The water resources for irrigation can be classified into two kinds viz., natural and artificial. The former includes rains, rivers, tributaries, streams and small gullies, while the latter includes man made structures such as reservoirs, ponds, ditches, tanks, wells, canals and river channels.

The earliest irrigation activity from the archaeological record has been noticed at some of the Indus Valley sites. Writing on water sources of the Indus Valley people, Shereen Ratnagar[3] points out that they might have depended on ground water, available in the form of aquifers as noticed in Kutch or in the remnants of summer inundations found at Larkhana, or in the courses of small spring-fed rivers like the Sind Kohistan. The Indus people are also said to have used lift irrigation systems for agricultural purposes.[4]

The irrigation techniques after the end of the Indus Valley civilization, are known to us from statements in the earliest literary sources. In this regard we have some of the first references to irrigation facilities in the Vedas, the earliest literature available. For instance, the Rigveda[5] mentions four sources of water, viz., from sky, sea, rivers and wells. The Yajurveda[6] mentions additional sources of water from reservoirs and canals. Irrigation by wells,[7] tanks[8] and canals[9] is also described alongwith earthen dams.[10] Transport of water through large bags of skin,[11] a water-wheel[12] and a moat[13] have also been described in the Vedic literature. Panini mentions in the Aṣṭādhyāyi[14] the yugavaratra to mean 'yoke' or 'rope' or 'strap', by which the bullocks were driven for drawing water. A long earthen bucket used for irrigational purposes has also been mentioned.

Among the various physical regions of the Indian sub-continent, the Deccan is relatively dry area with limited seasonal rainfall and with a shortage of perennial rivers. The need to have water easily available and to avoid stress caused by draught and other causes must have led the earliest neolithic and chalcolithic communities settled in this part of the country to develop irrigation systems and also produce earthen water storage vessels. In this regard we have the first evidence of an irrigation canal from Inamgoan, a Jorwe site, in the western Deccan belonging to chalcolithic times.[15] This channel was excavated in trough shape, running to a length of 420 meters with an average width of 6 meters at the bottom and 8.70 meters on the top. It probably received water from the stream coming from the north-east of the site. Its construction explicitly denotes the innovative skills of the chalcolithic people in creating an artificial irrigation facility to promote agrarian production in this area.

In proto-historic Andhradesa however, neolithic people had lived near places where water was easily available, i.e., near rivers, rivulets and water basins, as noticed at places like Budigepalli, Peddabankur, Kadambapur, Polakonda, Chinnamarur, Chagatur, Utnoor, Uppair and Somasila in sub-region A; Veerapuram, Belum, Billasargam, Ramapuram, Eeleswaram, Nagarjunakonda, Gandlur and Gangivaripalem in sub-region B; Jami and Kesarapalli in sub-region C and Hulikal and Kundili Cherlopalli in sub-region D.[16]

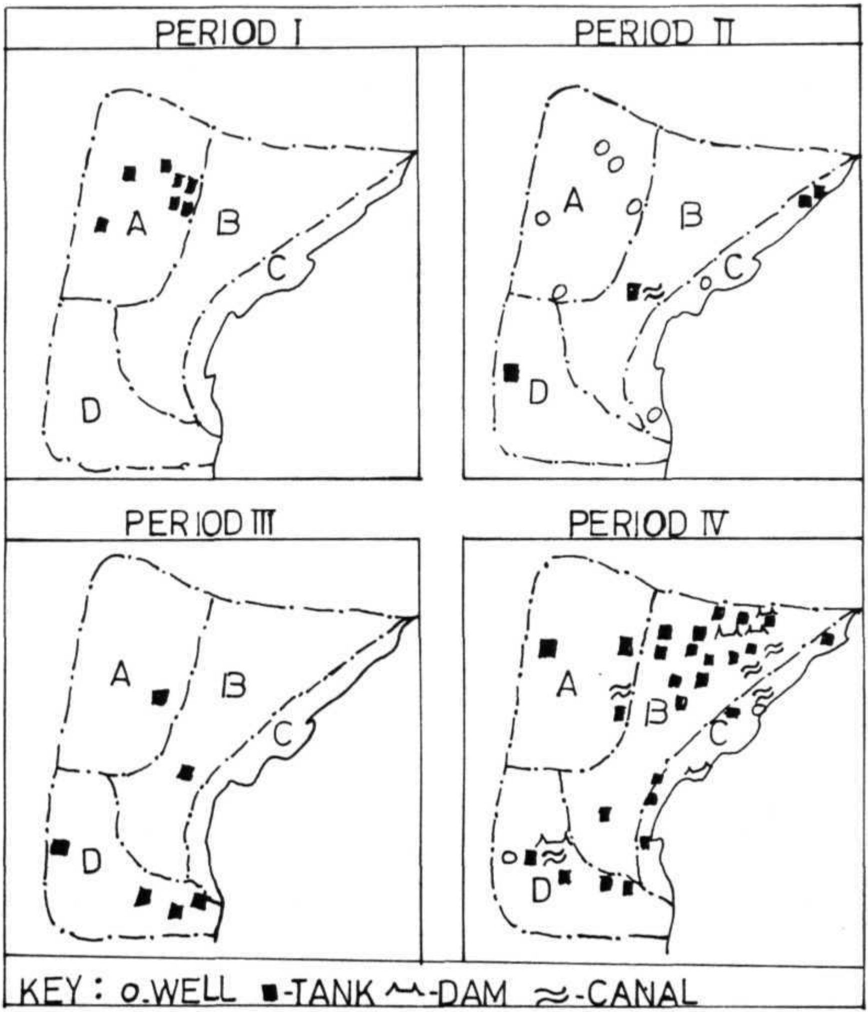
It is therefore, only from the megalithic phase of Period I of our study, that we see the emergence of an indigenous tradition of water engineering, using a run off storage system such as reservoirs and cisterns to ensure an annual water supply within the perimeter of habitation sites as a means of supplementing naturally occuring surface water sources. The Megalithic people led a sedentary life and possessed a broad based subsistence economy, supported by a specialised technology which included the construction of large scale water controls. In this regard, N.R.Banerji[17] points out that in south India, megalithic monuments are found located near large tanks which accommodated the rain water flowing from the slopes of the hillocks nearby. On this basis, he opines that the megalithic people possibly introduced tank irrigation in the south. Scholars like B.K.Gururaja Rao also observe that the megalithic people lived in villages consisting of a sizeable population indicated by the mass of organised labour, required for construction of huge sepulchral monuments and large irrigation tank bunds.[18] E.H.Hunt is also of the opinion that the economy of the megalithic people was based on agriculture which was carried out by irrigation.[19] Based on the evidence of palaeobotanical remains of rice and sugarcane obtained from south Indian megalithic sites, T.M.Srinivasan suggests that lift irrigation was in vogue towards the end of the period.[20]

In Andhradesa too, Megalithic burials at a few places have been noticed in close proximity to the irrigation tanks or perennial rivers. This led Krishna Sastry[21] to presume that these people were primarily agriculturists. Many of the burial sites of Period I have been noticed in the proximity of large irrigation tanks as at Budigepalli, Torruru, Kanukollu, Kadambapur, Polakonda, Rajagopalapet and Kethireddipalli in sub-region A.[22] Only a single site with similar kind of tanks have been reported from Nagarjunakonda in sub-region B.[23] It may be presumed that these tanks must have supplied drinking water to the house holds located at these sites, as well as used for sustaining their crops. In our recent survey conducted at a megalithic site called Damaravai[24] in sub-region B, we noticed a large number of dolmens, scattered on a chain of hillocks around the village. The slopes of the inner side of these hillocks gave rise to form a large tank, which was presumably utilised for both drinking water and for irrigational purposes. On the basis of the above evidence it is fair to surmise that large scale tank irrigation was initiated by the Megalithic people in early Andhradesa. [Map VI]

During Period II, i.e., from the 3rd century B.C. to the 3rd century A.D. of our study, which is characterised by the rise of state and urbanism, irrigation structures are found prolifically. Artificial resorts of water supply for irrigation purposes were initiated on a large scale to meet the water needs of the ever increasing agrarian and urban settlements of the early historic period. Water was collected during the rainy seasons in artificial reservoirs in order to tide over the situation during the lean period. We get considerable information on this subject from the literature of the period and epigraphs, which describe a variety of irrigation works for India as a whole. According to the <u>Arthaśāstra</u> of Kautilya,[25] the chief means of irrigation during the 3rd century B.C., were rivers, lakes, tanks, reservoirs and wells mentioned through such terms as <u>nadi</u>. <u>sara</u>. <u>tadaka</u>. <u>kūpa</u>. <u>utsa</u> and <u>adhara.</u>

Kautilya generally uses the term <u>setu</u> or <u>setubandha</u>. i.e., reservoir, built by putting up dams on streams in the general sense of an irrigation work and refers two types of <u>setus</u>. viz., <u>sahodaka</u>. wells and tanks which

MAP VI



DISTRIBUTION OF IRRIGATION STRUCTURES IN ANDHRADESA PERIOD WISE could be fed by such natural sources as springs, and aharavōdaka, tanks and embankments where water was stored.[26] A clear reference to canals for irrigation in the Arthasastra is found in a sutra which points out that water was set in motion by digging a khātapravartim, or a river dam and nadīnibandhavatōma or a tank.[27] It further details for us four different methods for 'setting water into motion' in order to have the land irrigated. On the basis of their efficiency the methods in ascendant order were hand-moved or hastapravartim, shoulder-moved or skander pravartim, lifted from tanks, rivers or Udghatam and machine-moved or strotavantra. Hand moved, obviously meant irrigation through manual labour probably suggesting that water was carried in pitchers from hand to hand. Shoulder moved probably meant the use of animal power, i.e., yoking bullock for drawings water with the help of a long rope. Udghātam in all probability referred to the method of lifting water from tanks, wells, etc., with the help of a contrivance with a long bamboo balanced on a level with a heavy load on one end and bucket on the other. Strotavantra was probably a kind of hydraulic machine with a wheel and buckets.[28]

Kautilya further gives considerable information on supervision and maintenance of irrigation works. He mentions that one of the duties of nagaraka or city superintendent, was to have constant vigilance and inspection of places of water supply, roads and water courses. Sītādhvaksha. was supposed to have among other things the knowledge of 'water divining'.[29] Samāharta was expected to record the number of water works (setubandha) and the sheds for drinking water in the area in his charge.[30] The private ownership of irrigation works is evident from the fact that Kautilya considers tanks and reservoirs as immovable property of an individual. The communal activity in building irrigation works is also noted by Kautilya. He suggests that all local people should cooperate in building dams, etc.[31] He also points out that all those who build new tanks and dams (tatākasetubandhaname navapravartane) should be given the benefit of exemption from taxes.[32]

The method of construction, organisation and management of hydraulic machinery in oriental countries, including India, led to a debate which hinges on the theory of 'Oriental Despotism' as envisaged by Wittfogel.[33] The essence of Wittfogel's argument focusses on the nature of the tasks in large scale irrigation, including canal construction. He points out that for proper irrigation, a large quantity of water had to be channelled and kept in bounds and this could only be done by the use of mass labour. This labour had to be coordinated, disciplined and led by a controlling authority.[34] Many scholars however, disagree with the theory of Karl Wittfogel, the proponent of 'Oriental Despotism'. According to Romila Thapar,[35] the type of irrigation needed in any country is dependent on ecology, crops, land size, climate, water balances, soil and the actual mechanism of obtaining, transporting and storing water in addition to calendric activities. Irrigation in some cases, could thus be used both to supplement rainfall, in other cases to cultivate a second crop. In the early historical period infact, the major form of irrigation was carried out by building bandhas or dams across small streams and converting them into tanks. These traditional small-scale irrigation works therefore, did not need a despotic centralized political authority to execute them. In the same way V.K.Jain,[36] opines that in ancient India irrigation was provisionally conducted by such minor works as wells, tanks, ponds, etc., which did not require either the mobilisation of labour on a large scale or a powerful bureaucracy to organise and manage them. These works were owned and maintained by local people, individually or collectively. There is, however, evidence for the early period in India that Kings also took interest is providing irrigation facilities. Nanda Kishore[37] points out that to cope with the famine both the people and the kings took special care to construct irrigation works of small as well as enormous size. The number and size of huge water works began to increase with the introduction of feudal elements in Indian polity during the early centuries after the Christian era.[38]

A direct proof of the active interest taken by the Mauryan Kings in providing irrigational facilities is the Girnar rock-edict[39] wherein we learn that in Saurastra, Sudarśana lake was constructed by the Governor of Chandra Gupta Maurya and then repaired by the Governor of Asoka. Except the Sudars'ana lake, there is no large scale irrigation work which may justify state enterprise in irrigation for the ancient Indian context, prior to the sixth century A.D.

The inscriptions of Period II throw some light on the methods and works of irrigation in the Deccan as a whole, which can also be taken into account while dealing with the irrigation techniques of Andhradesa in the early historical context. Sātavāhana inscriptions refer to the term hala both in the sense of a measure of land and an iron plough.[40] The Nasik inscription[41] of Madharīputra speaks of the guild of ōdayantrikas, the makers of the water machines. Usavadāta is eulogised as the maker of tanks or taḍāka. and wells udapāna.[42] The Amaravati epigraph of the time of

Rajan Siri Śivamaka Sada, mentions a pāniyaghārika, i.e., superintendent of water houses, possibly for controlling the distribution of water.[43] The Myakadoni inscription of Pulumāvi records the construction of a large tank meant for irrigation. Symbols on the obverse of some early Satavahana coins from Kolhapur, represent the water-wheel used for irrigation.[45] Further, the contemporary literature to Satavahana rule also furnishes some information on the irrigational techniques corroborating the epigraphic and numismatic data mentioned above. The early Buddhist text Cullavagga refers to the use of water machines for lifting water.[46] The Gāthāsaptaśati mentions a water lifting device called rahattaghadia.[47] The above discussion leads us to surmise that agriculture was the main stay of the people and that both kings and wealthy elites in society took interest in the extension of agriculture by creating and improving irrigational facilities. H.P.Ray[48] rightly observes that judicious use of irrigation was responsible for increased agrarian productivity during the Satavahana period.

For early Andhradesa archaeological remains shedding some light on how water supply was organised are available from almost all the subregions of our study. These wells and cisterns dug near and around the habitation area found at Kotilingala, Peddabankur, Kondapur, Kudalisangameswaram in sub-region A; Nagarjunakonda in sub-region B; Majeru in sub-region C; and at Ramapuram in sub-region D have been dealt with above in the habitation buildings and public utility structures section of this chapter [Chapter II.1]. The excavations at Peddabankur in sub-region A have brought to light a good number of brick wells and cisterns.[49] As many as 22 wells, all built in brick were noticed here. One of these was lined with terracotta rings. The wells were built with wedge shaped bricks of size 30 x 20 cms which is a major technological breakthrough of the period. [Plate VI] Brick cisterns square and rectangular 1n shape were also brought to light in the Peddabankur excavations.[50] Brick wells have also been reported from Kotilingala,[51] Kondapur[52] and Kudalisangamesvaram[53] in the same sub-region. These wells enabled individual families and seperate residential quarters, to have access to their own water supply and avoid drawing drinking water from surface water sources which must have been liable to pollution.[54]

Interestingly, rock-cut cisterns and tanks meant for water supply and storage for Buddhist settlements are noted prolifically on the hills and hillocks in sub-region C. These have been found at Pavurallakonda, Bavikonda and Thotlakonda and Gopalapatnam. As these Buddist settlements are located on hill tops and away from natural water sources, the Buddhists preferred to scoop the rock into troughs to collect and store rain water for drinking purposes during the period after the rainy season. These cisterns involve techniques of scooping the rock first, by levelling the rocky terrain, then marking the size of the cistern to be excavated and finally proceeding to excavate by removing the mass using the iron tools such as pick-axes, chisels and hammers. Steps were provided on one side to facilitate the Bhikkus to get into the cisterns in order to get the water by vessels. There are 16 such troughs at Pavurallakonda,[55] six at Gopalapatnam,[56] eleven at Thotlakonda[57] and three at Bavikonda.[58]

The techniques of scooping the rock into cisterns can be explained in the following manner based on the Thotlakonda examples. At Thotlakonda,[59] [CHART IIB] a series of rock cut cisterns were excavated which were meant

CHART II B

Pariod II: Irrigation Structures

S.No.	Name of the Site	Sub-region	Well	Tank	Embankment/ Dam	Canal/ Channel	Sluice/ Gate
					Type of Irrigation Structure		
1.	Myakadoni	D	-	✓	⊡	-	-
2.	Nagarjunakonda	B	-	M	⊡ ⧄	✓	✓
3.	Thotlakonda	C	M	M	⧄	-	-

Key:

⊡ Earth ◫ Brick ⧄ Stone M Rock-cut

for collection of rain water for use of the Buddhist settlement. Channels were provided where ever necessary along the gradients for a free flow of water, from the higher contours. Channels cut in the rocky surface connecting one cistern to another were apparently used for regulating the excess water from the cisterns at the higher contour. The floors of the cisterns were plastered with lime to arrest seepage, since the walls of cisterns could have fissures. All the cisterns were provided with steps [Plate IX], All around these a rectangular dry masonary rubble wall in lime mortor was constructed for probably preventing the animals access to the troughs. Occasional occurrence of post holes on the periphery of some of the cisterns indicate some sort of roof over them. The wells or cisterns covered with a shade are mentioned as udapānaśāla and pōdhis in Buddhist literature.[60] In inscriptions found located near the rock-cut cisterns at Junnar, Ganeshpahar, Kanheri, Kuda and Nasik Caves of Western India, these water cisterns are specially called pōdhis. Drinking water cisterns were called pāniyapōdhi and bathing cisterns are called as sananapodhi as has been noticed at the Junnar and Kuda Caves.[61]

The situation of these troughs suggests that the selection of slopy parts of the summit for collection of maximum rainwater. On the southern side of the settlement at Thotlakonda, there is a big tank which was also probably fed by rain water. Attempts had been made by the experts to scoop the slopy inlets into the tank by trimming the bouldary surface of the hillock, for a free flow of rain water into the tank which formed the main source of water for the entire settlement.

At Bavikonda,[62] another site along the north Andhra coast there are three tanks on the hill top. The tanks are oval in shape and vary in size from 30 x 50 meters to 135 x 90 meters. Here also the rocky terrace was chiselled as inlet channels to collect rain waters into the rock cut cisterns.

We have the earliest evidence of the construction of a large tank meant for irrigation from Myakadoni[63] in subregion D. **[CHART IIB]** Being a semi-arid region, the cropping pattern in sub-region D mostly relied on the artificial irrigation facilities such as tanks and wells since the rainfall in this region even today is low. The sub-region has been called dry zone according to the study of M.Ramudu who has done research on the area and its irrigation facilities.[64] This large irrigational tank at Myakadoni still serves as the main water storage system for agricultural purposes. The selection of the site for such a huge tank denotes the foresight of the people of the early historic period that it had a very wide catchment area for collecting rain water. The tank bund was constructed by earth not only from that which was dug out but also from that which was carted from the nearby areas for the purpose. Hundreds of bullock carts and a few hundreds of ordinary labourers supervised by a limited number of foremen, might have been employed in the work denoting a collective effort under the control of well trained and experienced technical people in building tanks.

During the 3rd century **A.D.,** the people of **Nagarjunakonda** had tapped **many** sources for providing water supply to the city, both for domestic and irrigational purposes**[CHART II B].** They primarily relied on natural sources of water. The river Krishna which is a perennial source of water must have been utilised to the maximum extent for this purpose. Besides this, canals, wells and tanks were excavated. Canals were dug from rivers to feed tanks of small sizes which in turn were used as the main source of water supply to the fields by means of branch channels. Irrigation by means of inundation was also popular during the period. Evidence of an ancient canal on the eastern side of the valley reveals the engineering skill of the people during this early period. Farrington defines an irrigation canal as, "a delicate artifact, designed with engineering precision to transport a required amount of water from source to field in order to maintain an adequate soil moisture environment in the later".[65]

According to R.Subrahmanyam,[66] the above canal at Nagarjunakonda must have served as a substantial source of water for all the people. The water trickling down from the surrounding hills, through gullies was tapped and diverted into this canal by constructing a rubble cross wall. On either side of the canal, thick randum rubble embankment walls were built on a good foundation of hard gravel. The bunds seem to have been raised to a height of 2'-0 over the wall. The excavation in this canal have yielded typical Ikshvaku antiquities. This canal ran to a length of 100 meters with an average width of 50-0 and 6'-0 in depth. The building of this canal stands as testimony to the skills of the engineers of the Ikshvaku period. I.K.Sarma,[67] opines that this canal might have served both domestic and irrigational purposes.

People of Nagarjunakonda did not allow the water flowing from nearby hill to go waste. They built a number of tanks with earthen embankments in semi-circular fashion as noticed on the southern fringe of the valley. [CHART II B] The embankments are found to be of morrum or red earth mixed with rubble and gravel. The tank found near the university area, at Nagarjunakonda might have been fed by the waters of the canal already described above. At the foot of the Phirangimotu hill, some vestiges of another embankment of rubble with a sluice and drain have been noticed.

A rubble wall 17 feet in length with a sluice of brick masonry provided for regulating the out-flow of water was also noticed. Sluices are generally mechanical contrivances in the form of gates by which the flow of water can be controlled from the main canal into other branch channels. They are usually costructed on the tank bunds to allow the surplus water to flow out and keep the tank intact from developing cracks. R.Subrahmanyam[68] opines that these tanks found at Nagarjunakonda were used for storing water for irrigation purpose.

Construction of wells in circular, elliptical, square or rectangular shape either in coursed rubble or brick, associated with residential structures have also been noticed at Nargarjunakonda. A well of huge proportions is found on the Nagarjuna hill area. This well about 160 feet in diameter, probably served as a water source for the garrison stationed at the fort on the hill top as R.Subrahmanyam opines.[69] It is 80 feet deep and stands as a monumental example of the labour used in the execution of such a large scale excavation in rock. All round it had a retaining wall in brick. An Abhira inscription dated to the 30th regnal year of Vasusena refers to this excavation of a huge well called Vesisa Mahātada.[70]

During Period II, a marked development is thus evident with advanced techniques in providing water supply to domestic and irrigational purposes through artificial means. To distribute the water, canals were excavated which were provided with sluices for the first time in the early historical context of Andhradesa. The contemporary literature and epigraphs also provide information on the various modes of irrigation systems initiated by the royalty as well as wealthy individuals in society. The management of these water works was however, kept under the control of the local rural communities. It is only during this period that natural water was systematically tapped into low lying areas by building earthen embankments and stored for future use. Wells were also dug into soils where rain fall was low. The people possessed knowledge in excavating the wells and huge tanks in hard rock, as noticed at Tholtakonda and Pavurallakonda in sub-region C and Nagarjunakonda in sub-region B. [MAP VI]

Period III is considered as one of transition, from an ancient to early medieval economy. The latter has been described as feudal in character as an outcome of the land grant system.[71] It is also to be noted that there was a growth in rural settlements as a result of the decline in trade and industry and these settlements became the nucleus of agricultural expansion. A recent study, on the Vishnukundin records made by Krishna Prasad Babu, reveals that all the records of the Vishnukundin period mention grama and village settlements, whereas only a few refer to puras.[72] R.N.Nandi while studying the neighbouring Karnataka, during the period says that because of agrarian expansion due to the land grant economy there was also a gradual improvement in irrigation techniques.[73] The extant archaeological remains relating to irrigation structures for this period are absent, save one or two examples. Hence we have to depend upon the contemporary perceptions mentioned in the epigraphs and literary works wherein references to excavation of tanks and wells are made.

Irrigation was carried out by wells and tanks during the Vishnukundin period as the Tunvnaiagudem charter of Govinda Varma describes him as builder of wells and tanks[74] [Chart II C]. The Vilavetti plates of Pallava Simhavarman (A. D. 436-460) records the collection of tax from kupa darsakas which further reveals that there were some experts in water divining who approved of the sites proposed for digging wells.[75] The British Museum plates of Charudevi, the queen of Pallava Yuvaraja Buddha Varma, record an irrigational tank called rājatatāka,[76] meaning the king of tanks. The above references show that irrigation was carried out by wells and tanks. The tanks at Turimella[77] in sub-region B, Chilamakuru[78] and Kondapalli[79] in sub-region D [Chart II C] were constructed during the period in order to bring the waste lands under cultivation, according to the inscriptions of places mentioned above. An inscription datable to the 9th century A.D. found at Gudimallam in sub-region D informs that the local tank was desilted by the Pallava king Danti Vikrama Varma.[80] Another inscription from Avilala in subregion D dated to 867 A.D. of Nandivarma Pallavamalla III refers to a tank named Avilaleri[81] [Map VI]. The above inscriptional evidences provided us information that in all most all subregions, agriculture was carried out only by tank irrigation. We have no other information as to how these tanks were excavated or built. On the other hand we have some information on these aspects available for the contiguous region of Tamilnadu. A Pandyan record[82] datable to the 8th century A.D. shows that two distinct technical advances were made in building the embankments of tanks and the banks of canals. According to this inscription, dressed stones were pitched to the earthen embankments in place of the traditional rubble and laterite material, and these dressed stones were arranged to a stringline technique.[83] Probably the same

CHART II C

Period III: Irrigation Structures

S.No.	Name of the Site	Sub-region	Well	Tan	Embankment/ Dam	Canal/ Channel	Sluice/ Gate
				Type of Irrigation Structure			
1.	Avilala	D	-	✓	⊡	-	-
2.	Chilamakuru	D	-	✓	⊡	-	-
3.	Gandharikota	A	-	✓	⊡ ⧄ ᙏ	✓	✓
4.	Gudimallam	D	-	✓	⊡	-	-
5.	Kondapalli	D	-	✓	⊡	-	-
6.	Tummalagude	A	-	✓	⊡	-	-
7.	Turimella	B	-	✓	⊡	-	-

Key:

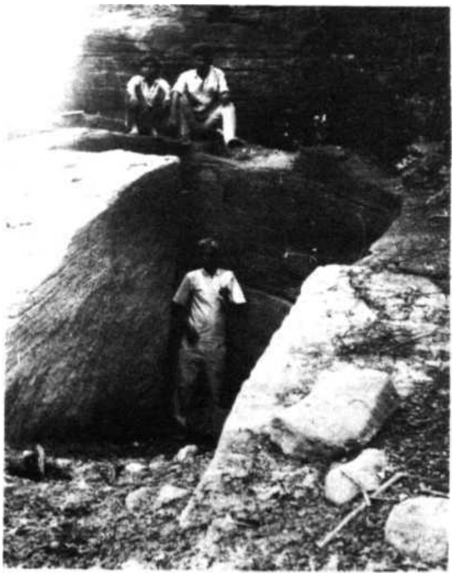
⊡ Earth ▥ Brick ⧄ Stone ᙏ Rock-cut

method of construction might have been adopted for the tanks of this period in Andhrdesa too.

Regarding the methods of irrigation, we have a few literary evidences among which Medhatithi (825-900 A.D.) documents a method of irrigation known as the Upamitibhavaprapañchakatha, the early prevalence of lift irrigation by Persian water wheel and leather buckets.[84] For this period in our area of study we have only one extant tank where we see a new irrigation technology, that resulted in the construction of a rock-cut and masonry dam, with underground channels, which were provided with sluice gates.[85] This has been noticed at Gandharikota [Plate IX] in sub-region A. At the foot of the hills of Gandharikota was a concealed a rock-out channel with a sluice of the early medieval period, datable to the 8th century A.D. The sluice was actually cut into the natural rock of Gondwana series to a depth of 12'-0 to 15'-0 in semi-circular form and connected to a rock-cut rectangular channel of the same depth, and provided with a gate. Another sluice, cut into the well above the earlier one at a height of one metre, was intended for the outflow of water, from a higher level when the tank was full. Over this rock-cut channel, lay the ceiling slabs, serving both the purpose of covering the channel and also preventing the debris and other vegetable matter from falling into it. Interestingly, one of the ceiling slabs has a hole of 0.45 metres in diametre, probably meant for manual operation of the sluice gate. The above information leads us to surmise that the people had sound knowledge of surveying the surroundings before selecting the areas to be utilised as tanks. The arrangement of the sluice gates, and rock-cut channels for inflow and outflow of water can be taken as a technological advancement in creating irrigation facilities and

PLATE IX

Period II: Rock-cut cistern, Thotlakonda, Sub-region C



Period III: Rock-cut canal, Gandharikota, Sub-region A indicates the engineering skill in regulating water without letting it go waste. These mark unique achievements in the rock-cut technology for irrigation purposes. The water supply system of Gandharikota is an excellent example, without parallel, of a well-planned and superbly realised hydro-technical project, which has demonstrated its capacity to resist the destructive powers of nature and human disasters and thus survives till today. The same technology has been in operation for more than 1000 years and still serves as a working water management system.

To assess the building technology of the irrigation structures of this period, we have only epigraphical information for Andhradesa on one hand and the solitary example of a unique rock-cut tank on the other hand. As the epigraphs of the period refer to excavation of tanks and wells it can thus be surmised that most of the area in all the sub-regions was irrigated by tanks excavated and we can notice an increase in the number of tanks when compared to Period II. The earthen embankments were made by depositing earth either by cart or head loads with an involvement of large amount of labour. The only extant archaeological remain of a rock-cut tank at Gandharikota reveals that the people of authority were responsible for financing to create such a unique hydrological project.

The building technology of irrigation structures of period IV can be **studied** based on literary, epigraphic and extant remains, found in our area of study. This period sees changes in two stages, namely, stage I and II i.e., from 1000 to 1200 A.D. **and** from 1200 to 1400 A.D. respectively. During stage I of the period, only digging of tanks, canals and wells was **known, whereas in stage II, massive earthen** dams were built for irrigational purposes besides continuing the earlier methods. This classification also facilitates us to compare and contrast the technological developments from one stage to another in each sub-region. During stage I irrigation technology was continued or developed with new devices such as construction of large scale reservoirs with a net work of controlling canals and distributary channels. It must be emphasised that many of the tanks and lakes of the period even today continue to supply water to some thousands of acres in sub-regions A and B. Most of the tanks, wells or canals were dug at the instance of kings, queens, chiefs commanders, local communities and even private individuals. The state during the period IV had its economic base in agricultural productivity which was subsequently achieved through proper water management. The facilities for year round storage had intensified cultivation through irrigation of second crop. The rulers realised that irrigation was a major technical innovation to improve the efficiency of the local agricultural systems. The hydraulic modifications of the environment had included embankments to expand the water catchment area, dams to impound water for surface storage in order to recharge ground water and to transport water **through** canals for cultivation.

In Stage II i.e., specifically during the Kakatiya period there was an acceleration of irrigation by tanks, reservoirs, dams or canals. Irrigation water was considered as a catalyst for bringing a change in production through use of better technology of dry land agriculture. Since water management technology is location specific technology and has to be **developed** in different soil or climatic environments, the Kakatiya administration, through their feudal lords spent huge amounts on creating irrigation works. For providing irrigation to the farmer's satisfation on the one hand, and ensuring better use of water on the other, many methods were used or strategies evolved by the Kakatiya monarchs particularly since the choice of irrigation method depended on land topography, soil characteristics, quantity of water available and so on.

During the period, excavation of large tanks and canals was also evident from the contiguous regions to Andhradesa. In this regard we have some evidences of such works executed by the later Chalukyas in Karnataka and Cholas in Tamilnadu. The Later Chalukyan queen Rayamati built a large reservoir which was connected to river Saraswati by a 300 feet long channel. Recent archaeological operations have brought to light arrangements of stone sluice gates to inlet the water into the lake.[86] Likewise in Tamilnadu, according to Tiruvalangadu plates,[87] Rajendra I (A.D. 1012-1044) had celebrated his victory in the north by constructing a large irrigation tank Cola-gangam, and an embankment 24 kilometers long and was provided with sluices and canals for the irrigation of a larger area.

The literature of the period also provides us information about the excavation of tanks, canals and sluices along with some technical details. Narmada classifies the dykes into two types, i.e., kheya which were dug into the ground and the other called bandhya which were constructed above the ground level. The former represent wells and canals whereas the latter represent the embankments, i.e., tanks, Vijñānešvara (1076-1126 A.D.) in his Mitākshara mentions that building of tanks and other irrigation works was looked upon as of fundamental requirement of society.[89] According to another medieval work lekhāpaddhati, the government had been divided into

32 departments among which the vārigrihakarana functioned to looking after the construction, maintenance and repairs of water works.[90] The Pratapa Charitra[91] mentions that Ganapatideva had built big tanks at Nellore, Ganapuram, Elur, Gangapuram and Ekasilapuram. The Sivayōgasāram mentions that Annaya the minister of Induluri family has constructed many tanks along the banks of Krishna and Godavari rivers respectively.[92]

For the second stage of the period under study in Andhradesa we have some information on hydrology and irrigation facilities recorded in some inscriptions, which reveal the traditional system of the use of water sources and methods of dam construction in South India. In this regard an inscription[93] from Porumamilla dated to 1369 A.D. [CHART.IID.29] in sub-region D records that a reservoir called Anantasagar was built by Bhaskara Bhavadura, by employing 1000 labourers and 100 bullock carts every day to get stones from the quarry for the masonry dam. This dam was built to a length of 500 rekhadandas. 8 rekhadandas in width, and seven in height. The inscription also quotes the verses from Hemadri's Vratakhanda and enumerates as many as 12 sadhanas which were essential for building a reservoir. They included such things as a king with righteousness, a Brahmin having knowledge in hydrology, i.e., Pathas sastra, the availability or ground with hard clay, a river with sweet water, a hill in contact with the reservoir, a dam built of stones in between the hills, two extreme points, a deep and extensive bed, a quarry with straight and long stones, level and fertile land in the neighbouring area, a water course i.e., a sluice built of strong stones and finally, a gang of skilled men in the construction of dams. The inscription further says that with these essentials, an excellent tank could easily be built. It also enumerates six faults to be noted while constructing a reservoir such as water oozing from the dam, saline soil, situation at the boundary of two kingdoms, elevation in the middle of the tank, scanty supply of water or extensive stretch of land and scanty ground and excess of water. All the above criteria to build a good tank tally with the extant reservoirs of the Kākatiyas.

The epigraphical records of the period provide information, that tanks of enormous size were built by the Kings and his subordinates. For instance, the Chiefs of Kanduru, Velanadu, Chāgi, Parichchedi, Eastern Ganga, Chola, and Kakatiyas have directly taken up excavating the tanks for irrigation purposes. An inscription dated to 1041 A.D. mentions that a Kadamba Chief has constructed a tank in Sabbinadu in sub-region A.[94] The Kanduri Choda King Udayana Choda has built a tank at Nelakondapalli in sub-region B.[95] Kulottunga Choda Gonka of Velanadu has constructed a tank at Timmapuram in sub-region C in 1161 A.D.[96] The Parichchedi King Kusumāyudha had built two tanks in 1222 A.D. at Prattipadu in the same sub-region.[97] A Chagi Chief Potaraja had excavated two tanks in 1230 A.D.[98] The Eastern Ganga King Indravarma built a tank called Rāja Tatāka at Achutapuram in sub-region C.[99] The Chola King Rajendra Chola I had excavated a tank at Mekalachampalli in sub-region D in 1016 A.D.[100] The Kākatiya King Prola I is credited with construction of a tank at Kesamudram in sub-region B.[101] Rudra had built a big tank at Panugallu in sub-region B.[102] Ganapatideva had built tanks at Nellore, Elur, Ganapapuram and Ekasilapuri in sub-regions B and C[103] [Chart II D]. The Nirōstyakāvya[104] of Hanumakonda reveals "In the country are hundreds of tanks". The Kākatiya Kings excavated hundred of tanks throughout the length and breadth of their country.[105] The ideology of the period might have prompted the Kings because construction of a tank was regarded as an act of a charity and one of the seven meritorious acts called as the Saptasantanas.[106]

In addition to the State's direct involvement in constructing irrigational works, there are also a few instances to show that the local bodies such as Prabhus and Nadu assemblies have also contributed their mite. An inscription from Nandikandi[107] in sub-region A databale to the 12th century A.D. refers to the excavation of a tank called madivājanakere and a gift of some land by the Prabhus. the local body of the village, to those people who actually dug the tank. In another instance, the Attirala Inscription[108] records that the nādu assembly, i.e., an assembly of local bodies governing at district level called Pottapinadu decided to construct a bund on the river Cheyyeru by raising contributions from each of village the said assembly, to prevent the possible damage to the temple at Attirala. In this case it is clear that though the temple was built by royalty, it was considered as a common property of the entire district. This type of evidences mentioned above proves beyond doubt that the construction and maintenance of such works were also undertaken at the community level.

Information available from inscriptions of the period regarding the different types of irrigational works has been thoroughly utilised in writings that have emerged from the 1960's onwards on the social, economic and cultural history of the period under study.[109] The study of technological aspects of these irrigation structures however remain unresearched. Hence an attempt to understand the level of building technology of these structures is made by us. Special emphasis was given to the remarkable hydro-technical installations in the Kakatiya Kingdom among which the huge lakes at Ramappa, Pakhal, Ghanpur, Lakhnavaram and Bayyaram are important built during the regnal period of Ganapatideva **[Chart IID** 23, 24, 10, 16, 5]. According to an inscription[110] the Ramappa lake at Palampet was built by Recharla Rudra, the Commander-in-Chief of Ganapatideva in 1213 A.D. The Pakhal lake was built by Jagadalu Mummadi in the 13th century A.D.[111] Suitable sites were selected as at Ramappa, Ghanpur and Pakhal where the embankments were made to impound rain water and to capture it from a relatively gentle slope drawing from the ridges behind these lakes. In each case the bunds were built in between two hills connecting both. The length of the bunds at Ramappa, Ghanpur and Pakhal measure 2000 ft, 7000 ft, and 4500 ft, with a width of 30ft, 25 ft and 50 ft respectively. The height of the bund at Ramappa was 56 ft, at Ghanpur it is 48 ft whereas it is only 30 feet at Pakhal. There are 4 channels at Ramappa and Ghanpur, whereas the Pakhal lake has 40 channels **[Map VI].**

During the period the embankments were always raised by throwing up earth, all around the tank bed, on the plains and level areas. In the hilly tracts, the task was much easier than in plains and a group of hills could be easily joined together. We now discuss the details as to how the dam at Ramappa was built during those days. The basal width of the dam at **Ramappa** comes nearly to 100 ft. This embankment which stretched for 1 km long was connected to two hills on either side. The engineers planned that the rain waters from the hills and ridges, automatically collect and form into a reservoir. The tank bund at Ramappa was designed in such a way that it had a slope both towards the inside and the outside with a flat top facilitating the excess water to overflow, what we call now a days **a** spillway **[Figure 5].** To avoid any type of erosive cutting of the earthen

CHART II D

Period IV: Irrigation Structures

S.No.	Nave of the Site	Sub-region	Well	Tank	Embankment/ Dam	Canal/ Channel	Sluice/ Gate	Spillway
					Type of Irrigation Structure			
	Achutapur				⊡			
	Amrabad							
	Attirala				D			
	Badnehalu							
	Bayyarai					√	J	√
	Dosapadu							
	Ekasilapuri							
	Eluru							
	Gangapurai			√	⊡	-	-	
10.	Ghanpur			√	⊡	√	√	
11.	Gudivada				-	√	√	
12.	Gumuduru							
13.	Hanumakonda			√				
14.	Kesamudram			√	⊡			
15.	Kolanupaka			√		√	√	

contd...

Key: ⊡ Earth   Brick   Stone   Rock-cut

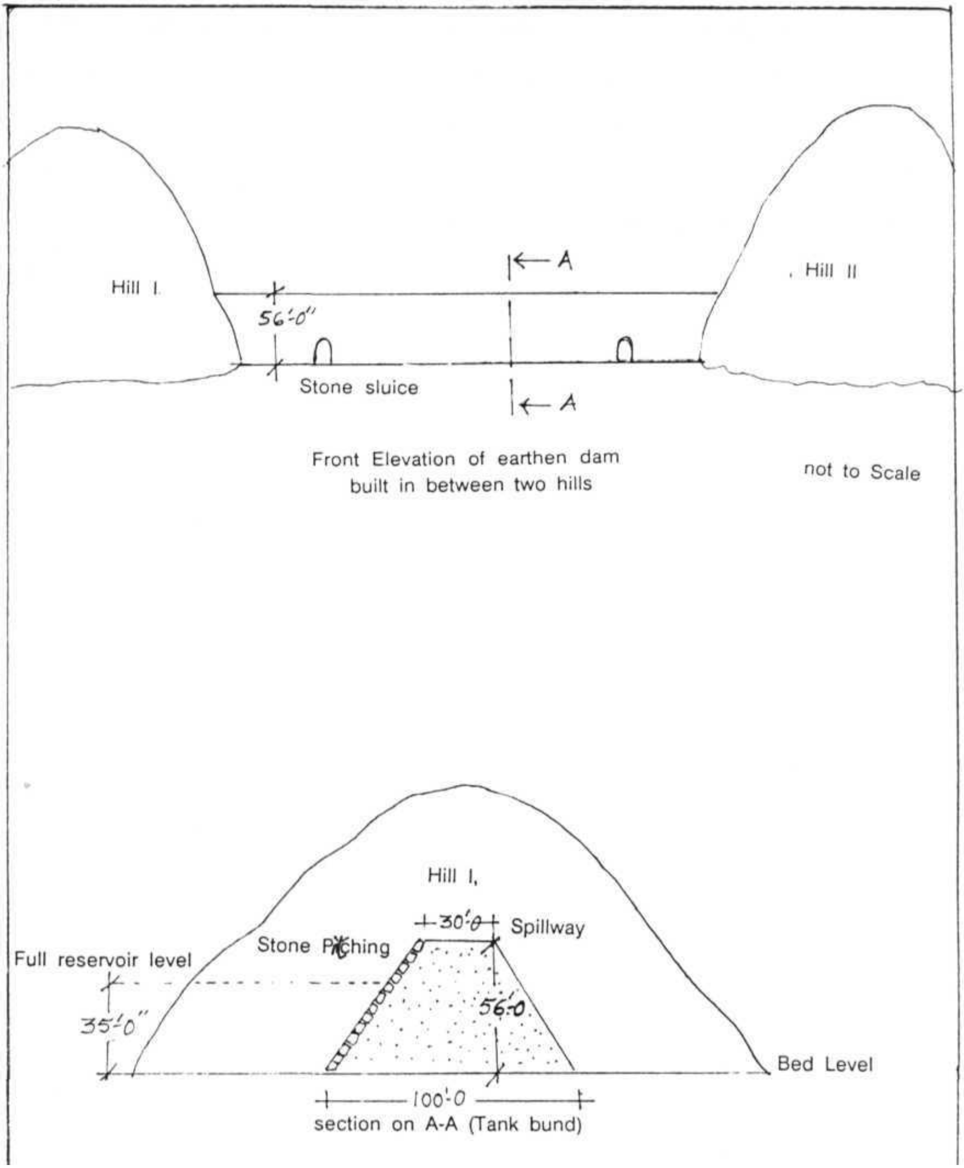
CHART II D contd...

S.No.	Name of the Site	Sub-region	Well	Tank	Type of Irrigation Structure			Spillway
					Embankment/ Dam	Canal/ Channel	Sluice/ Gate	
16.	Lakgnavaram	B	-	√	⊡	√	-	√
17.	Lembaka	D	-	√	⊡	√	√	-
18.	Mareddipalli	D	-	√	⊡	√	√	√
19.	Mekalachchampalle	D	-	√	⊡	√	√	√
20.	Nandikandi	A	-	√	⊡	-	-	-
21.	Nelakondapalli	B	-	√	⊡	√	√	-
22.	Nellore	C	-	√	⊡	-	-	-
23.	Pakhal	B	-	√	⊡	√	√	√
24.	Palampet	B	-	√	⊡	√	√	√
25.	Panugalli	B	-	√	⊡	√	√	-
26.	Pedapulacheruvu	B	-	√	⊡	-	-	-
27.	Penugonda	D	-	√	⊡	√	√	-
28.	Prattipadu	C	-	√	⊡	-	-	-
29.	Porumamilla	D	-	√	⧅	√	√	-
30.	Tadlapaka	D	-	√	⊡	√	√	-
31.	Timmapuram	C	-	√	⊡	-	-	-

Key:

⊡ Earth ▥ Brick ⧅ Stone ʍ Rock-cut

FIGURE 5



Period IV:Details of an irrigation structure at Palampet, Sub-region B

(Sketch based on the details furnished in Y. Gopala Reddy, 'Agriculture Under the Kakatiyas', Itihas. Vol.1 No.1, 1973, pp.58-62) dams of the period, which would divert water from human use, the hydrologists planted trees and pitched stones on the inner face of the bund, to protect it from the ravages of periodic floodings, a feature noticed at Ramappa and Ghanpur lakes. In this regard we have an inscription[112] which mentions that rows of trees called Kattava were planted on the tank bund of the period with a view to add strength to it and also to preserve the bund from erosion. The sluices were built on either side of the bund not only to regulate the water supply but also to protect the foot of the spillway from erosive action.

Removal of silt deposit from the reservoir's bed continued as a recurrent activity when situation demanded and this was organised by individuals or, collectively, at a communal level. The above observations on the tank at Ramappa reveals that the people who were actually involved in building it possessed high degree of technical knowledge. This tank still serves as a water source for nearly 4,350 acres. P.Sreenivasa Char rightly quotes the description of this tank as given in the Palampet Inscription of Recherla Rudra that states: "which stands like an ocean that has come either from fear of the submarine fire and looks like a mirror of the city".[113] Gulam Yazdani similarly speaks highly of these tanks. He writes: "Warangal, the metropolis of this dynasty (Kakatiyas) abounds in magnificient tanks and the titanic dykes and sluice gates of Pakhal, Lakhnavaram and Ramappa lakes are object lessons even to the modern engineers".[114] The above study reveals that major irrigational works were built in stage II of period IV and it is interesting to note that all these hydrological projects were invariably located in sub-region B only.

Canals were dug to feed the tanks from the rivers and rivulets or to carry water from tanks to the fields. Inscriptions of period IV also refer to canals and channels dugout from the rivers and streams for irrigation purposes. Evidence of canals or channels dugout from the rivers Vamsadhara, Saptagodavari, Krishna, Gundlakamma, Naguleru and Swarnamukhi in sub-regions A,B,C and D are available.[115] [CHART.IID]. Two canals, Rāyasahasramalla Kalva and Gandapendera Kālva were excavated from the bed of the Cheyyeru river at Lembaka and Tadlapaka in sub-region D during the 13th century A.D.[116] At Kolanupaka in sub-region A, a canal by name Vamsavardhana Kalva was drawn from Aler river to feed a tank which was dug in 1279 A.D.[117] The Amarabad Inscritpion dated to 1290 A.D. refers to a canal dug from the local stream called Pogasirivagu.[118] Canals were also excavated at Palampet, Ghanpur and Pakhal in sub-region B.[119] The method of excavating canals can be deduced on a close look of those found at Ramappa lake. For this a low gradient was selected and these canals were dug out accordingly, to a length depending upon the discharge and storage water of the respective tank. Sometimes these canals were cased with stone which were called as Kattumgommus. The others which had earthen embankments were called as Ana-Kālvas in the inscriptions of the period.[120] Sevaral such canals used for irrigation purposes have been described.[121] Maximum numbers of canals were excavated in sub-regions B and D where the rainfall was low and the fields purely depended on artificial irrigation facilities.

As in the earlier periods irrigation was also carried out by well water during the period IV. Well irrigation was preferred in the areas where there was water scarcity or low rainfall, particularly in Palnadu area of sub-region B and Rayalaseema area in sub-region D.[122] Excavation of wells was mainly taken up by private individuals as this was small scale irrigation. Information on state's participation in excavating wells is not forthcoming. A few inscriptions from sub-region C and D furnish data on well irrigation from stage I of the period [CHART.IID.4,11,12]. A well was excavated by certain Malla at Gumudur in sub-region B according to an inscription datable to the 11th century A.D. found at the same place.[123] An inscription from Badnehalu[124] near Adoni in sub-region D dated to 1055 A.D. refers to a certain Pergade Virarakshasa who caused the construction of a well in the black cotton soil. The inscription also mentions that a gift of 12 mattars of land was made by him for its maintenance to attend to frequent repairs.

An inscription dated to 1237 A.D. from Gudivada[125] in sub-region C [CHART IID. 11] refers to the construction of a well with bricks by Gudivada Pdtanaboya, who appointed a person to draw water from this well and supply it into a Kaluqādi. meaning a downward water channel, built of stone for easy flow of water into the fields. There was an explanation as to why the well was cased with bricks. The soil around Gudivada was black cotton soil where the well was dug and the earthen walls of the well are liable to collapse anytime causing inconvenience to draw water if they were encased. Pōtanabōya who belonged to an agro-pastoral community must have had earlier experience in this regard, which led to the construction of the well with bricks to prevent its collapse. Similarly, the earthen bunds of the canal were also liable to breach and collapse, especially when the canal carried water to its full velocity. In order to overcome this casuality, the inner sides of the canal were lined with stones as a permanent measure. The construction of wells and canals lined with brick and stone denotes a development in building technology in stage II of the period as unlined wells were found in stage I.

Certain devices were used to draw water in well irrigation among which etam and ratna are mentioned in the inscriptions of the period. The Hanumakonda inscription[126] mentions etam while the Dosapadu epigraph[127] refers to a ratna. These are found mentioned in the form of a gift alongwith necessary wood and bullocks. In addition to the above, other devices called guda and m5ta were used to lift the water. The term gūḍa is a device made of palm leaf or bamboo matting, in the shape of a bucket either end of which was tied with ropes and these ropes are held by two persons. To fill the bucket, the operating people bend their bodies to the front and then draw the ropes in order to empty the water in a channel dug at higher level. Etam was a device in which an iron or leather bucket was tied to a pole fixed horizontally in between two vertical posts. At the other end of the horizontal pole, a counter weight, probably a stone was tied. A single man could operate it manually by pulling it up and pushing down.[128] Irrigation by means of draught animals was known as mōta. In this system water was drawn by buckets which were tied to the yoke. The bulls moved forward and backward while drawing the water. In order to do this an earthen ramp with a downward slope was necessary at the well. In the last system called raṭna, a pully was fixed to a wheel arranged with a number of small buckets. The wheel fixed vertically was mechanically rotated by a horizontal wheel whose movement was made by a pair of oxen rotating around the well. Maximum water could be drawn by this method when compared to the above methods. All the above devices are still in use to draw water in dry land and semi-arid agricultural zones in sub-regions A, B and D.

We do not have clear cut evidence on the exact cost involved in building irrigational works of the period. Only a few inscriptions mention the amounts spent for raising some of the tank bunds. An inscription datable to the 13th century A.D. from Amarabad[129] in sub-region A informs us that a certain Mallisetti met an expenditure of 30 _mādas_ towards the charges for constructing a bund of a tank belonging to Swayambhudeva. Similar evidence comes from an inscription dated to 1272 A.D. found at Attirala in sub-region D which records that the residents of Pottapinadu met in the premises of Parasuramesvara temple at Attirala and they decided to raise on _māda_ from every village in the district to meet the expenditure for constructing an embankment on the side of the river Cheyyeru in order to prevent the damage to the temple from the floods. Another inscription dated to 1293 A.D. from Tripurantakam[130] in sub-region B refers to the cost of construction of two tanks in the village of Pedapulacheruvu. The inscription also mentions that a certain Reddy had spent 241 golden _Gadyānās_. for building a tank called _Kumārasamudra_ and one lady Potasani had spent 156 golden _Gadyānās_ for building another tank called _Tripurasamudra_ at the same place.

The evidence from the above inscriptions reveals that the amounts were spent by individuals and the cost in each case varied depending upon the quantum of the work done. As there was no unitary rate available for a standard quantum of work mentioned in either literary or epigraphical source, we can not assess the exact cost involved for the execution of a particular work. The cost included the payment towards the wages of the people, both technical and non-technical, engaged for the supervision and digging and bunding; the charges for the bullock carts engaged and the expenditure incurred towards the purchase of necessary material in this regard. In the absence of the evidence of the cost of the construction of tanks taken up by the state, it can be fairly surmised that all the above expenditure might have been met in kind or land. In one inscription[131] it is mentioned that Kakatiya Ganapatideva granted lands to the priest Manchanarya for the construction of a fine tank.

Big hydraulic works required expert people and one such was called a Jalasutrada. Though we do not have any direct reference to them from Andhradesa, an inscription from contiguous region or Karnataka dated to 1388 A.D., speaks about the accomplishments of the hydraulic engineer, Jalasutrada. Singaya Bhatta who was the master of ten sciences, dasavidyāchakravarti. The inscription further mentions that he led the river Pennar, through a channel from Kattudi to the Siruvella tank at Penugonda in sub-region D and gave it the name of Pratapa Bukkaraya Mandalakaluva.[132] The Porumamilla Tank Inscription[133] of the same time also mentions the requirement of a Brahmin who was well versed in Pathas-sastra i.e., knowledge in hydraulics. Based on the above information we can surmise that the Kakatiya Kings who built massive dams at Palampet, Ghanpur, Pakhal and Lakhnavaram seem to have utilised the services of experts in hydro-technology.

The construction of large tanks and big dams of the Kakatiya period further indicated the involvement of different social groups. These specialised groups engaged in building large tanks and irrigational works were called Upparas and Vaddars. Some records from Nellore district provide information in this regard. A Machavaram record[134] of the 16th century A.D. mentions that some grains were collected from the farmers who raised crops from the wet lands that were distributed water from the tanks of Machavaram, Kandukuru, Mopadu and Kondamudempalli. The same record also says that the grain was to be given to the people called Upparas, Vaddars and Pedabōyas, who were looking after the works of digging, maintenance and repairs to the tanks. Even today the same people are largely engaged in major irrigational projects in Andhra Pradesh. These people temporarily pitch up their tents at the work spots and stay there until the work is completed and after that they return to their native place and attend to agricultural work. For the maintenance of such people, land grants called dasabandha[135] were given. An inscription dated to 1387 A.D. from Mareddipalli in Anantapur district of sub-region D, refers to a dasabandha grant to two persons who dug a feeder channel to a tank of that village from the rivulet Chitteru.[136]

The above study reveals that natural irrigation by way of run off-storage system was practiced at some alluvial pockets in Period I. During Period II, in order to have more secure supply of water, the people exploited ground water by diggiing permanent wells and tanks for the first time. Techniques of cutting through rock to top acquifers were the innovation of the period as applied at Thotlakonda in sub-region C. These irrigational works were built with limited technology financed by people at local, regional and central levels. A further development in building technology was observed during Period III in the form of excavatiing large scale tanks with canals and control systems. Spread of irrigation tanks in almost all sub-regions has been noticed.

The evolution of technology of the irrigation structures of Period IV reveals that the irrigational works were built by the Kings, ministers, feudal chiefs and individials. The irrigation structures included wells, tanks, lakes, canals and sluices. During stage I of the period, irrigation was carried out by wells, tanks and canals. During stage II, major hydro-technological projects were taken up in the whole of Andhradesa. Local bodies had also contributed for building and maintenance of these structures. A major change from stage I to II was selection of hilly tracts to locate large tanks by building massive earthen dams in between the hills. The bunds were built by earth and sometimes pitched up with stones. Trees were planted on the bunds to protect them from erosion. Lengthy canals with distributary channels were connected to the stone built sluices of the tanks. Canals were also dug from rivers and rivulet to feed the tanks. Canal bunds were lined with stones. Major irrigational works and canals are located in sub-regions B and D. Wells were also lined with brick during thiis period. Water lifting devices like ētam and rātnam were employed to draw a large quantum of water on economical basis. Experts in hydro-technology and specialised groups for digging and making embankments were engaged. During the period a large area of land was brought under active cultivation by building many irrigational structures throughout Andhradesa. Thus in a study of the evolution of the building technology of irrigation structures it can be concluded that simple and limited technology was available for protohistoric period when water was used for irrigation purposes by run off storage system.

During Period II, a notable development in water supply and storage systems was observed in the excavation of wells and tanks which were encased with bricks and cordoned with high bunds repectively. When compared to the earlier dependence on natural water sources in Period I, these were definitely a marked achievement. A further improvement in water supply was observed at a good number of habitations situated on hills. To conserve the water for further use, where natural water sources are within their reach, the people excavated tanks and cisterns in hard rock as seen at Thotlakonda, Pavurallakonda, Gopalapatnam and Bavikonda. The technological development in metallurgy also facilitated in manufacturing iron and steel implements used to excavate the hard rock. A good number of wells and tanks were also excavated as small scale water works continued to be supported by royalty and wealthy individuals who had the services of specialists at their disposal.

Most significantly, many of the tanks built or excavated in early medieval times in Andhradesa are still in use irrigating several acres of lands as noticed at Tummalagudem and Gandharikota in sub-region A; Turimella in sub-region B and Avilala, Chilamakuru, Gudimallam and Kondapalli in sub-region D. Noteworthy progress had been made in the field of irrigation technology in Period III in providing large scale water controls, in the form of especially tanks and their discharge channels.

The culmination of irrigation technology in Period IV has to be related to the state's ability to spend large amounts of money on these installations, with the help of both technical and non-technical people. Thus, the final operation of hydraulic installations at huge lakes like Palampet, Lakhnavaram, Ghanpur, Bayyaram and Pakal are a few examples which help us assess the extensive basis of water storage that was developed and these can be said to be 'object lessons' to modern irrigation engineers.

FOOTNOTES

1. T.M.Srinivasan, Irrigation and Water Supply (in South India 200 B.C.-1600 A.D.). Madras, 1991, p.1.

2. Andrews Sherratt, 'Water, Soil and Seasonability in Early Cereal Cultivation', WA, vol.11, no.3, p.321.

3. Sherratt, Ratnagar , Enquiries into Political Organisation of Harappan Society. Pune, 1991, p.8.

4. Ibid. p.17.

5. Rgveda. VII.49.1.

6. Yajurveda. XVI, 37-8.

7. Rgveda. I.30.1; I.55.8.

8. Ibid, X, 101-5.7.

9. Ibid, V, 85.3.

10. Ibid. VII, 18.8,9.

11. Ibid. III, 32.15.

12. Ibid. X, 93.3.

13. Ibid. X, 101.5,7.

14. Astādhyāyi.III. 3-12.3 also see V.S.Agrawala, India as Known to Pānini. Varanasi, 1933, p. 204.

15. M.K.Dhawalikar, H.D.Sankalia and Z.D.Ansari, Excavations at Inamgoan. vol.1, pt.1, Pune, 1988, p.248.

16. The sites are listed based on the survey reports on neolithic and chalcolithic sites in Andhra Pradesh that are available with various departments such as the State Department of Archaeology and Museums, Hyderabad, Archaeological Survey of India, South-Eastern Circle, Hyderabad, and Birla Archaeological and Cultural Research Institute, Hydedrabad. See also V.V.Krishna Sastry, The Proto and Early Historical Cultures of A.P.. Hyderabad, 1983, pp.1-42.

17. N.R.Banerji, Iron Age in India. Delhi, 1969, p.210. Also see K.R.Srinivasan, 'A Survey of South Indian Megaliths', AI, no.9, p.109.

18. B.K.Gururaja Rao, 'Socio-Economic Life in Proto-historic Karnataka', in A.V.N.Murthy and B.K.Gururaja Rao (eds.), Rangavalli: Recent Researches in Indology (S.R.Rao Felicitation Volume), Delhi, 1983, pp.59-62.

19. E.H.Hunt, 'Hyderabad Cairns and their Significance', JRAI, vol.24, p.140.

20. T.M.Srinivasan, 'Water lifting Devices in Ancient India', IJHSC, vol.5, no.2, p.381; See A.Sundara, The Early Chamber Tombs of South India. Delhi, 1981, p.217.

21. V.V.Krishna Sastry, Op. Cit.. 1983, p.103.

22. Ibid, p.103.

23. R.Subrahmanyam, 'Secular Remains at Nagarjunakonda', JAHRS, vol.XXXVIII, pt.IV, 1987, p.37.

24. E.Siva Nagi Reddy, 'Survey Report on Megalithic Site at Damaravai in Warangal District. 5-7 June 1993; (Typed) available with Deptarment of Archaeology & Museums, Hyderabad.

25. Arthasastra. II.24-18; II.38-4, III.8-2; III.9-3; III.9-33.

26. Ibid. II.1-20.

27. Sibesh Bhattacharya, 'Land, Soil, Rainfall Irrigation in Arthasastra of Kautilya', IESHR, 1978, p.217.

28. V.K.Jain, 'Dynamics of Hydraulic Activity in Mauryan and Post Mauryan Times', PIHC, 52nd Session, Delhi, 1991-92, pp.162-168.

29. Arthasastra. II.24.1.

30. Ibid. II.35.3.

31. Ibid. III.8-2.

32. V.K.Jain, Op. Cit.. 1991-92, p.165.

33. Wittfogel Proposes two types of farming viz., hydro-agriculture and hydraulic agriculture. According to him, hydro-agriculture represents minor irrigation works such as wells, ditches which can be built by local individuals fairly or a group of people whereas the hydraulic agriculture is carried out under the large scale irrigation works such as tanks, channels which require organisational patterns and social control of the State. Summarised from Karl Wittfogel, Oriental Despotism: A Comparative Study of Total Power. New Haven, 1959 (Reprint), pp.3-12.

34. Ibid. p.18.

35. R.Thapar, From Lineage to State. Delhi, 1984, pp.75-76.

36. V.K.Jain, Op. Cit.. 1991-92, pp.162-168.

37. K.Nanda Kishore, 'Hydraulic Agriculture in Peninsular India c.300 B.C.-1300 A.D.', PIHC. Waltair Session, 1979, p.211.

38. R.S.Sharma, Indian Feudalism (c.300-1200 A.D.), Calcutta, 1975, p.42.

39. EI, vol.VIII, Inscription no.6.

40. A.Senart, 'The Inscriptions of the Caves at Karle', EI, vol.VIII, p.66.

41. Ibid. Inscription no.15.

42. D.C.Sircar, Select Inscriptions. vol.1, Calcutta, 1970, p.161.

43. H.P.Ray, Monastry and Guild. Delhi, 1986, p.93.

44. EI, vol.XIV, p.153.

45. J.Allan, Catalogue of Coins of Ancient India. London, 1936, pl.XXXII.

46. Cullavagga. v.62.

47. Gāthāsaptaśati. 490.

48. H.P.Ray, Op. Cit.. 1986, p.4.

49. V.V.Krishna Sastry, Op. Cit.. 1983, p.141.

50. Ibid, p.143.

51. Ibid. p.142.

52. G.Yazdani, 'Excavations at Kondapur (c.250 B.C.-250 A.D.)', ABORI. vol.XXII, 1941, pp.171-185.

53. IAE. 1978-79, p.2.

54. Robert Miller, 'Water use in Syria and Palestine from the Neolithic to the Bronze Age', WA, vol.11, no.3, p.333.

55. ARAP. 1991-92 (cyclostyled), pp.12-13.

56. ARAP. 1992-93 (cyclostyled), p.16

57. V.V.Krishna Sastry,' et al, Thotlakonda (A Buddhist Site in Andhra Pradesh), Hyderabad, 1992, p.15.

58. N.R.V.Prasad, Bavikonda. (Buddhist site in North Coastal Andhra), Hyderabad, 1994, p.40.

59. V.V.Krishna Sastry, et al, Op.Cit.. 1992, pp.55-57.

60. C.S.Upasak, Dictionary of Early Buddhist Monastic Terms. Varanasi, 1975, p.43.

61. S.Nagaraju, Buddhist Architecture of Western India. Delhi, 1981, p.107,206 & 221.

62. N.R.V.Prasad, Op.Cit. 1994, p.40

63. EI, vol.XIV, p.153.

64. M.Ramudu, 'Tank Irrigation under the Rayas of Vijayanagara: Some Theoretical Considerations', PAPHC. 13th Session, Srisailam, 1989, pp.76-79.

65. I.S.Farrington, 'The Archaeology of Irrigation Canals with special reference to Peru', WA, vol.11, no.3, p.287. He further says that 'the construction of a canal must be exact because lack of awareness of, or inattention to the principles of open channel hydraulics by either boulders or operators may result in severe erosional or depositional problems. Water losses from an irrigation system generally occur during conveyance. The construction, shape, form and gradient ' of an archaeological canal provide a valuable record of its engineering qualities and of the hydrology of the irrigation-agricultural system.... The construction technology of canals and other irrigation devices is critical to the efficient operation of a system, for a canal must be built precisely to carry a set amount of water at, permissible velocities with little or no damage to itself. This is a summarised version of his above cited article.

66. R.Subrahmanyam, Op. Cit.. 1987, pp.36-38.

67. I.K.Sarma, 'Ancient Canals', JIH, vol.XL, pt.ii, pp.307-309.

68. R.Subrahmanyam, Op. Cit.. 1987, p.38.

69. Ibid. p.40.

70. Ibid. p.40.

71. P.Tejaswini, 'Social Groups and Economic Change 7th-13th century A.D.', in Aloka Parasher-Sen (ed.), Social and Economic History of the Deccan Some Interpretations. Delhi, 1993, pp.158-160.

72. J.Krishna Prasad Babu, 'Social and Economic Change (A.D. 400- 700)', in Aloka Parasher-Sen (ed.), Op. Cit.. 1993, pp.115-134.

73. R.N.Nandi, 'Growth of Rural Economy in Early India', Presidential Address, PIHC. 44th Session, 1984, Annamalai Nagar, pp.1-72.

74. EA, vol.11, p.15.

75. SII. vol.XII, pt.2, Inscription no.5.

76. EI, vol.XIII, p.145.

77. EI, vol.XXIX, p.160.

78. SII, vol.X, no.603.

79. Ibid. no.3.

80. ARE, 1903, no.226.

81. Ibid. 1937-38, no.188.

82. SII, vol.XIV, no.44.

83. Rajan Gurukkal, 'Aspects of Reservoir System of Irrigation in the Early Pandya State', SIH, vol.2, no.2, pp.159-162.

84. Referred to in M.S.Randhawa, A History of Agriculture in India, vol.1, New Delhi, 1980, p.482 also see R.Thomas Rosin, 'The Tradition of Ground Water Irrigation in North Western India', Human Ecology. vol.21, no.1, 1993, p.54.

85. ARAP. 1990-91, pp.11-20 (cyclostyled).

86. Referred to in K.Krishna Murari, The Chalukyas of Kalyana. Delhi, 1977, pp.191-195 and also see D.C.Sircar, Indian Epigraphical Glossary. Delhi, 1966 (SV.Karana).

87. SII, vol.VIII, pt.iii, p.425.

88. Nāradasmrti. XI, 18-20.

89. Mitakshara. II-156.

90. Referred to in K.Krishna Murari, Op. Cit.. 1977, p.194.

91. Referred to in P.V.P.Sastry, The Kakatiyas of Warangal. Hyderabad, 1978, p.204.

92. Y.Gopala Reddy, 'Agriculture under the Kakatiyas', Itihas. vol.1, no.1, 1973, p.59.

93. £1, vol.XIV, pp.99-108.

94. ARE, 1941-42, no.9.

95. B.N.Sastry, Kanduru Chōdula Charitra Saṁskriti Sāsanalu. Hyderabad, 1984, p.205.

96. SII, vol.X, no.151.

97. Ibid. no.269.

98. Ibid. no.275.

99. EI, Vol.11, p.17; also see Sanjukta Datta, 'A Note on Udakabandha', PIHC. 53rd session, Warangal, 1992-93, pp.676-679.

100. ARE, for 1931-32, no.190.

101. HAS, no.13, p.49.

102. Ibid. p.49.

103. Y.Gopala Reddy, Op. Cit.. 1973, p.58.

104. EI, vol.III, pp.88f.

105. For more details of tanks excavated during the period see Y.Gopala Reddy, Op. Cit. . 1973, pp.58-60.

106. EI, vol.III, pp.88f.

107. ARE, 1960-61, no.100

108. Ibid. 1911-12, no.404

109. These works include, G.Yazdani, Op. Cit.. 1960, Y.Gopala Reddy, Op. Cit.. 1973; P.V.P.Sastry, Op. Cit. 1978; and K.Radhakrishna Murthy, Socio Economic Conditions in Medieval Andhradesa, Tirupati, 1987; A recent study by T.M.Srinivasan, Op. Cit.. 1991 embodies some aspects on the method of construction of a Kakatiya tank at Palampet only. Much light on Andhradesa could not be shed probably because his concern was for South India as a whole.

110. P.V.P.Sastry, Op. Cit.. 1978, p.205.

111. Ibid. p.205.

112. SII, vol.X, no.448.

113. P.Sreenivasachar, Ramappa and Other Temples at Palampet. Hyderabad, 1953, Verse 48 of Inscription.

114. G.Yazdani, 'Ramappa Temple'. MASI. no.6, Delhi, 1954, p.1.

115. K.Radhakrishna Murthy, Op. Cit. , 1987, pp.148-149.

116. HAS, no.13, p.134.

117. Ibid. p.82.

118. CTI, vol.III, p.40.

119. Y.Gopala Reddy, Op. Cit. 1973, p.62.

120. G.Yazdani, Op. Cit. 1960, p.682.

121. For more details on canals of the period, see Y.Gopala

Reddy, Op. Cit. 1973, pp.63-64.

122. K.Radhakrishna Murthy, Op. Cit.. 1987, p.148.

123. HAS, no.13, p.81.

124. SII, vol.IX, pt.i, no.116.

125. Ibid. vol.V, no.213.

126. HAS, no.13, p.24.

127. Ibid. no.18, Ng.3.

128. T.M.Srinivasan, Op. Cit. 1991, pp.185-186.

129. HAS, no.19, p.40.

130. fill, vol.X, no.475.

131. EI, vol.XXXIV, p.61.

132. EC, vol.X, Gb.no.6, p.212.

133. EI, vol.XIV, pp.99-108.

134. NDI,vol.II, p.1089.

135. V.R.R.Dikshitar, 'Dasabandha', JIH, vol.III, 1934, p.174.

136. ARE, 1918, no.819.

CHAPTER III: POLITICAL SPACE

III.11 DEFENCE STRUCTURES

CHAPTER III POLITICAL SPACE

III.1 DEFENCE STRUCTURES

'Political Space' here means the actual place where political organisations operate the process of decision making[1] and regulate the use of force and leadership.[2] The early Indian text on polity, the Arthaśastra enumerates that protection of the kingdom and his subjects was one of the main duties of the King.[3] The desire to defend the people from external dangers led to the building of forts in ancient India. Defence was one of the functions of the forts. In this context, political space physically embodies the seats of power, i.e., defence buildings and their accessories. The discussion on the evolution of building technology of the defence structures begins with understanding the meaning of defence mechanism.

Defence is defined as any action that constitutes resistance against attack. It is also regarded as a need requiring the erection of a physical barrier against aggression. This may include the protection of gardens and fields, particularly during the planting and growing seasons, the protection of stored food, the protection of human habitation areas and of animals, the protection of tools, working areas, such as raw materials and route of communication for trade.[4] Early prehistoric people built their dwellings on stilts, piles, on trees or platforms and raised terraces as protection against wild animals and intruders. It can be regarded as fairly well-established that the early Homo Sapiens in the Upper Paleolithic times must have been living 1n social groups and that these groups probably defended some kind of territory against intrusion.[5] In the beginning the presence of traps, pitfalls and barricades along the approaches to a settlement may have been thought of as sufficient to impede attackers and give a warning to the defenders.

In general, however, the temporary habitation areas of mobile hunters and gatherers were not demarcated and were no more than imaginary lines drawn between natural features. A settlement could most easily be protected if it is located in, or near, a naturally defended position, as for instance, on a higher ground, amongst rocks, in dense vegetation or on river bends. In prehistoric societies, as Ruth Tringham,[6] points out, the minimum requirements of the demarcation of a habitation territory may have been met by natural boundaries. Where there were no natural barriers available, the minimal means of demarcation appear to have been supplemented by an artificial demarcation of a barrier. It is further likely that there were measures taken against threats and aggression by animal or human agencies, and that they had a defensive or protective function in addition to being a passive demarcation of the habitation. Clear examples of such kinds of defence can be identified as an island surrounded by a fence,[7] a hilltop or promontory settlement surrounded by a ditch, bank or wall,[8] a settlement comprising concentric circles of houses which could further be surrounded by a strong physical barrier[9] or a mound surrounded by a physical barrier. The existence of these in the prehistoric societies may be attested through the excavation of ditches and moats surrounding habitation sites. Their intended function could be either to protect people from animal or human attack, or, only to demarcate the settlement. The width and depth of these would also depend on the soils or rocks into which the ditches were dug and the tools used in their excavation. In many societies the provision of walls around the dwellings and courtyards served to retain the privacy of their occupants which could also have been used as a means of regulating social relations and preventing the entrance of undesirable visitors into certain sections of a dwelling or settlement. Finally, environment could have provided natural advantages for defence and this must have influenced the choice of the site for a settlement. The reasons that have influenced people to defend a particular place or territory from time immemorial are therefore, likely to be complex to explain and analyse. According the Rowlands,[10] the degree to which settlements may be defended seem to depend on the following four facts: (a) their permanance, (b) the availability of alternative refuges, (c) the intensity of warfare, and (d) the value attached to staying in and defending a settlement by its inhabitants.

Gordon Childe's main criteria to distinguish the early city from a pre-urban settlement was the absorption of a major share of surplus by the non-producing city-dwelling ruling class, which in turn, conferred substantial benefits upon them in the planning and organisation of the city. The institutionalisation of warfare along with the increasing need to protect the urban settlements finally led to the emergence of fortifications in ancient times and this was true of ancient India as well.[11] The planning of the defence buildings mainly depended on the availability of building materials 1n the area. Variation in the pattern of planning of defence buildings was, however, chiefly due to local limitations of the geographical layout of where the forts emerged. It has been suggested by scholars that the technical skills and materials used for construction of habitations have a tendency to be adapted for the needs of defence.[12] In some cases, the defence of settlements might require the use of different materials than normally used for building habitations. The Mentifiq tribe of the Euphrates delta, for instance, lived 1n reed huts that were vulnerable to fire but they constructed small mud forts beside each home for protection against attack.[13]

Physical barriers which could be used for defence 1f necessary, also served as a clear demarcation between the administrative, political, religious and the market areas of a settlement.[14] Scholars like Trigger[15] have opined that fortresses, city walls and enclosures around public buildings indicate a concern with defence that was already present 1n tribal societies but, which in the early civilisations, was directed increasingly against potential internal as well as external enemies. These structures were evidently designed to impress foreign enemies as well as potential theives and rebels with the power of the authorities who were able to build and maintain them.

In focussing on Andhradesa, archaeological investigations have revealed that human habitation 1n the Palaeolithic period was concentrated on the banks of rivers, rivulets and forest areas and 1n natural caves and caverns. These natural caves served both as habitation areas and for defence purposes. In pre and proto-historic societies the defence structures must be seen necessarily as part of the habitation buildings and the details of the latter have been discussed above [Chapter II.1].

Recent excavations conducted at Muchchaatla Chintamanugavi[16] in sub-region D has revealed a prolonged occupation of the caves by men inhabiting the Mesolithic period. In the next stage, the Neolithic folk mostly selected terraces of the hill for settlement in the beginning. After acquiring adequate knowledge in food production the people had to live on a more or less, permanent basis in open areas near their agricultural fields. Some times, they lived in pits and it might be interpreted that this was done so that they would protect themselves from wild animals. Excavations at places like Utnoor,[17] Nagarjunakonda,[18] Gandlur[19] and Veerapuram[20] have attested to this kind of pit dwelling activity during the Neolithic phase. These pit dwellings helped to protect them from nature as well as from predators and other human communities. However, these early examples do not help us to clearly distinguish between the natural and built areas. Further, whether they were exclusively made in this way for defence against enemies is difficult to suggest because political activity was still organised by the tribal community as a whole and therefore, to differentiate between the social and political areas cannot be envisaged. It can thus be surmised that caves provided 'natural protection' to early man and later on, when man began to make pits, they served both as dwellings as well as protective areas. In the Lower Krishna Valley a number of Neolithic sites have been located on the terraces of granited hills. The locations indicate that the Neolithic people also selected such naturally protected areas surrounded By ranges of boulders and hills for their habitation.[21]

In early Andhradesa, the idea of creating a fence for a cluster of houses or burials can be found from Period I of our study. The construction of a barricade or a fence with wooden posts for cattle penns in the Neolithic context has been well-attested at Utnoor and Nagarjunakonda.[22] In Period I and II of the Neolithic site at Utnoor, post-holes implying stockades have been noticed suggesting barricades for small cattle penns without any additional support. A fence of upright wooden posts must have served several purposes, to control the movement of domestic animals, to protect them from wild animals, and also to defend the inhabitants from sporadic raiding or surprise attacks. Fences also served as demarcation lines but may not have been effective barriers against a concentrated human attack.[23] One of the methods used to strengthen wooden fences in prehistoric temperate Europe was to construct a bank of earth backing on to the fence.[24] At Jambuladinna[25] in sub-region D, two small hillocks locally called Chinnadandukonda and Peddadandukonda, about 1 kilometre east of the village were noticed. Here, were found manmade lincets with crudely fabricated retaining walls that dated back to Neolithic times. The occurrence of Neolithic greyware, stone artifacts and stone blades enable us to fix the chronological horizon of this site. These lincets notably served both residential and defence purposes. Similar structures built around habitations and burial complexes have been seen at Chinnamarur[26] and Valigonda[27] and a group of hutments at Chagatur.[28] These examples clearly show that not only the Neolithic folk, but the Megalithic people in Andhradesa too had constructed barricades around their dwellings for safety and protection. These incipient walls were further perfected by the inhabitants to plan a dry masonry wall as at Chagatur in sub-region A.[29] In course of time these early protective walls gave way to the construction of fortifications during the early historic period in Andhradesa.

Defence mechanism began to proliferate in settled societies. The reason for this is that political authority now had to be exerted by a State. In order to protect people from other States, new defence strategies were evolved. In this context aggression definitely created an environment 1n which new forms of defence associated with different technical skills and materials had to be adopted, particularly in the face of an enemy using new military tactics and weapons.[30] The earliest evidence of fortifications, it has been pointed out, are a tower and wall that were excavated in the pre-pottery Neolithic village at Jericho.[31] It has been suggested that the fortifications here were constructed to control trade and resources and also for the demarcation of a market area as early as 7000 B.C.[32] These early fortifications were made of mud brick followed by baked brick during the mature phases of the Bronze Age. Barriers of stone, on the other hand, were not preferred because they took much longer to construct and required greater manpower to quarry and manufacture. Apart from exceptional settlements in Iberia and Greece,[33] dated to circa 2300 B.C. by C14 method, where complex encircling bastioned walls of stone were built, factors of time along with skill and manpower seem to have prevented the exploitation of stone in the construction of demarcation barriers in Europe until the Iron Age and the Roman conquest. This was when there was a need for strong indestructible walls to defend against large scale human attacks with a complex war machinery.[34]

In the Indian context the Harappan Civilization of the third millennium B.C. gives the earliest example of defence structures. A recent study suggests that the buildings of the citadels were confined to the large centres of dominance in the core area and to those centres established amongst 'alien' peoples.[35] At fifteen Harappan sites such as Mohenjodaro, Harappa, Gonweriwala, Banawali, Kalibangan, Milanthal, Rakhigarhi, Balakot, Sotka-koh, Sutkagen-dor, Desalpur, Kotara Junikaram, Dholavara, Surkotada and Lothal there were citadels.[36] A citadel 1s defined as a fortress or castle near a city intended to keep the inhabitants in subjection, or to provide a final point of defence. At Mohenjodaro and Harappa the citadel was a parallelogram whose buildings were laid on mud or mud brick platforms respectively. Wheeler has unearthed at these places strong and massive fortifications built of hardened earth and mud bricks, with high strong and wide ramparts.[37]

Ratnagar argues that citadel sites represent the emergence of small and independent seats of power at safe distance from the core zone, when the Harappan states or ruling houses branched and fissioned or disintegrated into small units. In such situations some ambitious individuals cast off their ties with the centre and built their own centres in emulation of the central seats of domination.[38] The Harappans surely had defence in mind when they provided such massive walls for fortifications. The enclosures with adjacent towers such as we see at Harappa, Mohenjodaro, Kalibangan, Banwali, Suthagena-dor, and Surkotada had definitely served defence purposes. At Banawali, the peripheral town wall also had rectangular bastions, an elaborate towered gateway 1n the east and a surrounding moat.[39] Kesarwani who has studied the Harappan gateways admits that the elaborate south gateway at Surkotada shows provision for very closely guarded entry.[40] Here, the entry was gained by a short flight of steps, a right angled turn, then mounting of a ramp, at the top of which another right angled turn gave access to a second flight of steps and a 1.7 meter wide entrance way flanked by a guardroom. At the Sutkogen-dor citadel the southern entrance was flanked by massive stone towers.[41] The citadels of the Harappan sites were militarily defended at high places which saw ceremonial storage and other activities and contained presumably elite residences.[42] On the India sub-continent these above examples are some of the best illustrations of the early evolution of defence structures. In contrast to the Indus Valley, the Ganges valley from the second millennium B.C. also witnessed the construction of different types of defence buildings. However, these descriptions are based on literary sources.

It is also felt necessary to introduce the literary references to fort constructions in order to understand the common fund of knowledge that the early Indians shared. Early literature provides sufficient information on the defence buildings right from Rigvedic times onwards. According to this early literature the defence buildings would mean all kinds of structures made prominently for military purposes. This includes accessories such as earthen ramparts, enclosure walls, moats, gateways, guard-rooms, etc. The Rig Veda mentions the words pur, durga and dehi to mean rampart, fort, stronghold or defence wall.[43] Villages, towns and cities with hundred enclosures and fortifications have been referred to.[44] It also mentions forts made of asmamayi (Stone) and ayasi (Iron).[45] The Atharva Veda[46] points to the existence of the Vapra or rampart. The Rig Veda further mentions Agni and Indra as destroyers of forts and invokes them in several hymns to display their process in order to destroy the forts of the dasas and asuras. It calls Indra as Purandara[47], i.e., the demolisher of the forts. The Atharva Veda describes forts of Gods as 'impregnable with eight. circles and nine portals'.[48] Panini mentions terms for towns, town planning, fort, rampart, moat, gates and watch towers.[49] According to him the most important parts of a city were moats, ramparts and gates which served as the main defences. The plan of the city was usually square or rectangular, pierced with four gates, one in the middle of the wall on each side facing the four quarters.

In the Deccan the earliest mud fortifications can be dated to between 1500 B.C. - 1200 B.C. 1n the Jorwe phase at the sites of Diamabad[50] and Inamgoan.[51] These have been reported as the earliest attempts at the construction of defence walls around the habitational area South of the Vindhyas. At Inamgoan, besides houses, there were some other structures which were exposed during the course of excavations. These included a ditch and the fortification wall around the site, a Jetty on the river front, and an embankment and irrigation channel which are all specimens of public works. The excavator opines that the ditch was probably dug 1n period II (c 1400 - 1000 B.C.).[52] since the stone clusters which probably represent bastions overlay the Malwa level of habitation. The ditch measured 195 metres long and 20 metres wide. It is likely that a mud wall was constructed of stone rubble almost parallel to the ditch running north-south. The heap of stones found here were considered the remains of a bastion of the fortification wall. It is likely that the wall itself was of mud but, at regular intervals, had bastions built of stone rubble set in mud mortor. A massive wall which measured 240 metres in length and with an average width of 3 metres, was constructed for protecting the habitation designated as Inamgoan-I from river floods. The existence of these defence structures suggested by a moat and fortification, have led Dhavalikar[53] to opine that the Chalcolithic settlements represent a strong militaristic nature. At another Jorwe phase site of Diamabad,[54] a defence wall around the habitation area also attests to the above view.

Around the 6th century B.C. after the rise of early State 1n India, stone walls around the political centres began to be regularly built. The earliest architectural remains of the historical period in India which throw some light on this type of evidence is the fort wall of Rajagriha[55] dated to the time of Ajatasatru which was built of heavy boulders. The wall is faced with rough massive blocks in dry stone walling and has occasional salient bastions. The outer most wall may date back to the 6th century B.C.[56] According to Ghosh[57] after the downfall of the Harappan civilization in about 1500 B.C., India appears to have lapsed into a village economy since there are no significant architectural remains giving information on forts. Ancient Rajagriha therefore provides the earliest evidence of the kind in the Ganges Valley. These fortification walls at Rajgir have bastions at intervals and extends about forty-five kilometres along the crest of the surrounding hills. The bastions are built of massive pieces of undressed stone, one to two metres in length, carefully fitted and bonded together. No mortar, cement or clamps of any kind have been used in the stone work. These cyclopaen walls, though devoid of any aesthetic merit, are one of the architectural wonders of India.

That there were many such forsts is evident from literary references to them. Buddhist literature provides copious references to defence buildings. The Digha Nikāya mentions a border city defended by strong ramparts and towers and provided with a single gate. This leads us to believe that cities of strategic importance were strongly fortified.[58] The Samvutta Nikāya and the Anguttara Nikāya refer to forts.[59] The Jatakas also suggest the existence of forts around the towns and cities. The towns as mentioned in the Jataka tales were surrounded by walls and moats interspersed with gates and watch towers while the villages were sometimes protected by bamboo palisades. The Mahaummaqqa Jataka[60] points out that the city of Mithila was surrounded by a rampart with watch towers at the gates. The rampart was provided with three moats, and it was outside of the ramparts that a water moat, a mud moat and a dry moat existed. The Milindapanha[61] also refers to different types of moats like the deep moats and triple moats. The commentary on the text informs us of an utkinnatara udaka or a water moat, kaddamma or a mud moat and sukha or a dry moat. The same text also describes the nagara. called Sagala with a rampart, watch tower, and city gates. It 1s significant to note that the Milindapanha preserves an account of how a city was to be built.

Apart from the early Buddhist texts, literary references on fortifications some valuables details on types of fort constructions are available from Kautilya's famous treatise on polity, i.e., the Arthasastra.[62] As a political strategier he realised the importance of a fort in its true sense. According to him, at all the four quarters of the boundaries of the empire defensive fortifications against an enemy in war were to be constructed on grounds naturally best fitted for the purpose. These have been described as a water fortification (audaka) which was like an island in the midst of a river, or a plain surrounded by a low ground, a mountainous fortification, parvata which was a rocky tract or a cave, a desert fort dhanvara. which was situated in a wild tract devoid of water and over grown with thickest growing in barren soil or a forest fortification, vanadurqa. which was to be full of wagtail; khajana. water and thickets. Of these Kautilya preferred a river or mountain fort. For Kautilya, the fort occupied a central place in his saptanga scheme as an element of the state and he enjoins upon the King to rear up adequate defence on all four quarters of the boundaries of the Kingdom.[63] Another notworthy work on society and polity for the early historic period is the Manusmriti.[64] Manu also mentions that hill forts were the best ones. Manu was specific in mentioning that a King should build a town with fortress for safety.[65] On close observation of the above literary references it has been observed by us that the defence buildings in early Andhradesa were built strictly following the textual prescriptions. Most of the early historic fortifications followed these specifications. Some important ones reported from regions contiguous to Andhradesa are found at Sisupalgarh[66] in Orissa and Sannathi and Banavasi in Karnataka.[67] For convenience, the evolution of building technology of the defence buildings in Andhradesa can be studied period wise taking the evidences from all sub-regions in account. Defence buildings were made with mud in the beginning and then strengthened and perfected with a better technology by constructing them with brick and stone.

The earliest fortifications of mud, brick and stone in Āndhradeśa have been found at Kotilingala, Dhulikatta, Bodhan, Budigepalli, Vadluru in sub-region A, at Nelakondapalli, Veerapuram, Eeleswaram and Nagarjunakonda in sub-region B, at Dharanikota, Dantapura, Kotamitta, Puduru in sub-region C and at Satanikota in sub-region D [Map VII and Chart IIIB].

The forts of Period II in their first phase of construction were mainly of mud with earthen ramparts, which were strengthened by brick revetment or construction of brick walls over the existing mud walls. The plans of the forts varied from square to rectangular and elliptical to circular.[68] Rectangular forts have been noticed at Kotilingala, Dhulikatta,[69] Budigepalli,[70] Veerapuram[71] and Nagarjunakonda[72]. Only at Dharanikota[73] do we find a fort square 1n plan. The Elliptical plan was preferred at Satanikota[74] whereas it was circular at Kotamitta[75]. Forts built of mud and gravel as building material have been reported from Kotilingala,[76] Dharanikota,[77] Bodhan,[78] Vadluru,[79] Budigepalli,[80] Dantapura[81] and Nelakondapalli.[82] The brick forts of the period were seen at Kotilingala,[83] Eeleswaram,[84] Veerapuram,[85] Kotamitta[86] and Puduru. Stone forts were built in a limited scale as noticed at Satanikota and Nagarjunakonda only **[Chart III B].**

The fortifications were provided with moats dug into the ground or cut into the rock. Sometimes, the builders planned in such a way that the natural rivers or streams formed moats on one or two sides. Moats dug into the ground all around the rampart walls have been reported from Kotilingala, Kotamitta and Nagarjunakonda whereas the forts at Satanikota and Nagarjunakonda had rock-cut moats.

The associated structures of defence buildings of this period such as gates, guardrooms, bastions have also to be discussed as part of this building technology. The forts at Kotilingala, Dhulikatta, Eeleswaram, Kotamitta and Satanikota had gates and gateways provided to restrict and regulate entry of the people as a security measure **[[Chart III B].** The forts at Kotilingala, Dhulikatta, Eeleswaram, Satanikota and Nagarjunakonda had guardrooms. Buttresses or bastions have been reported from Kotilingala, Satanikota and Nagarjunakonda. The foundations of earthen and brick forts were built with randum rubble as seen at Kolilingala and some forts have been built directly on the sheet rock, a **feature observed at**

CHART III B

Period II: Defence Structures

S.No.	Name of the Site	Sub-region	Plan of Fort	Type of fort	Building Material	Associated Structure			
						Moat	Bastion	Gate	Guard Room
1.	Bodhan	A	O	Land Fort	Mud, Brick	√	-	-	-
2.	Budigapalli	A	X	Land Fort	Mud	-	-	-	-
3.	Dantapura	C	O	Land Fort	Mud	-	-	-	-
4.	Dharanikota	C	O	Land Fort	Mud, Brick	-	-	-	-
5.	Dhulikatta	A	X	Land Fort	Mud, Brick	√	-	√	√
6.	Kondapur	A	O	Land Fort	Mud	-	-	-	-
7.	Kotamitta	C	O	Land Fort	Mud, Brick	-	-	-	-
8.	Kotilingala	A	X	Land Fort	Mud, Brick	√	√	√	√
9.	Nagarjunakonda	B	X	Hill Fort	Mud, Stone	√	√	√	√
10.	Nelakondapalli	B	O	Land Fort	Mud	-	-	-	-
11.	Puduru	C	O	Land Fort	Mud, Brick	√	-	√	√
12.	Satanikota	D	C	Land Fort	Mud, Brick, Stone	√	√	√	√
13.	Sasanikota	D	O	Land Fort	Mud	-	-	-	-
14.	Vadluru	A	O	Land Fort	Mud	-	-	-	-
15.	Veerapuram	B	X	Land Fort	Mud, Brick	-	-	-	-
16.	Yeleswaram	B	O	Land Fort	Mud, Brick	√	-	√	√

Key:

Land Fort

Hill Fort

Water Fort

tfood Fort

Mud

Brick

Stone

Elliptical C

Circular O

Square T

Rectangular X

Satanikota and Nagarjunakonda. The forts were built on plains 1n the early phase of period II and in the second and last phase some forts were built on hills, as at Nagarjunakonda. The forts at Kotilingala, Dhulikatta, Bodhan, Kotamitta, Dharanikota, Dantapura, Puduru, and Nelakondapalli were built on the plains [Chart III B].

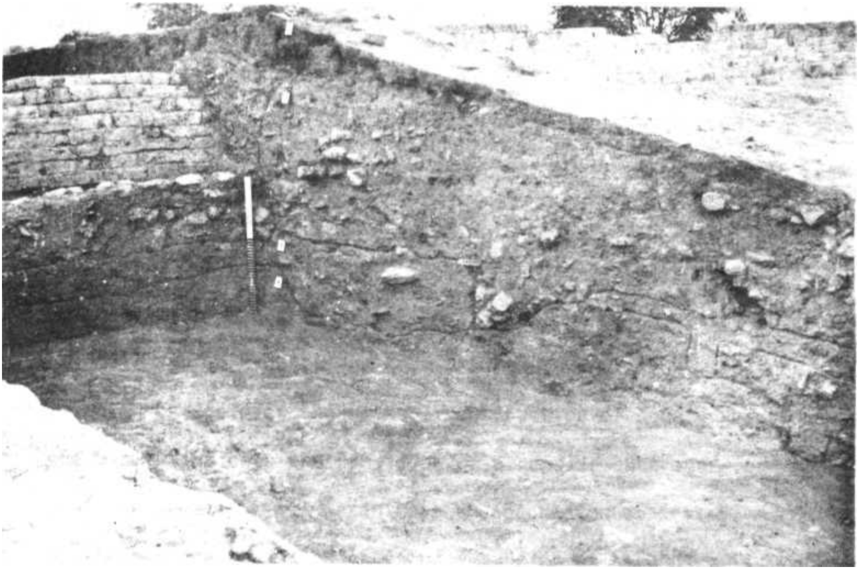
To understand the techniques, plan and strategies 1n fort making at greater depth we have to go into the details of some of the early fortifications in Andhradesa. The recent excavations conducted at Kotilingala in sub-region A have revealed a fortified city datable to the 4th-3rd centuries B.C. which continued its existence upto the 2nd century A.D. with two phases of construction. The first phase is characterised by a mud fort along with the occurrence of the coins of the pre-Satavahana Kings,[87] black and red ware datable from the 4th century B.C. to the 2nd century B.C. The second phase datable from the 2nd century B.C. to 2nd century A.D. has also yielded rich numismatic data and structural activity of the fort in brick. The rich cultural milieu and the fortification with bastions and guardrooms remind us of the towns of the Mahājanapada sites in northern India.[88] During the second phase some parts of the earlier mud fort were found to have been strengthened by bricks. This was a significant development in fort making as noticed at Kotilingala for the first time 1n Andhradesa [Plate X]. A compact rubble foundation to the fortification was also traced. The fortification wall running east-west with 11 courses of bricks built in offset fashion with mud mortar belonged to phase II, measuring a total length of 19 metres and a height of 1.10 metres. Another important structure was a bastion or watch tower at the south-east corner, rectangular in shape. This is also noticed for the first time 1n

Āndhradeśa as a technique in fort making. The size of the brick used was 59 x 29 x 8 cms. This is the earliest fortification so far reported from Andhradesa constructed with mud in its first phase and later strengthened and perfected by brick layers in the succeeding phase on a well laid foundations of rubble stones.[89]

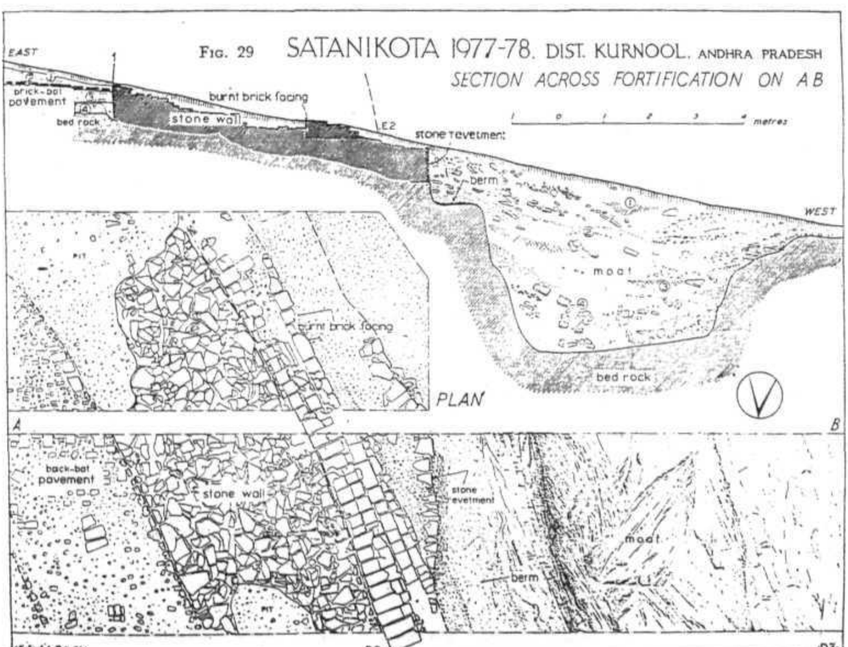
At Dharanikota[90] in sub-region C also several structural phases have been identified in the construction of the fort wall which served as an embankment cum warf connected to the river Krishna by digging a navigational channel. This is the earliest structural evidence of a port attached to a fort walled city so far reported from Andhradesa.[91] Similar evidence of an early historical wharf built of brick was found in the now defunct Rajbandar port on the Elephanta island dated to the 2nd century A.D.[92] At Dharanikota, the first phase was an earthen rampart [Chart III B]. In its phase II the earthen wharf was replaced by a brick one. A new ramp was provided on the embankment. Some structural modifications were made in phase IV. The fort was strengthened by providing a retaining wall of laterite blocks arranged on its top portion in phase V. The excavations at the same site yielded NBP ware, redware and iron objects along with brick structures from the early phase of period 1 A, datable to about the 4th century B.C. This has also been corroborated by the method of C14 dating, which gives a time frame of 405 + 100 B.C. to 145 + 100 B.C.[93] 30'-0 high and 60'-0 wide walls running to 500 metres were found on each side which was a remarkable feat of the times and speaks of the utilization of huge amounts of expenditure and control of manpower by a stable political authority. The earth was probably brought from the surrounding areas by cart loads and was dumped at the site marked for raising the earthen ramparts. As the height of the walls was gradually raised head loads of earth were bought to meet the required amount. The builders took keen interest in making the section of the wall into a trapezoidal shape which could withstand seasonal rains and was also difficult to climb. At Amaravati[94] a coping stone of a railing offers a clear description of the outskirts of a city with a gatehouse surrounded by a fort wall. However, it is the details from Dharanikota which clearly show us the different stages in the perfecting of a walled fortification especially one which was located near a river and also functioned as a port. The absence of a moat may be explained due to its situation on the river bed of Krishna.[95] At Dantapura in the same sub-region, the mud for has walls of 60'-0" wide and 38'-0" high. The earth was well rammed and made compact.

[96]

Excavations at Satanikota in sub-region D revealed advanced techniques in making moats which were now cut into the natural rock [Plate X]. The walls were now built with brick and stone which 1s a development from the earlier use of mud for walls and moats. Phase I of Period II at this site is represented by a fortification wall built on a promontory datable to the 1st century B.C. The fort was built in 5 hectares of area elliptical on plan. It was enclosed by a stone wall of 3.20 metres wide built of Cuddapah slabs in mud mortar. The rugged external face of the wall was with well made baked bricks facing of 1.45 metres width. Except for some parts on the north side, the rampart was defended by a deep moat. Chisel marks in the moat are a fine testimony to the hard and sustained work of the stone cutters, to scoop out the channel from a hard living rock. The cutting itself was a great feat of rock-cut technology when explosives for blasting rocks were not available. This is an advancement in the building technology of the defence buildings. In order to cut the



Period II: Brick wall over a mud rampart, Kotilingala, Sub-region A



Period **II** : **Rock-cut moat around** a Stone **fortification wall faced with brick, Satanikota, Sub-region D** moat in rock, large amounts of skilled labour and material were involved and this can be contrasted to earlier fortifications at Dharanikota, Kotilingala and Dhulikatta which had the moats excavated in the clayey soils. There was a berm i.e., an offset cut into the rock in between the moat and the base of the wall. No other of its kind is so far reported from any other early historic fort. The gateway of the fort was approached by a flight of steps. The post-holes near the gateway indicate the existence of a draw bridge over the moat. Kautilya[97] too had proposed a movable bridge over the moats. Construction of square bastions abutting the walls indicate the provision of a regular buttress for strengthening the fort wall. At Satanikota the provision of gates, deep moat and buttresses further indicate the expansion of technology 1n planning the fortifications of Period II.

At Eeleswaram[98] the entire early historic site 1n its Period II, datable to between the 1st-2nd centuries A.D., was enclosed by a rectangular brick fortification wall. The enclosure wall here was found to be similar in construction to that of Sisupalgarh.[99] It had a mud core reinforced on either side with burnt brick. The northern side was pierced with a large gateway, flanked by guardrooms.

During the second half of the 3rd century A.D. construction of forts on hills began, though the building of fortifications on river banks and plains continued side by side. This is evident in the continuance of earthen embankments which have been noticed at Nelakondapalli in sub-region B. The excavations at Nagarjunakonda, also in sub-region B, have revealed some advanced and sophisticated techniques 1n making hill forts by locating 1t near the river bend and on the hills. The low lying portion was raised either, with mud or, stone. The excavations laid bare the remains of a citadel of the city of Vijayapuri[100] with a fort, ditch, gates and barracks. The enclosure wall was 3000 x 2000 ft. 1n a trapezoidal shape, which ran along the right bank of river Krishna. The builders built a mud fort, a <u>sthaladurga</u>. on the plains and the hilly tract was fortified to serve as <u>giridurga</u> to take refuge in times of siege and offer resistance. The <u>sthaladurga</u> was located on the right bank of the river Krishna and was flanked by the low lying hillocks. On its western side, the river Krishna served as a natural defence and only certain portions were built by brick to complete the shape of the mud fort. It was quardrilateral in shape and roughly confirmed to the <u>karmukha</u> or bow shaped citadel, described by Kautilya. The rampart walls which were built in two phases, were 16'-0 above the ground level. The first phase was represented by an earthen rampart, about 80 feet wide at the base. The brick structure in its second phase was built during the 4th century A.D. The entire hillock was fortified by rings of walls built of solid granite blocks around the hill. Both at its base and on its top, there were four main gates at the four cardinal directions. The thickness of the walls varied from 15 to 20 feet. The builders also excavated a ditch or moat, 12 feet in depth and with a varying width of 74 to 132 feet. Some portion of the ditch had been cut into the natural rock. The main gateway of the citadel was on the eastern side and a narrow postern gate was on the northern side which possibly served as an emergency exit.[101] Subways on either side of the gateway were also provided. There were guardrooms on either side of the gateways. Zig-zag passages provided through the gateways were technically planned to operate the traffic of people with tight vigilance in order to properly gaurd all direct approaches and further they rendered entry into the fort complicated and difficult.[102]

The foundations of the fort walls so far discussed were always constructed of natural rock itself. The surface was prepared either by the rough levelling of irregular ground or by the filling in of cavities with small stones held firmly together by clay which made the bed of the foundations level. The first massive stone layers supported the rest of the wall. These were made of large sized irregular boulders dragged into position upon an artificial ramp with the aid of rollers and crow bars. These boulders presented a unified and vertical surface. Selection of a naturally suitable hilly area, the accessibility of a river bank which served as a natural moat, flat areas on hills which would serve to build barracks, parade grounds, water supply, storage facilities, bastions, enclosures to gates, guardrooms to safeguard the gateways, zig-zag passages to enter the fort all developed from simple to sophisticated constructions by the 3rd-4th centuries A.D. The above-cited example of Nagarjunakonda in particular, can be marked as one such fort where the most complicated techniques were applied. They exhibit not only sound technical skills but the ability of the society to provide resources to build it. Further, the military strategists of the time were careful to follow the textual prescriptions on making well-guarded forts that were an absolute necessity when States vied with each other for supremacy.

During Period III of our study, defence structures have not been found prolifically 1n the archaeological record because of the then prevailing political and economic situation in early medieval Andhradesa. This period saw the emergence of small States, rise and spread of 'feudal' like tendencies and degeneration 1n the economic well-being of the people due to the fragmentation of land holdings and the decline 1n trade and towns. Some of these aspects have been discussed 1n depth 1n chapter I.3 above. A major tendency of the period was the formation of new agrarain settlements. Around these, major temple complexes began to emerge. Though many of these small kingdoms used substantial resources to build monumental buildings like temples, evidence on forts for the early medieval period is limited. In the absence of empirical data based on archaeology we have to rely upon the literature and epigraphs of the period 1n which some description on the various types of defence buildings is available. The few archaeological evidences of defence structures that are available are at Keesaragutta and Tummalagudem in sub-region A and at Pedavegi in sub-region C, all datable to 4th-5th centuries A.D. The fort at Gandharikota in sub-region A, and Gutti in sub-region D databale to 8th-9th centuries A.D. are the other surviving examples. A new type of fort built of wood with simple technology known as *Bōyakottams* and datable to the 9th-10th centuries A.D., are interesting examples of the building technology of the defence structures during this phase [Chart III C].

Early Medieval texts that reflect on architecture like the *Brihatsamhita*. datable to 6th century A.D. and the *Visnudharmōttara*. datable to the 8th century A.D., provide some Information regarding the[103] layout and construction of defence buildings. The *Brhatsamhita* considers three types of forts, viz., *giridurga*. *sailadurga* and *ātavikadurga*. The *Visnudharmōttara* in its second *khanda* (chapter 26) entitled '*Durga Sampatti Varnanam*' describes various layouts of forts, different types of forts, the disposition of various structures in the fort and so on. The terms vapra and chāya find frequent mention to mean ramparts of earth or mud in the Mahabharata.[104] The Aranyakānda contains an interesting account of defence against siege. The Ramayana[105] mentions that the city of Ayodhya which means impregnable or unassailable, was surrounded by a deep moat and guarded by a huge gateway and towers. Kiskindha, the abode of Sugriva was a forest fort provided with golden gates, moat and citadel. Lanka, the capital of Ravana, was a typical mixed fort, furnished with four huge gates and four bridges across the moat running around the town. The gates and bridges were provided with yantras or missiles like Sataghni.

The Hatsya Purana.[106] refers to six different kinds of forts, viz., dhanusa. mahi. nara. vriksha. iala and giridurga. According to it, the castle was to be surrounded by ramparts and a ditch. Four roads were to be laid out to form squares. The place selected for a fort was preferably to be located on the banks of a river in the shape of a crescent. In addition to the main gates, it is advised to have secret doors to the fort as well. Some of these textual prescriptions had an impact on fort building activity in early medieval Andhradesa.

The forts at Pedavegi,[107] Gutti[108] and Gandharikota[109] Tummalagudem[110] in sub-regions C, D, and A respectively, were built on circular plan where as the one at Keesaragutta[111] in sub-region A was rectangular. Regarding the materials used for the buildings, the forts at Keesaragutta and Pedavegi were of brick, and the forts at Tummalagudem and Gutti were built with stone. The unique fort at Gandharikota in sub-region A was of a rock-cut variety. The Boyakottams in sub-region C were built of wood. The forts at Keesaragutta, Gutti, Pedavegi, and Gandharikota all had gateways. Bastions were reported at Keesaragutta and Gandharikota only. A moat was noticed only at Pedavegi. The ones at Keesaragutta, Gutti and Gandharikota belonged to the category of hill forts i.e., giridurgas whereas the one at Pedavegi was a sthaladurga. The Bōyakoṭṭams, being located in forested areas can be said to belong to the vanadurga type [Chart III C].

The fort at Keesaragutta[112] was built on a hill spread out to 3 to 4 square kilometres, datable to the 4th-5th centuries A.D. It was provided with four gateways on four sides prefaced by a strategic secondary wall in the shape of a crescentic bulge to stop the onslaught of the enemies. This brick fort was raised on a 3 metre wide stone foundation. Plans of the guardrooms near the main gate have also been traced. Some gates were also found towards the local water pond on the hill. There are still traces of pathways inside the fort in between the civilian and the religious structures. The selection of the site here was on a hill and the uneven surface of the area was used for raising walls. Construction of a fort on the hill with all the accessories such as secondary wall, gateways, guardrooms can be said to be an important development on the technology that was used in the earlier forts. The crescentic shaped strategic wall was added to safeguard the main gate. The location of the fort on the hill facilitated the inhabitants to be vigilant and enabled them to keep a vigilant eye on the enemy coming towards the fort. As indicated in texts like the Arthaśāstra, the builders had accordingly selected a very strategic place for building this hillfort, i.e. giridurga. It was a fort was built with burnt bricks, though the gateways, steps and bastions were built with stone. The foundations of the fort were constructed with

CHART III C

Period III: Defence Structures

S.No.	Name of the Site	Sub-region	Plan of Fort	Type of fort	Building Material	Associated Structure			
						Moat	Bastion	Gate	Guard Room
1.	Alampur	A	0			√	√	√	√
2.	Dharanikota	C	0			-	-	-	-
3.	Divi	C	0			-	-	-	-
4.	Gandharikota	A	0			-	√	√	√
5.	Gutti	D	0			-	√	√	-
6.	Hanumakonda	B	0			-	-	√	-
7.	Kandukuru	C	-			-	-	-	-
8.	Kattem	C	-			-	-	-	-
9.	Keesaragutta	A	X			-	√	√	√
10.	Kolanu	C	-			-	-	-	-
11.	Mukhalingam	C	0			-	-	-	-
12.	Nellore	C	-			-	-	-	-
13.	Pedavegi	C	0			√	-	-	-
14.	Tummalagudem	A	0			-	√	√	√
15.	Yanamadala	C	0			√	-	-	-

toy;

land Fort

Hill Fort

Hater Fort

Wood Fort

Mud

Brick

Stone

Rock-cut

Circular 0

Rectangular X

stone over which brick walls were raised.[113] The existence of forts at Vengi, Kudura and Pistapura 1n sub-region C during the 4th-5th centuries A.D., can be noted from Allahabad pillar inscription.[114] Pistapura, modern Pithapuram was also mentioned in Aihole inscription and Maruturu plates of Pulakesi II both referring to his capture of this fort. However, at present only the remains of earthen fort at Vengi and Pithapuram can be seen and thus not much can be discussed on the building technology of these two forts.

Excavations at Pedavegi[115] have revealed a fortification, datable to the 4th-5th centuries A.D. The rim of the fortification had encircled an area of one square kilometre. The walls here are extant to some extent on the southern and western sides. The gravel make up of the fortification wall was to a thickness of 7.1 metres above the first working level. Subsequently, a brick veneer was found at a depth of 0.35 metres along the western edge of the fortification wall. A moat with silt and a water borne layer was also traced. Vengi continued to enjoy a place of political importance in the history of Andhradesa and Eastern Chalukyas are often called the Chalukyas of Vengi. Though the administrative officers of the eastern Chālukyan Kingdom included a Durgapati. an officer-in-charge of forts or defence,[116] there is no archaeological evidence of a full-fledged fort that could have been their capital.

A unique rock-cut fort datable to the 8th-9th centuries A.D. has been noticed at Gandharikota[117] 1n sub-region A [Plate XI]. The natural bouldary outcrop has been meticulously cut. The stone was removed by the 'blocking technique' and chiselled to give an even and uniform appearance of a rock-cut fortification. On the southern side of the fortification, a door way portal measuring 2.75 x 1.50 metres was also cut in the rock. Another interesting feature is that the hillock from where the dressed stones have been quarried for construction of the walls has been done 1n such a way that the quarried hill face appears like a square bastion. After climbing the rock-cut steps on the western side of the bastion, lies a big gate or royal portal, the approach way of which was cut into the hillock. Lines were also grooved into the hill for scooping it for guardrooms but left unfinished. This is a rare example in the technological evolution of building fortifications and departs from the traditional method of building the earthen, brick or dressed stone forts which had been prolific in Andhradesa and elsewhere. Experts in scooping or quarrying the rock were employed to work on the naturally suitable hill for building an ideal defence structure probably because it was more stable and permanent than the mud, brick or stone forts. Rock-cut technology was available to specialists of the time as the Buddhist cave temples of the early centuries A.D. all over the Deccan had been scooped using this technology. These aspects of rock-cut technology have been discussed by us in detail in Chapter V.1.

Forts built of wood called Bōyakottams were also known datable to between the 7th-8th centuries A.D. from sub-region C. The Addanki inscription of Pandaranga mentions his expedition against the Bōyakoṭṭams[118] when he dismantled them. These were essentially strongholds of the Boyas who were a war like tribe. The homeland of the Boyas has been referred to as B5vaviharadesa.[119] Bōyavīdu[120] and Bōyavila[121] 1n the inscriptions. The Bovavihāradesa of these inscriptions, according to

Hanumantha Rao, roughly corresponded to the eastern taluks of the present day Nellore district, viz., Kanigiri, Atmakur and Udayagiri. Politically the Boyas had been organised into 12 kottams by the 7th century A.D.[122] The meaning of the word kottam is a fortress and each of the kottams might have developed around a fortified form and were under a Boya Chieftain known as Siṁhāsana Bova.[124]

Since the B5yas were essentially known as a tribe, their original homeland was probably 1n the forested regions. The above 1nscr1pt1onal reference to the Bovakottams being dismantled indicates that these defence structures were primarily made of wood because of its ready availability in the forests. A possible way of making them was by piling wooden logs one above other. This 1s a rare indication of defence buildings constructed with materials of a malleable nature. Interestingly, these co-existed with strong forts of stone and bricks that have been described by us above. Lack of financial stability probably because of their inability to control large agrarian tracts meant that, unlike other Kingdoms, these tribal communities continued to construct Kottams with a primitive technology.

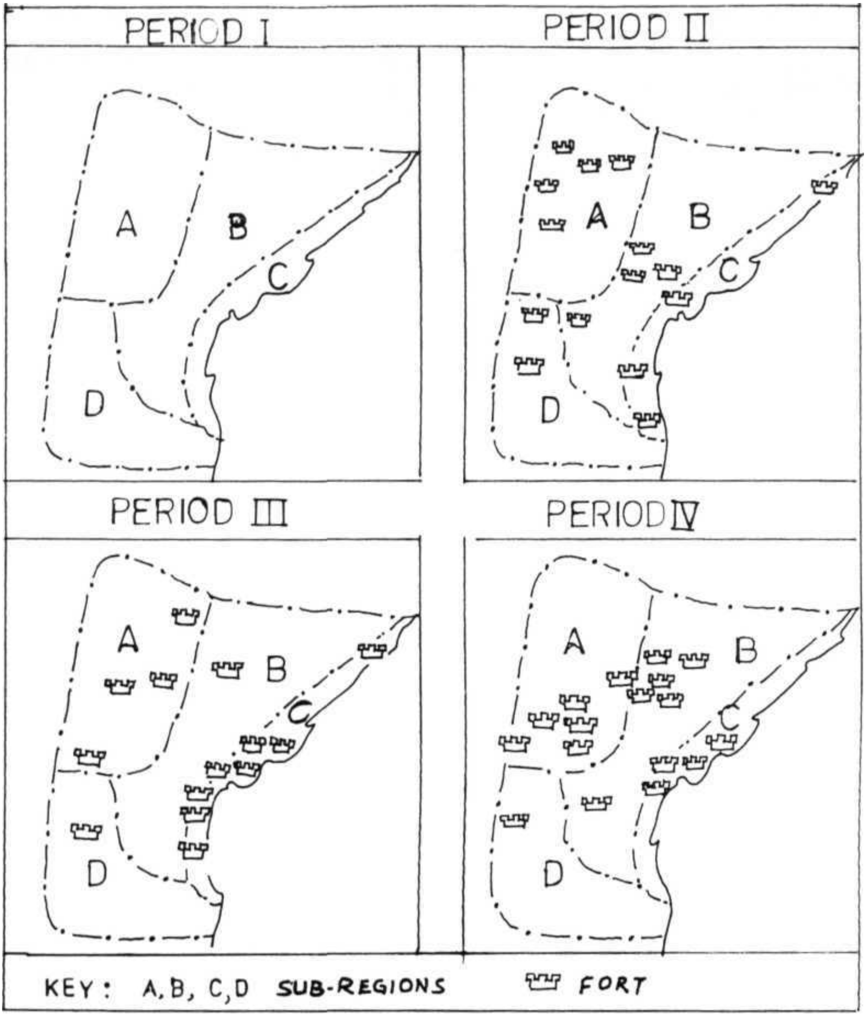
During the Period IV, we find that trade re-emerged which in turn led to the rise of urban centres once again. Now these emerged on a large scale around temple complexes. Both inland and sea-borne trade was carried on. The political authority also expanded to new areas and major Kingdoms emerged with vast tracts of lands under their control. By atleast the 12th century A.D., the entire Andhradesa came under a single rule having many minor dynasties as vassals. In this context, a wide network of building new forts began to appear. For this period as well we have to, to some extent, rely upon the medieval literature and inscriptions for Information on the existence of forts and how they were built in the different sub-regions of Andhradesa. The literary and silpa texts particularly the Manasara[125] mentions seven types of forts, viz., giri. vana. salila. panka. ratha. deva. and misra durgas. They were said to be circular, square or rectangular, surrounded by moats, enclosure walls and ramparts and furnished with various entrances, exits and gateways. It is also suggested that circumambulating flight of steps and secret staircases in the walls were to be constructed. Towers were said to be built on enclosure walls. In the interior were constructed tanks, ponds, canal, etc. The texts further elaborate that inside the forts various kinds of roads were to be laid and buildings for different castes and professions were to be created in a suitable manner. The Samarangana Sūtradhāra.[126] written by King Bhoja (1000-1055 A.D.) in its Chapter 10 called Puranivesa deals with town planning of three sizes of cities each having its contingent of moat, city wall, gateway, towers, roads and buildings. The Yuktikalpataru[127] also written by the same King, deals with a description of military buildings as akrtam. natural and krtam. artificial. The Nītivākyāmrtam[128] of Somadeva Suri adopts an altogether different classification. According to him, forts were of two kinds, svābhāvika and āhārya. The svābhāvika forts were those endowed with natural facilities like high hills, water resources, etc., while the aharva or artificial ones were those provided with ramparts, missiles and fire weapons. In these cases entry and exit ways were to be strictly guarded by adept soldiers.

We next detail some information from inscriptions which provide information on forts before discussing the archaeological remains of the period in the different sub-regions of Andhradesa. The Kalidindi plates[129] of Rajaraja refers to capture of the forts of Bezawada, Dharanikota and Chebrolu, indicative of the existence of these forts. But the extant remains are visible only at Dharanikota. The Chebrolu inscription[130] dated to 1006 A.D. of Satyasraya, son of Taila II of the Western Chalukyan dynasty records his title as Durgatraya Malla while referring to his capture and burning down of the Dannala and the Enamadala forts. Regarding the ancient fort at Rajahmundry which came into prominence during the early medieval period, Sewell has observed "there existed an old fort with walls of great size and height made of earth faced with stones".[131] Thus it is only his observation that informs us of the existence of an earthen fort at Rajahmundry.

Besides references to the existence of mud, brick and stone forts from various sources, we have interesting evidence of the existence of water forts or jaladurgas. Water forts at Kolleru and Divi are well known. The Allahabad pillar inscription calls Kolleru as the Kunala lake while the Aihole inscription of Pulakesin II refers clearly to the existences of a jaladurga.[132] Its continued existence in the subsequent period is known through the Chelluru plates of Chalukya Chola King Kulottunga II dated to 1234 A.D. wherein it is referred to as Sarasipuri of Kolanu whose Chief at that time was Katamanayaka.[133] The Timmapuram plates of Vishnuvardhana I inform us that the fort of Pistapura was captured by him and since then he was known as Vishamasiddhi. As early as the days of Kautilya it had been prescribed that the King should cause a nature made fortress, a water fort surrounded on all sides by water.[134] The Matsva Purana while describing six types of forts had mentioned the importance of a jaladurga. Divi was built into a beautiful jaladurga and later developed by Narayana, the brother of Jillaboya who was conferred the rulership of Divisima.[135]

Extant earthen ramparts have been noticed at Kanduru, Vardhamanapuram, Puduru and Kaluvakolanu[136] 1n sub-region **A datable** to between the 11th-12th centuries A.D **[Map VII and Chart III D]. These** massive earthen ramparts were raised to a height of about 20 feet with a basal width of 40 feet spread in 2 to 3 square kilometres. The Hanumankonda inscription dated to 1163-64 A.D. refers to the caputre of the Vardhamanapuram fort. At Ramakrishnapuram,[137] in sub-region B there was a square fortress with four bastions at the cardinal points connected by rubble and mud walls datable to the 11th-12th centuries A.D. A mud fort is also noticed at Kolanupaka which was referred to as Kollipaka-7000 and whose walls were said to have been surrounded by tall trees.[138] At present only remnants of mud walls are visible on the outskirts of the same village. Bhuvanagiri in the same sub-region was known as Tribhuvanagiri was a hill fort built with stone. The Kolanupaka inscription of Vikramāditya VI dated to 1106 A.D. mentions it as a fort.[139] The local hillock was selected to erect the fortification. Stone walls were constructed on the hill with gateways provided with steps on either side. Massive stone blocks were used in the construction without any binding material as the extant remains reveal.

Remnants of a rectangular stone fort built connecting the two local hillocks with a circular bastion at three **different** levels has been noticed at Mallikudurla[140] in sub-region B datable to between the 12th-13th centuries A.D. **[Chart III D].** The fort at Musalimadugu[141] also in the same sub-region, datable to **the** 13th-14th centuries A.D., had gateways and



DISTRIBUTION OF DEFFNCE STRUCTURES PERIODWISE

CHART III D

Period IV: Defence Structures

S.No.	Name of the Site	Sub-region	Plan of Fort	Type of fort	Building Material	Associated Structure: Moat	Bastion	Gate	Guard Room
1.	Adoni	D	0	Hill Fort	Stone	✓	✓	✓	✓
2.	Bhongir	A	0	Hill Fort	Stone	-	✓	✓	✓
3.	Dharanikota	C	0	Land Fort	Mud	✓	-	-	-
4.	Divi	C	-	Water Fort		-	-	-	-
5.	Ghanpur	A	0	Land Fort	Mud	-	-	-	-
6.	Gutti	D	0	Hill Fort	Stone	-	✓	✓	-
7.	Hanumakonda	B	0	Hill Fort	Stone	-	-	-	-
8.	Kaluakolanu	A	0	Land Fort	Mud	✓	-	-	-
9.	Kanduru	A	0	Land Fort	Mud	-	-	-	-
10.	Kolanu	C	-	Water Fort		-	-	-	-
11.	Konlanupaka	A	0	Land Fort	Mud	✓	✓	-	-
12.	Mallikudurla	B	T	Hill Fort	Mud, Stone	-	-	-	-
13.	Musalimadugu	B	0	Land Fort	Mud, Stone	✓	✓	-	-
14.	Panugallu	A	0	Land Fort	Mud	-	-	-	-
15.	Puduru	A	0	Land Fort	Mud	-	-	-	-

contd...

Key:

Land Fort		Mud		Elliptical	C
Hill Fort		Brick		Circular	0
Water Fort		Stone		Square	T
Wood Fort				Rectangular	X

CHART III D contd...

S.No.	Name of the Site	Sub-region	Plan of Fort	Type of fort	Building Material	Associated Structure: Moat	Bastion	Gate	Guard Room
16.	Raichur	A	0			√	√	√	-
17.	Ramakrishnapuram	B	T			√	√	-	-
18.	Shankarampet	B	0			-	-	-	-
19.	Uppair	A	0			-	-	-	-
20.	Vardhamanapuram	A	0			√	-	-	-
21.	Warangal	B	0 T			√	√	√	√
22.	Yanamadala	C	0			√	-	-	-

Key:

Land Fort	Mud	Elliptical	C
Hill Fort	Brick	Circular	0
later Fort	Stone	Square	T
Wood Fort		Rectangular	X

bastions which were constructed with blocks of shale, while the inner core of the wall was filled with mud and stone pieces. It had its main entrance on the east and had a number of rectangular and circular bastions. The fort was surrounded by a moat. The width of the wall measured 8.00 metres and its height was 1.20 metres. A rectangular bastion was cut from stone and measured 6.0 x 30 metres which revealed that it was constructed with bend stones connected to the main wall. The inner edge of the wall was vertical and consisted of well packed earth and stones. The outer face showed a curve. This fort at Musalimadugu was mentioned in the Somadevarājiyam, a text of the 14th century A.D.[142]

The best fort of the period, built with advanced techniques in plan and execution can be seen at Warangal[143] [Plate XI]. It consisted of three rampart walls. The first was built of mud and was about 10'-0 in height. According to a tradition, the mud fort was provided with seventy five bastions, the protection of each being entrusted to a Nayaka in the service of the King. The second fort was the huge mud wall outside Warangal city which had four gates. The wall was surrounded by a deep moat, filled with water. The outer mud fort covered an area of 19 kilometres in circumference. As the Warangal fort was approached from the north, it had a wide and deep moat which encircled the mud rampart. Immediately after the moat, within 4 to 5 metres distance, stood a high and imposing mud rampart. Built of heaped up soil, it rose to about 14 to 17 metres high with a basal width of 4 to 6 metres. On the top, it had a narrow wall walk of 3 metres wide. The Warangal fort was built in concentric circles designed to sustain any attack. According to the description of Amir Khusro, the perimeter of the mud fort was 12,346 yards.

PLATE XI

Period III: Rock-cut gateway, Gandharikota, Sub-region A

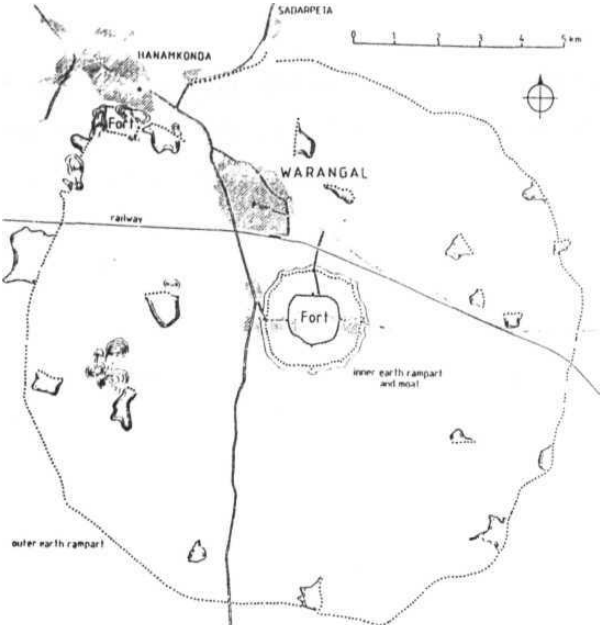
Period IV: Earthen rampart, Warangal, Sub-region B

The fort consisted of several bastions and was built very strongly. The inner most ring was built of stones, finely fitted 1n irregular fashion, without any mortar, to a height of no less than 6 metres. Regularly spaced 45 bastions rectangular in shape measuring 12 x 16 metres, projected outward.[144] In brief, the fort of Warangal consisted of two moats, two ramparts of mud and stone, eight gateways and a number of bastions interspersed at regular intervals.

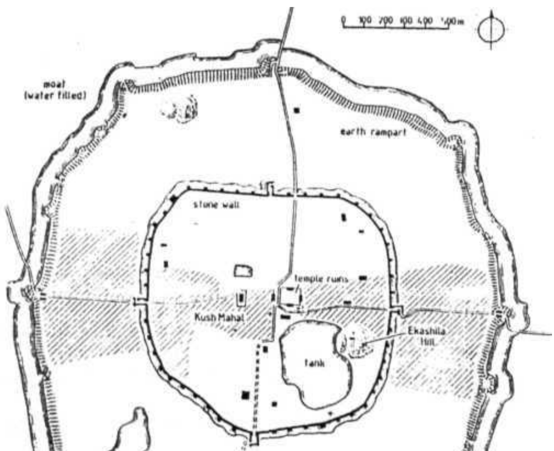
On plan the outer fort appears to be circular in plan, whereas the inner stone fort was rectangular [Figure 6]. The method of construction of the stone wall was the use of cyclopaen masonry, i.e., piling up stones one above the other in horizontal and vertical order alternately so as to balance the enormous weight. There was thus no use of lime mortar as a binding material. A staircase of 18 steps in the form of a gallery was built along the inside of the stone fort rising to a height of 7.4 metres.

In an overview, it can be concluded that since time immemorial defence mechanisms were established by the erection of a physical barrier against aggression. For pre-historic societies the natural caves served both as habitation areas as well as for defence purposes. During the proto historic times, i.e., period I of our study, defence structures must be seen as part of the habitation buildings. Sometimes, people lived in underground pits so that they could protect themselves from wild animals and other human communities. We can not see a major difference between natural and built areas during this phase because political activity was still organised by the tribal community. Therefore, structures built around habitations by the whole community served as barricades for safety

FIGURE 6



Period IV:Circular plan of Warangal fort, Sub-region B
(a) Outer **earthen rampart.**



(b) Inner earthen and stone forts.
(Reproduced from G. Michell, 'City as Cosmogram: the Circular plan of Warangal', SAS No.8, 1992, p.p. 1-18)

and protection as noticed at Chinnamarur and Chagatur. ,. -

In Period II, as the State emerged in a settled peasant society, defence mechanism began to proliferate. From the 4th century B.C. onwards a well-developed town planning with a spurt in building activity prompted by the availability of agricultural surplus led full-fledged defence structures being made strongholds of the elite in society. The defence buildings of Period II were at first mainly mud constructions. In their second phase they were strengthened by brick revetments which were overlaid on the existing mud walls. Almost all forts of this period were provided with moats dug into ground or, cut into the rock. The builders also utilised the natural rivers as moats on some sides as at Kotilingala, Dharanikota, Satanikota and Nagarjunakonda. Varied plans were experimented with while making these early forts and this explains that a store house of technical skills and knowledge was available for them. Gates, guardrooms and bastions and pathways were the other associated structures to these early defence buildings. Advanced techniques were used in making moats which were cut into the natural rock when explosives were not available to blast the stone. The provision of a draw bridge on the water filled moat and the fort walls built with brick and stone are significant developments in fort building and are first seen at Satanikota. Earlier mud walls had been built at Kotilingala and Dharanikota. Most of the forts were built on the plains excepting the one at Nagarjunakonda which was a hillfort. The plans, elevations and details of the most of the early historic defence buildings tally with the contemporary literary and sculptural descriptions of them. The archaeological evidence of defence buildings of the period reveal that they were built with a sophisticated and sound building technology and with a variety of building materials. Selection of a naturally suited hilly area, use of a the river as a moat, the availability of water all the year round, the construction of bastions enclosures for the gates, guardrooms near the gateways, zig-zag passages are some of the features which are outstanding at Nagarjunakonda. Therefore we can say that the developments in fort building here saw a climax for the early historic period.

The beginning of Period III was marked by a fall of stable empires, urban decay, decline in trade and the emergence of small Kingdoms. This necessarily meant that fragmented pockets of political control emerged all over Andhradesa. Therefore, we have few extant defence structures for this period like those found at Keesaragutta, Gandharikota in sub-region A, Pedavegi in sub-region C and Gutti in sub-region D. Building forts on hills was continued. The concepts of sthala, giri, vana. and jaladurgas of the early medieval literary works can be attested at places like Pedavegi, Keesaragutta, Gutti, Bōyakoṭṭams, Divi and Kolleru respectively. Interestingly, at Gandharikota, a new development in the building technology of defence structures can be noticed. Here the entire hill was cut, i.e., chiselled out of rock and shaped into a fort with gateways and bastions. On the other hand forts built with simple technologies using wood were also known in this period called as the Bōyakoṭṭams. Thus two contrasting materials of malleable wood and insitu stone co-existed with each other as material that were used for building forts during the early medieval period.

During Period IV, major Kingdoms once again emerged with political authority in Andhradeśa becoming increasingly centralized and this was coupled with the rise and growth of trade and agriculture. All this gave impetus to construct defence buildings with permanent building materials. During this period, in addition to the use of mud and stone for building forts, water forts became an important means to defend settlements. Divi and Kolleru are **well** known in this regard. Unlike the early historic examples in which the earthen ramparts were cased with bricks, the defence buildings in Period IV were pitched with stone blocks on their inner sides as noticed at Musalimaduga in sub-region B. Construction of stone forts on hills was also continued and the one at Bhuvanagiri in sub-region A and another at Hanumakonda in sub-region B are the best examples. A significant development in the building technology of the defence buildings of Period IV was the construction of forts with concentric circular walls surrounded by moats in which two outer walls were made of earthen ramparts and the inner most was built of stone as seen at the Kakatiyan Capital city of Warangal in sub-region B. The architects in planning the circular fortification here fulfilled both the cosmological as well as military considerations.

All the accessories of defence buildings as enumerated in the contemporary literary works are found at the Warangal fort. The cyclopaen masonry wall built with heavy stone blocks is a fine testimony to the engineering skills of the period. Provision of bastions, moats, guardrooms and gateways all bespeak of the care taken to make defence buildings as protective as possible. It is also implicit that the defence technology is related to ideology but in a different way, from how it affects religious buildings in **medieval** Andhradesa.

We have argued above that **evolution of** building **technology pertaining**

to defence structures, particularly forts, was fundamentally related to the nature of the State in the four phases of our study. Therefore, only in Period II and Period IV, when State systems tended to be strong and centralized and have enough resources to build monumental structures like forts. It is in both these periods that we also note considerable technological developments that improved the strategic quality of forts and the security that rulers expected from them. Not with-standing the several changes, the strong tradition of fort building in early Andhradesa, faithfully drew upon the rich knowledge of technique known in several literary texts of ancient India. Forts therefore, occupied a significant place in the political space of the region which, in turn, cannot be detached from the political ideology that motivated the various rulers of early Andhradesa.

FOOTNOTES

1. David Easton, 'An Approach to the Analaysis of Political Systems', World Politics. vol.9, 1957, p.383.

2. David L.Sills (ed.), International Encyclopaedia of Social Sciences. Volumes 11 & 12, New York, (Reprint Edition), 1972, p.193.

3. Arthasastra 15.1.1-2.

4. M.J.Rowlands, 'Defence as a Factor in the Organisation of Settlements'. in Ruth Tringham, et al (eds.), Man Settlement and Urbanisation. Duckworth, 1972, p.447.

5. R.D.Martin, 'Concepts and Human Territory' in Ruth Tringham, et al (eds.), Op. Cit.. 1972, p.442.

6. Ruth Tringham, 'Territorial Demarcation of Prehistoric Settlements', in Ruth Tringham, et al (eds.), Op. Cit.. 1972, p.466.

7. D.Fraser, Village Planning in the Primitive World. London, 1968, f1g.78.

8. R.Firth, 'Mori Hill Forts', Antiquity vol.I. p.68.

9. D.Fraser, Op. Cit., 1968, fig.49 (a).

10. M.J.Rowlands, Op. Cit.. 1972, p.456.

11. V.K.Thakur, 'Literary References to Fortifications in Ancient India', in A.V.Narasimha Murthy (ed.), Giridharasri. (Dr. G.S.Dikshit Felicitation Volume), Delhi 1987, pp.15-20.

12. M.J.Rowlands, Op. Cit. . 1972, p.450.

13. W.Thesiger, The Marsh Arabs. London, 1964, pp.213-214.

14. Ruth Tringham, Op. Cit.. 1972, p.470.

15. B.G.Trigger, 'Monumental Architecture: A Thermodynamic Explanation of Symbolic Behaviour', WA, vol.22, no.2, p.121.

16. M.L.K.Murthy, 'A Late Pliestocine Cave Site in Southern India', PAPS. vol.118, no.2, 1974, pp.196-239.

17. F.R.Allchin, Utnoor Excavations. Hyderabad, 1961, p.65.

18. R.Subrahmanyam, Nagarjunakonda-I. 1954-60. Delhi, 1975, p.98.

19. B.R.Subrahmanyam, 'Excavations at Gandlur', ARAP. 1982-83, Hyderabad, 1985, p.45.

20. T.V.G.Sastry, Brief Results of the Excavations at Veerapuram. BACRI, Hyderabad, 1981, pp.1-6.

21. V.V.Krishna Sastry, The Proto and Early Historical Cultures of A.P.. Hyderabad. 1983, pp.25-27.

22. F.R.Allchin, Op. Cit.. 1961, pp.66-68.

23. Ruth Tringham, Op. Cit.. 1972, p.468.

24. S.Piggot, Ancient Europe. Edinburg, 1965, fig.115.

25. ARAP. 1981-82, p.6.

26. V.V.Krishna Sastry, Op. Cit.. 1983, pp.37-38.

27. ARADN: 1939-40, p.44.

28. N.R.V.Prasad, 'Excavations at Chagatur', ARAP. 1978-79, p.12.

29. Ibid. p.12.

30. S.Andrzejewski, Military Organisation and Society. London, 1954, pp.75-76.

31. J.Mellart, Earliest Civilizations of the North East. London, 1965, pp.33-36.

32. V.G.Childe, What Happened in History. New York, 1982, p.58.

33. S.Piggot, Op. Cit. 1965, p.15.

34. Ibid. 1965, pp.199-207; 216-220.

35. Shereen Ratnagar, Enquiries into the Political Organisation of the Harappan Society. Poona, 1991, p.11.

36. Ibid. p.11.

37. R.E.M.Wheeler, 'Harappa-1946: Defences and Cemetary', AI, no.3, Delhi, 1949, pp.61-74.

38. Shereen Ratnagar, Op. Cit.. 1991, p.12.

39. Ibid. pp.12-13.

40. A.Kesarwani, Harappan Gateways: A Functional Reassessment. in B.B.Lal and S.P.Gupta (eds.), Frontiers of the Indus Civilization. Delhi, 1984, pp.63-73.

41. Ibid. p.65.

42. Shereen Ratnagar, Op. Cit.. 1991, p.119.

43. A.A.Macdonell, Vedic Index. Madras, 1958 (Rp) p.531.

44. Rig Veda I.58.8; I.166.8.

45. Ibid. IV.30-20; II.35-6.

46. Whitney's, (tr) Atharva Veda. Cambridge, 1905, pp.435-36.

47. S.S.Bhattacharya, (tr) Rig Veda Saṁhita, Aunda, Satara, 1912, p.461.

48. Whitney's (tr.) Atharva Veda. 1905, pp.435-36.

49. V.S.Agrawal, India as Known to Pānini. Lucknow, 1953, p.137.

50. IAR, 1958-59, p.18.

51. M.K.Dhavalikar and H.D.Sankalia, Excavations at Inamgoan. vol.1, Pune, 1988, pp.237.

52. Ibid. pp.238-240.

53. Ibid. pp.238-240.

54. IAS. 1958-59, p.19.

55. V.K.Thakur, Urbanisation in Ancient India. Delhi, 1981, p.116.

56. JAR, 1953-54, p.9.

57. A.Ghosh, 'The Architectural and Artistic Heritage of India', in S.K.Maity and Upendra Thakur (eds.), Indological Studies. (Prof.D.C. Sircar Commemoration volume). Delhi, 1987, pp.125-130.

58. Dīgha Nikava. II. 46.

59. Anguttara Nikava. IV. 106, 107; Samvutta Nikaya. II. 182.

60. Rhys Davids, Buddhist India. London, pp.42-46.

61. Milindapanha. I.34.

62. R.Shama Sastry, Arthaśāstra of Kautilya. 5th Edn., Mysore, 1958, pp.52-61.

63. Ibid. pp.62-81.

64. R.S.Betai, A Reconstruction of the Original Interpretation of the Manusmrti. Ahmedabad, 1970, pp.269-270.

65. Manusmrti VII,70 and 75-76.

66. According to its Excavator, Sisupalgarh was occupied between c.300 B.C. and A.D. 350 and the various periods are: I. Early period: c. 300-200 B.C.; IIA. Early middle period c.200-100 A.D.; IIB. Late middle period; c. 100-200 A.D. and III. Late period C.200-350 A.D., See B.B.Lal, 'Sisupalgarh - 1948', AJ, vol.5, 1949, pp.62-65.

67. S.K.Joshi, Defence Architecture in Early Karnataka. Delhi, 1985, p.154.

68. V.V.Krishna Sastry, Ibid. 1983, p.129.

69. Ibid. 1983, pp.132-33

70. Ibid. 1983, pp.132-33.

71. T.V.G.Sastry, Op. Cit.. 1981, pp.1-6.

72. R.Subrahmanyam, 'Secular Remains at Nagarjunakonda', JAHRS. vol.XXXVIII, pt.IV, 1986-87, Hyderabad, 1987, p.10.

73. IAR, 1962-63, pp.1-3.

74. N.C.Ghosh, Op. Cit.. 1988, p.92.

75. ARAP. 1983-84, p.10.

76. V.V.Krishna Sastry, Op. Cit.. 1983, p.129-132.

77. IAR, 1962-63, pp.1-3.

78. G.Yazdani, Early History of the Deccan. Vol.1, Delhi, 1962, p.26.

79. V.V.Krishna Sastry, Op. Cit. . 1983, pp.132-33.

80. Ibid. 1983, pp.132-33.

81. B.Subrahmanyam, 'Excavations at Dantapura', Department of Archaeology & Museums, Hyderabad, 1993, p.2, (Typewritten).

82. As one of the participants in the Excavation Programme at Nelakondapalli, a Buddhist site, 1n Khammam district, I had to stay there for one month during 1987-88. It was during this period that I surveyed the surroundings of the site and noticed the remains of a mud rampart. See E.Sivanagi Reddy, 'A Note on the Earthen Rampart at Nelakondapalli, Khammam District', Department of Archaeology and Museums, Hyderabad, 1988, p.2. (Typed Report).

83. V.V.Krishna Sastry, Op. Cit.. 1983, pp.132-33.

84. A.W.Khan, A Monograph on Yeleswaram Excavations. Hyderabad, 1964, p.10.

85. T.V.G.Sastry, Op. Cit.. 1981, pp.1-6.

86. ARAP, 1983-84, p.10.

87. P.V.P.Sastry, OP. Cit.. 1989, pp.71-76.

88. I.K.Sarma, OP. Cit.. 1990, p.110.

89. V.V.Krishna Sastry. Op. Cit.. 1983, p.131.

90. K.Raghavachary, 'Dharanikota and its Western Contacts' QHRS. vol.XII, 1972-73, pp.167-70.

91. I.K.Sarma, 'C14 Dates, NBP Ware and Early Historical Archaeology of Peninsular India', JIH, vol.41, pt.1, pp.49-59.

92. Ibid. pp.49-59.

93. H.Sarkar, 'Emergence of Urban Centres in Early Historic Andhradesa'. in B.M.Pande and B.D.Chattopadhyaya, (eds.) History and Archaeology. Delhi, 1987, pp.631-41.

94. J.Burgess, Buddhist Stupas at Amaravati and Jaggayyapeta. Madras, 1887, p.xxi, fig.2.

95. S.R.Rao, 'Dock and Wharfs' in A.Ghosh, (ed.) Encyclopaedia of Indian Archaeology. Delhi, 1989, p.

96. N.C.Ghosh, Op. Cit.. 1988, pp.92-100.

97. Arthaśāstra. 111.21-35.

98. A.W.Khan, Op. Cit.. 1964, p.10.

99. B.B.Lal, OP. Cit.. 1949, pp.62-105.

100. I.K.Sarma, 'Vijayapuri, the capital of Ikshvakus of Nagarjunakonda', IHQ. vol.XXXIII, 1962, pp.267-82.

101. Ibid. pp.267-82.

102. R.Subrahmanyam, Op. Cit.. 1987, p.8.

103. A.M.Sastry, Indian as. seen in Brihatsamhita of Varāhamihira. Delhi, 1975, p.473.

104. Mahabharata. II: 5, 25.

105. Rāmāyana: Kishkindha Kanda, 14-5.

106. B.C.Mazumdar, 'The Matsyapuranam', SBE, vol.1, Delhi, 1965, pp.226-229.

107. I.K.Sarma, Op. Cit.. 1990, p.10.

108. P.B.Desai, Jainism in South India. Appendix B, no.47, pp.37-75.

109. ARAP. 1990-91 (Cyclostyled), pp.11-17.

110. In our recent survey conducted at Tummalagudem we noticed a circular stone fort provided with gates and guardrooms on the local hillock called Indrapalagutta Tummalagudem is situated 10 kms away from Ramannapet on Bhongir-Chityala Road in Nalgonda district.

111. ARAP, 1975-76, pp.9-10.

112. Ibid, pp.9-10.

113. Ibid, pp.9-10.

114. EI, vol.VI, p.2.

115. I.K.Sarma, 'New Light on Vengipura: Excavations at the Ancient Historical city of Andhradesa', Puratattva no.17, Delhi, 1988, pp.15-21.

116. £1, vol.IV, p.307.

117. ARAP. 1990-91, (cyclostyled), pp.11-17.

118. EI, vol.XIX, pp.271-75.

119. NDI, vol.1, Atmakuru, no.32.

120. Ibid. Kandukur, no.10.

121. Ibid. Atmakuru, no.37.

122. B.S.L.Hanumantha Rao,'The Boyas in Medieval Andhra History', JAHRS. vol.38, pt.IV, Hyderabad, 1987, pp.77-92.

123. Ibid, pp.77-92.

124. Ibid. pp.77-92.

125. P.K.Acharya, Mānasara, an Encyclopaedia of Hindu Architecture, vol.VII, Allahabad, 1927, pp.226-229.

126. V.S.Agrawal, (ed.) Samarāngana Sutradhara of Bhoja. Baroda, 1966. p.

127. P.N.Bose, Silpaśāstram, Delhi, 1978, p.32.

128. Somadeva Suri, NTtivakvamrtam. pp.81-82.

129. EI, vol.XVI, p.17.

130. £11, vol.VI, no.102.

131. R.Sewell, Antiquarian Remains of Madras Presidency. Madras, 1882, p.21.

132. £1, vol.VI, p.2.

133. N.S.Ramachandra Murthy, Forts in Ancient and Medieval Andhra: A Study, Ph.D. Thesis, (unpublished), Karnatak University, Dharwar, 1981, p.120.

134. R.P.Kangle, The Arthasastra of Kautilya, vol.11, Delhi, 1986, p.61.

135. B.S.L.Hanumantha Rao, Op. Cit., 1987, p.91.

136. B.N.Sastry, Kanduri Chōdula Śāsanamulu Charitra. Samskrta, Hyderabad, 1984, p.44.

137. ARAP. 1982-83, p.5.

138. SII, vol.X, no.67.

139. P.V.P.Sastry, Select Inscriptions of A.P., Hyderabad, 1977, no.8.

140. ARAP, 1982-83, p.6.

141. R.Subrahmanyam, 'Musalimadugu and its Antiquities', in Sri Dineschandrika: Studies in Indology, Delhi, 1982, pp.176-180.

142. Ibid, p.178.

143. P.V.P.Sastry, The Kakatiyas of Warangal. Hyderabad, 1978, pp.95-110.

144. George Michell, 'City as Cosmogram: The Circular Plan of Warangal', SAS, no.8, 1992, pp.1-18.

CHAPTER IV: BURIAL SPACE

IV. 1 FUNERARY STRUCTURES

CHAPTER IV BURIAL SPACE

IV.1 FUNERARY STRUCTURES

Burial space occupies the uneasy area between life and death in the sense that mankind intervenes to commemorate the dead in this space. All human societies do not do so in the same way and in India some of the earliest endeavours were those of the Neolithic-Chalcolithic and Megalithic communities. For later communities followers of Brahmanism and Hinduism it as the cremation ground, and not the burial ground, that held significance and the <u>smasana</u> was a space that not only meant the end of physical life but was also considered the pre-requisite of every new creation.[1] In the present context therefore, funerary structures are only available to us for study during what has been delineated as Period I. It is necessary to deal with them under a separate chapter as they clearly do not occupy the secular space of Chapter II. Nor does it occupy Religious space of Chapter V since it is difficult to talk of the rise of institutionalized religion in the megalithic phase of human habitation. Further, whereas religious structures emerged in human society as sacred spaces where the veneration of different dieties was done, the burial space, though equally sacred, was an area where the veneration of the human dead was done. It has been noted by us above that extant remains of habitations of dwellings was relatively scant in megalithic times. In contrast the quantity of data on funerary structures is quite substantial and would otherwise remain undiscussed. By far the most important resaon for taking up a separate discussion on funerary structures is that this is the first available evidence that enables us to document and understand monumental stone technology that was evolved by people who were still part of a pre-state society. The men, material, tools and skills 1n such a society were necessarily nurtured by a segmented social set up which had, however been able to master its local environment and made valuable use of some of the hardest rocks available around them.

In the perception of the earliest Indian literature, the last sacrament in the life of a man was called anthvesti or the funeral. After the death of a person, his survivors consecrated his death for his future facility in the next world. In this connection, the Baudhavana Pitrmedha Sutras[2] say "one conquers the earth through the samskāras after the birth and through the samskaras after death, he conquers the heaven". The decomposition of the dead body might have also led the people either to free it for vultures, bury in the ground or burn it. The tenth mandala of the Rg Veda[3] mentions that at the time of burying the dead body the priest says "Go to the thy mother, Earth, the wide spread, delightful Earth; covers him up, May the earth heaped over him lie light; may thousands of particles of dust envelop him. I heap up the earth around thee placing (upon thee) this clod of earth; Let the paitra sustain this thy monument; may Yama make thee a dwelling here". However, after sometime this custom of burying the dead was replaced by cremation among the Hindus.[4] It is interesting to note that the Rg Veda[5] mentions that the bones of the deceased person were collected and buried and in some cases a funeral monument was erected. Sutras like Baudhavana Pitrmedha[6] hold that there was to be another funeral ceremony called Pitrmedha or smasana i.e., the building of a mound over the remains of a dead person. Satapatha Brahmana also describes this smasana ceremony. However, archaeological evidence for such practices are not available to us. We therefore, confine our discussions on the technology of building funerary structures in the context of the megalithic remains available in the Deccan and South India.

The tradition of burying the dead in and around Andhradesa goes back to the Neolithic-Chalcolithic times. During those early times people buried their dead either in urns or in extended burials inside their houses. Sometimes they are found in the interiors of the caves and at other times, away from habitation areas. This was a practice not only in Āndhradeśa, but also in regions contiguous to it. The Neolithic burial practices have been seen through extended burials in pits and urns at Brahmagiri,[8] Tekkalakota,[9] Hallur,[10] and T.Narsipur[11] in the neighbouring region of Karnataka. In Andhradesa, in one instance, the Neolithic people appear to have buried their dead in the interior of the caves. This was at Guthikonda[12] where human skeletal remains in association with hand made pottery having mat impressions and an antenna sword of copper were found in the dark interior of the cave. At Chinnamarur,[13] burials were found both within and outside the habitation area. Urn burials of the Neolithic-Chalcolithic period have been reported from Chagatur,[14] Ieej,[15] Nagarjunakonda[16] and Palavoy.[17] Neolithic-Chalcolithic burials have also been reported from shallow pits at Utnoor,[18] Pikhlihal[19] and Veerapuram.[20]

In course of time, this development of burying dead in the pits and urns was a tradition continued in the succeeding phase called the Megalithic period. Besides, various types of burial structures in the form of stone monuments also came into existence. They were funerary in nature since they contained skeletal remains, hence the terminology funerary structures to describe them. The continuity of burial practices from Chalcolithic times to Megalithic times cannot be discounted in Andhradesa.

The Megalithic funerary structures in Andhradesa are spread over a chronological period from about 600 B.C to 200 A.D., if not later. In fact, it is not rare to find an overlap situation from the megalithic to the early historic period. Over this long period of time, the skills involved in making these structures gradually evolved. It began with the filling of simple pit burials denoting the first stage of technology and culminated with the erection of huge menhirs over burial areas in certain cases. Our task is to identify the changes in the building technology from one type to another within the above mentioned chronological frame. Since most excavators and scholars[21] have already dealt with describing the different types of burials, and thus have provided us with valuable data on the megalithic culture in Andhradesa, in this chapter, our emphasis is on understanding the technological skills and changes involved in making these funerary structures.

The word 'megalith' is derived from the Greek words, viz., 'megathos', meaning 'huge' and 'lithos' meaning 'stone' ultimately denoting huge stones.[22] It may be more elaborately explained as a grave or a memorial erected in stone, dressed or in its natural form confined, enclosed or erected over the funerary assemblage. Graves without any lithic appendage containing cultural material of the period have also been called as megaliths.[23] The entire assemblage of megalithic burials can be studied under the following catagories, each having their individual building techniques. They are : p1t-burials, rock-cut pit-burials, cairn circles, stone circles with, or without, cist chambers, passage chambers or cist burials, dolmens and dolmenoid cists, menhirs, stone alignments and avenues. These different types cannot be attributed as belonging to a particular ethnic group. Though attribution of authorship to the megaliths is a very difficult task, scholars like Haimendorf, Childe, Gururaja Rao, and the Allchins' have tried to do this. Haimendorf[24] and Childe[25] postulated that the diffusion of the megalithism might have taken place through migrations by sea, along the western coast and thence into South India. According to Gururaja Rao[26] the origin of this culture was somewhere to the east of the Mediterranean sea and he opines that the megalithic people migrated from the North-Western border of India into South India. Similarly, the Allchins' propose that the South Indian Megalithic tradition came from the direction of the Caucasus, Iran and Central Asia.[27]

Usually a megalithic burial involved post-excarnation, complete inhumation and extended inhumation of dead bodies which were then laid in a North-South orientation in modes of burials like dolmenoid cists, urn burials, cists with port-holes, p1t-burials and circles and sarcophagae. These are particularly some of most common types found in Andhradesa. The funerary offerings in these burials included pottery, almost invariably black and redware, iron objects, personal ornaments and terracotta figurines.[29]

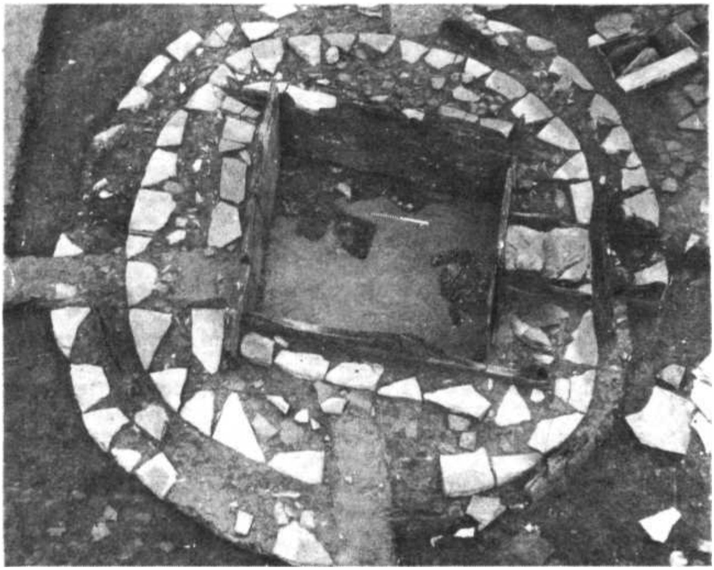
The study of the techniques, men and materials involved in the building technology of the megalithic burials of different types mentioned above is taken up for discussion against the background of their distribution pattern. Methods of arranging these burials varied from region to region. The techniques employed depended on the material available in each sub-region, which, in some cases, was different. Thus the development of technology and availability of raw materials were closely associated and these in turn, affected the methods of burial construction. We begin our study with a description of pit burials and their distribution in each sub-region of early Andhradesa.

The pit burial[30] termed as Meg. I at Site I at Uppalapadu[31] in sub-region A was a pit circle enclosing a rectangular pit. Funerary objects like pottery of redware, black ware, black and redware had been deposited on the floor. An iron rod, and one chisel were placed along the southern edge of the pit. The pit was filled upto 1.30 metres with light brown soil mixed with fine sand and silt. The rest of the pit was filled with black sticky clay. Finally, the pit was marked by a rubble packing encircled by longer stones. Meg.VII at the same site was also a pit burial and was dug into the natural soil and covered by a capstone in the centre of the pit in order to be a protective measure for the burial goods. At the same site, in Meg.II of Site II the floor space inside the pit was paved with cut shale stones making a platform to perform the burial practices. [Plate XII] On the eastern side of Meg. VII the pit was provided with a ramp which led to the pit proper. Either side of the passage was lined with stones. The pits were also filled up with earth and capped by a heap of shale stones and rubble.[32] Conglomerate blocks naturally available were arranged as circles in order to keep the filling of the pits intact and in some cases these burials were capped by huge capstones.

The circular form of the pit might have been drawn with a rope tied to a stick or rod fixed in the centre of the proposed grave and then the earth was probably dug out with the help of crow-bars, spades and reed baskets. After this was over, the skeletal remains and other funerary material were kept in the pit. The pit was then filled with earth or cairn packing. The depth, shape and size of the pits varied according to the conditions of the site and the funerary requirements. The entire operation required a certain number of persons to excavate the pit and fill the earth as well as for collecting the cairn filling locally. This meant the adoption of a fairly simple technology and this type of pit burials have been noticed at several places as tabulated in Chart IVA.

The rock-cut burials are the other type of burials found in the megalithic context. Scooping of rock or sheet rock for burying the dead or depositing the burial contents was initiated by the megalithic people. This was a further development in the pit-burial activity as noticed first at Uppalapadu[33] which took fulfledged shape at Jonnavada[34] where unique rock-cut burials have been noticed. At the former site Meg.IV was scooped out in rectangular fashion. Its floor was rammed with black clay mixed with lime concretions. Marks of crow bars are significantly seen on the vertical wall of the scooped pit. Jonnawada[35] in sub-region C [Plate XII] is an important site in understanding the earliest rock-cut technology in Andhradesa. Here, three burials were carved into the lateritic bed-rock in the shape of a jar with a flat base and an elongated opening with a narrow neck. The vertical section appears like an inverted funnel. A sarcophagus was placed on the eastern side of the burial. Burial I was excavated into the lateritic bed-rock with a diametre of 80 centimetres at the neck. The chamber was cut deeper towards the eastern side, where the sarcophagus was placed. The people who wanted to keep the skeletal remains of their dead in a safe enclosure, this time selected the hill slope and excavated into the lateritic rock. This was a difficult task and could only have been done with chisels and hammers to a depth sufficient for a man to enter into

PLATE XII



Period I: Cist burial, Uppalapadu, Sub-region A

Period I: Rock-cut Pit-burial, Jonnawada, Sub-region C it in order to keep the funerary material. The opening of the chamber was finally sealed by a capstone. Similar kind of rock-cut tombs sunk into the lateritic soil, with single or multiple chambers and a common open front court with flights of steps leading up to the surrounding ground level, have also been noticed at Kakkad in Trichur district of Kerala State.[36] Single and multiple chambered rock-cut burials have infact commonly been found in Kerala at places like Feroke and Perunimgulam Ansam.[37] In the case of Andhradesa we have only two examples to suggest that people were specialists 1n dressing or scooping shale stone at Uppalapadu in sub-region A and laterite rock at Jonnawada in sub-region C. Tools like crow bars, pick-axes, chisels and hammers were put to use in both the cases. This is a marked development from the earlier simple pit-burial making technology which did not require major tools and specialised skills.

The megalithic burials at Pochampadu[38] in sub-region A belonged to yet another category of funerary structures namely cairn circles.[39] Meg. I at the site consisted of a single circle of untrimmed 14 massive granite boulders and measured 3.60 metres in diametre. The space in between the boulders had a very thick scattering of rubble which was spread to the centre of the burial. The pit contained redware and black and redware bowls and dishes. The bottom of the pit was levelled up by a deposit of loose earth to act as cushion for the pottery. Two crushed skulls **were noticed** in the centre of the pit. The whole pit was then filled up with dug out earth and alluvial clay clods up to the brim level.

The constructional method at the pit however, reveals that after digging out the pits, the floors were neatly levelled and paved with fine earth collected from the river bed to act as cushion bed for the ritual offerings. Then the skeletal remains of the dead were kept in the pits along with other materials like iron objects, pottery and animal bones. Important to note among the objects found at Pochampadu is the recovery of an ivory comb [40] from under the skull of a skeleton put in Meg.I. The stones for making circles around the burial were mostly unhewn and collected locally. They were arranged in a circular fashion to keep the cairn intact from the burial so that the burial remains were protected from disturbance. This method of arranging the cairn circle denoted a further development in planning the funerary structures and perfected the earlier pit burial activity. Similar cairn burials either, in single or, double circles have been reported from a number of sites as tabulated in Chart IV A.

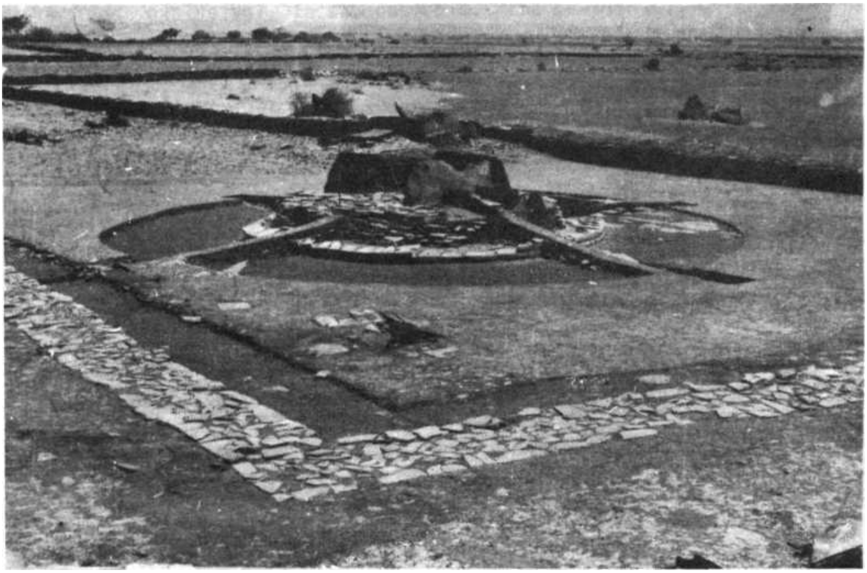
The burials encircled by huge dressed or undressed stones are called stone circles. [41] In the first stage they were sometimes arranged with rough and naturally available boulders. Subsequently, dressed or trimmed stones were employed which denoted an improvement in arriving at a regular circular shape on the already marked portion. They were also arranged in double and triple circles. Some burials were arranged with stone slabs planted in circular fashion by being trimmed on the top and sides. The slabs were important as they held the cairn filling of the burial firmly. Stone slabs of thin sections were also used to plant in the circle. This type involved simple knowledge of planting the slabs locally available and could be built and set-up in a short duration when compared to those **that** had to be cut from the boulders **[Chart IV A].**

The excavations at Chagatur [42] have revealed a full-fledged megalithic phase in period II. The megalithic complex consisted of massive port-holed cists,[43] with or without passage chambers, and these have been considered to be structurally unique. They include cists having circles, port-holed cist chambers, compartments and some cists in semblance with a proto type Buddhist stupa.[44] Further, the orthostats found here have graffiti marks. There are two impressive cist burials which have a passage chamber on the north enclosed by a rectangular dry stone masonry wall. These two cist burials have been termed as Meg.I and II. Interestingly, based upon their sizes the excavators have called them as the King's and Queen's burials respectively. Meg.I is a cist burial in swasthika pattern arranged with four orthostats enclosed by dressed stone slabs in a circle with a diametre of 11.0 metres. The cist was dug out to a depth of 3 metres and was divided into two compartments. To the northern half of these compartments, a bench like structure, supported by vertically planted stones on either side was also exposed. The other half of the burial was used for deposition of funerary material like skeletal remains along with redware bowls. The cist burial was enclosed by a rectangular wall with an entrance on the south side. This is a rare feature noticed in the megalithic context of South India as a whole [Plate XIII].

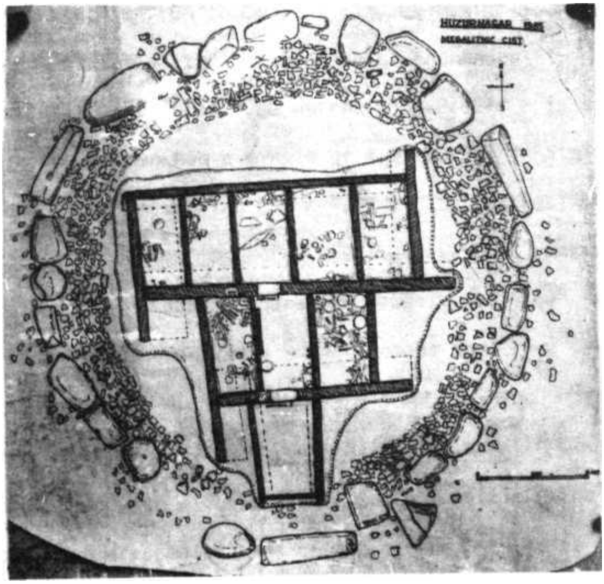
These two burials described above which were enclosed by a rectangular dry masonary wall in perfect right angled corners clearly testifies to the engineering knowledge in marking the plan on the ground by the megalithic people. Digging the pit to such a depth and arranging stone benches inside the burial for excarnation of bodies through the port-holed passage chamber are also significant technological details to be noted. Further, cutting, transportation, dressing and planting huge vertical slabs for orthostats, constructing the portion around the cist with a dry masonry wall above ground level and filling the gaps with the debris and providing a capstone on the orthostats cannot also be over-looked as technical achievements. Sometimes, as at Chinnamarur,[45] the floor of cist-4 here was made up of a dressed slab and covered with fine clay in order to provide a thick smooth bed for the dead body as well as to provide extra support to the vertical slabs preventing their collapse. The cists at Peddamarur[46] were enclosed by circles of vertically planted slabs. The space in between the cists and slabs was reinforced by a circular dry masonry wall a feature also noted at Uppalapadu and Gondimalla.[47]

Transcepted cists or multiple chambered cists have also been reported from sub-region B at Huzurnagar.[48] **[Plate XIII]** The cist burial exposed here has 9 chambers arranged in three rows with 1, 3 and 5 chambers in each row. Compartment I is a passage chamber. Compartment II was formed of four large slabs measuring 5.64 metres long with the inclusion of 0.87 metres limb extended towards the east. The height is 1.45 metres with a thickness of 0.23 metres and has a flat even surface with chisel marks on the edges. This compartment was subdivided into three chambers with the partition slabs laid in north-south direction. Compartment II was the largest of the three. The northern orthostat of this served as the southern orthostat of Compartment III, which was further divided into 5 chambers. Except in chamber 7, the remaining chambers were provided with flat dressed floor slabs. The floor of the 7th chamber was further filled with gravel. Portholes were provided for all the chambers. The orthostats were planted in an inwardly inclined position to prevent their collapse and further strengthened by piling up a cairn heap up to the capstone.[49]

PLATE XIII



Period I: Cist-burial with enclosure wall, Chagatur, Sub-region A



Period I: Multi-Chambered Cist-burial in a Stone circle, Huzurnagar, Sub-region B

The builders of the cists were experts in laying out the plan and in arranging a nine chambered cist. The above descbribed burial was a unique one noticed exclusively in sub-region B. The builder in this case had maintained an equ1-d1stance for each chamber with the aid of the centerline method and a measuring rod. The accuracy of angles and measurements bespeak of the calculative genius of the megalithic builders of the sub-region. For orientation of the burials they might have followed a uniform system with the help of sticks planting them in such a way so as to know its shade on either side at dawn and dusk. This method was perhaps necessary and served as an alternative to gnomon or compass which was not available during this early period. Cist burials encircled by stones, single or multiple chambered ones, sometimes, with capstones, have been reported from many sites in Andhradesa as tabulated in Chart IV A.

Another type of megalithic structure called Dolmen[50] has been found in three groups within a radius of 1 km and located on a local hillock called Galabhagutta, near Galabhagudem[51] in sub-region B. Similar dolmens have also been located at the nearby site of Kachanapalli. The height of each dolmen at Galabhagutta is 1.20 metres with 2.62 x 2.13 metres of inner measurements. The dolmen has a circle of 4.65 metres in diametre arranged with dressed stones measuring 2.5 x 0.66 x 0.20 metres in size. The capstone over the dolmen measured 3.0 x 2.8 x 0.25 metres. Both at Galabhagutta and Kachanapalli there are crudely depicted female figures erected in front of the entrance without hands and legs measuring 1.85 metres. Recently, in my field survey[52] some dolmens were found near Damaravai in sub-region B. The dolmens have circles with dressed stones in wedge shape on the outer side to form a perfect circle. The stones used for the circle were dressed with an offset at the base so as to rest firmly on the ground and then external surface was chiselled into concave or wedge shape to form a perfect circle. This arrangement reminds us of the stone veneered stūpas at Thotlakonda in sub-region C using the same technique of dressing, joining and construction.[53] Dolmens of various types have been reported from almost all the sub-regions as tabulated in Chart IV A. The Dolmens at Padra [Plate XIV] in sub-region A are noticed in clusters.

Attempts to extract cruciform figures probably of the dead have also been noticed at Damaravai. These were cut to a depth of 10 cm in living rock but the fissures in the rock did not allow the megalith builders to lift them intact. Some circles have two, and even three dolmens, in a row. The diametre of the circles varied from 8.0 to 18.0 metres. The length of the dolmen varied from 4.0 to 4.5 metres where as that of the capstones from 4.10 to 4.50 metres. The thickness of the capstones measured 0.50 metres. Similar cruciforms or, male and female figures, had earlier been noticed at the dolmenoid cists located at Dongatogu, Domada, Tottigutta, Kaperlaguru, Katapur, Mallur and Mangapet,[54] all in sub-region B. Regarding the cruciforms, E.O.James has opined that the images may have been employed as a substitutes for those who were buried. These have also been called Statue-menhirs.[55] The statue-menhirs have been reported from outside India as well in particular from the Channel Islands in Guerusky.[56]

The alignment of menhirs locally known as niluvurallu[57] often consisted of blocks of stones about 14 to 16 feet in height and 6 to 11 feet in girth. It is significant to note that they were without any chisel marks as has been noted about these at Mudumala[58] and Muraridoddi[59] in sub-region A. Krishna Sastry is of the opinion that these huge blocks might have been quarried by the fire setting method. These menhirs were arranged in a diagnol fashion. The even and odd numbered rows contain 6 and 7 menhirs respectively. There were altogether 7 rows. This demonstrates for us the skill in planning as well as the accuracy of their placement. The menhirs might have been erected and placed in position by arranging a sloppy ramp with crow bars, wooden stakes and a rope operated by 20 to 30 people under the direction of a skilled person. The construction of these monuments, often of colossal proportions, must have involved both enormous labour and technical skill. The menhirs at Ramanuthala and Urukonda[60] in sub-region A and at Lebarthy in sub-region B [Plate XIV] were planted and were packed with a heap of cairn at their bases.[61] The same 1s the case with those at Piklihal[62] 1n the contiguous region of Karnataka. The menhirs at Sanganakallu in Karanataka[63] had four stones planted at the bottom on the four sides arranged so that they did not tilt. The Menhirs have been reported from several places in Andhradesa as tabulated in **Chart IV A [Map VIII].**

The construction of dolmens and erection of menhirs required particular kinds of specialists in the field. The work involved quarrying, cutting, transporting, dressing and erection of massive slabs for use to make circle, walls and to be used as capstones. Besides, cruciforms or anthropomorphic figures required the further knowledge of first drawing the required shapes. The method of quarrying the granite slabs for the construction of tombs as practiced by ancients has been described by Newbold.[64] He suggests that, granite being a laminated material needed the stone to be burnt by piling up with wooden logs as this enabled extracting slabs in which the sound of splitting was to be judged. After this, iron tools were used for breaking the stones into necessary shapes. G.Keis[65]

PLATE XIV

Period I: A Dolmen, Padra, Sub-region A

Period I: A Menhir with supporting stones in the foundation, Lebarthy Sub-region B

CHART IV A

Period I: **Funerary** Structures

Sl. No.	Name of the site	Sub-region	Type of Funerary Structure							
			Pit	Rock-cut	Cairns & stone circle	Cist	Dolmen/ Dolmenoid cist	Menhir	Avenue	Alignment
1.	Agiripalli	C	-	-	√	-	-	-	-	-
2.	Alluru	D	√	-	-	-	-	-	-	-
3.	Amrabad	A		-	-	-	√	-	-	-
4.	Annasagaram	B	√	-	-	-	-	-	-	-
5.	Bairampalli	A	√	-	-	-	-	-	-	-
6.	Barrelagudem	B	-	-	-	-	√	-	-	-
7.	Basinikonda	D	-	-	-	-	√	-	-	-
8.	Bheemavaram	A	-	-	-	√	-	-	-	-
9.	Budavada	B	-	-	√	-	-	-	-	-
10.	Buddham	C	-	-	√	-	-	-	-	-
11.	Chagatur	A	-	-	√	√	-	-	-	-
12.	Chinnamarur	A	-	-	-	√	-	-	-	-
13.	Chintalacheruvu	B	-	-	√	-	-	-	-	-
14.	Chintapalli	A	-	-	√	-	√	-	-	-
15.	Cumbum	B	√	-		-	-	-	-	-
16.	Dachur	B	√	-	√	-	-	-	-	-
17.	Damaravai	B		-	-	-	√	-	-	-
18.	Domada	B	-	-	-	-	√	-	-	-

contd...

contd...

Sl. No.	Name of the site	Sub-region	Type of Funerary Structure							
			Pit	Rock-cut	Cairns & stone circle	Cist	Dolmen/ Dolmenoid cist	Menhir	Avenue	Alignment
19.	Dontatogu	B	–	–	–	–	√	–	–	–
20.	Ellampalli	D	–	–	–	–	√	–	–	–
21.	Gadiganamala	B	–	–	–	–	√	–	–	–
22.	Gajjelakonda	B	–	–	–	√	–	–	–	–
23.	Galabhagudem	B	–	–	–	–	√	–	–	–
24.	Gangaperur	D	–	–	√	–	–	–	–	–
25.	Garikapadu	B	–	–	√	–	–	–	–	–
26.	Goli	B	–	–	–	–	√	–	–	–
27.	Gollapalli	B	√	–	–	–	–	–	–	–
28.	Gondimalla	A	–	–	√	√	–	–	–	–
29.	Govindareddipalli	D	–	–	–	–	√	–	–	–
30.	Guntakal	D	–	–	√	–	–	–	–	–
31.	Hashmatpeta	A	–	–	√	√	–	–	–	–
32.	Hulikal	D	√	–	–	–	–	–	–	–
33.	Irlabanda	D	–	–	√	–	√	–	–	–
34.	Jaggayyapeta	B	–	–	√	–	–	–	–	–
35.	Jonnawada	C	–	√	–	–	–	–	–	–
36.	Kachanapalli	B	–	–	–	–	√	–	–	–
37.	Kadambagur	A	√	–	–	–	–	–	–	–
38.	Kalakatur	D	–	–	–	–	√	–	–	–
39.	Kalavagunta	D	–	–	√	–	–	–	–	–
40.	Kalyanadurg	D	–	–	√	–	–	–	–	–

contd...

contd...

Sl. No.	Name of the site	Sub-region	Type of Funerary Structure							
			Pit	Rock-cut	Cairns & stone circle	Cist	Dolmen/ Dolmenoid cist	Menhir	Avenue	Alignment
41.	Kambadur	D	–	–	√	–	–	–	–	–
42.	Kamepalli	B	–	–	–	–	√	–	–	–
43.	Kanyathirtham	D	–	–	√	–	–	–	–	–
44.	Kapertaguru	B	–	–	–	–	√	–	–	–
45.	Karapakala	A	–	–	√	–	–	–	–	–
46.	Karempudi	B	–	–	√	–	–	–	–	–
47.	Karlapahad	B	–	–	√	–	–	–	–	–
48.	Katapur	B	–	–	–	–	√	–	–	–
49.	Kuchidabba	C	–	–	√	–	–	–	–	–
50.	Lam	C	–	–	√	–	–	–	–	–
51.	Lebarthy	B	–	–	–	–	–	√	–	–
52.	Madhira	B	–	–	√	–	–	–	–	–
53.	Mallapuram	D	–	–	–	–	√	–	–	–
54.	Mallepadu	C	√	–	–	–	–	–	–	–
55.	Malleru	B	–	–	–	–	√	–	–	–
56.	Mangapeta	B	–	–	–	–	√	–	–	–
57.	Manikesvaram	B	–	–	√	–	–	–	–	–
58.	Maulali	A	–	–	–	–	√	–	–	–
59.	Medipalli	D	–	–	√	–	–	–	–	–
60.	Mekalabalayyapalli	D	–	–	√	–	–	–	–	–
61.	Mudumala	A	–	–	–	–	–	√	√	√

contd...

contd...

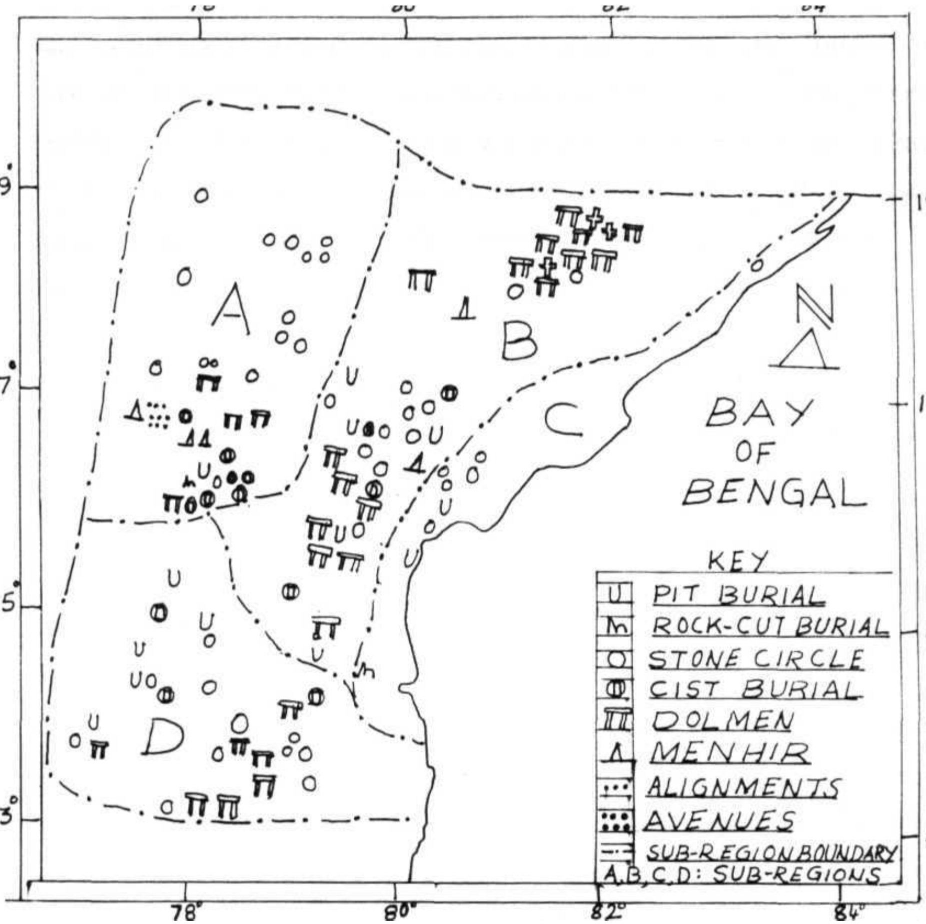
Sl. No.	Name of the site	Sub-region	Type of Funerary Structure							
			Pit	Rock-cut	Cairns & stone circle	Cist	Dolmen/ Dolmenoid cist	Menhir	Avenue	Alignment
62.	Mukthyala	B	–	–	–	✓	–	–	–	–
63.	Muraridoddi	A	–	–	–	–	–	✓	✓	✓
64.	Nagarjunakonda	B	✓	–	✓	✓	–	–	–	–
65.	Nallagunta	B	–	–	–	–	✓	–	–	–
66.	Padra	A	–	–	✓	–	–	–	–	–
67.	Paloneha	B	–	–	✓	–	–	–	–	–
68.	Pandavulametta	C	–	–	–	–	✓	–	–	–
69.	Panyam	D	✓	–	–	–	–	–	–	–
70.	Pedasanagallu	C	–	–	✓	–	–	–	–	–
71.	Peddamarur	A	–	–	✓	✓	–	–	–	–
72.	Pochampadu	A	–	–	✓	–	–	–	–	–
73.	Raigir	A	–	–	✓	–	–	–	–	–
74.	Rajampet	B	–	–	–	–	✓	–	–	–
75.	Ramanuthala	A	–	–	–	–	–	✓	–	–
76.	Ramathirtham	C	✓	–	–	–	–	–	–	–
77.	Ravipadu	B	✓	–	✓	–	–	–	–	–
78.	Ravirola	B	–	–	✓	–	–	–	–	–
79.	Serupalli	A	–	–	–	✓	–	–	–	–
80.	Sivapuram	B	–	–	–	–	✓	–	–	–
81.	Sundaragiri	A	–	–	✓	–	–	–	–	–
82.	Tadikonda	A	–	–	–	✓	–	–	–	–

contd...

contd...

Sl. No.	Name of the site	Sub-region	Type of Funerary Structure							
			Pit	Rock-cut	Cairns & stone circle	Cist	Dolmen/ Dolmenoid cist	Menhir	Avenue	Alignment
83.	Tadipatri	D	–	–	√	–	–	–	–	–
84.	Taticherla	B	–	–	–	√	–	–	–	–
85.	Tavalam	D	–	–	√	–	–	–	–	–
86.	Tavanampalle	D	–	–	–	–	√	–	–	–
87.	Telghir	A	–	–	√	–	–	–	–	–
88.	Tenneru	C	–	–	√	–	–	–	–	–
89.	Tottigutta	B	–	–	–	–	√	–	–	–
90.	Undrukonda	C	–	–	–	√	–	–	–	–
91.	Uppalapadu	A	√	√	–	√	–	–	–	–
92.	Urukonda	A	√	–	–	–	–	–	–	–
93.	Valigonda	A	–	–	√	–	–	–	–	–
94.	Velukuru	D	–	–	√	–	–	–	–	–
95.	Vengimaduru	B	–	–	–	–	√	–	–	–
96.	Yaguvacherlopalli	D	√	–	–	–	–	–	–	–
97.	Yarragondapalem	B	–	–	–	–	√	–	–	–
98.	Yelesvaram	B	–	–	√	√	–	–	–	–

MAP VIII



DISTRIBUTION OF FUNERARY STRUCTURES SUB - REGION WISE has proposed another method of splitting the stones through what he calls as the 'tongue and groove' method. After observing the scooping marks cut near a hillock at Benekal near Raichur, he proposed that this particular type of quarrying method might have been applied only by the dolmen builders. Splitting rock by 'tongue and groove' method using wooden plugs and iron wedges has hitherto been understood by Kies to be of a much later date.[66] Keeping this in mind, Keis fixed the chronology of the dolmens to be later than that of the pit, cairn and cist chambered burials.[67] Quarrying of stones for the megaliths must have been a recurrent activity and this knowledge is indicated in various degrees by the finish displayed in the stone slabs produced out of the local rocks at the different sites discussed above.

Gerald S.Hawkins[68] has proposed yet another method of quarrying while describing the stone henges of the Salisbury Plains in England. Here, he found that the splitting could have been done by wedging into cracks. He has suggested that sometimes the wedges were soaked with water to swell them or, alternatively, they could have been split by direct pounding. These methods might have been used as a comparatively advanced technique. Another method of cutting into rocks called the 'hot-cold-bash' meant that along a desired line of cleavage, fires were to be lit. Then, along these lines cold water was poured suddenly on the heated surface. Thus, while the area was 1n hot-to-cold stress 1t was bashed by mauls or heavy stones and the chunk of the stone is said to break off or, the line would open into a crack. The stones thus extracted were transported by wooden rollers to the site.[69] The site was then cleared, levelled and the plan of the dolmen was marked on the ground, followed by the dressed stone slabs being marked on the ground and finally, the dressed stone slabs were erected in position.

Usually, the stones were neatly dressed and the heights of each course of dolmens was standardised so that the top of each course served as bedding for the next course. The vertical joints were placed at right angles. Sometimes, the stones were dressed in such a manner that each stone would be fixed in the grove cut vertically in order to receive the other resembling a swasthika pattern. This helped keep the stones firm and tight.[70] This pattern was noticed at Damaravai in sub-region B. In most cases the finishing of the outer faces of the stones was only done after they were kept in position. In the next stage, the flat huge stones were placed on the vertical supports of the dolmens by moving them slowly from outside of the circles with the help of crow bars, wooden stakes, and rollers, from a sloped earthen ramp already laid for the purpose. Sometimes, wooden scaffolding might have also been laid to move the capstone which weighed nearly about 15 tons as 1n case of the Damaravai example.[71] The fine dressing was normally confined only to the exterior faces of the blocks of the circle that would ultimately be concealed with cairn packing.

Gerald S.Hawkins[72] gives us an idea as to how these huge stones were erected. According to him, "before erecting the stones, the builders dug the holes to the portion to be buried and the three sides of the hole were made vertical. The fourth one was sloped at 45^{o} angle to form a reception ramp. Opposite to this the hole was lined with thick wooden stakes to keep it from being gouged by the end of the descending stone which was rolled over the hole and tipped into the ramp its end sliding harmlessly down the stakes". He further writes "Then, with the aid of whatever hide or vegetable-fibre ropes and tackle, they could think of and make, some 200 men could have a 30 ton stone upright. And as soon as it was vertical, all empty space around its foot was filled, in an understandably frantic hurry. . . . .It is significant to note that the bottom of the uprights were carefully cut down to dull points, so that they were packed into thin holes and the stones could still be adjusted slightly by turning".[73]

The quarrying, cutting and dressing further required some marking materials such as a triangle, a measuring rod of a certain standard, a plumbob, hammers, either wooden or, of iron and iron chisels besides a good number of skilled, semi-skilled and ordinary labourers led by an expert in building such structures who also had organisational skills. During early stages of the meagalithic culture, the expert must have been a senior member of the tribe or clan.

The tradition of building or making funerary structures of simple pit-burials with a primitive technology of only digging a pit into the ground, and filling it with dug out earth up to the ground level was not difficult to execute in the first stage by the people of the early megalithic society. In the secondary stage, especially in the case of cairn burials, pits were packed with pebbles, cairn, rubble, shalestone pieces mixed with earth in the form of a hemispherical mound. In this method the hemispherical mound was arranged so that the rain water flowed very quickly from the structure enabling the funerary structure to last for a long time. This is obviously an important development in building the early funerary structures. On the other hand, the pit burials which were without any protrubarance above ground level naturally tended to disappear due to stagnation of water that was allowed to seep inside thereby causing damage to the burials and funerary material. By experience, the megalith builders overcame the above drawback by providing a mound filled with cairn. The floors were levelled and the top portion of the funerary objects were sealed by stones preventing the possible crush of skeletal remains and other associated funerary material.

A further development in this technique was observed in the making of stone circles. With reference to the cairn burial, since the mound was found disturbed during a course of time due to the occurrence of annual rains, a better method to preserve the structure had to be found. This resulted in building the stone circle which prevented the dislocation of the cairn packing. In the early stage, unhewn and naturally available boulders were brought and arranged into a circle. In the next stage of building the stone circle simply, trimmed stones and then finally perfectly dressed stones were employed denoting a still better technology than had been used earlier. To keep the funerary structure intact even double and triple circles began to be arranged with dressed stones.

The knowledge of extracting the stone from quarries or sheet rocks according to the geology of the sub-region helped the megalith builders to face the earthen walls of the burial pits with cut shale stones in square or rectangular shapes called the cists. Multi-chambered cists were also made. Neatly dressed slabs of considerable size, employed as orthostats, were planted in an inwardly inclined position to prevent their collapse and further strengthened by cairn fillings. The cists were arranged in swasthika pattern 1n such a way that the orthostats supported each other from internal collapse. In the oblong cists the orthostats had projections to the longer ones and in between the small orthostats were arranged in an inter-locked system. The latter orthostats were finally covered by capstones. To reach the cist chamber a passage lined with dressed slabs was also provided. The orthostat at the entrance had a porthole through which the burial contents were offered without removing or disturbing the structure. Sometimes, the inter-locked cist burials were further strengthened by construction of dry stone masonry which acted as external buttress. Besides, planting vertical stones on all the four sides of memorial nature, they also served in revetting the orthostats from collapsing. Taking all the precautions to keep the burial intact and to assure longevity, these arrangements revealed the depth of engineering knowledge of the megalith builders. The plan and life of a structure was determined by their discovery and the knowledge about the strength and durability of materials used. The side thrust and the lateral pressure of the heavy packing leading to collapse of the burials might have been the reason for their bettering and perfecting the funerary structure with a more advanced technology of employing non-perishable material. The latter went hand in hand with an increase in mathematical calculations and precision. For the entire family, or clan, funerary structures were enlarged and we find multi-chambered cists arranged in a single circle denoting advancement in building the burial structures as at Huzurnagar in sub-region B[74] [Plate XIII].

Another unique feature noted in the construction of these structures was the scooping of natural rock for ensuring funerary practices. Scooping into laterite rock bed in shape of an inverted funnel is evident in some cases, as at Jonnawada[75] in sub-region C [Plate XIII]. This was with a flat base and the neck portion was covered by a capstone arranged as a protection for the funerary remains. This could be removed for re-using the rock-cut burials whenever necessary. Their non-preference for this kind of burial revealed their ability of undertaking the difficult task of mastery the scooping technique. Often the rocks were very hard and these must have taken a long time to build.

A common feature found at many megalith sites was the erection of free standing funerary structures viz., dolmens, menhirs, avenues and alignments. Menhirs can be understood as long stones extracted from the different methods of quarrying as monoliths which were erected in front of the burials as appendages to the funerary structures. Transportation and erection of menhirs with scaffolding arrangements and packing them tightly with cairn or, planting small stones on all sides prevented their collapse.[76] This is a feature that has been observed at Muraridoddi in sub-region A. [Chart IV A.63] The erection of these menhirs revealed a distinct level of building technology. The erection of menhirs was a land mark in the history of building technology. The experience and skill of making these menhirs was inherited by sucessive generations in erecting the massive pillars of the Buddhist mandapas and the same know-how was adopted in the subsequent early historic period. This also denoted a radical change and marked evolution in the building technology of the megalithic people who had earlier made their funerary structures primarily below ground level and, to some extent, with a small elevation in the shape of mounds or cists arranged visible above the ground level. The menhirs which stood elegantly, naturally commanded a ve1w from a very long distances. The ones at Lebarthy 1n sub-region B are the best examples for this type of erection

[Plate XIV].

In the same category of monolith rock constructions described above, the construction of dolmens using a larger number of dressed slabs is evident during this period as well. These constructions were covered by a big capstone and finally, enclosed by well dressed wedge shaped stones revealing their sound knowledge in structural engineering. Most of the dolmens were located either on hill slopes and tops as noticed at Damaravai in sub-region B[77] and on the plains as found at Padra in sub-region A.[78] The quarried stones were neatly dressed and they were arranged in a cyclopean system of construction, i.e., placing the stones one above the other.

Sometimes, the corner of each stone had an offset-cut accommodating the other stone resembling the later day <u>nandvāvartha</u> type of joinry technique. The uneven surfaces of the ground on the granitoid hills were levelled to arrange the dolmens. The stone sacrophagae placed in them were also neatly dressed and sometimes had a smooth finishing. The place between circle and the dolmen was filled with medium sized pebble and chips of dressing waste mixed with clay for compactness. This has been found at the dolmen site at Damaravai in sub-region B.[79] Building of the dolmens with dressed stones, and covering them with a massive sheet rock might have demanded a slopped earthen ramp on which they could have been hauled. Both the inner and vertical forces were dressed and the walls stood to pulmbline. All these achievements no doubt paved a way for the development of building structural edifices in stone during the subsequent period, i.e., Period II of our study. Building of dolmens, as they were found in clusters and groups, might have been taken up as a collective project with specialists in the field being assigned the job. Likewise, the menhirs were often arranged in alignments and avenues. This required preconceived plans to erect them in straight or diagonal lines, which are still standing at Mudumala and Muraridoddi in sub-region A.[80] This existing fund of knowledge must have paved the way for erecting free standing <u>śilamandapas</u> of the Buddhists in the immediately succeeding peirod.

The above discussion reveals that the building technology in making funerary structures was first simple and primitive in case of pit-burials. In this case it was observed that to perfect the security of burial remains the community had to develop improved constructions like cairns, stone circles and cist chambers. In the next stage, free standing appendages were constructed to give permenance to the burials and amplified through dolmens, menhirs, avenues and alignments. The building technology of stone initiated by the megalithic people further continued during the early historical period in Andhradesa.

The evidence at the megalithic burial sites such as Muktyala and Galabhagutta has revealed the fact that the tradition of building the funerary structures continued into the early historic period. At Muktyala[81] on the orthostats of a cist burial, Sastry has identified a Brahmi label, incised on the port-hole which reads as 'Loovisri' and one more letter Ja below the porthole. At Galabhagutta[82] on an orthostat of a dolmenoid cist burial were written Brahmi letters of <u>Ma</u>, <u>Cha</u>, <u>Na</u>, <u>Tha</u>. The above two instances are indicative of the fact that the early historical people continued to perhaps follow the megalithic practices.

Some evidence in the constructional features observed at Chagatur, Uppalapadu and Gondimalla also lead us to conclude that the megalithic burial practices, being local traditions of making funerary structures, may have contributed a few structural ideas for the origin and development of building the <u>śārīraka</u> type of Buddhist <u>stūpas</u> in the early historical context of Andhradesa.[83] Further a dolmenoid cist apsidal on plan at Padra has been noted as striking feature of the Buddhist remains.[84] At Chagatur[85] [Plate XIII] the orthostats of the burials were constructed of heavy blocks, cut to size which, 1n turn encircled the other stones in a circular fashion from the base to support the heavy blocks. To this raised base was added a pavement of stones which can be compared to the <u>pradakshināpatha</u> of Buddhist <u>stupas</u>. Further, at the same site,[86] four huge vertical stones at each of the cardinal points were found. The vertical stones might have served as memorial stones and the intentional arrangement also satisfied some ceremonial function as noticed in case of a minor <u>stupa</u> at Thotlakonda.[87]

Another important find from this cist is a memorial stone depicting footprints probably meant for worship. The techniques in making the funerary structures at Chagatur and the structure of <u>stupas</u> found at Vaddamanu and Thotlakonda are observed to be similar in dressing and arrangement of the rim portion in circular form. The stone pavement around the orthostats of the megalithic burial at Chagatur and the stone venered <u>stūpas</u> built at Thotlakonda have close resemblances the process involved in making both the structures. Thus we suggest that there was close relationship between building funerary structures in the megalithic period and the subsequent development of the <u>stupas</u> constructions especially those that were meant to contain funerary remains.

The megalithic burials at Gondimalla[88] also bear some architectural features resembling a Buddhist stupa. The circles with horizontally paved shale slabs around the cists are found to be similar to the one found on the drum of the Buddhist stupa at Kesanapalli.[89] The circular dry wall of horizontally piled up shale slabs and the cist faced with vertically planted casing slabs was another similarity found between the two. The projection at the cardinal directions in the shape of an āyaka platform was yet another striking feature of the Buddhist stupa. Besides, we have important evidence of the construction of stūpas on megalithic burials. At Amaravati,[90] an urn burial was noticed below a subsidary Buddhist stupa. T.V.G.Sastry[91] has opined that the stupa at Vaddamanu was constructed following the local megalithic tradition as the central hub of it was made of boulders filling as is usually done in case of the megalithic cairn circle.

In another case, we noticed 1n the megalithic context the stones used for the circles of most of the dolmenoid cists at Damaravai,[92] were in wedge shape. Here, for the first time, an offset was provided at the plinth level offering a firm grip so that the stones of the circle could be neatly joined. This is a feature observed in case of stone veneered stupa at Thotlakonda, an important Buddhist site 1n sub-region C.

All the above evidences such as construction of megalithic burials in hemisperical section, planting of memorial stones at the cardinal points, provision of projected platforms in the shape of an avaka platform, construction of dry stone masonry 1n shape of a circumambulatory path, planting stone slabs of thin section to the outer face of burials resembling the later casing slabs and the use of wedge shaped stones with an offset at the footing, lead us to conclude that the local megalithic tradition of building the funerary structures that prevailed in Andhradesa formed the basic sub-strata of technical knowledge inherited by the architects who built early historic Buddhist stupas. It can be suggested that the impact of megalithsm is clearly seen in the architecture of the Buddhist stupas. The Buddhist literature also mentions that stupas should be erected over the bones of the dead persons. The Mahāparinibbana sutta says that the stupas might be erected over the corporeal remains of revered personalities to commeorate them. In layout, marking, making hemispherical mounds over the corporeal remains, abutting the core with stone or brick and finally, the portion between the outer and inner circle of a double circled burial, which probably evolved as the pradakshināpatha of the later day stupas in early historic Andhra, were all features of structural importance that were taken up and perfected in building these early historic structure which had links with funerary remains of the megalithic period.

FOOTNOTES

1. Siva, The Lord of creation, is often shown as sitting in the cremation ground which symbolizes the correct attitude of a Yogi. Indu Inderjit, Science of Symbols. New Delhi, 1977, p.68; p.143.

2. Baudhāyana Pitrmedha Sutra. III.1.4.

3. Rg Veda. X.18.10-13.

4. R.B.Pandey, Hindu Samskar as Socio-Religions Study of the Hindu Sacraments. Delhi, 1982, pp.240-241.

5. Rg Veda. X.18.11-13.

6. Baudhāyana Pitrmedha Sutra. III.1.18.

7. Satapatha Brāhmana. XIII.8.

8. R.E.M.Wheeler, 'Brahmagiri and Chandravalli', AI, Vol.4, 1947, pp.201-203.

9. M.S.Nagaraja Rao, Proto Historic Cultures of Tungabhadra Valley. Dharwar, 1971, pp.29-30.

10. M.S.Nagaraja Rao and K.C.Malhotra, The Stone Age Hill Dwellers of Tekkalakota. Poona, 1965, pp.27-33.

11. M.Seshadri, Excavations at T.Narsipur. Mysore, 1971, pp.19-20.

12. E.Sivanagi Reddy and B.Subrahmanyam, 'A Copper Antenna Sword from Proto-historic Andhra: A Study', PAPHC. 16th session, Karimnagar, 1992, pp.9-11.

13. B.Subrahmanyam, Protohistoric and Early Historical Cultures of Mahboobnagar Region (unpublished Ph.D. thesis) University of Mysore, Mysore, 1986, p.118.

14. V.V.Krishna Sastry, The Proto and Early historical Cultures of Andhra Pradesh. Hyderabad, 1983, p.38.

15. B.Subrahmanyam, Op. Cit., 1986, p.121.

16. R.Subrahmanyam, et al, Nagar.1unakonda-I: 1954-60. Delhi, 1975, p.105.

17. V.Rami Reddy, Prehistoric and Prohistoric cultures of Palavoy, South India. Hyderabad, 1976, p.12.

18. F.R.Allchin, Neolithic Cattle Keepers of South India. Cambridge, 1963, p.65.

19. F.R.Allchin, *Piklihhal Excavations*. Hyderabad, 1960, p.143.

20. T.V.G.Sastry, *Brief Results fif Veerapuram Excavations*. Hyderabad, 1981, p.3.

21. R.Subrahmanyam, et al, *Op. Cit.*. Delhi, 1975; V.V.Krishna Sastry, *Op. Cit.* 1983, pp.51-56, B.Subrahmanyam, *Op. Cit.*. 1986, p.120.

22. V.G.Childe, 'Megaliths', *AI*, Vol.4, 1947, p.5.

23. A.Sundara, *Early Chamber Tombs* of *South India*. Delhi, 1975, p.1.

24. C.V.F.Haimendorf, 'New Aspect of the Dravidian Problem', *IC*, Vol. II, 1953, pp.127-135.

25. V.Gordon Childe , *Op. Cit.*. 1947, p.12.

26. B. & R.Allchins, *The Rise of Civilization in India and Pakistan*. Delhi, 1983, p.342.

27. B.K.Gururaja Rao, *The Megalithic culture* in *South India*. Mysore, 1972, pp.325-326 and 330-334.

28. Bridget and Raymond Allchin, *The Rise of Civilization* in *India and Pakistan*. New Delhi, 1983, p.342.

29. S.B.Deo, *Problem of South Indian Megaliths*. Dharwar, 1973, pp.35-38.

30. The Pit burial is a simple method of disposing the dead in which the skeletal remains and other funerary goods are kept. This is later filled with earth and cairn packing, sometimes covered by a huge capstone. See K.P.Rao, *Deccan Megaliths*. Delhi, 1988, p.10.

31. B.Subrahmanyam, *Op. Cit.*. 1986, pp.202-203.

32. *ARAP*. 1976-77, pp.31-32.

33. B.Subrahmanyam, *Op. Cit,*. 1986, p.206.

34. *ARAP*. 1976-77, p.30

35. V.V.Krishna Sastry, *OP. Cit.*. 1983, p.67.

36. K.V.Soundar Rajan, *Megalithic Architecture in South India*. Missouri, 1975, p.6, f1g.6.

37. Lawrence S.Leshnik, *South Indian Megalithic Burials: The Pandukal Complex*. Weisbaden, 1971, p.77.

38. V.V.Krishna Sastry, *Op. Cit.*, 1983, pp.82-83.

39. In cairn burials, the pits after the dead are kept was sealed by cairns, i.e., small pebbles or stones and raised like a semicircular mound. This is called a cairn circle also known as a cairn burial or barrow. Below this cairn are kept the Urns or Sarcophagus for placement of skeletal remains and other funerary assemblage. Stone and wooden coffins have also been known below these cairns. See K.P.Rao, Op. Cit.. 1988, p.13.

40. E.Sivanagi Reddy and B.Subrahmanyam, 'Combs in Proto and Early Historic Andhra: A Study', PIHC. 51st session, Calcutta, 1992, pp.822-827.

41. Stone circles can be defined as burials enclosed by huge dressed or undressed boulders arranged on the ground forming a circle. The number of boulders used in the circle and the diametre vary from one circle to another. The boulders arranged in circular fashion served the purpose of keeping the Cairn filling of the burial intact. See A.Sundara, Op. Cit.. 1975, p.30.

42. B.Subrahmanyam, Op. Cit.. 1986, pp.211-215.

43. The cist burials which are also known as passage chambers are boxlike constructions made of slabs arranged in such a manner that each stone will hold the other finally to support each other from internal collapse. The cists were divided into two or more chambers by the insertion of dividing slabs in the cists and these are known as transcepted cists or chambered cist burials. See K.P.Rao, Op. Cit.. 1988, p.10.

44. B.Subrahmanyam, Op. Cit.. 1986, p.212.

45. Ibid. p.177.

46. Ibid. p.151.

47. Ibid. p.159.

48. ARAP. 1982-83, Hyderabad, 1988, pp.38-43.

49. B.Subrahmanyam, Op. Cit.. 1986, p.221.

50. Dolmens are burials built of stone partially buried and partially exposed above the ground, covered by a broad capstone. Stone slabs are boulders arranged in a square or rectangular plan with a capstone which is called a dolmen. The word dolmen is derived from 'doV meaning table and 'men' meaning stone which consisted of a number of upright supports and a flat horizontal roofing slab. See J.Meringer, History of Religion: The Gods of the Prehistoric Man. (Eng.Tr). London, 1960, p.159.

51. ARAP. 1982-83, pp.7-8.

52. E.Siva Nagi Reddy, 'Explorations at a Megalithic Site at Damaravai in Warangal district, A.P.', (Unpublished report) Department of Archaeology and Museums Hyderabad, 1993, pp. 1-6. Survey was conducted under the guidance of N.Ramakrishna Rao of Warangal Office.

53. V.V.Krishna Sastry, et al Thotlakonda (A Buddhist site in Andhra Pradesh). Hyderabad, 1992, p.28.

54. K.P.Rao, Op. Cit.. 1988, pp.20-34.

55. E.O.James, Prehistoric Religion. London, 1957, p.130.

56. Ibid, p.170.

57. A huge dressed or undressed stone erected vertically on or near a burial is known as a menhir. A group of menhirs arranged in a line are called alignments and these lines are arranged in parallel order they are called the avenues. See K.P.Rao, Op. Cit.. 1988, p.10.

58. V.V.Krishna Sastry, Op. Cit.. 1983, p.58.

59. 'Archaeological Finds', JHGS. vol.IV, Hyderabad, 1941, pp.85-89, pl.X, no.1.

60. B.Subrahmanyam, Op. Cit. . 1986, pp.169-170.

61. I have explored the Megalithic menhir site at Lebarthy in Warangal District, during my field study 1n June, 1993.

62. A.Sundara, Op. Cit.. 1975, p.132.

63. Ibid. 1975, p.71.

64. Captain Newbold, JHAS. 1916, Hyderabad, P.213.

65. G.Keis, 'Archaeological Finds', JHGS. vol.11 Pt.I., 1934, P.12,13 and pp.76-82.

66. Ibid. p.79.

67. Ibid. p.122.

68. Gerald S.Hawkins, Stone Henge Decoded Fontana, 1972, p.96.

69. Ibid. p.97.

70. A.Sundara, Op. Cit.. 1975, p.219.

71. E.Siva Nagi Reddy, OP. Cit.. 1993, pp.1-6.

72. Gerald S.Hawkins, Op. Cit.. 1972, p.98.

73. Ibid. pp.98-99.

74. ARAP. 1982-83, pp.38-43.

75. V.V.Krishna Sastry, Op. Cit.. 1983, p.67, pl.23.

76. Ibid. p.58.

77. E.Siva Nagi Reddy, Op. Cit.. 1993, pp.1-6.

78. V.V.Krishna Sastry, Op. Cit.. 1983, pp.54-55.

79. E.Siva Nagi Reddy, Op. Cit.. 1993, pp.1-6.

80. V.V.Krishna Sastry, Op. Cit.. 1983, p.58, pl.13(d)

81. V.Sankara Sastri, Buddhajayanthi Special Souvenier. 1956, pp.13-24.

82. ARAP. 1982-83, p.10.

83. V.V.Krishna Sastry, et al, Op. Cit.. 1992, pp.18-20; Leshnik also says that stupa and Megalithic Cairn burials are similar in plan and execution and further he adds that the funerary traditions of the megalithic peole were responsible in building the later day stupas. See Lawrence S.Leshnik, Op. Cit.. 1971, pp.31-32.

84. B.Subrahmanyam, Op. Cit.. 1986, p.167.

85. Ibid. p.270.

86. Ibid. p.198.

87. V.V.Krishna Sastry, Op. Cit.. 1992, p.28.

88. B.Subrahmanyam, Op. Cit.. 1986, pp.161-162.

89. A.W. Khan, A Monograph on an Early Buddhist Stupa at Kesanapalli Hyderabad, 1969, p.12.

90. A.Rea, 'Excavations at Amaravathi', ARASI. 1908-09, Madras, 1912, pp.88-91.

91. T.V.G.Sastry, Exvacations at Vaddamaru in Krishna Valley. Hyderabad, 1984, p.3.

92. E.Siva Nagi Reddy, Op. Cit.. 1993, pp.1-6.

CHAPTER V: RELIGIOUS SPACE

V.1 ROCK-CUT MONUMENTS

CHAPTER V RELIGIOUS SPACE

V.1 ROCK-CUT MONUMENTS

'Religious Space' here means the place where auguries are made and worship performed to God or supernatural powers. In this sense, 'Religious Space' in ancient India includes all the structures built exclusively for religious purposes such as the Buddhist stupas. chaitvas. vihāras. jaina monasteries and Brahmanical temples. These religious structures were made in different building materials viz., brick and stone in case of free standing monuments whereas some were made in the form of caves cut into the rock. Chronologically speaking the last category of monuments were caused to be excavated first and then the technology improved and they began to be built in brick and stone. Archaeological evidence for religious buildings in early Andhradesa comes forth only from Period II onwards, though we have some perceptions of an early form of Brahmanical structure mentioned in the Vedic literature. In the following sections of this chapter the evolution of building technology of these religious monuments is studied, dividing them into three categories viz., Rock-cut monuments, brick monuments and stone monuments.

We begin our discussion on the monumental buildings of rock-cut technology with a brief introduction on the origin of rock-cut technology in India in general and Andhradesa in particular, taking into account its prevalence in the contiguous regions around Andhradesa. Archaeological investigations in Andhradesa have revealed that human habitation during the Palaeolithic period was concentrated mainly along the banks of rivers and in the forests as this was convenient for collecting food materials and taking shelter in natural caves or caverns. The Mesolithic people also continued to live in natural caves and sub-terranean passages which have been noticed at Muchchatla Chintamanugavi[1] and Belum[2] in sub-region D. During the Neolithic period people continued to live in natural caves and under serpenthood shaped rock-shelters as noticed at Dupadugattu,[3] Sanganonpalli[4] and Uppair[5] in sub-region A, and at Kethavaram[6] in sub-region B. During the course of the evolution of Neolithic society people began to live in pits, cut into the ground as dwelling pits which have been uncovered at Utnoor[7] in sub-region A, Veerapuram,[8] Nagarjunakonda[9] and Gandluru[10] in sub-region B. Evidence of scooped or dressed activity during the Megalithic period has been noticed under the serpent hood shaped natural rock-shelters at Budigepalli[11] in sub-region A. Scooping and cutting the rock for funerary buildings is also known from Jonnawada[12] in sub-region C. The people who wanted to keep the skeletal remains of their dead in safe enclosures, selected the hill slopes and excavated the laterite rock. These early evidences attest to the knowledge of scooping and cutting of live rock, which had its origins in the later phase of Period I of our study. Earlier, as is well-known, the most natural instinct of man for many centuries during the pre-historic period was to find shelter in caves and rock-cut shelters. This was no exception in the case of Andhradesa. There were no monumental buildings consciously built by man, but naturally availble in nature. As the dawn of history emerged in early India, natural caves or caverns began to be selected for the dwelling of the monks or ascetics during the rainy season known as vassavasa when perigrination was not possible.

One of the early Buddhist texts[13] states: "as in olden times the bhikkus dwell now here and there, in the woods, at the foot of trees, on hill sides, in grottoes, in natural caves, in cemeteries, in forests, in open lands and in heaps of straw". The same text also informs us that "there were some vihāras and monasteries but these were thatched; in the cold season they were cold and in the hot season hot".[14] On the request of the bhikkus. the Buddha was said to have allowed the monks to use guhas or caves among the other five kinds of dwellings.[15] The Buddha himself is said to have stayed in the natural caves of Saptaparni at Rajagriha.[16] The Buddhist monks must have thus lived in natural caves upto the 3rd century B.C. if not later, when they shifted to rock-cut caves soon after the excavation of caves was initiated during this period. During the Mauryan period excavating of rock-cut caves can be seen in the natural caves of the period at Ramgarh and Budhani.[17] Similarly, in Āndhradeśa also, natural caves at Kapparaopet in sub-region A, seem to have been used by Jaina ascetics as dwelling places and hence the hill in which they lived is called as Munulagutta,[18] meaning 'the hill of the ascetics'. Here, the natural rock inside the cave was fashioned into four rock-cut beds to be used for sallekhana. a ritual practiced by Jaina monks during their last days. Based on the recovery of the coins of Simuka Satavahana near the caves, these caves are dated by P.V.P. Sastry to the 2nd century B.C.[19]

Apart from these early natural caves which were used for habitation, live rock was cut into caves for dwelling and religious purposes. The secluded location of the hills, far away from human habitation, with the tranquility necessary for the meditation and religious practices of the Buddhist and Jaina monks, was responsible for the selection of this kind of site. Soon there was the proliferation of rock-cut monastic and ritual retreats.[20]

In India the practice of rock-cut technology for monumental buildings was, for the first time, initiated during the Mauryan times and the earliest caves excavated are the caves called after Lomas Rishi and Sudama caves at Barabar and Nagarjuni hills in Bihar. These were scooped during the reigns of Asoka and his grandson Dasaratha.[21] These earliest examples of rock-cut buildings are the exact replicas of, probably the then existing wood and thatched structures. The caves 1n Barabar and Nagarjuni hills were excavated by quarrying into the hardest rock. Their carving and polishing was with a unique technique, which began and ended there within the same century. This method of rock-cut technology of the Magadhan region in all probability, served as models to the early examples of such rock-cut activity in the Western Deccan, coastal Andhra and Orissa. The beginning of rock-cut technology 1n the Western Deccan has been noticed at Ajanta, Bhaja, Kanheri, Kondavite and Pitalkhora and this goes back to the 3rd century B.C.[22] The Orissan examples at Udayagiri and Khandagiri on the other hand, were excavated by the Chedi King Kharavela 1n the 1st century B.C.[23] Rock-cut technology in early Andhradesa can be considered co-eval with the Mauryan experiments or be attributed to a slightly later date.

The monuments made with the help of rock-cut technology in Andhradesa can be studied in several varieties such as chaityagrihas, stūpas, vihāras, and cave temples. All the major religious faiths, viz., the Buddhism, Jainism and Hinduism have been affiliated to monumental buildings made with this technology. These monuments are studied below sub-regionwise in the different periods categorised by us above. These monuments have been found distributed in almost all the sub-regions of our study. The earliest rock-cut monument has been reported in the form of a chaityagriha at Guntupalli in sub-region C and the earliest vihāra in the same technique, has also been reported from the same site. Those at Rampa Errampalem and Sankaram have also been found in the same sub-region and belong to an early period. Monolithic stupas cut-out of rock-boulders have been reported from Karukonda in sub-region B **[Map IX & Chart V B]**. Rock-cut temples of the Brahmanical faith have been found near Vijayawada and its suburbs in sub-region C, at Bhairavakonda in sub-region B and at Gandharikota and Adavi Somanapalli in sub-region A In Period III **[Chart V C]**. A few Jaina rock-cut caves have been noted at Sangamayyakonda in sub-region C belonging to Period IV **[Chart V D]**. Thus it can be seen that rock-cut technology began to operate from as early as the 3rd century B.C. and continued upto the 12th century A.D. It is however significant to note that it is coterminus with the brick and stone built technologies in early Āndhradeśa.

The earliest sites of rock-cut caves in Andhradesa are located in a fertile tract which has its own economic implications. A general increase in the wealth affected the development of rock-cut technology in that, donations began to be made for it. The building of rock-cut monuments and their maintenance needed money and patronage.[24] The members of the royalty and chieftains and important officers of the State contributed to the excavation of the caves.[25] Besides the ideological concepts of the monks and the availability of suitable mass of rock, trained architects and sculptors, under the supervision of a Navakammika, assisted by Silavaddhakis, Mithikas and Aveśanins, smiths and painters were factors responsible for the excavation of these caves which Geoferry Scott calls: "Useful satellites of architecutural history".[26]

The earliest rock-cut chaitvagriha of Andhradesa found at Guntupalli[207] is similar in plan to the circular chaitvas at Mahakali and Junnar.[208] The entrance facade of the Guntupalli rock-cut chaitva arch resembles the facade of the Lomas Rishi cave [Plate XV]. The chaitva consists of a small circular chamber containing a rock-cut stupa in the centre with a domed roof, surmounted by curved stone ribs resembling an umbrella frame.[29] The vaulted roof seems to have been a copy of an evolved form of wooden structure, with long radiating rafters running downwards from a single point and crossing at regular intervals through horizontally laid rafters.[30] This treatment shows that an earlier practice in wood was transferred into stone which turned out to be more permanent. A large curved arch, above the main entrance, was cut out to form a chaitva window, through which light was admitted which fell directly on the stupa inside.[31] Percy Brown[32] has rightly observed, "it is here that a small circular chamber has been found which explains the kind of shelter that was first erected over the stupa the beginning of chaitya hall".

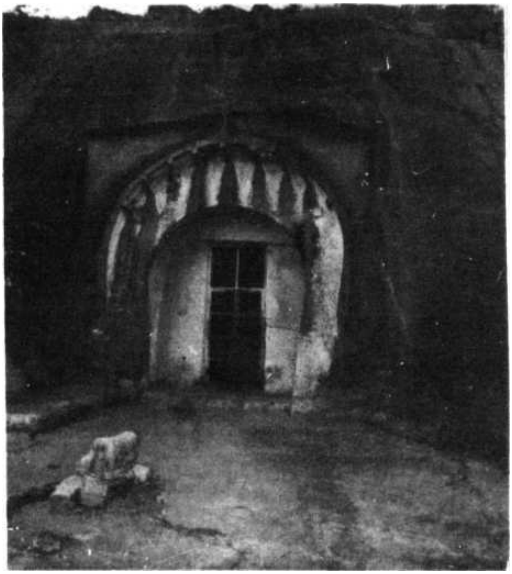
The measurements of the various parts like the height, width, the radius and centres of the doorway and the arch of this chaitva could be said to have been derived from a 'grid pattern'.[33] The pattern was evolved with the help of a ball of string and certain nails. S.Ganesh Rao[34] who has observed and studied the arch of the facade of Lomas Rishi cave has concluded that "it was carved on the grid pattern, where mathematical calculations and scientific precision was applied". In our recent survey in and around Gopalapatnam, a Buddhist site 1n sub-region C the rock-cut cells along with a few natural caves were provided with rock-cut beds, windows and doorways, the caves are to be datable to the 2nd century B.C. [Plate XV]

Another site, where rock-cut stūpas 1n Āndhradeśa have been noticed is Karukonda[36] in sub-region B [Plate XVI]. This is the only site which has stūpas of big size cut-out from living rocky boulders. Based on architectural style these cut-out stūpas have been dated to the 3rd-4th centuries A.D.[37] At Salihundam, a 4th century A.D. Buddhist site in sub-region C, nearly 30 small votive stūpas were cut-out in similar method. Here, the stupas did not require much scaffolding because the scooping of the natural rocky terrace was started from the sheet rock of one metre height. Cutting out the natural outcrop was entirely different from the cut-in technology. In the case of the former, the selected boulder was to be first provided with some scaffolding all around so as to draw the elevational plan in the first instance and its cutting would begin from the top itself, after removing the unnecessary mass through a slow chiselling process. Probably cane rings were used to the required diametre of the stupa and also a hemispherical cane frame in elevation might have been used to achieve the perfect circle and hemispherical shape. It is also possible that a pre-drawn scale model of the stūpa on cloth was consulted while cutting out these stupas.

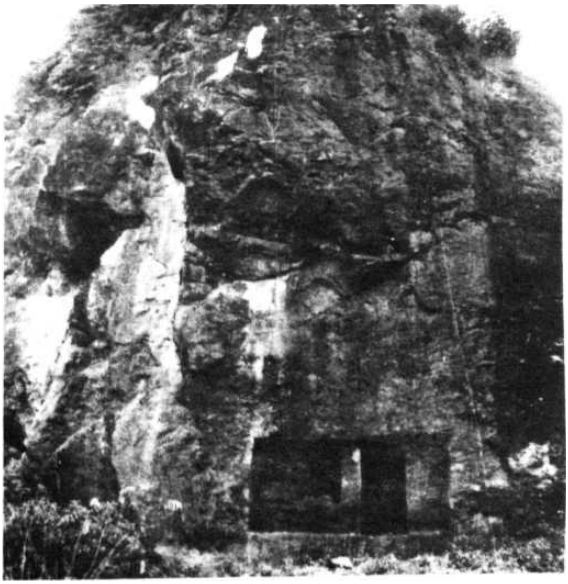
Apart from the stūpas the rock-cut technology was also used to build viharas in Andhradesa. Here, we notice certain interesting features in plan and execution. The vihara sometimes became both a monastic dwelling

and a sanctuary as has been observed at Guntupalli, where rock-cut chaitya and vihāra were excavated side-by-s1de.

PLATE XV



Period II: Rock-cut Chaityagriha, Guntupalli, **Sub-region C**



Period II: Rock-cut Vihara, Gopalapatnam, Sub-region C

As mentioned above, caves were preferred for dwelling by the Buddhist monks and probably permanance may have been one of the reasons that led them to choose excavating of rock-cut viharas in preference to wooden structures and even, brick or stone built structures. Indeed, this has been stated by a donor at a cave in Kanheri. He states in an inscription that the excavation of a chaitya could be ensured until the end of the cosmic era.[38] From the technical point of view, to select a cave dwelling meant that it had to be cool during summer and warm during cold seasons.

Rock-cut viharas in Andhrades'a have only been found located at places like Guntupalli, Rampa Errampalem and Sankaram in sub-region C. It is in this sub-region that the geological pre-requisite of the existence of suitable rock for excavation of caves was readily available. At Guntupalli[39] five rock-cut viharas with rectangular halls and cells have been reported. The front facade was carved with three doorways, and two cells had windows on either side. The portion above the doors and windows was decorated with horse-shoe arches with finials. The ceiling portion of the facade looked like a chaitva window, with radiating ribs again, resembling a wooden structure.[40] The rectangular halls were pierced with openings into cells, sometimes containing raised beds and pillows which were also cut in rock. Niches were provided in the walls probably to keep the lamps. Scholars like I.K. Sarma[41] opine that these cells were residential in nature. It has also been suggested that there was an evolutionary pattern from single cell to a row of cells in quadrangular form, found at Guntupalli.[42] Small channels were seen on the floor, in all probability meant for drainage. A drain or sewer known as niddhamana or niddhamanamāgga has been mentioned in literature.[43] Based on the palaeography of a Brahmi inscription found on the steps leading to the monasteries and the crude finish of the vihara with its plain walls bereft of any decoration, it has been suggested by scholars that a date of 2nd century B.C.[44] be assigned to these constructions.

Three rock-cut residential cells intended for Buddhist monks, square, rectangular and circular on plan, have been reported from Rampa Errampalem.[45] The square cell here has a screen wall at the entrance to shed light into the interior of the cell. This is a new technological innovation when compared to the Guntupalli caves where windows were provided with cavities in the wall to probably fix wooden frames with wooden door leaves.

A few Jaina caves with their entrances carved with simple jambed designs have been reported from Sangamayyakonda[46] in sub-region C. These caves are plain and bear the carvings of the Jaina tīrthānkaras. Based on stylistic grounds of sculpture and architecture, these caves are dated to 12th century A.D. The absence of decorative motifs denote that the rock-cut technology discontinued from this period onwards, for, we do not have any rock-cut monument excavated after this period.

Some caves being unfinished or semifinished, furnish good clues for the study of the different techniques adopted in scooping, chiselling and smoothening the walls, celling and floor surfaces of these monumental buildings. For this we have evidence coming from the caves of the Barabar hills, Nasik and Ajanta in the Western Deccan, from the Udayagiri and Khandagiri caves in Orissa and most importantly from our point of view from

Guntupalli in Andhradesa. Based on their individual observations different methods of scooping have been proposed by scholars like Dehejia,[47] Nagaraju,[48] Gupta[49] and Mohapatra.[50] According to Gupta[51] the work was of two types: One type of scooping was used for removing the matrix of the rock so as to obtain a hollow interior. The other type of scooping was used to chisel out the rough surface as per the plan, in height and depth. In the first type the work involved 'blocking' and 'rough chiselling' techniques. In this connection Gupta cites the example of the Barhut Sculpture[52] which depicts the method of rock-hewing in 'blocking technique'. The Sculptural panel from Barhut[53] shows the method of excavation of a hill for making a cave. The sculptors were using long pointed tools and chisels for scooping the rock. For cutting the upper portion, the workers had made landing steps by fixing nails at regular intervals without using ladders for scaffolding [Figure 7].

After completing the process of blocking and rough dressing, fine chiselling was undertaken with pointed chisels, as seen from the walls of the Guntupalli example. The sculptors have left extant some marks on the walls and also some stone ridges to follow up on the work. However this is left incomplete. The chiselling of ridges were gradually removed with grooves to obtain a flat surface. Gupta[54] calls this work of removing the ridges as 'pecking'. In this method, the final shape of the cave arch, ceiling, walls and flooring was obtained, after which a fine smooth surface was attained by using the flat chisels. The walls and ceilings might have been rubbed with stones, mixed with sand and water so as to remove all the chisel marks.[55] Finishing was probably done simultaneously on the outside when the interior work was going on. Cutting of the mass between the architectural members, probably went on side by side, as Vidya

FIGURE 7

Period II: A Sculptural panel showing sculptors excavating a cave Bahrut

(Reproduced from S.P.Gupta, The Roots of Indian Art, Delhi, 1981, p.206, Pl.4 (b))

Dehejia has observed from the unfinished cave V at Ajanta.[56] The cutting of the cave according to her, began from the ceiling, downwards, thus minimising the need for scaffolding 1n the preliminary stage. On the other hand, S.P. Gupta[57] has opined that the work of cutting the cave progressed from the bottom to the top upwards. Kail[58] however, agrees with Dehejia in this regard.

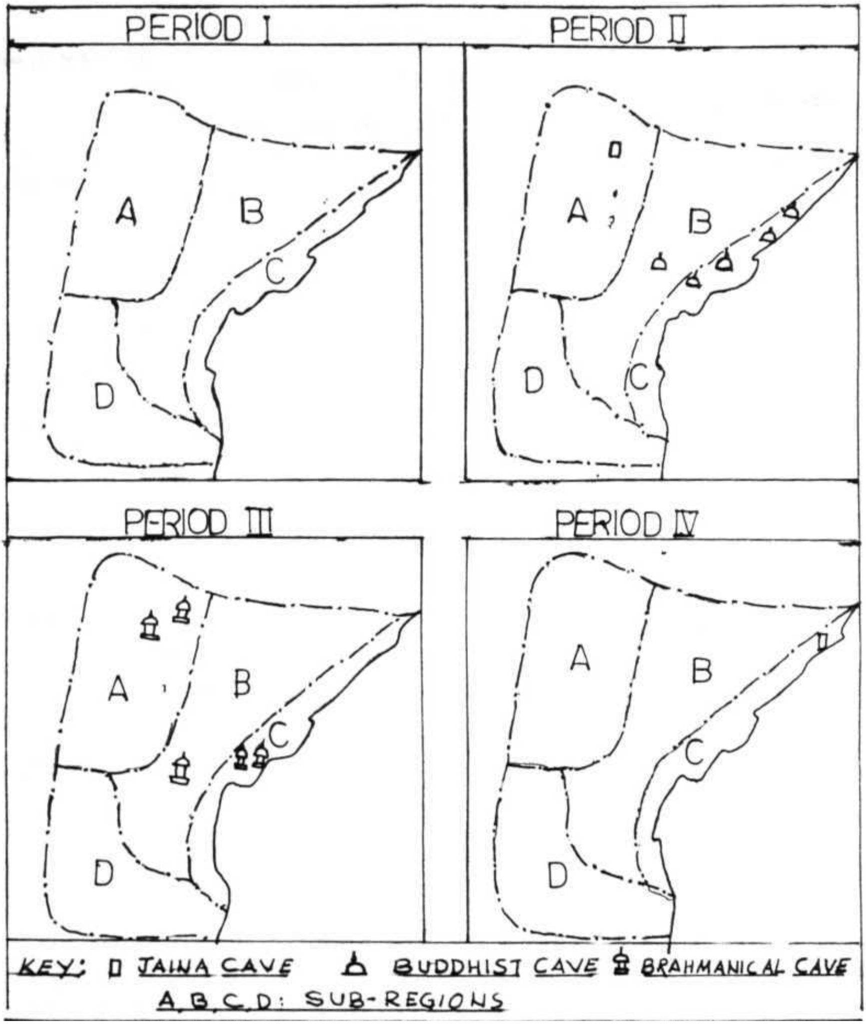
On observing some of the unfinished rock-cut cells at Guntupalli, the process and techniques of excavation can further be explained. In the first stage, the design was drawn on the rock which was then cut to get a perpendicular line so as to obtain a clear vertical face. This enabled the workers to proceed with the plan into a verandah or hall or the cells inside. After making the initial arrangements for minimum scaffolding, the cutting was probably started from the ceiling. In the next stage the horse-shoe projected gables over the doors and windows were taken up for workmanship and these were blocked out. Raised beds and niches were also carved accordingly.

There is no evidence to learn, on how much time it took for excavating these caves. This probably varied from place to place. At Guntupalli, for instance, it must have taken at least four to five years for completing both the chaitya and the viharas. This is on the basis of an estimate provided by S. Mizuno and T. Nagahiro[59] in the case of the Buddhist caves at 'Yun-Kang' 1n northern China, excavated during the 5th century A.D.

During the period from the beginning of the 5th century A.D. the activity of cutting the rock for building Brahmanical temples has been noticed at the Undavalli,[60] the Mogalrajapuram and the Akkanna-Madanna caves[61] near Vijayawada in sub-region C, the caves at Bhairavakonda 1n sub-region B belonging to 5th-7th centuries A.D., and the caves at Gandharikota[62] and Adavi Somanapalli[63] in sub-region A which belong to the 9th century A.D. **[Chart** V C & **Map IX].**

After a lapse of four centuries, the rock-cut tradition was revived for building religious shrines, this time those of the Hindu faith. The caves at Mogalrajapuram and Undavalli were cut in sandstone while at Bhairavakonda the rock cut into was a schistose intrusion, in the hill particularly chosen, owing to its soft nature for scooping. Here, it should be mentioned that the earlier Buddhist caves were cut in Khondalite stone. There are two rock-cut caves in the Akkanna-Madanna group, five each at Undavalli and Mogalrajapuram. The cave temple in each case, contains a rectangular pillared hall with a single shrine chamber and sometimes with three cells. At Bhairavakonda the rock-cut caves are eight in number, similar in plan, with a square chamber in the rear and a pillared hall in the front. In the early caves at Vijayawada the beams, brackets and pillars were short and massive, devoid of sculptural decoration and with minimum inter columnar space like the Pallava cave temples.[64] The pillars of the early phase of rock-cut activity initiated by the Pallava architects were massive and short and there was a tendency for the pillars of the latter phase to become thinner and taller. Sometimes they were flatter with an oblong section and the space between them was wider. The mandapas of the Pallava cave temples were divided by an inner row of pillars and pilasters into artha and mahamandapas.[65] The pillars of the facade clearly resemble more the conventional type of contemporary

MAP IX



<u>DISTRIBUTION</u> OF <u>ROCK-CUT MONUMENTS</u>

PERIOD WISE

CHART Y B, C & 8

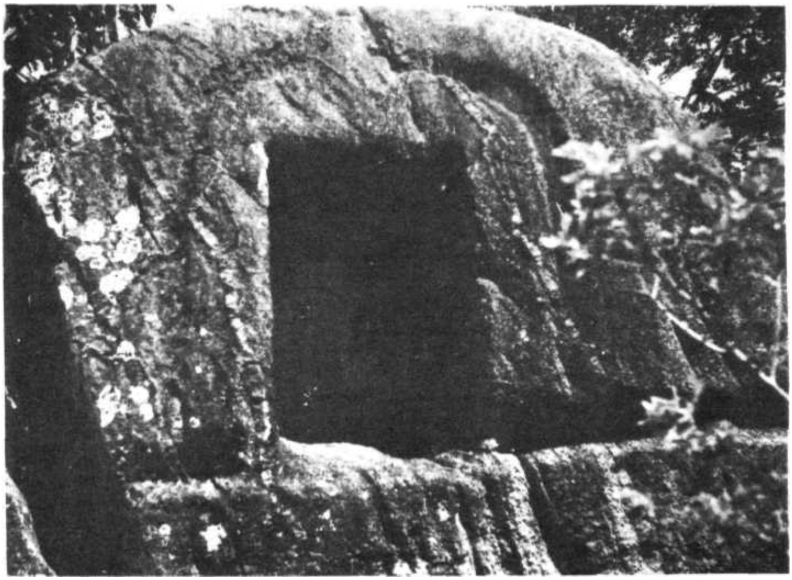
Period II: Rock-cut Monuments

S.No	Name of the Site	Sub-region	Type of Rock-cut Monuments									
			Buddhist			Jaina		Brahmanical		doors	windows	beds
			chaityagriha	stupa	vihara	cells	mantapas	cells	mantapas			
1.	Gopalapatnam	C	-	-	√	-	-	-	-	√	√	√
2.	Guntupalli	C	√	√	√	-	-	-	-	√	√	√
3.	Karukonda	B	-	√	-	-	-	-	-	-	-	-
4.	Munulagutta	A	-	-	-	√	-	-	-	-	-	√
5.	Rampa Errampalem	C	-	√	√	-	-	-	-	√	√	-
6.	Śankaram	C	√	√	√	-	-	-	-	√	-	-
	Period III: Rock-cut Monuments											
1.	Adavisomanapalli	A	-	-	-	√	-	√	-	√	-	-
2.	Bhairavakonda	B	-	-	-	-	-	√	√	√	-	-
3.	Gandharikota	A	-	-	-	-	-	√	-	√	-	-
4.	Mogalrajapuram	C	-	-	-	-	-	√	√	√	-	-
5.	Undavelli	C	-	-	-	-	-	√	√	√	-	-
	Period IV: Rock-cut Monuments											
1.	Sangamayyakonda	C	-	-	-	√	-	-	-	√	-	-

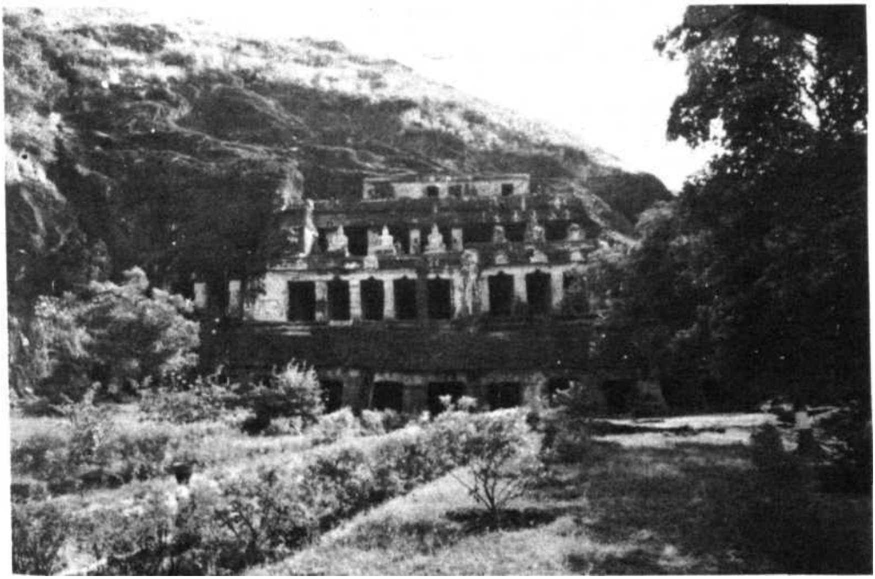
structural temples.[66] The mandapas of the cave temples at Vijayawada were divided into proximal and distal sections, the outer corresponding to the mahamandapa and the inner to the arhtamandapa. The front elevation of the facade was often cut to a varying depth into the sloping face of the rock according to the degree of the slope. The required height of the facade, was cut with an adhistāna as at Mogalrajapuram, having a flight of rock-cut steps in front. The top of the pillars were cut with massive taranga capitals with beams. The overhanging ledge projecting above the beam was left as a kapota and was sometimes made with decorations.

The Durga cave at Vijayawada[67] is the earliest, followed by the Akkanna-Madanna caves, with archaic features such as plain pillars. The development is seen in the next stage of rock-cut technology in these caves where the triple shrine cave was provided with taranga type of capitals for the pillars. Besides a spacious open front and decorated mouldings, on adhiṣṭāna and prastara[68] were also noted as improvements over the earlier caves. The Undavelli caves being the largest of the group at Vijayawada, reveal further developments in the rock-cut technology when compared to the Buddhist caves of Guntupalli in terms of plan, elevation, execution and amenities provided, like having stepped entrances with balustrades, spacious pillared halls for congregation and festive occasions, a broad opening on the front side, allowing sufficient light into the interior mandapas and even into the cells. Access from one storey to another was possible through the rock-cut steps **[Plate XVI].** Excavated in three storeys in receding order, excluding the unfinished ground floor, these caves are akin to the Do-tal and Teen-tal caves at Ellora.[69] The pillars of the ground floor were massive and without bases or capitals whereas the

PLATE XVI



Period II: Rock-cut Stupa, Karukonda, Sub-region B



Period III: Storied Rock-cut Temple, Undavelli, Sub-region C pillars of the upper storeys had the taranga capitals. The portion above the beams was carved like a cornice with Kudu decorations.

The softer nature of the mass and low tensile strength naturally allowed the sthapatis and workers to go deeper into the rock as at Undavalli whereas the hard granite rock at Mamallapuram[70] restricted the size of excavation. The process of excavation was done by the blocking and pecking techniques, as denoted by the chisel marks in the unfinished caves. After excavating the ground floor, some portion on the top was removed by scooping to obtain the vertical face. The design of the first floor and other floors was done by this method in descending order. The door jambs were carved with dwarapglas. The elaborate plans, elevation of storeys and expanse, fluted middle sections of the pillars, with corbels on the top and sculptural decorations when compared to other caves at Vijayawada were a substantial technical advancement from the earlier period. Since the caves were excavated at different heights, the excavators saved both labour and expenditure by following the configuration of the rock and by connecting different caves wherever necessary by rock-cut steps.

At Bhairavakonda[71] in sub-region B, a further development in rock-cut technology is observed, as, here the hill was scooped into caves at different levels presenting a panoramic view to the visitors. The front side slope was cut and totally removed to attain an open terraced front court, giving access to the temples and to accommodate more people on special occasions. The pillars of the facade were carved with aśwapada, fluted shaft and there was a special arrangement of the kuḍam, disc and taranaa podikas. Some times the front pillars were carved with lion bases similar to the ones found in the caves at Mahabalipuram. An increase in decoration and creating additional members to the pillars is a marked development here in comparison to the Undavelli examples. The pillars support the well-defined uttaram and kapota decorated with haṁsa, vāli and nāsi motifs. The sthapatis who were adept in structural engineering recognised that the pillars at the wall side were non-functional like the central ones and hence, provided half or engaged pillars. The size of the pillars was also reduced allowing sufficient light inside, in contrast to the massive pillars of Vijayawada caves.

72

At Gandharikota there are two rock-cut cells hewn into the natural rock on the southern face of the local hillock. On the hind wall were hewn some triangular niches for keeping lamps. The presence of mortice holes in the door sills indicates some sort of wooden doors for the cells. The roof portion was constructed with dressed stones above the rock-cut walls. The door-ways were carved with designs suggesting a date of about the 9th century A.D.

73

At Adavi Somanapalli a new technological development can be seen as in the case of the first cave. The rock surface here has been cut perpendicularly and then scooped into the plan of a mandapa supported by two non-functional crude pillars. In the second cave a beam and cornice were introduced and the pillars were cut with square bases, octogonal sections in the middle, and a square block, topped by taranga type of podikas below the beams. In the third and fourth caves, shrine chambers with a door-way were added by scooping. Some art motifs such as purnaghata on the door jambs have been depicted. The next stage of development is seen in the fourth cave where its flat ceiling was plastered with lime to obtain a smooth surface and then painted depicting some Puranic themes in different colours. On close observation it is noticed that the process of cutting the rock was the same as in the case of the above examples. The walls and ceilings were dressed flatly and were rubbed with stones to attain a smooth finish. Pillars were cut to a height of 2 metres whereas the height of the ceiling was 2.20 metres. Based on stylistic grounds these caves have been dated to the 9th century A.D.

To sum up, the origins of rock-cut technology in Andhradesa can be traced back to the 3rd century B.C. and it continued to be used for excavating religious structures upto the 12th century A.D. However, its continuity was broken in two spells, i.e., from the 1st to 5th centuries A.D. and from the 9th to 11th centuries A.D. In other words, this technology gradually became less important and then totally disappeared after 12th century A.D. This is because, activity of building the temples with stone as well as brick had gained momentum by the 7th century A.D.. The latter were now distributed over the plains whereas rock-cut technology was restricted to religious structures that were spread over hilly areas especially Buddhist and Jaina monasteries.

The above descriptions were taken up sub-reg1onwise against a site wise detailing of the various aspects which facilitated us to enquire the diffusion of rock-cut technology from the contiguous regions and highlight variations from one sub-region to another within the Andhradesa. The activity of using rock-cut technology was found in building different monuments such as the Buddhist chaitvas. vihāra complexes and cave temples of Brahmanical faith. Among these, as discussed above, the Buddhist chaitya at GuntupalU[74] 1n sub-region C belonged to the 3rd century B.C. and is the earliest monument cut into the natural rock, imitating the contemporary wooden structures, in shape and the Mauryan examples of Lomas Rishi cave 1n plan, elevation and execution. The rock-cut technology might have originated to create permanance. Further, monks needed to be away from posh habitations. The caves were cut with arched entrances and halls finished 1n vaulted roofs with radiated ribs.

Though the buildings of rock-cut technology are distributed in sub-regions A, B and C it is seen that 1n sub-region C there were a large majority of them concentrated. It was because of the rock deposites of Khondalite and Scists that facilitated the architects to scoop rock-cut monuments in this sub-region. The probable techniques employed in cutting these monuments included drawing of the plans and removing the stone in 'blocking' and 'pecking' techniques followed by chiselling.

The rock-cut technology initiated by the Buddhist architects during the 3rd-2nd centuries B.C. in sub-region C disappeared from the 1st century A.D. because of the lack of patronage that had been mainly fostered by royalty and merchants. This in turn was due to the decline in trade on the coastal port towns of Andhradesa. It was during the 5th-6th centuries A.D. that the rock-cut technology was resumed in the same sub-region in the excavation of some Brahmanical cave temples. The caves in and around Vijayawada, and after two centuries, at Bhairavakonda have been scooped into pillared halls, with ante chambers and sometimes, with three levels of excavated structures. The techniques employed at Bhairavakonda were more akin to those found at Mahabalipuram in Tamil Nadu, a region contiguous to sub-region B. There were few rock cut caves in sub-region A as noticed only at Gandharikota and Adavi Somanapalli. After a lapse of three centuries the activity was found at some Jaina caves at Sangamayyakonda in sub-region C. Artistic and architectural embellishments to provide sufficient light in the interior could not be fully achieved in rock-cut technology as a limited scope was possible for these. Further, from the early medieval times onwards building of free standing stone temples in almost all sub-regions gained momentum, supported by munificient grants offered by the local chiefs, nobles, and royalty. This hindered the progress of rock-cut technology and finally it disappeared by the 13th century A.D. 1n Andhradesa.

FOOTNOTES

1. M.L.K.Murthy, 'A Late Pleistocene Cave Site in Southern India', PAPS. vol.118, no.2, 1974, pp.196-230.

2. G.Krishnam Raju, 'Excavations at Belum Caves', ARAP. 1982-83, p. 15.

3. E.Sivanagi Reddy, 'Recent Discoveries in Painted Rock Shelters of Pre and Proto-historic Andhra', a paper presented at XVIII Session of A.P.History Congress. Tenali, 8-9th Jan, 1994. p.1.

4. Ibid. p.1. . . . . . .

5. Ibid. p.2.

6. V.Chandramouli, A Study of Microlithic Culture and Rock Paintings at Kethavaram. Kurnool District. M.Phil., Dissertation (unpublished), University of Hyderabad, Hyderabad, 1986, pp.25-40.

7. F.R.Allchin, Utnoor Excavations. Hyderabad, 1961, p.65.

8. T.V.G.Sastry, Brief Results of the Excavations at Veerapuram. Hyderabad, 1981, pp.1-6.

9. R.Subrahmanyam, et al., Nagarjunakonda-I: 1954-60. Delhi, 1975, p.98.

10. ARAP. 1982-83, p.45.

11. V.V.Krishna Sastry, Op. Cit.. 1983, p.

12. ARAP. 1976-77, pp.31-32.

13. Cullavagga. VI.1.

14. Ibid. VI.1.

15. H.Sarkar, Studies in Early Buddhist Architecture of India. Delhi, 1966, p.1.

16. S.P.Gupta, The Roots of Indian Art. Delhi, 1981, p.205.

17. Ibid. p.202.

18. G.Jawahar Lal, Jainism in Andhradesa. (as depicted 1n Epigraphs), Hyderabad, 1994, p.36.

19. P.V.P.Sastry, 'Coins of Simuka Satavahana Discovered'. JAAP. vol.1, no.1, 1979.

20. R.P.Mohapatra, Udayagiri and Khandagiri Caves. Delhi, 1981, p.85.

21. Owen C.Kail, The Cave Temples of India. London, 1971, p.1.

22. S.Nagarju, Buddhist Architecture of Western India. Delhi, 1981, p.104, 129, 218. According to Dehejia, the beginning of rock-cutting in the Western ghats coincided with the rise of the Satavahana dynasty. The first phase of rock-cut activity ranges between 100 B.C. - 20 B.C. and the second phase started rom A.D.50 and continued up to 200 A.D. See V.Dehejia, Rock-cut Temples of India. London, 1972, p.148.

23. R.P.Mohapatra, Op. Cit.. 1981, p.164.

24. S.Nagaraju, Op. Cit.. 1981, p.26.

25. Ibid. p.26.

26. Geoffery Scott, The Architecture of the Humanism. London, 1961, p.25.

27. H.Sarkar, Op. Cit, 1966, p.27.

28. Owen C.Kail, Op. Cit. 1971, p.44.

29. V.Dehejia, OP. Cit.. 1972, p.74, Pl.3, fig.2.

30. S.P.Gupta, Op. Cit.. 1981, p.216.

31. Owen C.Kail, Op. Cit.. 1971, p.24.

32. Percy Brown, Indian Architecture, (Buddhist and Hindu Periods) Vol. I Bombay, 1942, p.36.

33. S.P.Gupta, Op. Cit. . 1981, p.214, fig.5.

34. S.Ganesh Rao, in S.P.Gupta, Op. Cit.. 1981, pp.220-221.

35. E.Sivanagi Reddy, 'A Report on the Discovery of a Few Rock-cut Cells around Gopalapatnam near Tuni, Visakhapatnam District', available with the Dept. of Archaeology and Museums, Hyderabad, 1994. (typed)

36. G.Chandra Reddy, 'Rock-cut Buddhist Monuments of Karukonda', PAPHC. vol.12, 1988, pp.46-49.

37. R.Subrahmanyam, Salihundam: A Buddhist Site in Andhra Pradesh. Hyderabad, 1964, p.13.

38. ASWI-V. Ins.no.475.

39. ARAD. Southern Circle for 1916-17. Madras, p.30; R.Subrahmanyam, The Guntupalli Brahmi Inscription of Kharavela. Hyderabad, 1968; I.K.Sarma, Studies in Early Buddhist Monuments and Brahmi Inscriptions Of Andhradesa. Nagpur, 1988; Debala Mitra, Buddhist Monuments. Calcutta, 1971.

40. N.Jitendra Das, The Buddhist Architecture of Andhra. Delhi, 1993, pp.83-85.

41. I.K.Sarma, Op. Cit.. 1988, p.58.

42. J.Burgess and J.Fergusson, The Cave Temples of India. London, 1880, p.12.

43. Jgtaka. vol.1, nos.475, 490.

44. I.K.Sarma, 'Epigraphical Discoveries at Guntupalli', JESI. vol.V, p.58.

45. I.K.Sarma, OP. Cit.. 1988, p.33.

46. ARAP. 1982-83, p.9.

47. V.Dehejia, Op. Cit.. 1972.

48. S.Nagaraju, Op. Cit.. 1981.

49. S.P.Gupta, OP. Cit.. 1981.

50. R.P.Mohapatra, Op. Cit.. 1981.

51. S.P.Gupta. Op. Cit.. 1981.

52. Ibid, 1981, p.206.

53. Ibid. 1981, Pl.86b.

54. Ibid. 1981, p.207.

55. This can be deduced on observing the work of present day sculptors.

56. V.Dehejia, Op. Cit.. 1972, p.136.

57. S.P.Gupta, Op. Cit.. 1981, p.206.

58. Owen C.Kail, OP. Cit.. 1971, p.10. Regarding the technique of the excavation of the Udayagiri and Khandagiri caves datable to 1st century B.C., R.P. Mohapatra says that the excavators followed some ground plan with specific design. See R.P. Mohapatra, Op. Cit.. 1981, pp.64-65.

59. S.Mizuno and T.Nagahiro, Yun-Kang : The Buddhist Cave Temples of 5th Century A.D.. Northern China. vol.XVI, Kyoto, 1951-56, p.17.

60. K.V.Soundara Rajan, Architecture of the Early Hindu Temples of Andhra Pradesh. Hyderabad, 1965, pp.17-21.

61. Ibid, pp.21-23.

62. N.Ramakrishna Rao, 'Explorations in and around Gandharikota', ARAP. 1990-91, pp.11-20.

63. N.S.Ramachandra Murthy, 'Art and Architecture of Karimnagar district', PAPHC. VII Session, Warangal, 1983, pp.2-3.

64. K.R.Srinivasan, 'The Pallava Architecture of South India', AI, vol.14, p.117.

65. Ibid. p.124.

66. Ibid. p.125.

67. K.V.Soundara Rajan, Op. Cit.. 1965, p.17.

68. Ibid. 1965, pp.17-18, Pl.IV, fig.4.

69. K.R.Srinivasan, Temples of South India. Delhi, 1972, p.81.

70. R.Srinivasan, Op. Cit.. AI, p.117.

71. K.V.Soundara Rajan, Op. Cit.. 1965, pp.21-23.

72. N.Ramakrishna Rao, Op. Cit. • 1990-91, pp.11-20.

73. N.S.Ramachandra Murthy, Op. Cit.. 1983, p.2.

74. H.Sarkar, Op. Cit.. 1966, p.27.

V.2 BRICK MONUMENTS

V..2 BRICK MONUMENTS

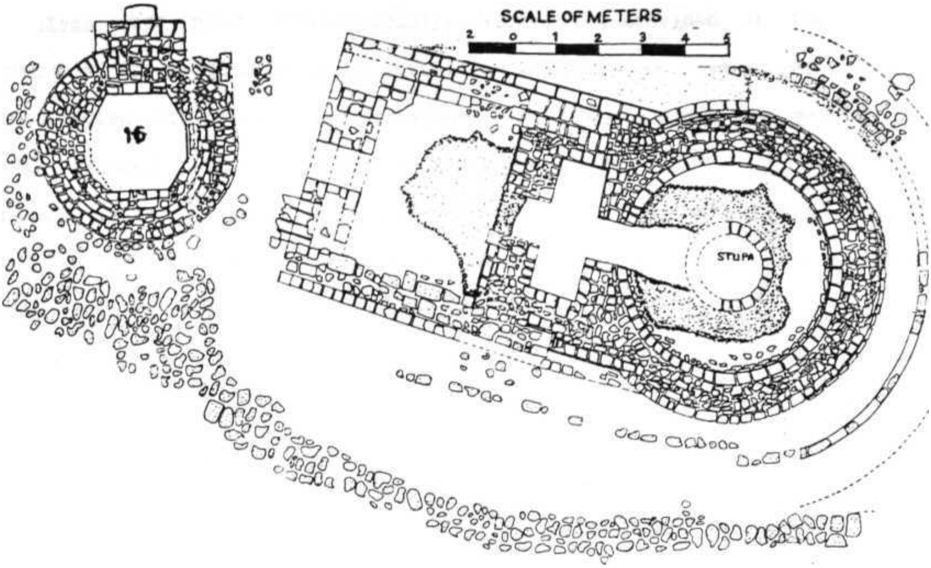
A change in the technology from rock-cut to brick has been noticed in free standing brick buildings which began 1n Andhradesa from the 2nd century B.C., i.e., Period II onwards and continued upto the 13th century A.D., i.e., Period IV. Rock-cut technology had to give way to brick because the former could only be located where natural rock was available whereas, bricks could be used any where, i.e., plains and hills. These brick buildings can be studied in their different forms ranging from chaityagrihas, stupas, and viharas of the Buddhist faith and temples of the Hindu faith.

We begin our discussion with the chaitvagrihas built in brick as these are the earliest brick structures known in the region under study. The chaityagriha at Guntupalli[1] in sub-region C is datable to the 2nd century B.C. This circular chaityagriha was raised on an adhistāna, having mouldings of upana, jagati and prati. Inside it, the wall portion was built to plumb, whereas the outer wall had projected mouldings from the wall. These mouldings have served as the footings of the basement and have also given beauty to the building. As the brick technology was in its initial stages, the masons provided heavy walls though this does not seem to have been necessary. Bricks were of the wedge shaped type and set in mud mortar with thin joints. Chamferred bricks were used for the mouldings denoting that the brick makers followed the designs intended for the proposed buildings and also prepared moulds accordingly 1n required sizes and shapes. These bricks might have been manufactured at the foot of the hillock, where, it is noticed that fine clay free from sand and gravel and water were easily available. Burnt bricks must have been carried to the hill top by head loads since the way to hill top was only meant for walking as no cart track can be located here. Wet clay paste was used as binding material. The constructional features of the circular brick Chaitya at Guntupalli reveals that the circular plan was almost copied from the local rock-cut examples. Circular chaityagrihas have also been reported from Bavikonda[2], Thotlakonda[3] and Salihundam[4] in the same sub-region [Chart V B 3, 25, 28] [Map X].

The surroundings of the Chaityas at Bavikonda and Thotlakonda were paved with rubble and plastered with lime [Plate 8]. The floors of the Chaityas were also plastered. Usage of lime was a technological improvement than the earlier use of mud mortar as lime offered longevity to the structure and also arrested the leakage of water. Lime must have been adopted by the builders after thoroughly observing the weathering effect on the unplastered ones.

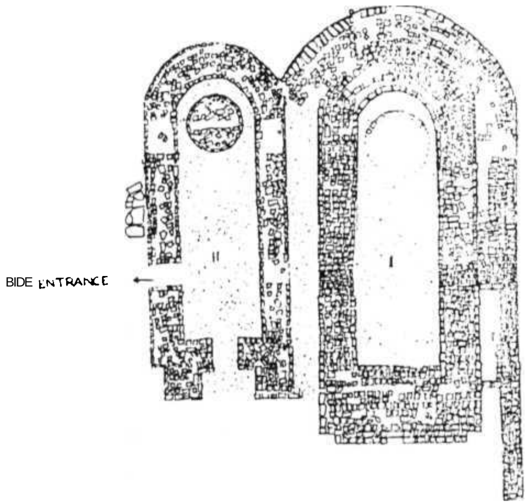
Besides the circular ones, apsidal Chaityas were also built for Buddhist worship. The earliest apsidal Chaitya built in brick has also been noticed at Guntupalli. This is followed by the ones at Ramatirtham, Sankaram, Bavikonda [Figure 8] and Thotlakonda, all located in sub-region C, and at Chandavaram and Nagarjunakonda in sub-region B [Chart V B 14A, 23, 26, 3, 28, 6, 18].[5] The apsidal Chaitya at Guntupalli, dated to 2nd century B.C., was located on a levelled terrace of the hillock which measured 16.75 x 4.40 metres in length and width respectively. The thickness of the side wall was 1.30 metres. A partition wall was constructed to separate the apse from the hall. Both circular and apsidal

FIGURE 8



(a) A circular brick Chaityagriha, Thotlakonda, Sub-region C

(Reproduced from V.V.Krishna Sastry et al, <u>Thotlakonda, A Buddhist Site in Andhra Pradesh</u>. Hyderabad, 1992, Fig.No.8)



(b) An apsidal brick Chaitya, Bavikonda, Sub-region C

(Reproduced from N.R.V.Prasad, <u>Bavikonda: A Buddhist Site in North Coastal Andhra Pradesh</u>, Hyderabad 1994, Fig.No.7)

Chaitvas were built simultaneously. Niches were provided in the wall probably to keep objects of worship or lamps. Door jambs were also constructed with brick in semi-octagonal plan. The basement was decorated with moulded bricks. The roof of the Chaitva was of brick and lime in barrel vaulted shape. A notable development in the brick technology noticed here was the reduction of the thickness of the wall to 1.30 metres when compared to 2.14 metres in the case of the circular Chaitva described above. Perhaps the masons might have constructed the latter with more width than the required for the sake of stability. Though it was difficult to make the apsidal chaitva. the shift from circular to apsidal plan may have beeen made as the latter accommodates more monks and worshippers inside it, than the former one.

Some interesting constructional features have been noted in an apsidal chaitvagriha at Chandavaram[6] in sub-region B datable to 2nd century B.C. The walls were constructed with brick courses whose middle portion was filled with rubble and pebble set in mud mortar. This can be said to have been an improvement in the building technology as the use of brick was curtailed and excessive wastage of it was saved. Interestingly, the entrance was constructed terminating into a semi-circular plan with a narrow entrance, an innovation noticed only in this example. In the later examples of apsidal Chaitvas found at Thotlakonda,[7] Ramatirtham,[8] Sankaram[9] and Salihundam,[10] moulded bricks were used at the plinth level. Recovery of terracotta finials within the Chaitvas lead us to surmise that the barrel vaulted roof was decorated with finials made by specialists in the field.

During the second phase of Period II of our study, the apsidal Chaityas at Nagarjunakonda[11] in sub-region B of the 3rd century A.D. [Chart V B 18] were constructed on well elevated platforms. These raised floors were approached by flights of steps. This might have been due to the low lying profile of the area near the river, with possibility of water stagnation and to overcome this, the floors were raised. The interior floor and the surrounding area of the Chaityas were laid with lime concrete or, sometimes paved with dressed slabs. Laying of lime concrete on the floors was also an improvement in the building technology of the period as in the earlier period only lime mortar was used to plaster the floorings. Stone pebbles and brick bats were mixed 1n the lime mortar probably to attain longevity of the floor so that 1t did not demand periodical repairs. A further development in the building technology of the brick structures was noticed here as the outer walls were encased with stone slabs. This was an engineering technique applied to arrest the rain water from entering the structure. For an earlier period at Thotlakonda[12] stone slabs were planted only upto the plinth level whereas here the slabs were arranged upto the wall portion.

Construction of partition walls was continued with a view to probably provide a clear background on the rear portion for the votive stupa or idol in the chaityagriha. The architects, after careful consideration and observation, wanted to transmit the super imposed load of the roof by arranging the lime stone pillars duly inserted into the longitudinal wall. Every care was taken to relieve the walls from receiving the load. Wedge shaped bricks were used for the apse portion, of the Chaitya. the votive stupa and the moon stones. In constructing the walls, scaffolding probably of wood and ropes must have been used. Foundations below the groundlevel were laid by excavating a pit into the ground to a depth of 1'-0 and this was filled with random rubble stones set in mud mortar as a level course upon which the brick courses were raised.

The above discussion reveals that the brick built Chaitva plans were circular and apsidal and had moulded basements which probably provided for additional strength to the structure. The floor levels were raised to considerable height and were approached by steps. Mud and lime were used for masonry, flooring and plastering. Later, the Chaitvas were provided with stone basements as seen at Nagarjunakonda,[13] a new development not noticed in the brick basement at Guntupalli.[14] The doors were provided with brick jambs. Wedge shaped, rectangular and square bricks were manufactured. The vaulted roofs were made of bricks and lime mortar. The vault shape was probably arrived at by arranging a wooden frame or using the centering technique. The walls were invariably plastered in the early examples and were then encased with stone slabs in the later periods. Over all an improvement is seen with regard to the brick technology which was evolved in the construction of chaitvaqrihas.

A similar development is underlined in the next part of our discussion which dwells on the building technology of the brick stūpas. The antiquity of building stupas in Āndhradeśa goes back to the 4th century B.C. It can be stated that below a later dated stupa, at Amaravati, a megalithic burial was found followed by the evidence of NBP ware and Mauryan polish which suggests the early beginning of stupa construction. A simple building technology was involved 1n making funerary structures in case of the pit burials and dolmenoid cists which were constructed above the ground level in hemispherical shape. For instance, the funerary structures noticed at Chagatur,[15] Peddamarur[16] and Gondimalla[17] in the form of the construction of the circle with dressed stones and cairn filling were in hemispherical shape. At Chagatur there was a raised basement resembling a Pradakshināpatha. Ultimately, these developments contributed partially in laying the foundations for the development of stūpas from the technical point of view. These emerged in the early historical context of Āndhradeśa. In this context, it is interesting to note that a small stupa at Amaravati was raised exactly on an urn burial.[18]

We have some evidences on how stūpas were to be built in the literature of the Buddhists. It is significant to note that the techniques involved and the process of building a stupa has been fully explained in Buddhist texts like the Mahāvaṁśa[19] datable to 3rd century A.D. According to it the stupa construction should be supervised by a superintendent of works called as Kammādhiṭṭāya or Navakarmika. In this connection the first step suggested according to the above work was to select a proper site for the proposed stupa. Next, this site was to be marked by putting a post on the ground. On an auspicious day, the people and the King were supposed to attend the site for laying the foundation stone. The foundations were to be filled with pulvarised stones mixed with slabs. This system contributed to the making of a solid base for the construction of a hemispherical dome. The text further adds that a Pradaksināpatha was to be provided all around the dome, which was to enable the pilgrims to circumanbulate the dome. In the second stage the drum was supposed to be constructed with bricks and then encased with stone for stability. It can be said that for the early stūpas. the anda was constructed of mud which was covered with brick or stone later as observed at Chandavaram. This formed the third stage of the construction. After that a <u>hārmika</u> with a post in the centre, crowned by umbrellas was to be kept as the last stage of construction. The text continues to describe that a second <u>Pradakshināpatha</u>. around the base of the <u>stupa</u> was to be constructed subsequently. Railings of wood or stone were to be erected around the <u>pradaksināpatha</u> and <u>hārmika</u>. To reach the drum, a <u>sopana</u> or staircase was to be constructed. The <u>Mahāvaṁśa</u> also suggests that the <u>stupa</u> construction must be considered as a collective project, in which everybody joined hands and its completion, the text says, was to be a source of joy for ever.

In all probability keeping in view the textual traditions and taking into account the methods delineated therein, the architects of early Āndhradeśa normally selected a suitable site in close proximity to where building materials such as stone were available or, near the river bed for collection of alluvial soil for making fine bricks and mortars. The availability of water needed for construction and lime deposits also determined the choosing of a site. Alternatively, the hilly tract was also often selected as the terrain served as a good foundation for the buildings saving a lot of expenditure on making the foundations.

The Buddhist <u>stupas</u> built in brick, both solid and wheel-shaped types have been found mainly in sub-regions B and C. These two sub-regions have fertile tracts and were well connected by trade routes both land and sea and therefore, they became the locales where Buddhist pilgrims concentrated. Very few <u>stupas</u> have been noticed 1n sub-region A, this being an area with largely semi-arid soils. For probably the same reason only one Buddhist <u>stupa</u> has been noticed in sub-region D. <u>stūpas</u>

constructed on hills, exploiting the natural sloped terraces have been noticed at Bavikonda, Thotlakonda, Pavurallakonda and Gopalapatnam in sub-region C, at Chandavaram, Phanigiri and Nagarjunakonda in sub-region B, and at Nandaluru in sub-region D.

In sub-region C, the earliest stūpa was constructed at Amaravati. Some of the earliest donative records[20] mentioned it as mahāchaitya datable to the 3rd century B.C. Recent excavations at the site conducted by I.K. Sarma[21] have revealed a two period sequences in which Period IA is characterised by early Mauryan building activity datable to the 4th century B.C., and Period I is, which, said to be Asokan, i.e., the 3rd century B.C. The latter has yielded a good number of Northern black polished shreds and some structural additions. The above evidence reveals that the stūpa at Amaravati had its foundations right from the pre-Mauryan period.

The stupa at Amaravati was a solid variety type, filled with brick [Chart V B 2]. The vertical portion of the dome was also embellished with slabs. The curved portion was plastered in lime and had stucco decorations. Over the top of the drum was a harmika railing from the centre of which rose the shaft of the Chātrāvali.[22] It's size was the largest of all the stūpas of Andhradesa and measured 168'-0 in diametre at the dome and 198'-0 including the lower Pradaksināpatha. The drum had a projection of 32'-0 by 6'-0 ayaka platforms built of brick at the cardinal points.[23] There was a Pradakṣināpatha around the drum with a width of 11'-3" paved with slabs on a well laid brick flooring.

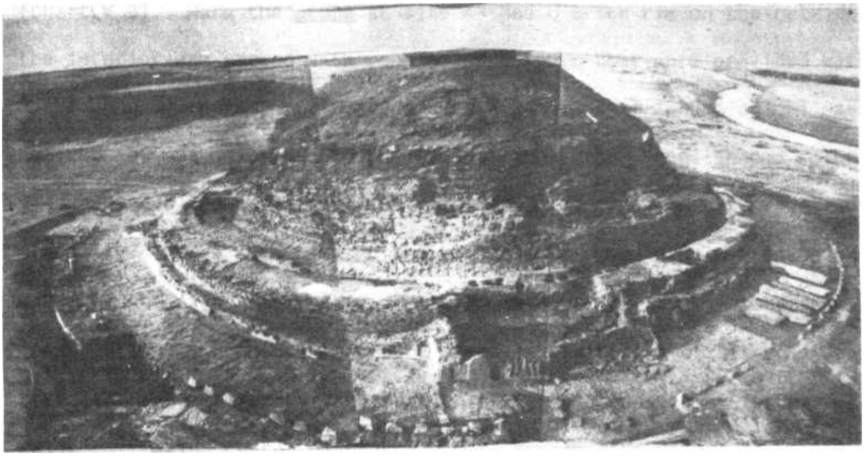
The stūpa at Vaddamanu[24] (area VDM IV) has also yielded NBP ware during the course of excavations. There 1s a label inscription found on the rock reading Rājā Dā(So) maka which, along with the NBP ware, indicate that the beginning of the stupa construction can be datable to the Mauryan period. The method of construction here, however, varies from that of the Amaravati[25] example of the similar period. The Vaddamanu stupa has three concentric circles with a width of 120 metres, each arranged with stone blocks and brick linings on either side. The solid variety of stupas have also been found at Dhulikatta, Bhattiprolu, Chandavaram, Bavikonda and Thotlakonda [Chart V B].

The stupa at Bhattiprolu[26] was built of brick with the central portion in wheel-shaped plan. Scholars like I.K. Sarma[27] opine that the beginning of the wheel-shaped plan must be traced to the Mauryan time. The tube like brick body at the centre of the stupa was intended for marking the centre of the dome in order to facilitate the laying of brick courses according to plan. In this connection a passage in the Mahāvaṁśa[28] describes that a King Devānāmpiya Tissa (c.250-210 B.C.) should be remembered, as, he selected an auspicious site for the future construction of a Mahāstūpa and 1n doing so, his first action 1n this connection, was to mark the spot by the erection of a vupa. The drum and dome parts came to shape after the wooden and axial parts were fixed. The Pradakṣiṇāpatha was paved with brick. Wedge shaped bricks were used on the central hub portion. An inscription in 3rd century B.C. characters has been found on the relic caskets recovered from the stūpa at Bhattiprolu,[29] which records that the stūpa was constructed by one Raja Kuberaka probably a local Chief or King.[30]

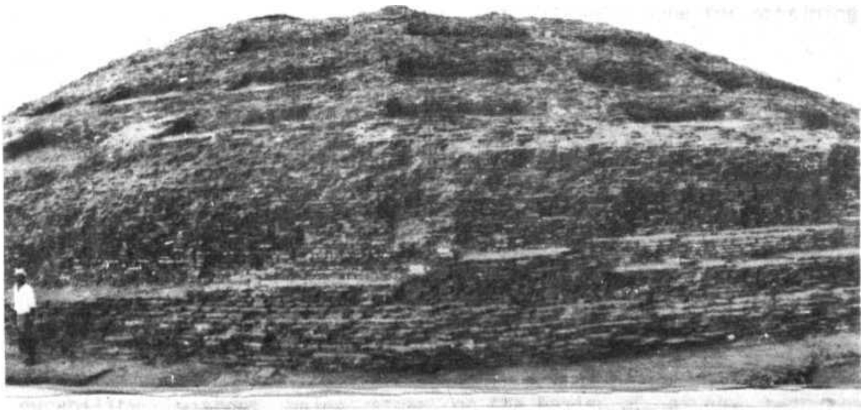
The stupas at Dhulikatta[31] and Chandavaram[32] datable to the 3rd-2nd centuries B.C. belong to the solid variety type. An important aspect which can be said to be a technological improvement in constructing brick stūpas has been noticed at Dhulikatta. Here, the stupa was constructed on a raised platform of bricks built on rubble foundation, whereas the stūpa at Chandavaram was built on a levelled terrace of a hillock [Plate XVII]. In both the cases, the core was filled with brick and mud. At Chandavaram, the architects, with foresight, took advantage of a natural hill slope in arranging the terraces of the stupa 1n order to obviate erosion which would have caused seepage of water into the foundation of the stūpa during the rainy season. Bricks were paved in header and stretcher method. Wedge shaped bricks were used at Chandavaram, whereas, at Dhulikatta the masons filled the gaps between the rectangular bricks with earth and brick bats to be able to get a perfect circle. Plastering was done in both the cases. Another technological achievement which can be seen in case of the stupa at Garikapadu that belongs to the 3rd Century B.C., was that its central core was filled up with lime concrete, which afforded stability to the structure. This is a rare feature to be noticed at such an early date. stupas constructed with similar constructional technology have also been noticed at Gudivada,[33] Thotlakonda[34] and Bavikonda[35] in sub-region C built between the 2nd century B.C. and the 1st century A.D.

From the next phase of Period II, i.e, from the 2nd century A.D. onwards stupas were built in brick in wheel-shaped or in concentric circles with radiating spokes connected to the hub some times, in Swastika shape or, in square shape emanating from the hub at the centre. The stupa at Pedaganjam[36] had its hub in Swastika pattern. The stupas at Ghantasala,[37] and Alluru,[38] in sub-region C and the stupas at Nagarjunakonda[39], Phanigiri,[40] Jaggayyapeta,[41] Gummadidurru[42] and Nelakondaplli[43] [Plate XVII]

PLATE XVII



Period II: Solid type of brick Stupa, Chandavaram, Sub-region B



Period II: Wheel-shaped brick Stupa, Nelakondapalli, Sub-region B in sub-region B were built in wheel-shaped plan. A majority of the stupas at Nagarjunakonda were built in wheel-shaped plan with avaka platforms[44] [Chart V B]. Here the stupa at site 43 had a brick rim on the outside and the interior was packed with rubble and earth. They were provided with 4, 6, 8 and 10 spokes. In highlighting some of the technological aspects noticed by us, it can be pointed out that the wheel-shaped plan had gradually evolved and came to be selected as it provided better structural stability. It also minimised the expenditure on materials. Based on the size of the stūpa the number of spokes were, accordingly, increased as a constructional technique to ensure stability. In case of larger stupas the strength was ensured by the addition of rings connected by further radial walls,[45] which were plastered. For example, the stupa on site 9 at Nagarjunakonda had two concentric circles, each 24 ft and 41 ft in diametres and with eight and sixteen spokes respectively. In the first instance the first circle was built with 8 spokes and in between this was filled with mud, whereas, the second concentric circle was connected by sixteen radiant walls also filled by debri and finally, the outer wall was built with bricks. This arrangement was obviously done for attaining the best possible structural stability.[46]

It has been noticed that stupa building activity began on the plains. These were mainly of the solid variety type, filled with earth inside the brick walls of the drum and the dome. Making of wedge shaped bricks and their use for stupas was noticed for the first time in early Āndhradeśa at Amaravati. Great emphasis was laid on stability and durability, without using stone on the basis of a new technique of providing internal concentric circles. Pradaksināpathas were also paved with bricks and plastered. Steps leading to the upper Pradaksināpatha were built of bricks and plastered as seen at Chandavaram.[47] The stupas built in brick technology reveal that the builders were experts in layouts, making circles with a central axis or tube like yupa. After making the plan they started building the drum and the dome of the solid variety type. This was followed and perfected by innovating the wheel-shaped stupas while ensuring the structural stability. Mud was used as binding material. The inner core was filled with mud, morrum, brick bats stones and sometimes with mud and bricks 1n alternate courses. Some stupas had rubble foundations as in the case of Thotlakonda, Bavikonda and Gopalapatnam in sub-region C and Dhulikatta in sub-region A, whereas the stupas at Chandavaram and Phan1g1ri were built on hilly terraces [Chart V B].

There was a gradual evolution in the building of stupas 1n early Andhradesa. Though brick work was considered inferior to stone masonary, it was realised that this could be overcome if the bricks were properly manufactured and laid in layers. Infact, this had the advantage of being composed in small units and gave a flexibility of greater constructional possibilities. This was specially needed for the construction of circular buildings and the knowledge of good brick making techniques was essential for the execution of such works. Regarding the stability of formation and strength of construction, Percy Brown[48] writes 1n the case of the Amaravati stūpa. that it "formed a grand structural foundation to the Mahastupa". Using gnomon for marking the orientation of the building and other such aspects all speak of the involvement and expertise of the building technologists and engineers of the age. Regarding the transportation of materials and execution of stūpa buildings, we have some idea as to how this was done, as, it is found depicted 1n the Barhut Sculptures.[49] In this representation, the bricks, stone blocks and paving stones are seen loaded onto carts which were drawn by a pair of humped oxen. One of these is seen having arrived at the site and the animals are shown unyoked, while a porter is shown carrying basket loads on his head or shoulder between the cart and the building site. The brick pavers are seen squatted on the ground arranging the material on the prepared ground in a regular pattern. For this early period such descriptions on technology are rare pictoral evidence.

Viharas were part of Buddhist religious establishments and the dwelling places of the monks. They were also built 1n brick at a good number of Buddhist sites both on plains and on hilltops. vihāras situated on the plains have been reported from Dhulikatta in sub-region A, at Nelakondapalli 1n sub-region B, and Dharanikota, Bhattiprolu, Gudivada, Alluru and Ghantasala in sub-region C [Chart V B]. Vihāras on the plains have not been reported from sub-region D. Brick built Viharas situated on hilltops have been noticed at Thotlakonda, Bavikonda, Gopalapatnam, Pavurallakonda, Ramatirtham, Salihundam, and Sankaram in sub-region C; at Chandavaram, Phanigiri and Nagarjunakonda in sub-region B and at the solitary site of Nandaluru in sub-region D [Chart V B].

At Amaravati in sub-region C, the existence of huts built of wattle and daub and posts near the stupa have been brought to light in recent excavations. These formed part of the Vihāra and are dated to the earliest structural activity at the stupa site which is said to belong to the pre-Mauryan Period 1A, i.e., 400-300 B.C.[50] At Bhattiprolu, a two winged brick-built Vihāra was brought to light which consisted of four cells, rectangular in plan, provided with verandahs, datable to 2nd century B.C.

To accommodate more monks the size of the vihāras gradually grew and partitions were made to provide separate dwelling rooms for the monks. These partitioned rooms were known as Parivena.[51] The bricks were laid in course lengthwise on either side of each layer, sometimes, widthwise as stretcher and header, using mud as binding material. The hearthing, i.e., portion between the two brick courses of a layer, was filled with brick bats and mud. Brick laying was a fine testimony to the engineering skills of the period. The bricks used for construction of walls were fine, well burnt using the clay soils available nearby.

The exterior and interior walls were well-plastered in fine lime. The presence of seashells in the lime plaster indicates that they were grounded and mixed with river sand for preparing lime mortar and also used in lime concrete. This was noticed in the case of all the Vihāras in the north coastal area of Andhradesa. Even today, people who live 1n coastal areas use seashells for making lime mortar, simply because they are locally available and serve as a good binding material. Lime making troughs have been reported from Ramatirtham.[52] Slime of trees was said to have been mixed while plastering the Vihāra.[53] Trowels of different sizes had been used to plaster the walls. The Vihāras were decorated with stucco designs and terracotta finials. Pieces of stucco work and earthen finials recovered from Thotlakonda[54] and Bavikonda[55] excavations attest to this. The excavations also yielded iron nails and revets, suggesting that wooden doors and rafters were used for the doorways and roofings respectively.[56]

The floors of the Vihāras were laid with small nodules of stone covered by lime plaster, which were sometimes given a brick paving. The other structures noticed at a good number of sites, as at Thotlakonda, included a store room, refectory and a kitchen. The kitchen compex called Kappivabhumi[57] was built outside the Viharas. near water sources as noticed at Thotlakonda. There was also a refectory near it. The separate entity for the kitchen complex, away from the main monastery was probably meant to provide tranquility and sanctity for the residential cells. The technique in laying floor with lime concrete inside the refectory is interesting. The ground was first levelled and was partitioned with rubbles and bricks and them rammed. After that, lime concrete was filled up inside the blocks in order to keep it intact. The floor was thus laid, because, usually in a kitchen, the usage of water was considerable and could cause damage to the clay floors, thereby demanding frequent repairs. Often wet floors attracted termites and insects, which would also be unhygenic in the cooking area. To overcome these disadvantages, the builders opted to lay such insect or damp proof course, for floors, with lime mortar or lime concrete as at the refectory at Thotlakonda[58] [Plate XVIII].

[59]

The Vihāras at Chandavaram were constructed on stone foundations and were provided with verandahs. The flooring was strengthened by a deposit of compact mud concrete, mixed with chips of shale stones. These Viharas. on the recovery of Satavahana coins, have been dated to the 2nd century B.C. Chamferred bricks were used for the outer course of the wall to drain off the rain water. They also added beauty to the structure. Moulded bricks were used for the Purnaghatas, the bases of the pilasters on either side of the doorways.[60] The cells at Thotlakonda had wooden doors with 0-60 metres as openings, provided with thresholds, Ummaras[61] at the doors.

Thus carpenters and iron smiths played an important role in building these

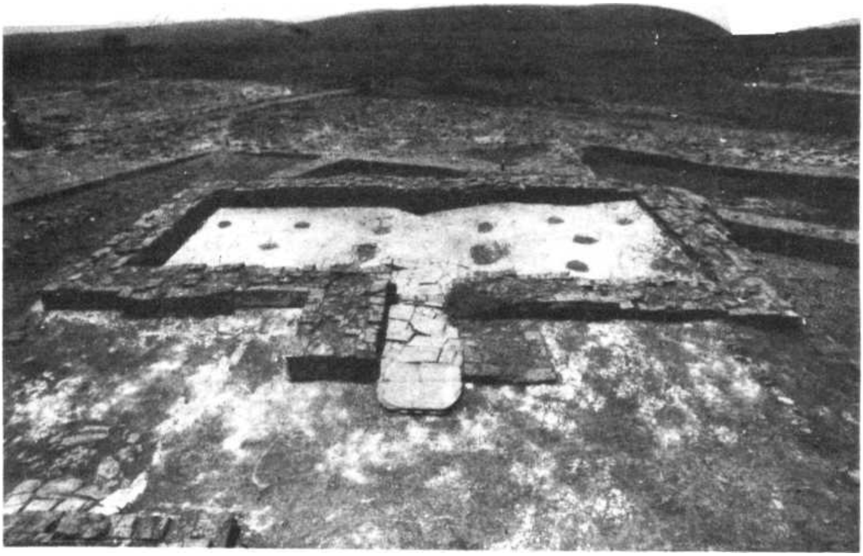
The occurrence of a large number of perforated tiles suggests that the roofs of the Viharas were covered by them arranged one above the other on wooden rafters. The tiles recovered from the excavations at Thotlakonda were thick, well burnt and light red in colour. They had circular projections at the top and had deep grooves along the body. They were slighly convex, so that rain water could pass through the grooves easily. Each tile measured 18 x 15 x 2 cms. It had a thick edge on one side which was sloppy and its edge on the other side had a flat underside. Each tile had a deep side groove to provide better grip for the overlapping tile. Some tiles had perforation at the upper end which were meant for fixing to the frame of the roof. Similar tiles have been reported from Satanikota,[63] Salihundam[64] and Bavikonda[65] [Chart VI B].

Some amenities were provided in the Viharas to meet the daily needs of the monks. A wooden peg, a bamboo, or a string was driven into the wall to hang the robes of the monks. Some cells had raised benches to keep valuable articles. Stone or brick benches called middis[66] were allowed to be used as beds for the monks in the Viharas. Legged saddle querns with pestles have also been found in the cells.

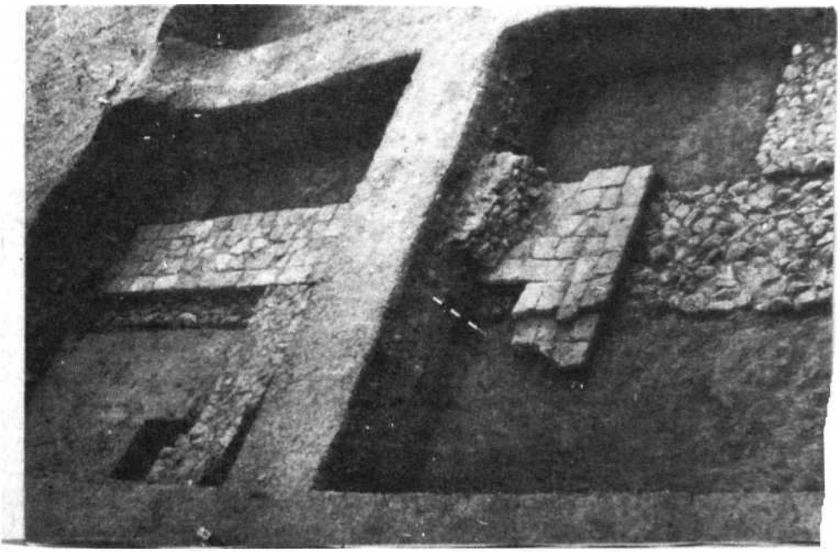
The Viharas at Phanigiri[67] were constructed on the hill top in different tiers. The walls were supported by brick buttresses so that the structure did not collapse and could also withstand rain water erosion. Remains of brick built Viharas raised on rubble foundation set in mud mortar has been exposed to view at KesanapaTH[68] and Nelakondapalli,[69] **[Plate XVIII]** both datable to the 3rd century A.D.

The Viharas at Nagarjunakonda[70] were constructed during the last half of the 3rd century A.D. They seem to have been built with definitely improved technical skills when compared to the preceding examples. They had some associated buildings such as kitchen, dining hall, store room, bathrooms with drainage facilities and some of them were connected to the Viharas with pathways or staircases consisting of balustraded steps. All the units were enclosed by a compound wall. The building materials were the same as those of the early phase of Period II mentioned above. The outer courses of the brick wall were decorated with mouldings in lime mortar at the plinth level. The number of cells in the Viharas varied from one to the other, ranging from two to thirty cells.[71] The monasteries could accommodate nine to thirtytwo persons according to the space of the Viharas. The main change of the period was that the Viharas now had larger size cells which were also made more ornate. Most of the Vihāras were of the Chatuśśāla type.

The walls of these cells were plastered in lime whereas the floors were paved with brick or laid with lime concrete. The roofs were laid with perforated or grooved tiles. Niches were provided in the brick walls for keeping lamps or books. A new development in the monastic buildings at Nagarjunakonda is that there were three separate chambers, two of which were circular in shape externally and square internally, the third one being oblong. H. Sarkar[72] opines that these chambers might have been used by the senior monks, āchāryas or vinaya dharas. Some technical skills were



Period II: A brick refectory with lime concrete floor, Thotlakonda, Sub-region C



Period II: Brick wall of a Vihara on rubble foundation, Nelakondapalli, Sub-region B

CHART VI B

Period II: Brick Monuments

S.No	Name of the Site	Sub-region	Situated on: Plain	Hills	Type of Buddhist Monuments: Chaitya	Stupa	Vihara	Type of Brahmanical Monuments: Garbha griha	Artha mandapa	Maha mandapa	Type of- Mortor	Floor	roof
1.	Alluru	C	√	-	-	⊕	√	-	-	-	M	-	-
2.	Amaravathi	C	√	-	-	●	√	-	-	-	M	-	-
3.	BaviKonda	C	-	√	O ⊂⊃	●	√	-	-	-	L	L	∿
4.	Bhattiprolu	C	√	-	-	⊕	√	-	-	-	M	-	-
5.	Chabolu	B	√	-	-	-	-	□	-	-	M	-	-
6.	Chandavaram	B	-	√	⊂⊃	●	√	-	-	-	M	-	-
7.	Chejarla	B	√	-	-	-	-	⊂⊃	√	-	M	-	-
8.	Dhulikatta	A	√	-	-	●	-	-	-	-	M	-	-
9.	Garikapadu	B	√	-	-	⊕	-	-	-	-	M	M	-
10.	Ghantasala	C	√	-	-	⊕	√	-	-	-	M	-	-
11.	Gopalapatnam	C	-	√	-	●	√	-	-	-	M	M	-
12.	Gudimallam	D	√	-	-	.	-	⊂⊃	√	√	M	-	-
13.	Gudivada	C	√	-	-	●	√	-	-	-	M	-	-
14.	Gummadidurru	B	√	-	-	⊕	-	-	-	-	M	-	-
14A.	Guntupalli	C	-	√	O	●	-	-	-	-	M	-	-
15.	Jaggayyapeta	B	√	-	-	⊕	-	-	-	-	M	M	-
16.	Kandi	A	√	-	-	-	-	O	√	-	M	-	-
17.	Kesanapalli	B	-	√	-	●	-	-	-	-	M	-	-

contd...

Key:

O circular — ● Solid stupa — M Mud

⊂⊃ apsidal — ⊕ Wheel shaped stupa — L Lime

□ square — ∿ Tile

CHART VI B contd...

S.No	Name of the Site	Sub-region	Situated on		Type of Buddhist Monuments			Type of Brahmanical Monuments			Type of-		
			Plain	Hills	Chaitya	Stupa	Vihara	Garbha griha	Artha mandapa	Maha mandapa	Mortor	Floor	roof
18.	Nagarjunakonda	B	-	✓	-	● ⊕	✓	▭ □	✓	✓	M,L	-	-
19.	Nandaluru	D	-	✓	-	●	✓	-	-	-	L	-	-
20.	Nelakondapalli	B	✓	-	-	⊕	✓	-	-	-	M	-	-
21.	Pavurallakonda	C	-	✓	-	●	✓	-	-	-	M	M	-
22.	Phanigiri	B	-	✓	-	⊕	✓	-	-	-	M	-	-
23.	Ramathirtham	C	-	✓	▭	-	✓	-	-	-	L	-	-
24.	Rangapur	A	✓	-	-	-	-	□	✓	-	M	-	-
25.	Salihundam	C	-	✓	○	-	✓	-	-	-	L	-	≈
26.	Sankaram	C	-	✓	▭	-	✓	-	-	-	L	-	-
27.	Somasila	A	✓	-	-	-	-	□	✓	-	M	-	-
28.	Thotlakonda	C	-	✓	○ ▭	●	✓	-	-	-	M,L	L	≈
29.	Vaddamanu	B	-	✓	-	⊕	✓	-	-	-	M	-	-
30.	Veerapuram	B	✓	-	-	-	-	□	-	-	M	-	-

Key:

○ circula

● Solid stupa

M Mud

▭ apsidal

⊕ Wheel shaped stupa

L Lime

□ square

≈ Tile

involved in making these cells and these can be explained as follows. In the first stage a circle was probably marked on the ground with two diametres pointing to the cardinals being drawn. In the second stage the square or oblong shapes were derived. These arrangements needed some precision and mathematical calculations which the simple rectangular or square cells, usually arranged with set-squares, turning the quadrants at right angle triangle, did not need. This is certainly a development in how building plans were being made more sophisticated. The necessity to distinguish the dwellings of senior monks from the ordinary dwelling units of the other monks probably led to these innovations being made.

To conclude the discussion on Viharas in Āndhradeśa, it was noted that brick built ones were found situated on hills and on the plains located mainly near water sources. They were invariably constructed with brick using mud and lime as binding materials. Each cell was provided with doorways. Sills and steps ended with moon stones. Some cells had stone benches and pillows. The walls were plastered in lime and decorated with stuccos. The basements of some of the Viharas were constructed with chamferred or moulded bricks and the surroundings were laid with concrete. Wells and drains were provided. The floors were laid either by paving brick or concrete. Roofs were made with corrugated, perforated and grooved tiles. Well laid stone pathways were also noticed at many Vihara sites. Viharas of all the sub-regions had pillared mandapas, refectory, kitchen, bathroom, storerooms and other such facilities. The engineers of the period had a good fund of knowledge in structural engineering and understanding the relative strength of materials to be used for building rooms for the everyday living of the monks. According to Sarkar, the circular plan of the early <u>stubas</u> might have been a copy of the existing primitive circular hutments, extant by the time of building the circular stupa.[73] He further noted that the apsidal plan accommodated more monks inside the structure and provided a wider area than the circular one.[74]

Structures made of brick affiliated to the Buddhist faith were contemporaneanous with those of the Hindu faith in early historical Andhradesa. Based on archaeological evidence, it can be suggested that the earliest Hindu temples were found mainly in sub-region A and B, in particular, around the confluence of the rivers Krishna and Tungabhadra and distributed upto the Nagarjunakonda valley. The earliest Brahmanical temples were square and sometimes elliptical in plan, constructed of brick in mud mortar. To strengthen the walls, projected mouldings were constructed at plinth level. In the later stage of brick technology the temples were notable for their elaboration from having simple <u>garbhagriha</u> and <u>antarala</u> to the addition of <u>mahāmandapas</u> supported by monolithic columns. Occasionally, clusters of temples were enclosed by a <u>prākāra</u> wall. The floors were laid with lime concrete as well as brick and stone. Evidence has proved that the roofs were laid with thatch and tiles as a common practice, for the early historical period, i.e., Period II. The level of building technology of the early brick temples in Andhradesa can be known from the sites of their existence which have been excavated in the different sub-regions. The important among these are located at Gudimallam in sub-region D, Rangapur, Chabolu, Somasila in sub-region A, and Veerapuram, Nagarjunakonda and Chejarla in sub-region B [Chart VI B] [Map X].

Foundations of a Saivite brick temple datable to the 2nd century B.C.

has been reported from Gudimallam.[75] In the subsequent phase assigned to the 1st century A.D. an apsidal brick temple was constructed around the Linga. This is a unique and exceptional evidence in the whole of coastal Andhra. It was probably influenced by the Buddhist structures which existed at this time in Andhradesa and both were similar in the technological aspects involved in building them. Other evidence was noticed at Chejarla[76] in sub-region B, datable to the 2nd century A.D. where the temple was built on apsidal plan.

A good number of brick temples, datable between the 1st and 2nd centuries A.D. have been brought to light recently in sub-region A at various places. A square brick temple with a simple adhistana having upana and padmajagati, constructed out of chamferred bricks, has been reported from Rangapur.[77] The flooring was levelled and paved with slabs. The thickness of the wall was 0.95 metres. The adoption of square plan to build a Hindu temple was an innovation here. The bricks were laid using the bond stones very close to each other. Their joints reveal the skill in fine joinry. The bricks were very fine in course, manufactured with local alluvial soil of the river Krishna and were well burnt. In my recent survey I have noticed for the first time, two brick temples of the Saivite faith, datable to 2nd century A.D. at Somasila in sub-region A on left of river Krishna. Both the temples had garbhalaya and arthamandapas.[78]

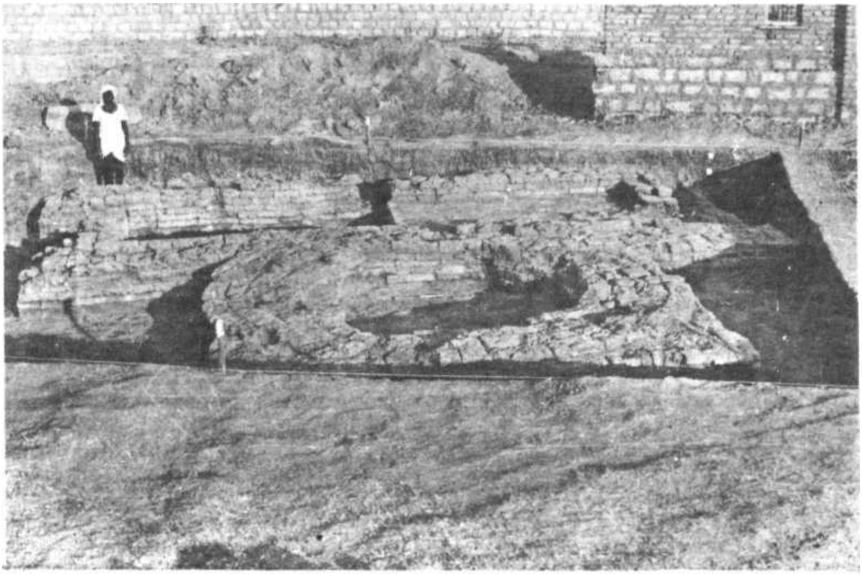
At Veerapuram,[79] in the first stage of construction of brick temples, the primitive feature of raising the wall with bricks with a footing has been noticed. All the temples in this stage had a circumabulatory passage around them suggesting an additional development in building the early temples. They were also provided with well laid pathways to withstand the live load of the pilgrims. Temples further had drains connected to a trough, from which the accumulated water of ablution could be removed. This arrangement was made to maintain hygiene, an important aspect of consideration for the builders of those times. The adhistānas were of the mañchaka type, in which the walls were provided with projected mouldings. The floors were brick paved ones on the level ground inside the temples.

In the second stage, datable to the 3rd century A.D., some significant technological advancements were noticed wherein the floorings were raised to a certain height with brick using lime mortar and the drains were lined with stones. Two more offsets were added at the bases suggesting for more strength at the plinth level. The aspects in building technology noticed in these early temples here were marked by the existence of square plans, brick floors, drains of bricks and stone and to the subsequent addition of mandapas to meet the ritual need of the congregations of people on the front side of the temples.

The last century of Period II witnesses a spurt in building activity of Brahmanical temples at Nagarjunakonda[80] in sub-region B. The temples here were apsidal, oblong or square in plan with single or double shrines having mandapas in the front. The architects were experts in spatial organisation of temples and subsidiary temples were built within the compound walls. The thickness of the walls varied from 1.00 to 4.0 metres according to the size of the temples. The external and internal surfaces were plastered and stucco decorations were also continued to be made. The technique of the construction of walls was quite sound. Vertical straight joints were avoided and bonding was ensured by laying one header for every two stretchers. The brick walls of the temples were encased by Cuddapah slabs externally, in order to buttress them and also to arrest the seapage of rain water. This is noticed here for the first time. A brick temple altogether in a different plan, i.e., garbhagriha in octagonal plan, with a rectangular antichamber alongwith some stucco decorative motifs datable to 3rd century A.D., has been unearthed at Kandi[81] in sub-region A [Plate **XIX].** Floors were lime plastered, brick paved, lime concreted and stone lined. Significantly, kilns of tiles and lime pounding troughs have been noticed at the site. The technology of making multi-storeed buildings as in the case of the Sarvadevadhivasa called as Srivilāsa[82] was also known. Roofs were probably laid with bricks and tiles. The flat roofs were provided with roof drains facilitating the rain water to flow away from the roof as they knew that stagnation of water on the roof may lead to leakage. Thus by the end of Period II, the builders were found possessing sound knowledge in brick built technology and were experts in planning, organising and overcoming the defects of the earlier period. It is further noticed that though rock-cut technology had been popular around this time, free standing temples were initiated during the same period in brick technology. In addition to brick, stone was also employed side by side to encase the walls or for the staircases and the main cult objects in the temples were also of made of stone.

Building the temples with improved brick technology was further continued in Period III in Andhradesa. Brick temples of the Hindu faith have been reported from Gummadam,[83] Keesaragutta,[84] and Kudavelli[85] in sub-region A, Yeleswaram,[86] Chejarla[87] and Siddeswaram[88] in sub-region B, and at Pedavegi[89] in sub-region C **[Chart VI C] [Map X].** All the temples

PLATE XIX



Period II: A brick Temple on octagonal plan, Kandi, **Sub-region A**

Period III: A square brick Temple, Gummadam, Sub-region A

were built between the 4th and the 6th centuries A.D.

On plan, the temples were square at Gummadam [Plate XIX], Siddheswaram and Eeleswaram, whereas, the one at Pedavegi was in rectangular shape [Chart VI C]. Both square and rectangular temples were seen at Keesaragutta. In all the cases mud was used for brick masonry. The floors were arranged with bricks. Circumambulatory paths, all around them, were provided with bricks as at Keesaragutta and Pedavegi. Covered drains were provided to temples attached to brick troughs outside. This is a new development seen at Keesaragutta for the first time as the earlier temples had open drains.

The basements, i.e., adhistanas of the temples at Siddheswaram, Keesaragutta, Chejarla and Pedavegi were built with moulded bricks and sometimes with chamferred ones. A significant feature noticed at Keesaragutta was the arrangement of stone slabs horizontally on the brick basement for giving strength to the superstructure and also to transmit the load equally to the entire width of the wall. This temple is the best example for understanding the striking transition from brick to stone technology. Another significant feature of Period III was the construction of stone temples over the foundation of brick temples as noticed at Siddheswaram in sub-region B and Pedavegi in sub-region C.

The walls were built of bricks set in mud mortar with their joints. Postholes inside the temples at Keesaragutta[90] and Pedavegi[91] indicate the existence of thatched roofings supported by wooden posts [Chart VI C 6]. A notable development in building technology of this period has been revealed in that the architects planned buildings to be constructed with elevated basements. By this the floor level was arranged at a considerable height from the ground level without allowing the rain water into the structure as noticed at Pedavegi and Keesaragutta.

In the subsequent phase of development from the 7th century to the 9th century A.D. temples built of brick have been noticed at Gollattagudi[92] in sub-region A[93] and at Pitikayagulla[94] and Tripurantakam in sub-region B [Chart VI C 2, 7, 9] which reveal that the brick technology continued to be adopted, although magnificient stone temples were also built simultaneously all over Andhradesa. At Gollattagudi, some interesting features of brick technology have been noticed. The foundation trenches were excavated and filled with brick masonry of mud mortar, the remaining part of the foundation trench was filled with brick bats mixed with mud and finally rammed for consolidation. In the first phase of construction, i.e., during the 7th century A.D., the original ground level was raised at the temple by spreading the excavated morrum to a considerable thickness, so as to arrest the seapage of water. In the second phase, datable to the 8th century A.D. another brick temple was built, on a firmly laid stone basemment of 1.80 metres in height over the rubble foundations[95]. The foundation was then overlaid with flat dressed granite slabs which were paved all around the temple, to give an even surface for marking and building the superstructure in brick and also to add strength to it. This is obviously an improvement from the technology known in the earlier period. The walls, however were built as in the earlier examples. The brick was given a glazy finish and therefore failed to retain the lime plaster coated on 1t. The walls were decorated 1n stuccos, duly painted in bright colours. The builders overcame the disadvantages of small units 1n bridging spaces by using stone for lintels, jambs, perforated windows and pillars. The temple at Gollattagudi now extant with its full view was built in four storees. Its interior was built in kadalikākarana fashion, i.e., the walls of the vimāna were built projecting inwards and leading to the top, to close the ceiling. The bricks were made out of fine and lavigated clay, well burnt and some sort of slip was given to offer a lustruous glaze visible even today [Plate XX]. This speaks of the technical achievement of the brick makers of those times. The bricks measured 40 x 20 x 7 cms. The bricks were pre-burnt and moulded according to the individual requirements. The excavator of this site is of the opinion that the necessary carved and ornamental details were chiselled out of the brick work after the walls were built. This view is however, difficult to accept.[96]

The floors were laid with bricks and lime. A further development in the brick technology was marked by the usage of stone as an associate building material. Perforated jallis, windows, carved in style as found at the Alampur temples were fitted to the brick temples for providing sufficient lighting. The excavator, based on the style of the jallis has dated these temples to the 7th and 8th centuries A.D.[97]

Temples built in brick were also known from Pitikayagulla and Tripurantakam, datable to the 8th and 9th centuries A.D. respectively, comparable to the western Ganga examples of Karnataka of the same period.[98] Both sites are in sub-region B.[99] The temple at Pitikayagulla is a square one with a simple adhiṣṭāna, plain walls surmounted by kapota. talas with a hemispherical dome. The walls and vimāna portions were plastered in lime. The top tiers were built with an outward curve on the top portion of kapota. facilitating the rain water to drop to the bottom from the superstructure. The pillars of the front mandapa was devoid of a roof but bear close resemblance to the one found at a temple at Satyavolu, a nearby site, datable to the 8th century A.D.

The temple at Tripurantakam[101] was also built entirely in bricks and is similar to the Gollattagudi example in all respects. Niches to keep the idols were provided for in the walls. The bricks were well moulded, set in fine mud mortar. Plastering of the walls was not observed here. As this temple has a close resemblance to the stone example of Rupala Sangameswaram temple,[102] it has been dated to the 9th century A.D.

The above features lead us to conclude that brick technology was employed in building the temples beginning from the 1st century A.D. and continued upto the 9th century A.D. The plans were square, rectangular and apsidal. The foundations were filled with brick bats and stone. Brick and mud were the primary building materials. Walls were plastered. Stone slabs were also employed mainly on the walls at the basement level and for lintels and as jallis. The builders were experts both 1n the designing and execution of these structures. Many of these temples stand even today speaking of the technological skills of the people of early medieval Andhradesa.

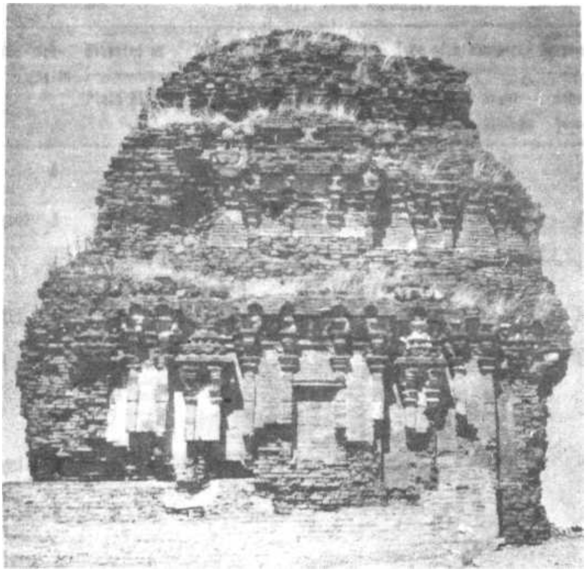
In Period IV, though temples began to be made in stone most of the vimānas were built in brick, using light weight bricks and fine lime mortar. Mud as mortar was discarded once for all. Both chamferred and moulded bricks were used. The process of brick making was followed as prescribed in the Mayamata[103] a medieval silpa text.

Sometimes, the entire miniature sikhara model was moulded solidly like dressed stone blocks which were fixed to the vimānas as noticed at Palampet[104] and Pillalamarri[105] [Plate XX] in sub-region B[Chart VI D 2, 3] [Map X]. The inner portion of the brick vimāna was constructed in Kadalikakarana fashion wherein the sikhara was built generally by corbelling of courses of bricks overlapping each other inside, until they met and closed the opening with a stone or brick called Mūrthnestika. The outer faces of the brick sikhara were plastered with lime mortar and occasionally, decorated with stucco. Some sikharas were provided with sukanāsis over the arthamandapas.

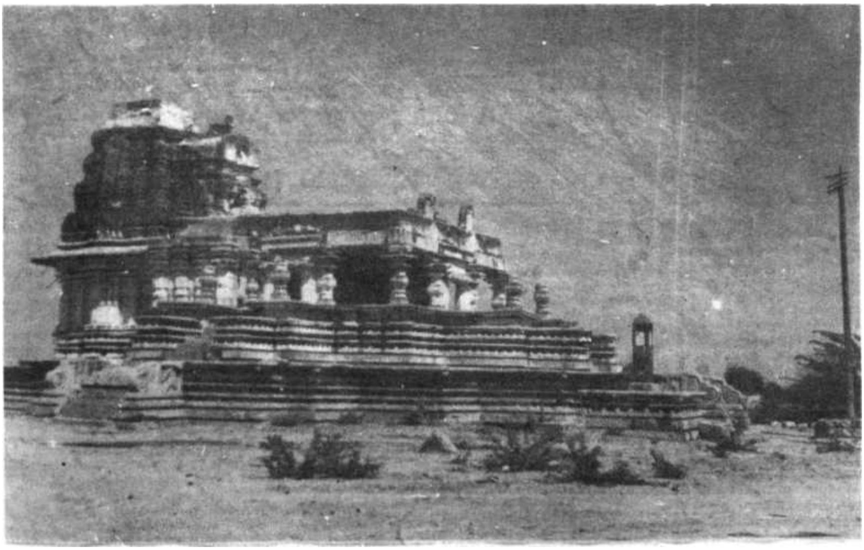
The thickness of the brick structure of the vimana at Adikesava temple at Chebrolu[106] [Chart VI D 1] in sub-region C databale to 13th century A.D., has a wall all around, 1.50 metres in width, sometimes, even more than the thickness of the temple walls of the period. The brick work of the vimanas of the period was plastered with lime mortar called vajralepa a glue cement, made of vegetable substances mixed with several ingredients. The Silpa ratna[107] prescribes that powder of lime should be mixed with saps of milky trees and sand in different proportions. Thus the architects of Period IV followed the silpa texts and possessed good knowledge of the use of brick technology which had now been refined for use in vimanas and sikharas only and these gave stature to the monumental buildings which survive even today.

Innovations in manufacturing Sun dried bricks had been made during the last phase of Period I as observed at Gandluru in sub-region B for the

PLATE XX



Period III: A brick Temple with moulded bricks, Gollathagudi, Sub-region A



Period IV: Brick Vimana over **Stone Temple, Pillalamarri, Sub-region** B

CHART VI C & D

Period III: Brick Monuments

S.No	Name of the Site	Sub-region	Situated on		Type of Buddhist Monuments			Type of Brahmanical Monuments			Type of-			Enclosure
			Plain	Hills	Chaitya	Stupa	Vihara	Garbha griha	Artha mandapa	Maha mandapa	Mortor	Floor	roof	
1.	Chejarla	B	√	-	-	-	-	⊂⊐	√	√	L	-	-	√
2.	Gollappagudi	A	√	-	-	-	-	(Jaina)	√	√	L	-	-	-
3.	Gummadam	A	√	-	-	-	-	□	-	-	M	-	-	√
4.	Kesaragutta	A	-	√	-	-	-	□	-	-	M	-	⋀	√
5.	Kudavelli	A	√	-	-	-	-	□	√	-	M	-	-	-
6.	Pedavegi	C	√	-	-	-	-	□	-	-	M	-	⋀	√
7.	Pitakayagulla	B	√	-	-	-	-	□	√	-	M	-	-	-
8.	Siddeshwaram	B	√	-	-	-	-	□	√	√	M	-	-	-
9.	Tripurantakam	B	√	-	-	-	-	□	√	-	M	-	-	-
10.	Yeleswaram	B	√	-	-	-	-	□	√	√	M	-	-	√

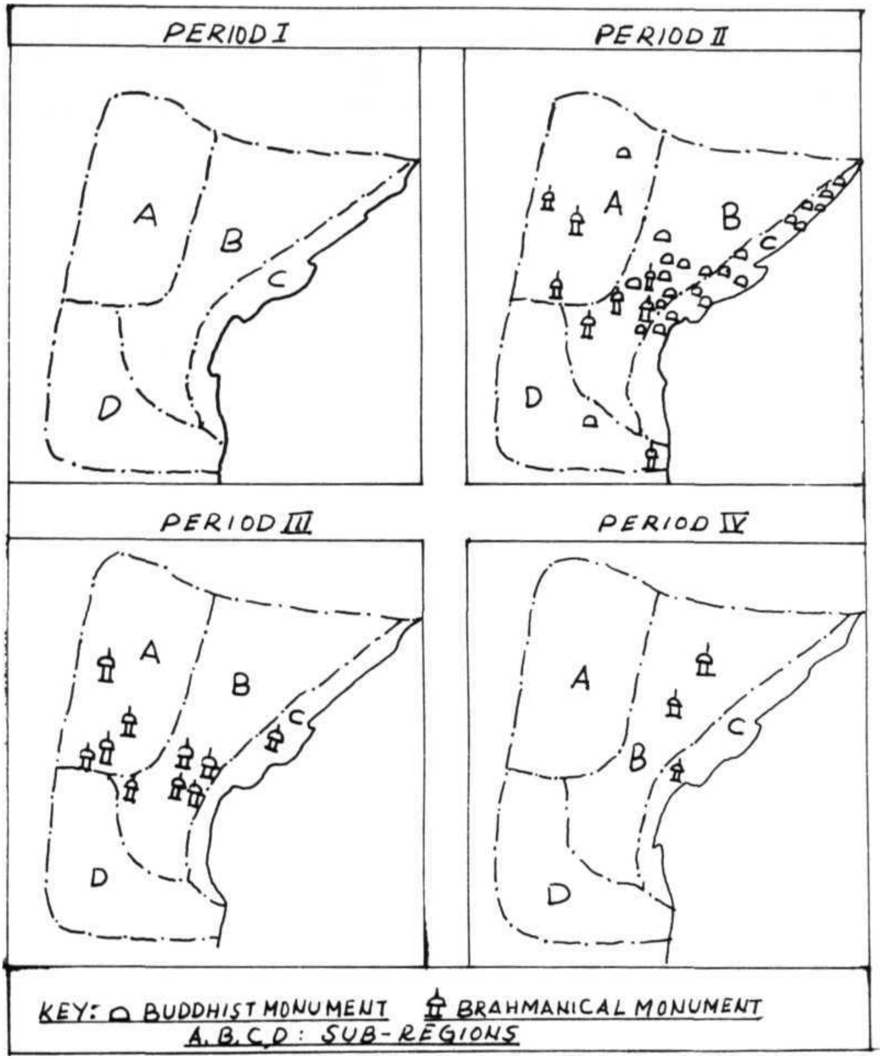
Period IV: Brick Monuments

S.No	Name of the Site	Sub-region	Plain	Hills	Chaitya	Stupa	Vihara	Garbha griha	Artha mandapa	Maha mandapa	Mortor	Floor	roof	Enclosure
1.	Chebrolu	C	√	-	-	-	-	□	-	-	L	-	□	-
2.	Palampet	B	√	-	-	-	-	□	-	-	L	-	□	-
3.	Pillalamarri	B	√	-	-	-	-	□	-	-	L	-	□	-

Key:

0	circular	●	Solid stupa	M	Mud
⊂⊐	apsidal	⊕	Wheel shaped stupa	L	Lime
□	square			≈	Tile
				⋀	Thatch
				⊠	Stone

MAP-X



DISTRIBUTION OF BRICK MONUMENT
PERIODWISE

first time, in proto-historic Āndhradeśa. It was at the beginning of Period II that brick was used prolifically to build habitational, public utility, defence and religious structures in Andhradesa and this trend continued upto the end of Period II. Building of residential, defence and religious structures in brick technology was done on a very limited scale because of the fact that stone technology gained momentum in Period III. During period IV, as stone became the principal building material brick became an associate to stone, and had been used to only construct certain parts above the stone roofed temple structures, i.e., the vimānas. It is also observed that as long as brick remained in use, thatched or tiled roofings were common for all types of buildings. As the brick structures needed frequent repairs such as the plastering of external surface, thatched roofings supported by wooden frames decayed and maintenance of these structures became very expensive and their life span was also comparatively short. Brick technology was therefore not found suitable to build monumental buildings which had to last long. To overcome all these disadvantages and to find an alternative building material which afforded longevity to the monuments, the brick technology lost it prominance. It had to give way for innovations in stone, since basements, walls, and ceilings all had to be made permanent. We next turn to discuss the evolution of building technology in stone which is described in the following section.

FOOTNOTES

1. I.K.Sarma, Studies in Early Buddhist Monuments and Brahmi Inscriptions of Andhradesa. Nagpur, 1986, p.62.

2. IAR, 1983-84, p.7. , ,

3. V.V.Krishna Sastry, et al, Thotlakonda (A Buddhist Site in Andhra Pradesh). Hyderabad, 1992, pp.32-36.

4. N.Jitendra Das, The Buddhist Architecture in Andhradesa. Delhi, 1993, p.122.

5. I.K.Sarma, OP. Cit.. 1986, p.62.

6. IAR, 1976-77, pp.8-9.

7. V.V.Krishna Sastry, et al, Op. Cit., 1992, pp.32-36.

8. ARASI. 1910-11, pp.79-82, pl.XLIII, fig.12, 13.

9. Ibid. 1908-09, p.159.

10. ARAD. Southern Circle. Madras, 1919-20, p.34.

11. N.Jitendra Das, OP. Cit.. 1993, p.131.

12. V.V.Krishna Sastry, et al, Op. pit.. 1992, pp.32-36.

13. H.Sarkar, Studies in Early Buddhist Architecture of India. Delhi, 1966, p.80, fig.23.

14. I.K.Sarma. Op. Cit. 1986, pp.30-31.

15. V.V.Krishna Sastry, The Proto and Early Historical Cultures of A.P.. Hyderabad, 1983, p.59.

16. Ibid. pp.60-67.

17. Ibid. p.58.

18. IAR, 1963-64, p.

19. Mahāvaṁsa. ch.1981.

20. EI, vol.XV, p.259.

21. I.K.Sarma, 'Some More Inscriptions from Amaravati Excavations and the Chronology of the Mahastupa', JESI, no.1, Mysore, 1974, pp.60-74.

22. Debala Mitra, Buddhist Monuments. Calcutta, 1971, p.204.

23. Ibid. pp.203-204.

24. T.V.G.Sastry, Vaddamanu: Excavations and Explorations in Krishna Valley. Hyderabad, 1984, p.4.

25. Debala Mitra, Op. Cit., 1971, p.204.

26. R.Sewell, List of Antiquarian Remains in Madras Presidency. vol.1, Madras, 1882, p.77.

27. I.K.Sarma, Op. Cit.. 1986, p.31.

28. Mahāvaṁsa. ch.28, 1-2.

29. I.K.Sarma, OP. Cit.. 1986, p.31.

30. Mahavamsa. ch.28, 1-2.

31. V.V.Krishna Sastry, Op. Cit.. 1983, p.144.

32. IAR, 1976-77, pp.8-9.

33. Debala Mitra, Op. Cit.. 1971, p.206.

34. V.V.Krishna Sastry, et al, Op. Cit.. 1992, pp.32-36.

35. N.R.V.Prasad, Bavikonda: A Buddhist Site in Andhra Pradesh. Hyderabad, 1994, p.19.

36. N.Jitendra Das, Op. Cit.. 1993, p.39.

37. H.Sarkar, Op. Cit.. 1966, p.91, fig.25.

38. Debala Mitra, Op. Cit.. 1971, p.213.

39. H.Sarkar, Op. Cit.. 1966, pp.84-85.

40. K.M.Ahmed, Phanigiri Boudharama Sidhilalu (Telugu). Hyderabad, 1950, pp.1-3.

41. Debala Mitra, Op. Cit.. 1971, p.211.

42. N.Jitendra Das, Op. Cit.. 1993, p.

43. ARAP, 1984-85, p.10.

44. H.Sarkar, Op. Cit.. 1966, pp.84-85.

45. Debala Mitra, Op. Cit.. 1971, p.208.

46. H.Sarkar, Op. Cit.. 1966, p.87.

47. ARAP. 1976-77, pp.17-24.

48. Brown Percy, Indian Architecture (Buddhist and Hindu Periods). vol.1, Bombay, 1942, pp.37-38.

49. A.K.Coomara Swamy, La Sculpture de Barhut. Pl.XXVI, fig.67.

50. IAR, 1973-74, p.4.

51. Mahāvagga. VI. 23-1.

52. ARASD.SC. Madras. 1908-09. pp.10-11; 1909-10, pp.20-22 and 1911-12, pp.13-14.

53. C.S.Upasak, Dictionary of Early Buddhist Monastic Terms. Varanasi, 1975, p.36.

54. V.V.Krishna Sastry, et al, Op. Cit.. 1992, p.86.

55. N.R.V.Prasad, Op. Cit., 1994, Pl.XLV.

56. There are references to iron bolts and nails called aggalāni or silver bolts, rajatāggalāni were made as they were used for small door leaves. See Jataka. vol.V, no.169; vol.11, nos.276, 483.

57. V.V.Krishna Sastry, et al, Op. Cit.. 1992, p.98.

58. Ibid, p.98.

59. IAR, 1976-77, pp.8-9.

60. V.V.Krishna Sastry, et al, Op. Cit., 1992, p.86.

61. The evidences of thresholds at Thotlakonda tallies with the descriptions of Dhammapada Aṭṭakatha as it mentions that 'Channa sleeps with this head keeping on the threshold', See Dhammapada Attakatha. 1.221.

62. V.V.Krishna Sastry, et al, Op. Cit. 1992, p.86.

63. N.C.Ghosh, Satanikota Excavations; 1977-80. Delhi, 1988. p.101.

64. R.Subrahmanyam, Salihundam: A Buddhist Site in Andhra Pradesh. Hyderabad, 1964, p.103.

65. ARAP. 1984-85, p.20.

66. I.B.Horner (tr), 'Cullavagga', SBB, vol.XX, London, 1952. p.241.

67. K.M.Ahmed, Op. Cit. 1950, pp.1-3.

68. A.W.Khan, A Monograph on an Early Buddhist Stupa at Kesanapalle. Hyderabad, 1969, Pl.IV.

69. ARAP. 1992-93, p.12 (cyclostyled).

70. H.Sarkar, Op. Cit.. 1966, p.93.

71. Ibid, pp.86-88.

72. Ibid, p.93.

73. Ibid. p.25.

74. Ibid. p.30.

75. I.K.Sarma, The Development of Early Saiva Art and Architecture. Delhi, 1982, p.48.

76. Ibid. p.138.

77. Ibid. p.88-90.

78. A group of 13 temples have been reconstructed after dismantling them from the lower contour which were threatened by the Srisailam Project submergence at Somasila in Mahaboobnagar District. During my stay there I explored the suburbs of Somasila village and discovered these two early brick temples.

79. T.V.G.Sastry, Veerapuram: Type Site for Cultural Study in the Krishna Valley. Hyderabad, 1984, p.42.

80. R.Subrahmanyam, 'Brahmanical Structures at Nagarjunakonda', Itihas. vol.VIII, no.1. Hyderabad, 1981, pp.13-27.

81. N.R.V.Prasad, 'Excavations at Kandi', ARAP. 1982-83, p.11.

82. P.K.Acharya, Indian Architecture. Allahabad, 1927, p.464.

83. I.K.Sarma, Op. Cit. 1982, p.49.

84. ARAP. 1982-83, p.24.

85. IAR, 1978-79, pp.39-40. Pls.V.B. and VI.A.

86. A.W.Khan, A Monograph on Yeleswaram Excavations. Hyderabad, 1963, p.24.

87. I.K.Sarma, 'Brahmanical Architecture during the Satavahana period in Andhra', Itihas. vol.VIII, no.1, 1981, p.32. fig.1.

88. Ibid. pp.37-38.

89. I.K.Sarma, 'New Light on Vengipura: Excavations at the Ancient Historical City of Āndhradeśa'. Puratattva. vol.17, Delhi, 1988, pp.15-21.

90. ARAP. 1982-83, pp.23-24.

91. I.K.Sarma, Op. Cit.. 1988, pp.15-21.

92. ARAP. 1971-72, pp.4-6; 1972-73, pp.7-9.

93. Bruno Dagens, Entre Alampur et Srisailam. Pondichery, 1984, Tome II, Pl. 12.

94. Ibid, Pl.11.

95. ARAP. 1971-72, p.6.

96. Ibid. 1972-73, p.8.

97. Ibid. 1971-72, p.5.

98. I.K.Sarma, 'Brick Temples of the Western Gangas', in Srinidhi: Perspectives in Indian Archaeology. Art and Culture. Madras, 1983, pp.67-82.

99. Bruno Dagens, Op. Cit.. 1984, Tome II, Pl.12.

100. B.R.Prasad, Chalukyan Temples of Andhradesa. Delhi, 1983, p.70.

101. Bruno Dagens, Op. Cit.. 1984, Tome II, Pl.11.

102. B.R.Prasad, Art of South India: Andhra Pradesh. Delhi, 1980, p.53.

103. See Bruno Dagens, Mayamata. Pondichery, 1970, pp.310-311 wherein it is mentioned that to make bricks soils free from gravel, stones, roots, bones or clads had to be selected, having fine sand, of uniform colour and pleasant to touch. A lump of earth should be thrown into water and then stirred and kneaded repeatedly forty times with one's feet. Then it should be wet with waters of Ksīra. pine, Kadamba, Amra and Abhyanksha trees barks and the waters of the three fruits Amalaka, Bahela and Haritaka and the process of kneading continued for a month. Then the bricks were prepared proportionately and were to be dried and evenly baked. After an interval of considerable time they were to soaked in water, taken out and dried completely and then used 1n the construction. But the method of preparing floating bricks like the ones used at Palampet temple has not so far been come across in any text.

104. E.Sivanagi Reddy and B.Subrahmanyam, 'Materials and Techniques of the Kakatiya Temples', Paper presented at National Seminar on Kakatiya Art and Architecture. held during 17-19 November 1990, at Telugu University, Srisailam, (computer-typed), p.18.

105. Ibid, p.19.

106. At the Adikesava temple at Chebrolu in Guntur District as one of the participants in the conservation work of Vimana portion of the same temple, I have noted these details. The temple in typical Kakatiyan style had a Sikhara built with moulded bricks. A thick coat of plaster was observed here and there.

107. Silparathna. Ch.XIV. 58-75.

V.3 STONE MONUMENTS

V.3 STONE MONUMENTS

The construction of funerary buildings was initiated in monolith stone primarily by the megalithic people during Period I. Stone, because of its permanance was subsequently adopted for building stubas in the early historical period not only 1n northern India but also 1n Andhradesa. It was initially used either, as a protective, measure for surrounding enclosures or rail or, for structural supports.[1] The activity of working in stone for monumental purposes began 1n India during the 3rd century B.C. when emperor Aśoka was responsible for selecting and employing stone as a medium for symbolic monuments in the shape of free standing pillars near stupas and for the railings of stupas.[2]

The origin and development of building technology 1n stone can be studied in a variety of structural buildings like Buddhist stupas. viharas. mandapas. stone-pathways and temples of the Hindu faith, which are found in large numbers located in the different sub-regions of Andhradesa, beginning from Period II and continuing upto Period IV. It 1s significant to note that after the excavation of rock-cut temples, brick is never exclusively used but it is always used along with stone. Stone was almost always employed for flooring, drum and dome portions of stupas railings, pillars, beams, steps, balustrades and for enclosing the walls of the stupas. viharas and temples.

Some stupas were built with neatly dressed stones, encasing the solid mud filled varieties as found at Guntupalli,[3] Thotlakonda[4] and Bavikonda[5] 1n sub-region C and at Nagarjunakonda in sub-region B [Chart VII B]. The core was also filled by stones or rubble as noticed at Vaddamanu[7] and Gummadidurru[8] 1n sub-region B. The dressed stones used for encasing the mud core were wedge shaped, which were joined closely with blade like edges to both vertical and horizontal joints. Each dressed block was cut in convex shape vertically, to give the hemispherical shape to the stupa.

Most of the stone veneered stupas had brick body to the drum and dome portions. This method of construction of stupas in stone is a technological improvement when compared to those only made of brick. The stupas at Bavikonda and Thotlakonda were made of locally available khondalite stone, whereas the stupas of Guntupalli and Nagarjunakonda were of the Palnadu lime stone. As Percy Brown[9] rightly opines stone was probably employed for stupas and accessories because other materials were subject to disintegrate owing to the rigours of the climate. Stone, on the other hand became the most common builders material because it was durable. Many stupas constructed of stone are found located in sub-region C and B only mainly because the geological deposits of lime stones in the Palnadu area in sub-region B and around Vizianagarm area 1n sub-region C were easily available [Map III]. At Pashigoan in sub-region A, the entire stupa was built with lime stone transported from Palnadu area to a distance of nearly 300 kms. The other reason why the Buddhists preferred lime stone in building the stupas was that it was easy to chisel and carve the drum and dome portions with Jātaka tales which were the common means of decoration, conveying a religious message. Lime stones could easily be cut and polished and as applied for facing the drum, avaka platform and dome of the stupas.

The drum, dome, avaka platforms of the stupas of Period II were faced with lime stones and the railings were erected 1n both granite and lime stones, as observed in some of the above mentioned sub-regions of Andhradesa. The drum of the Amaravati stupa. datable to the 2nd century A.D., was veneered with decorated slabs alternating it with pilasters which were cemented to each other with strong lime mortar. The facing stone work required a frame work with enough strength to support the facing. This was achieved by the architects by introducing pilasters with vertical grooves on either side, in order to hold the casing slabs. This technique reveals perfection in structural engineering and a sound knowledge in building technology. The lime stone quarried in thick slabs from Palnadu area was transported to the workspot. The casing slabs were dressed in slight wedge shape, so as to suit to the circular body of the brick drum of the stūpa. The work of dressing was done with knowledge accumulated over generations of experience of the artists who were adept in handling the stone. The stone quarrying methods were more or less like the ones described while explaining the funerary structures of the megalithic tradition [Chapter IV]. Many stūpas in Andhradesa were encased with dressed slabs of lime stone, details of which are tabulated in Chart VII B.

The railings that served the purpose of protecting the religious edifices, i.e., the stupas. were built of granite, limestone and khondalite stones, according to the availability of each variety in the particular sub-region. The stone used for the uprights of the railing at Amaravati[11] was granite, which was quarried locally. They were carved in octagonal shape and polished by expert sculptors, by using the grinding technique, after dressing them with the help of pointed and flat chisels. There were three intermediary cross bars and these were finally crowned with a massive coping stone. The granite uprights bear lenticular sockets into which were fitted the cross bars recalling the techniques employed in the wooden examples. The uprights, often inscribed, bear typical Mauryan polish, which reveals that an earlier stupa was built by Asoka here in the 3rd century B.C.[12] The railings of the Amaravati stupa also have a close resemblance to the typical Hauryan polish, noticed in the stuoa railings of Vaisali and Sarnath.[13] The huge granite slabs here, have footings at the base, in order to rest firmly on the ground, a feature noticed at a megalithic burial, i.e., the dolmenoid cist at Damaravai in sub-region B where, the outer circle was built with wedge shaped sand stones carved with bases on either side. It is observed that granite stone was used only at Amaravati in sub-region C in massive pieces, for the purpose of making railing during the 3rd century B.C. Stupas with lime stone railings, have been noticed at Bhattiprolu in sub-region C, Chandavaram and Jaggayyapeta in sub-region B. The absence of the use of granites 1n other sub-regions was because, it was difficult to quarry, cut, transport, dress and handle in building operations. The architects opted for lime stone which could be more easily handled and was further economical to use than the former.

The floors of the oradaksinaoatha of the stupas and the inside floors of the chaityaqrihas. viharas and temples were laid with dressed stones. The oradaksinaoatha around the Amaravati stupa[14] was laid with cut limestones over the brick flooring. The floors of the viharas at Thotlakonda and Bavikonda[15] were laid with stone nodules covered by lime plastering. The floors around some stone stuoas at Thotlakonda and Bavikonda were paved with large sized and dressed khondalite stones closely fitted [Plate XXI]. Steps and moon stones were also arranged by dressed slabs. The flooring of the oradaksinaoatha at Jaggayyapeta[16] was paved with dressed slabs stretched across the interior of the _stupa_. The technique of laying the floor with lime concrete inside the refectory at Thotlakonda is interesting. The ground was first levelled and partitioned with rubble and bricks and then rammed. After that lime concrete was filled up inside the blocks in order to keep it intact.

The builders knew that the primary characteristics of a flooring material must be durable and be able to resist impact, abrasion, water, also be comfortable to walk on and finally, be easily maintained. The arrangement of floors in or around the structures described above, reveals the advancement and significant development in building technology of the period when compared to the limited longevity of clay, lime or concreted floors, noticed at some of the sites, viz., Dhulikatta, Pashigaon, Ghantasala, Bhattiprolu, etc. of the same period [Chart VII B]. The experience of the builders guided them to go for sophisticated stone floors so as to make them permanant. Some of them are still extant in good condition at sites like Thotlakonda, Bavikonda, Nagarjunakonda, and Phanigiri.

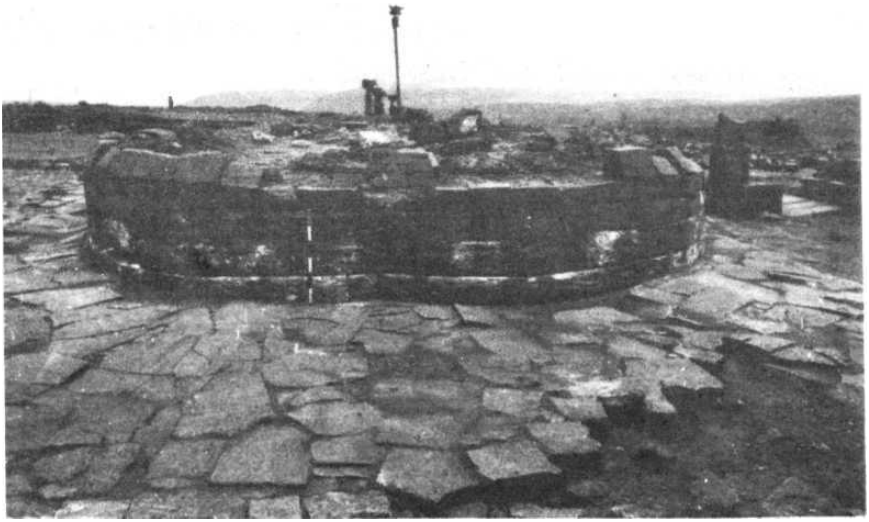
The _mandapas_ at the Buddhist settlements were also constructed in dressed stones. The earliest _mandapa_ in Andhradesa has been noticed at Chandavaram in sub-region B, where some interesting constructional techniques of a pillared _mandapa_ are revealed in the excavations. On a strengthened and levelled terrace of the hill, the architects built a 16 pillared _mandapa_. The lime stone pillars measuring 3.0 metres in height, depicted with full and half lotus medallions, were found set up, four in each row. The pillars were found driven into the ground to a depth of 50 cms. To prevent possible slide, a flat shale stone was inserted underneath and this inturn was girdled with construction of brick in two courses for affording stability. For fixing of the square bases of the columns, the shale bed was scooped to the required depth. The scooped slots measured 82 x 82 x 40 cms. The above points reveal that the architects were perfect in planning and utilising the hill terraces, by levelling and stengthening them so that they could hold the pillars of the mandapa. They also had sound knowledge in erecting the pillars of the mandapas. duly inserting them into the scooped ground and fixing the columns with stones, on which the brick casing could be made.[18] The pillar bases at Vaddamanu in sub-region C were also reinforced with brick casing, datable to the 3rd century B.C. There are literary descriptions which tally with the practical knowledge as noticed in the construction of pillared halls just described. In literature, pillared halls, the mandapas are called Sthunavabandha harmya.[19] In the Visuddhimagga.[20] we find descriptions of the setting up of pillars in the foundations or the structural basement. They are described as being supported by stone bases and fastened to them with a kind of cement called silesa.

At Thotlakonda,[21] excavations have brought to light a large square pillared hall, called upōsathāgāra used by the bhikkus to recite the pathimokha collectively by the sangha. This hall measured 23.5 x 23.50 metres and was situated in the centre of the vihāra. It had 64 pillars of khondalite stone with 8 pillars in each row. The hall had a raised platform constructed 25 cms in height above the ground level so that the rain water would not enter inside.

The foundation details of the pillars throw some light on the engineering techniques known to the people. The pillars, 4.25 metres in height, were kept on dressed stone bases cut to a depth of 10 cms. inside so as to insert the base of the pillar. This arrangement, reminds us of the so called 'underpinning technique'[22] employed for the foundations of the pillars at Thotlakonda [Plate XXI]. The depth of the foundation of the pillars at Thotlakonda was 60 cms. and this was fixed with rubble and earth tightly in the ground. Since the khondalite stone itself was quite poros and as such a monolithic pillar could not be extracted from the quarry, two stone blocks were fixed one above the other. Sockets were cut on the top portion of the pillars for fixing the wooden rafters to lay the roof covered with tiles. The pillars might have been extracted either from the area where the rock-cut cisterns were made or the local quarry, and were erected with a minimum number of people, using scaffolding and wooden pullies with ropes and also earthen ramps. A rare evidence of pillars carved with a capital comes from a ruined mandapa at Salihundam.[23] Arrangement of capital 1n '+' shape is a technical advancement facilitating to receive the beams.

Mandapas constructed of lime stone pillars which are square from bottom to top, fluted 1n the middle section, were noticed at Alluru,[24] Ghantasala,[25] Ramatirtham,[26] Salihundam[27] in sub-region C and at Chandavaram[28], Vaddamanu[29] and Nagarjunakonda[30] in sub-region 8 [Hap IX & Chart VIII B]. We do not have any report of their existence in sub-regions A and D probably because the pillars were mostly made of lime stone here and this had to be transported from such a long distance to places like Dhulikatta or Nandaluru 1n sub-regions A and D respectively. These were two important Buddhist sites situated very far away from the deposit

PLATE XXI



Period II: A stone veneered Stupa, Thotlakonda, Sub-region C

Period II: Foundation of a pillar in 'under pinning technique', Thotlakonda quarries of sub-region C. The use of lime stone here was hence restricted only to decorate the drum and for a certain portion of the dome of the stupas. Slabs intended for encasing were generally thin sheets whereas the stone blocks for pillars were heavy and lengthy needing extensive expenditure and labour in transporting over a long distance. However, at Thotlakonda the availability of local khondalite stone, though not of a fine quality, was able to resist stress and strain. The technology of quarrying the heavy blocks was by the 'tongue and groove' method. The techniques that enabled the erection of menhirs in Period I were probably the same ones employed by the Buddhist architects in erecting the massive pillars of the mandapas.

Foundations and basements of the brick built vihāras were constructed of rubble stones. The viharas at Chandavaram[31] were constructed on shale stone foundation and artificially made terraces supported by retaining walls which were provided with stone and brick steps. The viharas at Thotlakonda,[32] Nelakondapalli,[33] and Nagarjunakonda[34] were built on rubble foundations [Chart VII B]. Stone benches were provided in the viharas.[35] The inner walls of the vihāras at Nandaluru[36] in sub-region D were encased with shale stones. A bathroom of the Buddhist establishment at Nagarjunakonda,[37] constructed during the 3rd century A.D., had a stone trough, which was connected to an underground drain, built of Cuddapah slabs which was once again connected to a soakpit formed by alternate courses of rubble, pebble, sand and lime.[38] This can be considered as a model specimen for even a modern sanitary engineer. Drains constructed with dressed stones and set in lime mortar are noticed at Salihundam[39] in sub-region C and at Nagarjunakonda[40] in sub-region B. Each vihara cell at

Bavikonda[41] was provided with a stone threshold with sockets to fix the doors.

The most important engineering technique employed was in laying the pathways connecting the internal structures of the vihāra complex at Thotlakonda.[42] The stone pathway was paved and buttressed with dressed stones with a revetment on either side [Figure 9]. The end of the pathway at each level was connected by means of steps preceded by moon stones, since different levels of the terraces had to be connected. At the beginning or, end of each, a pair of balustrades was fixed on either side. The balustrades with rounded tops and rectangular shafts, served to denote the level of a pathway to accordingly step up or step down. The protuberances were dressed evenly and the depressions were filled with rubble and earth and paved with flat stones, to obtain an even surface. A pathway paved with flat boulders and a stone revitment on either side was laid from the tank to the vihara at Thotlakonda.[43] The building technology in laying the pathways involved at the first stage was to level the rocky surface by cutting and removing the undulations. In the next stage the levelled surface was pitched up, with dressed stones close to each other and the gaps between the stones were filled up with lime mortar. In the third stage, on either side of the pathway, vertical dressed stones were planted as buttresses and also, to act as a revetment 1n order to withstand the side thrust of the pathway. Stone pathways were also reported from Salihundam[44] [Chart VII B, 19] Pathways were paved with stone blocks dressed on top, side and their bottoms were roughy hewn. The faces of the stones are large 1n area than the bed. Lime stones, Khondalites and shale had average abrasion resistance. Thus, the technology used to build

FIGURE 9

A stone pathway connecting the Vihara and kitchen complex.
Thotlakonda, Sub-region C

(Reproduced from V.V. Krishna Sastry, et al Thotlakonda. A Buddhist Site in Andhra Pradesh. Hyderabad, 1992, Fig.No.8) pathways and roadways was considerably developed in Period II.

Stone as a building material was employed in association with brick construction to temples 1n Andhradesa from Period II onwards. The earliest evidence comes from a temple at Gudimallam[45] where a *śivalinga* of black basalt stone, was set on the polished buff stone rings and enclosed by a square railing of lime stones. The carved slabs of the railing around the *linga* were fixed on each side into socketed vertical stumps, which, in turn, stood on flat anvils at the foundations, recalling the 'underpinning technique'.[46] This technique might have been adopted by the architects from a similar tradition found 1n the Buddhist structures specially, since it had a *vedika* around 1t. This is a unique evidence to note, in case of a Brahmanical temple. The lotus medallion of the stone upright and artistic features of the *linga* and other associated finds have facilitated scholars to date it to the 2nd century B.C.[47] Cuddapah slab floors were laid for the temples at Veerapuram,[48] Chejarla[49] and Nagarjunakonda[50] [Chart VII B].

Massive and tall *Dwajasthambhas* and pillars were delicately extracted from the local quarry, by the 'tongue and groove' method as found at Nagarjunakonda.[51] The *Dwa.iasthambhas* were cubical at the bottom, octagonal in the centre, cylindrical and tapering at the top and fixed over a high pedestal. This bespeaks of the fine geometrical knowledge of the architects. The brick core of the temples at Nagarjunakonda[52] were encased by Cuddapah slabs externally, in order to butress them and to protect them from the entry of rain water. This is an important technological advancement employed during Period II. In order to protect the temples from floods, stone walls were raised abutting the river banks.[53]

CHART VII B

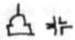
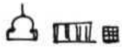
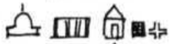
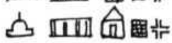
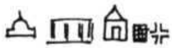
Period II: Stone foments

S.No	Name of the Site	Sub-region	Situated on: Plains	Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Brahmanical Monuments
1.	Alluru	B	✓	-	Lime		
2.	Amaravathi	C	✓	-	Granite & Lime		
3.	Bavikonda	C	-	✓	Khondalite		
4.	Bhattiprolu	C	✓	-	Lime		
5.	Chandavaram	B	-	✓	Lime		
6.	Chejarla	B	✓	-	Shale		
7.	Dhulikatta	A	✓	-	lime	- -	- -
8.	Ghantasala	C	✓	-	Lime		
9.	Gudimallam	D	✓	-	Basalt		
10.	Gummadidurru	B	✓	-	Lime		
11.	Guntupalli	C	-	✓	Lime & Khondalite		
12.	Jaggayyapeta	B	✓	-	Lime		
13.	Nagarjunakonda	C	-	✓	Lime & Shale		

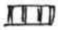
contd..

Key: stupa, Torana, Enclosure, mandapa, Floor, vihara, Roof, Temple, Pathway

CHART VII B contd.,

S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Stone Used in: Brahmanical Monuments
14.	Nandaluru	D	_	/	Lime		
15 .	Nelakondapalli	B	/	-	Granite		
16.	Pashigoan	A	/	-	lime		
17.	Phanigiri	B	-	/	Lime		
18.	Ramathirtham	C	-	/	Khondalite		
19.	Salihundam	C	-	/	Khondalite		
20.	Thotlakonda	C	-	/	Khondalite		
21.	Vaddamanu	B	-	/	Granite		
22.	Veerapuram	B	/	-	Shale		

Key:  stupa  Torana Enclosure 

 mandapa  Floor

 vihara  Roof

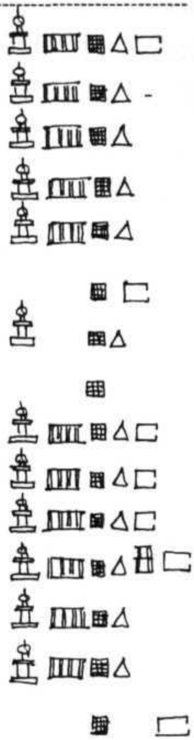
 Temple  Pathway

In Period III the sole use of stone in constructing the entire temple can now be focussed upon. The temples at Gummadam[54] were enclosed by a prakara wall constructed of dressed shale stone [Chart VII C]. For the pranala. lengthy stone with a channel cut on the top side was employed. The architects took care in selecting stone for the pranāla so that the water did not percolate into the brick structures causing damage to its structural stability. This has been noticed at Siddeswaram[55] in sub-region B [Chart VII C, 20]. At Keesaragutta[56] a brick temple of the 5th century A.D. was visible up to the basement only over which rectangular stone slabs were placed for giving strength to the superstructure [Chart VII C, 8]. This is a significant development in building technology and it is here that we notice a slow transition from brick to stone.

The prakara around the brick temples at Pedavegi[57] were encased with dressed sand stone blocks to the brick walls. This feature was continued in Andhradesa from the 3rd century A.D. onwards. A brick temple termed as No.2 in importance by the excavators at Gollattagudi,[58] datable to the 7th century A.D., was constructed on a rubble stone foundation of 1.80 metres below the ground level. This as well as the door jambs were dressed in granite stones [Chart VII C, 4]. Here, both brick and stone temples were built side-by-side in the same period.

From about the 7th century A.D. onwards, a large number of temples in stone were built. This is seen in almost all the sub-regions. In an unprecedented manner, royalty as well as officers and wealthy individuals and dedicated men donated materials to build these temples. Our concern is not with giving details of achievements of individuals/dynasties and this

S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Stone Used in: Brahmanical Monuments
1.	Alampur	A	√	-	Sand		
2.	Attirala	D	√	-	Shale		
3.	Chilamakuru	D	√	-	Shale		
4.	Gollathagudi	A	√	-	Granite		
5.	Gudimallam	D	√	-	Granite		
6.	Gummadam	A	√	-	Shale		
7.	Kanipakkam	D	√	-	Granite		
8.	Keesaragutta	A	-	√	Granite		
9.	Kudalisangameswaram	D	√	-	Sand		
10.	Mahanandi	D	√	-	Sand		
11.	Mukhalingam	C	√	-	Sand		
12.	Panchalingala	A	√	-	Shale		
13.	Panyam	D	√	-	Sand		
14.	Papanasi	A	√	-	Shale		
15 .	Pedavegi	C	√	-	Sand		



contd...

Key: stupa — Torana — Enclosure

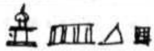
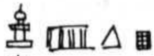
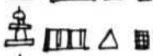
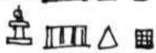
mandapa — Floor

vihara — Roof

Temple — Pathway

Storeyed Mandapa

CHART VII C contd...

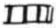
S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Stone Used in: Brahmanical Monuments
16.	Pondugula	B	/	-	Shale		
17.	Pushpagiri	D	/	-	Shale		
18.	Ramagiri	D	/	-	Granite		
19.	Rupala Sangameswaram	B	-	/	Sand		
20.	Siddhesvaram	B	/	-	Shale		

Key:

 stupa

 Torana

 Enclosure

 mandapa

 Floor

 vihara

 Roof

 Temple

 Pathway

 Storeyed Mandapa

patronage of temple building activity, nor, is it with discussing how these temples can be attributed to a particular King or his successor. In fact, it is of some significance to note that no temple under study can be attributed to have been entirely constructed by a single King. On the other hand most of the temples were constructed with revenues from different royal lineages and sometimes even from local Chiefs and functionaries of the area, where they were located. In some cases funding came from local wealthy people of the community at large. Thus, to attribute the foundation of temples to a single authority is difficult to establish on the basis of the empirical evidence available. Further, apart from funds in appreciating the large scale operations involved in building such monuments, their planning and organisation was infact in the hands of skilled and unskilled craftsmen and workers.

Important temples built during the 7th century A.D. were the Navabrahma group of nine temples and the Kudalisangamesvaram temple in sub-region A. These were built in red sand stone brought from a nearby quarry, located just on the other side of Alampur town and on the opposite bank of river Tungabhadra at Satanikota in sub-region D. A good number of carved and uncarved stone slabs are still seen scattered at Satanikota indicating that this was the source for the sand stone. Inscriptions denoting a guild of architects called as Utpattipidugu, datable to the 7th-8th centuries A.D. are seen at both Alampur and Satanikota, also attesting the fact that there was considerable construction and stone cutting activity in the region. The same quarry must have been used for the Kudali Sangamesvaram temple, built at the confluence of rivers Krishna and Tungabhadra.

On close examination, it has been observed that the temples of the period were built on a levelled surface, after having duly filled the foundation trench with heavy blocks of stones called Adharasila which served the purpose of being equivalent to a concrete bed of modern times. Above this, a basement of neatly dressed slabs was raised to a height of one metre with off-sets on either side, so as to diffuse the load of the superstructure on to the foundation slabs. This phenomenon 1s clearly observed at Alampur, in case of a dilapidated tempe built in Chalukyan style. Since it is not a protected monument,[59] its plinth was opened by us by laying a trial trench on the rear side of the temple, to observe how the foundation was laid. The study of foundations of early temples is a much neglected aspect, because, in usual circumstances, the foundations were buried 1n the ground and therefore, it is never possible to study them. A piece of research on the subject for northern Indian monuments was carried out by V.H.Joshi.[60] Thus the data from Alampur and suburbs, reveals important details of, how the foundations of the early stone temples were made. As the temples at Kudali Sangamesvaram and Papanasi, built during the 6th to 8th centuries A.D. were threatened by the waters of the Srisailam Hydro Electric Project, they had to be removed 1n order to reconstruct them at a higher contour. This opportunity also offered us a chance to examine the foundation 1n detail, even below the ground level after the temples were completely dismantled upto the plinth level. In this regard scholars like N.C.Ghosh[61] and I.K.Sarma[62] furnish very valuable and hither to unknown Information on traditional methods of how the foundations of early temples were laid. According to I.K.Sarma, the ground at the foundation level was levelled at a depth of 7.45 metres and the foundation trench was filled up with compact brown earth, alternated by roughly dressed shale stone slabs, for the garbhagriha portion, to a depth of 3.90 metres [63] **[Figure 10].** The foundations were made strong for the garbhagriha because of its heavy load and for the pillared mandapa on the front side of the temple, they were narrower, in thickness because of its comparatively less weight. A similar feature of laying foundations was noticed at the Papanasi temples, where the foundations of the temples were laid in horizontal layers of shale stone and brown earth alternated to a thickness of 1.00 metre below the upana, the first layer of the temples. [64] This suggests that the sthapathis of the 6th-7th centuries A.D. had followed a uniform pattern of laying the foundations to temples. To limit the actual temple plan, the upana layer had to be marked with a linear drawing by chiselling in an incised manner, so as to check the plumb line of the superstructure. After that, dressed stones were placed one above the other closely fitted with their joints duly cramped, with iron dowels to keep the layer intact and enable a structural stability. After this the foundation course and the basement called adhiṣṭāna was built.

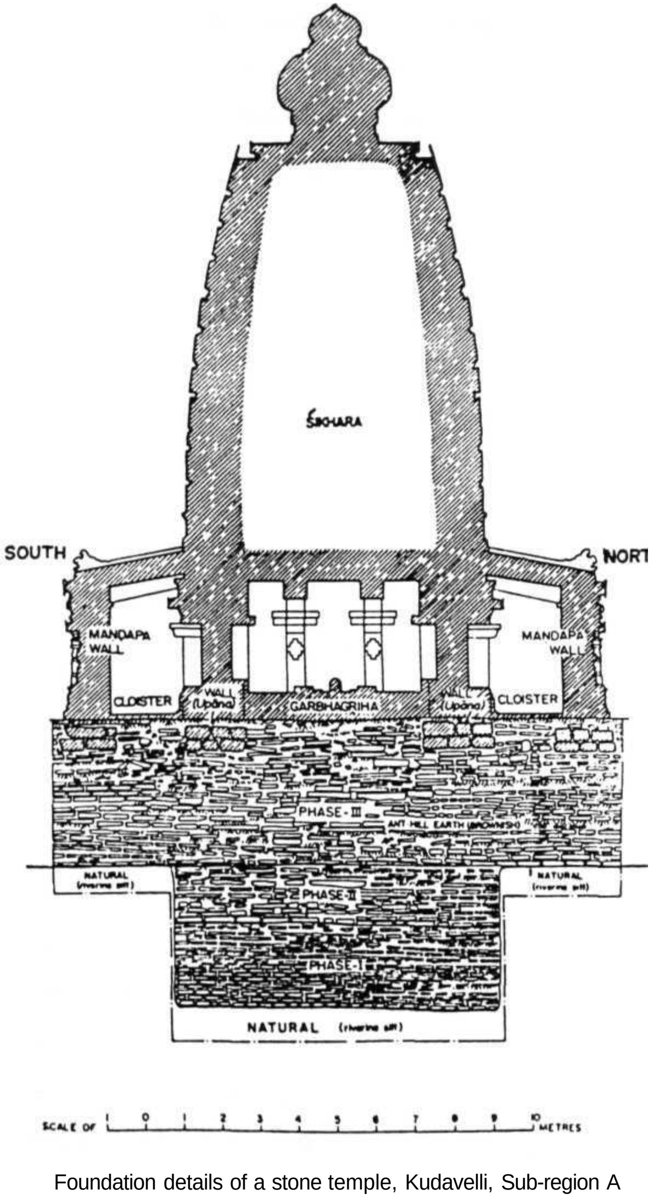
In a discussion on the walls and ceiling of the early stone temples it is noticed that the walls were mostly in single course for the garbhalava. the arthamandapa, and the enclosure wall, in case of the sāṅdhāra variety of temples. In contrast to this pattern, an early stone temple datable to 7th century A.D. at Pondugula [65] **[Chart VII C, 16]** in sub-region B, was built in two storeyes having a great basal width, i.e., a wall with greater thickness denoting the stage of experimenting with stone. At Alampur **screen** walls, i.e., latticed windows were provided in different sizes and **shapes** for **allowing sufficient** light inside the temple. After the walls were built, the next aspect that was taken up was, erection of pillars set

FIGURE 10

SAṄGAMEŚVARA TEMPLE KUDAVELLI

DIST MAHBUBNAGAR (AP.)

CROSS-SECTION ŚIKHARA, GARBHAGRIHA AND FOUNDATION?



Foundation details of a stone temple, Kudavelli, Sub-region A

Reproduced from I.K. Sarma, 'Alampur Temples: Rare Evidences on Constructional Modes and Consecrational Rites' in A.V.N. Murthy, I.K.Sarma (eds), Ramachandrika. *t* (O.Ramachandraiah Felicitation Volume), Vol.1, Delhi, 1993, Fig.No.24) in line with the help of scaffolding material. This also enabled the laying of the roof, over the walled and pillared structure. The garbhālaya was provided with a flat roof, supported by four pillars apart from the walls. This is a distinct feature noticed in case of the early stone temples of this particular sub-region and is found at Panchalingala and Alampur which were built during the 6th to 8th centuries A.D. This arrangement of laying the roof supported by pillars in the temple, denotes a sound technological knowledge of the early sthapathis. They wanted to distribute the superstructural load of the stone vimanas built either in Rekhānāgara, i.e., parabolic style or in Kadamba nagara, i.e., stepped pyramidal type on to, not only the walls, but also on to the central four pillars, affording structural stability to the entire structure. Here, it should be noted that the vimānas were also built of stone with massive walls.

Earlier, in the section on brick technology we, had noticed postholes in and around the brick temples at Nagarjunakonda[66] in sub-region B datable to 3rd-4th centuries A.D. and at Keesaragutta[67] in sub-region A datable to the 5th century A.D. The post-holes found inside these early brick temples were meant to erect wooden posts to support the thatched roofs which were of light weight. Now these were totally replaced by stone and being heavy their load had to be properly distributed. The roof of the mahamandapa was sometimes elevated and a slopped bent roof was provided for free flow of rain water from the top of the temple. Lime mortar was used for filling the gaps in between the roof slabs on top side. A layer of lime concrete, a mixture of lime, sand and small river rolled pebbles was laid as a water proofing course, on which lime plastering has been done so as to make it leakproof. This was noticed at Alampur while dismantling a 7th century temple;[68] an aspect found on the main temples at Alampur as well. The Mukhalingam temples, however, differ from the Alampur examples in terms of the treatment ceiling. The Mukhalingam temples have no ceilings on the inside, but instead there is a corbelled roof above. Visible only from inside, the corbelled arch was arranged over the lintels of the doors evidently planted to relieve the heavy load over it as in case of the Orissan temples of the same period. The same technique was followed by the local architects who built the Mukhalingam temples. The mahamandapa called as Jagmohana had a flat roof with sides of its outer surface slightly sloping from the centre so as to drain out the rain water. The temples during the period were enclosed by stone prakaras as seen at Alampur.[69] Every care was taken to releive the load bearing on the door frames and it was well planned to distribute the same on to the vertical pillars arranged inside the temple behind the door jambs. All these features of building technology are seen at Alampur, Kudavelli, in sub-region A,[70] and at Rupala Sangameśvaram temples[71] **[Plate XXII]** in sub-region B, at Mukhalingam[72] in sub-region C and Mahanandi and Panyam[73] in sub-region D **[Map** XI & Chart **VII C].**

Construction of double storeyed mandapas was an innovation of Period III. The double storeyed mandapa at Panchalingala[74] in sub-region A was built with roughly carved plain pillars of shale stone. The pillars of the first floor were erected and set exactly on the ones of the ground floor, based on centre line and the plumb line method. To erect the pillars, roof and sun shades of the first floor of this storeyed mandapa. an earthen ramp must have been probably laid in a slopy manner, which facilitated the builders to climb to the top of the **ground floor.**[75]

During the 9th-10th centuries A.D. some new elements in temple building activity, such as building temples on apsidal plan with barrel vaulted roof and 1n two storeys with an access by staircases have been observed. The temples at Chilamakuru[76] in sub-region 0 have been built on apsidal plan during the 9th century A.D. The temples at Attirala,[77] Gudimallam,[78] Kanipakkam and Ramagiri[79] in sub-region D, Papanasi 1n sub-region A, Pushpagiri in sub-region B have been built on apsidal plan [Chart VII C]. In sub-region C this plan was conspicuously absent for stone temples. In the same sub-region, temples were built in a new way, i.e. in two storeys on the inside as seen at the Pañchārāma sites, viz., Amaravati, Draksharama, Palakollu, Bhimavaram and Samalkota.[80] The ground floor of these, was neither functional nor solid and the upper storey was reached by a flight of steps from either inside the ground floor or from the outside.[81] This arrangemment was done, in accordance with the height of the tall linga and to offer worship from the first floor. The garbagriha and pillared halls in the upper floor were provided with windows on the sides. Absence of the central four pillars in garbhagriha is noteworthy which was a feature widely prevalent in the case of the temples, built during the 6th-7th centuries A.D. in sub-region A and B. Roofing was done with flat celling slabs.

During Period IV, from the 10th century A.D. onwards a spurt in the activity of building temples 1n stone upto the roof level and sometimes the entire temple has been observed. Above the superstructure of stone temples, the vimānas were some times built in brick. However, temples built to a remarkable height with extended mandapas built prolifically in stone have been noticed during the period.

Gopalareddy[82] has classified the temples of the period into four categories, viz., ekakuta dwikuta, trikūta and mandapas. Recently, Sivanagi Reddy and Subrahmanyam have reported another variety, called panchakūta[83] temples at Ramanujapuram and Atmakur in sub-region B. Ekakuta temples are seen with garbhālaya and arthmandapa: dwikūta or yugala type consist of the temples either facing each other or standing side-by-side in 'L' shape or facing each other connected by a common mandapa noticeable at Mallesvaram[84] in sub-region A. In the trikuta variety, the main shrine is supposed to be in the centre, the remaining two constructed on either side are connected by a common rangamandapa. Another variety of trikūta has three shrines all in a row with a common mandapa as noticed at Kusumanchi.[85] In panchakūta variety, two more temples, each on either side to the existing trikuta plan are added with another common mandapa.[86]

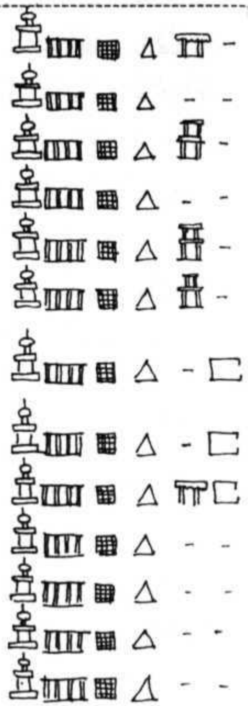
Earlier, scholars like Yazdani,[87] Murthy,[88] Ramarao,[89] Sarma,[90] Srinivasan,[91] Rajendra Prasad,[92] Prasada Rao,[93] and Ramanaiah,[94] have all dealt with the art and architectural form of the temples of this period describing the details in all their grandeur. However, a focus on only their technological feats is still a dessitram. The architects of the period preferred a combination of various building materials like sand, stone, brick, lime, iron and wood, depending on the properties of each item. The geology of each sub-region played prominant role in building the temples. The architects used sand for filling the foundation trench and in preparation of lime mortar and concretes. Sand bed foundations were provided for the temples at Nidikonda, Palampet,[95] Hanumakonda[96] 1n sub-region B and at Nagunuru and Mantheni 1n sub-region A. Granite and sand stone were chosen for almost all the exterior and interior of the temples whereas, the load bearing components like pillars, beams and floor slabs were carved in basalt stone. Basalt stone was also used for decorative purposes such as the door frames, bracket figures, ceilings and sculptures. Certain temples were constructed either in red sand stone or white and pink granite stones exclusively. The temples at Jakaram, Ramanujapuram, Ghanpur, Palampet, all 1n sub-region B, and those at Nagunuru, Mantheni and Ranjala in sub-region A were constructed in red sand stone during the 13th century A.D. The temples at Chebrolu, Kanchikacherla in sub-region C; at Kothupalli, Kalabgur, Tumukunta and Kaluvakolanu in sub-region A were built in granite only. The Keerthi toranas and Swayambhu temple at Warangal were built in pink granite stone.[97] The temples at Nagulapadu, Nidikonda, Hanumakonda, Palampet, and Ghanpur were constructed in a combination of basalt with sand stone and granite. Sedimentary rocks or shale stones were also used in construction of temples at places like Malleswaram in sub-region A, Siddesvaram in sub-region B and Pushpagiri in sub-region D [Chart VII D]. Use of stone slabs of massive size was the characteristic feature of the building technology of the period. Different types of stone were preferred to other materials because of their being able to withstand the vicissititudes of the climate and seasonal variations.[98] Timber, bamboos and ropes were brought for scaffolding. The craftsmen of various categories, viz., the Chief architect, Sthapathi. stone carvers, blacksmiths, masons, painters and ordinary workers became full time workers in temple building.

Selection of suitable site was an important criterion in temple construction. The architects of the period seem to have followed the

CHART VII D

Period IV: Stone Monuments

S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Stone Used in: Brahmanical Monuments
1.	Ainole	B	√	-	Granite & Basalt	-	
2.	Atmakuru	B	√	-	Granite	-	
3.	Banda Rameshwarapalli	A	√	-	Granite	-	
4.	Chebrolu	C	√	-	Granite	-	
5.	Duddeda	A	√	-	Granite	-	
6.	Gambhiraopeta	A	√	-	Granite	-	
7.	Ghanpur	B	√	-	Sand & Basalt	-	
8.	Godisala	A	√	-	Granite & Basalt	-	
9.	Hanumakonda	B	√	-	Granite	-	
10.	Jakaram	B	√	-	Sand	-	
11.	Janagoan	A	√	-	Sand	-	
12.	Kalabagur	A	√	-	Granite	-	
13.	Kanchikacherla	B	√	-	Granite	-	



contd...

Key:

stupa

mandapa

vihara

Temple

Storeyed mandapa

Torana

Floor

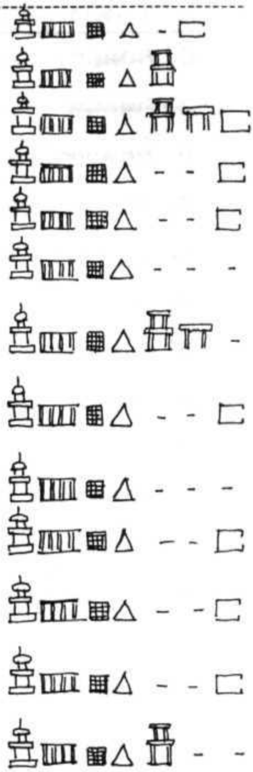
Roof

Pathway

Enclosure

CHART VII D contd...

S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments	Stone Used in: Brahmanical Monuments
14.	Katakshapur	B	√	_	Granite	-	
15.	Kodavatur	B	√	-	Granite	-	
16.	Kolanupaka	B	√	-	Granite	-	
17.	Kondaparthi	B	√	-	Granite	-	
18.	Kothapalli	A	√	-	Granite	-	
19.	Kusumanchi	B	√	-	Granite	-	
20.	Mallesvaram	A	√	-	Sand & Shale	-	
21.	Manthani	A	√	-	Sand & Basalt	-	
22.	Nagulapadu	B	√	-	Granite & Basalt	-	
23.	Nagunuru	A	√	-	Sand	-	
24.	Nidikonda	B	√	-	Granite & Basalt	-	
25.	Palampet	B	√	-	Sand & Basalt	-	
26.	Pangal	B	√	-	Granite & Basalt	-	



contd..

Key:

stupa

Torana

Enclosure

mandapa

Floor

vihara

Roof

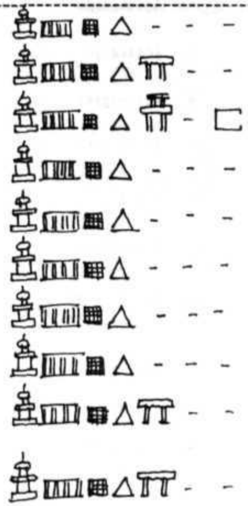
Temple

Pathway

Storeyed mandapa

CHART VII D contd...

S.No	Name of the Site	Sub-region	Situated on: Plains	Situated on: Hills	Type of Stone	Stone Used in: Buddhist Monuments for	Stone Used in: Brahmanical Monuments
27.	Pushpagiri	D	✓	-	Shale	-	
28.	Ramagundam	A	✓	-	Sand	-	
29.	Ramanujapur	B	✓	-	Sand	-	
30.	Ramjala	A	✓	-	Sand	-	
31.	Siddheswaram	B	✓	-	Shale	-	
32.	Somasila	A	✓	-	Sand	-	
33.	Tripurantakam	B	✓	-	Granite	-	
34.	TumuGunta	A	✓	-	Granite	-	
35.	Vallala	A	✓	-	Granite	-	
36.	Warangal	B	✓	-	Granite & Basalt	-	



Key:

stupa — Torana — Enclosure

mandapa — Floor

vihara — Roof

Temple — Pathway

Storeyed mandapa

principles laid down in the *Agama* and *Silpa* texts in this regard. Though the traditions were known earlier many of these texts were written down during this period. The temples were constructed near the confluence of rivers, in the tanks, on the tankbunds, 1n forests, on hills and hill slopes and on the plains.[99] Before the construction work was taken up, the fitness of the soil was to be checked according to the *Silpa Sastras*.[100] A pit was to be dug and the dug out earth was to be filled again into the pit if it exceeded the height of the pit soil was of good quality. In another method, water was put into the pit and observed the next morning and then the quality of the soil was adjudged.[101] The soil thus selected was to be tilled and levelled.[102] Details of how foundations were to be laid have also been described in texts. According to them, the foundation pit was to be dug to a depth of one man's height with raised hands, or should be dug until the rock bottom or water level was met.[103] The pit was then to be filled with fine earth to a height of 8" on which a layer of mud concrete, a mixure of stones and wet clay, was to be laid to a height of one *hasta* followed by sand. It was then to be cured with water duly trodden by elephants and levelled with rammers. The next course upto the height of the pit, was to be packed with the same concrete described above and this was finally followed by stones and bricks as the first course of the temple. Some other texts[104] prescribe only stones for filling the foundation pit. On this course, called the *ādhāraśila*, stood the entire temple.[105] Medieval texts on temple architecture, viz., the *Manasara*[106] and the *Mayamata*[107] have prescribed certain norms for laying the foundations of the temples. The use of a saturated sand bed has been mentioned in these texts.[108] The architects of the medieval times in Āndhradeśa followed the same methods for the temples that were built at

Nidikonda, Hanumakonda, Palampet, Ghanpur and Nagulapadu in sub-region B. The foundation trenches at Jakaram[109] and Ramanujapuram[110] were filled up with fine earth, collected from the rivers or tanks as mentioned in the MSnasara. In the Marīchisaṁhita.[111] the construction of a wall, called Khatakudya in the foundation pit has been mentioned over which the plinth of the temple was to be constructed. Had the architects followed the method in the building of the above mentioned temples they would not have collapsed.

After the foundations were laid, stones quarried for the temple vargams were brought to the site. Some of the quarrying methods of the period have been observed by us at places like Ramanujapuram, Katakshapur, Palampet and Hanumakonda in our field survey. Heavy to medium sized stones were extracted from the selected local quarry, after marking the sizes in linear drawings in red oxide. This was followed by chisel marking on the bouldery surface. Iron chisels, with flat tips of considerable size, were then inserted with groves already made on the line and were hammered out one by one progressively to get the stone cut to the required sizes. This was done in the conventional 'blocking technique' which was followed by the 'ridge and groove technique'.[112]

In another method of extraction, wooden wedges were placed in small holes, carved in the rock and then swollen by sprinkling of water to cause splitting of the rock. Instances of lines of small holes prepared for this purpose on boulders are a very common sight at the quarries of Ramanujapuram and Palampet [Plate XXII]. Stone was commonly extracted from the surface of the rock exposed to the open air, against the principles laid down in the Silpaśāstras which prescribes that those stones were to be

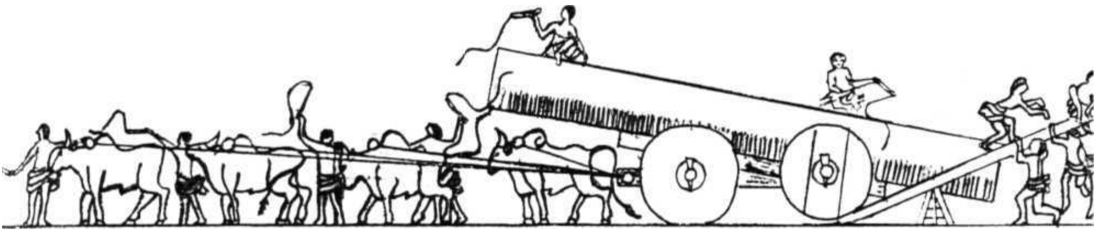
PLATE XXII

Period III: Stone Temple built on a levelled foundation wall, Rupala Sangamesvaram, Sub-region B

Period IV: Stone extraction by 'ridge and groove technique' at a medieval quarry, Ramanujapur, Sub-region B selected which were buried in the ground in order to overcome the weathering effect. The stones thus obtained were transported by wooden carts drawn by oxen or elephants. The technique of transportation of heavy blocks from the quarry to the site has been clearly depicted in a linear drawing on one of the walls of the Raichur fort, the wall[113] being datable to the 13th century A.D. **[Figure 11].** Mention has also been made in a Jaina chronicle to this practice referring to the transportation of the temple vargams in an ox-drawn cart for the construction of the temple at Mount Abu.[114]

The stones thus brought to the site of construction were dressed as per the plan and elevation. The stones intended for making architectural members like upana, jagati, pillars, beams, eve slabs, latticed-windows, etc. were first marked with red oxide and then chiselled with pointed chisels of varied size in order to get deep marks. Different degrees of dressing have been noticed. In the second stage, flat chisels were used to smoothen the surface and later on, they were polished with grinding stones specially made for the architectural members such as door-frames pillars, beams, ceilings, floor slabs, and other vargams. A small wooden cart drawn manually was employed to transport the finished ones from the workshop to the actual spot of construction. While dismantaling the Kakatiya temple at Ramanujapur in Warangal District we have used a small wooden Cart to shift the temple vargams 1n the same method **[Plate XXIII].** For lifting and arranging the stones of the adhiṣṭāna and mandapa. an iron pully block with ropes had to be used. An earthen ramp according to the required height was also used for building the walls and the śikharas. According to a local legend, the **great** temple at Tanjore was constructed by laying an earthen rampart as well as wooden scaffolding.[115] Brick work over the roof was

FIGURE 11

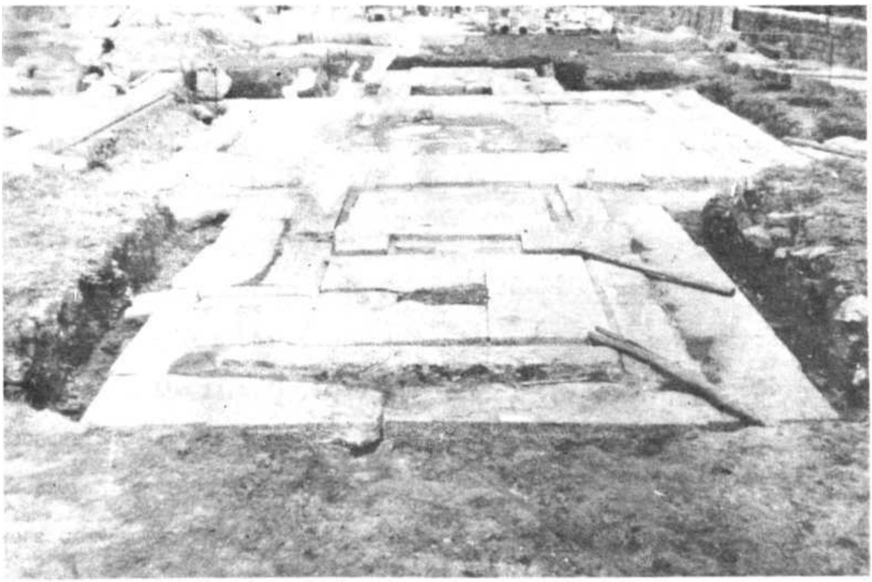


Period IV:A linear drawing of transportation of heavy stones on a wooden cart, Raichur, Sub-region A

Reproduced from A.Valwashen, Living. Architecture-India. Calcutta, 1969, p.181)

PLATE XXIII

A small wooden cart drawn by men to transport the Temple Vargams within the site, Ramanujapur, Sub-region B



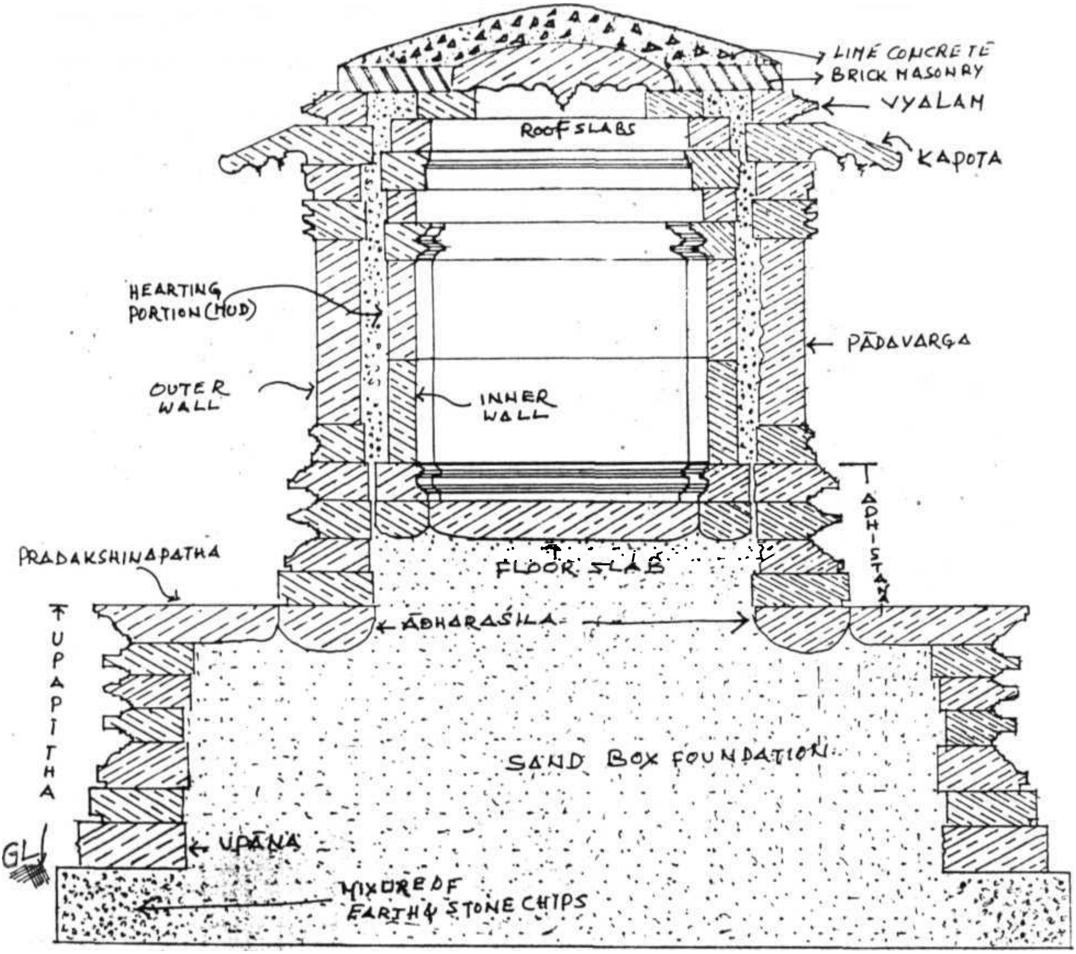
Period IV: Adharasiia layer, Godisala, Sub-region A attended to by wooden scaffolding and for finishing the bottom sides of the ceilings and eve slab, shiftable wooden ladder-scaffolding was put in use.

Temporary ramps such as the one that remains at Bhojpur[116] must have been erected at the sites of all the large temples to facilitate the transportation of the huge stone blocks from the work sites to their place on the monument. The ramp at Bhojpur is a long sloping structure, raised behind the temple, built of semi-dressed slabs of the local sand stone, topped by compact earth and sand. It rose from the natural ground over three hundred feet away in the immediate vicinity of workshops and sloped gently upwards to attain a total height of forty feet. One method used in case of the Lingaraja temple[117] at Bhuvanesvar was an inclined earthen plane, which was constructed towards the west, whose remains are still to be seen on casual digging. Generally, the ramps at the work sites must have been removed or dismantled after the completion of the construction as is evident in the case of the temples of the Kakatiyas.

The stones for construction of the first layer, <u>upana</u>. of the retaining wall <u>pradakshinapatha</u> were long, heavy and broad. The average stone measured 10'-0 x 3'-0 x 1'-0. Each stone had an uneven bottom, levelled surface on the top, fine finish on the front side, while the rear side was left unchiselled. The uneven bottom was provided to obtain a firm grip over the sand bed against lateral movements. According to the plan, after paving the first layer of stones with fine joints, over the sand bed foundation, it was again filled with sand to the height of the first course. The sand was pounded and packed beneath this layer. Iron dowels were cramped at the joints after obtaining the uniform level of the layer. At the joints, the stones were grooved to a considerable depth so as to insert the iron dowels. The clamps thus inserted were hammered in red hot to ensure that the joints had fixed firmly. The iron dowels have been found intact on some of the inside layers of the temples in sub-region A and B as noticed at Nidikonda, Jakaram, Ramanujapur and Godisala visible even today. A similar method of construction was employed for all the layers, upto the first terrace or pradaksināpatha. Corresponding to this level the floor slabs of the pradaksinapatha and the ādhāraśila of the adhistāna were arranged over the saturated sand bed. Fine mortar of mud was used under the floor slabs in order to avoid the tilting of the slabs in the future and also to fill the gaps inside them. This was clearly noticed while dismantiling the temples at Nidikonda.[118]

The technique in shaping the ādhāraśila stone was quite interesting [Figure 12]. In cross section, most of the stones were more or less semi-circular having a broad upper surface and a blunt projected under surface. The layer acted as a catalyst or a shock-absorber while transmitting the superimposed load directly to the ground. The adhistana layers were constructed on the adharasila in the same manner as explained in the case of the Pradaksināpatha. The adhistāna here acted as another retaining wall for the saturated sand bed, filled inside, on which the floor slabs of the garbhālaya, arthamandapa were arranged for the second terrace, i.e., the actual flooring of the temple. In some cases the sand stone slabs used for floor beams were subjected to a very high bending force, which resulted in a tensil strength of about 150 kg/sq.cm. Infact, the sand stone floor beams could not take such a high tensil load and invariably failed under tension. The same was the case with columns as in case of the mandapa at Palampet.[119] On a prepared platform of stone slabs, kept on the sand bed,

FIGURE 12



Period IV:Sectional elevation of a Kakatiya temple, Nidikonda, Sub-region B the columns were erected at suitable places taking care to see that their load was distributed on to the sand bed through the floor beams by raft action.[120] The columns, as well as the walls, of the temples were not provided with deep foundations as noticed in case of Nidikonda, Jakaram, and Palampet temples in sub-region B.[121] Pillars are carved out of long slabs which were extracted horizontally in the quarry and then installed vertically. In some case as observed at Jakaram and the Thousand Pillared temple, the stone became prone to disquamation and vertical cracks.

The columns were carved out of granite, dolerite and redsand stones. Dolerite stone was used for pillars where the intensity of load was found high in case of the Kakatiya temples. It is observed that the compressive strength of granites ranged from 1000-2000 kg/sq.cm while the tensil strength varied from 80-160 kg/sq.cm. For the dolerite rocks, the compressive strength varied from 2000-3000 kg/sq.cm. The Chelvai sand stone strength was found to be ranging from 600-1000 kg/sq.cm while their tensil strength varied from 50-80 kg/sq.cm.[122]

The outer wall of the temple started over the adhistāna kapota layer, whereas the inner wall was raised from the floor level. The door-frames were also erected at this stage. The inner wall was constructed with heavy stone blocks in horizontal courses, whereas the outer wall had both horizontal and vertical slabs. The pādavarga was usually made of two parallel facings of stone slabs placed on edges, with a filling of earth in the space between them. This was a rule for this entire period. The thickness of the wall varied from 1.00 mtr. to 1.50 mtrs. as noticed at Ramanujapuram, Ghanpur and Nidikonda in sub-region B whereas the

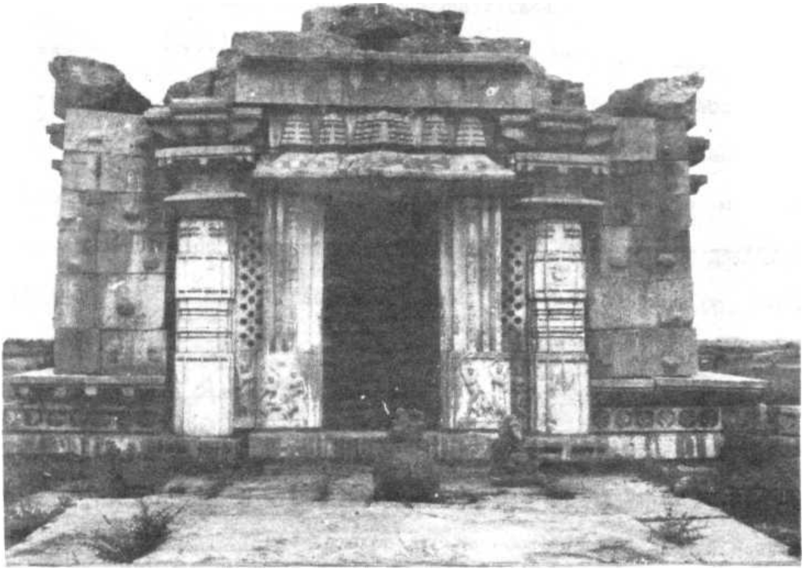
Venkateswara Temple at Somasila in sub-region A, was constructed with a single course of wall only. There were thorough-stones called as bonds in some cases as observed at Somasila temples built with two layers. No mortar was used for joints in the walls, a common feature for all temples of the period. Another interesting feature noted at some temples of Period IV was provision of stone bulbs on the exterior surface of the stones of the wall portion which were used to lift and lead the stones during construction of the temples, as seen at Kusumanchi in sub-region B or Somasila in sub-region A. These stone bulbs were chiselled off after the construction of the temple is over in all respects [Plate XXIV]. This is considered as an important aspect of the stone technology of Period IV.

Further, the stones were placed one over the other and the monolithic action was achieved by counter weights in the form of the other members being placed on them. Dowel bars were used to attain the monolithic action. As soon as the layer of stones had been set up, stones for the next layer were cut into shape, carved and marked with members and kept ready for erection.

The vertical monolithic wall of the temples in general was superimposed by phalikāpadma and podika layers. At the roof level both the inner and outer layers were levelled equally. The hearting portion was filled with earth, sometimes with stone chips. Simultaneoulsy, erection of the rangamandapa pillars over the floor slabs 1n grid pattern was done. Then, the beams were placed on the pillars, as well as on the inner walls and on the uttaram layer so as to obtain a uniform level of the structure.

The roof inside the garbhagriha. Arthamandapa and the central span of

PLATE XXIV



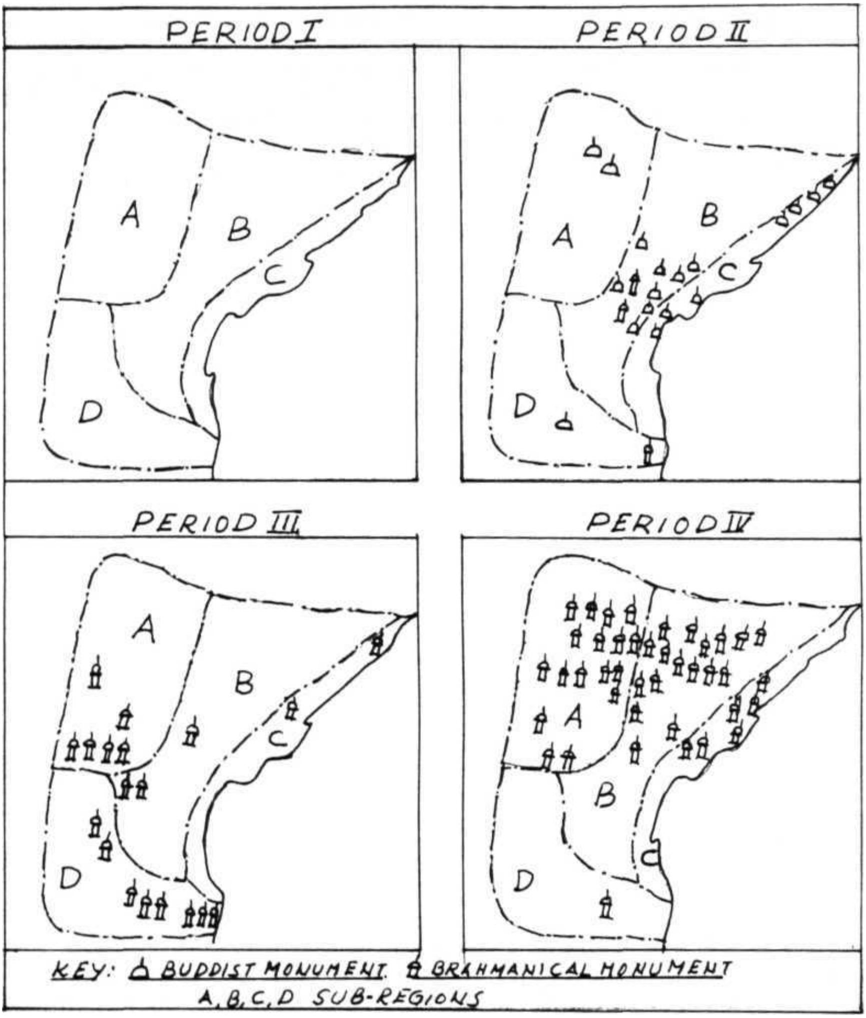
Period IV: Provision of stone bulbs on the walls used to lift and lead the stone during Temple construction, Kusumanchi, Sub-region B

Period IV: Double storied pillared Mandapa and Temple built with stone sikhara, Panagal, Sub-region B the rangamandapa were arranged in Lupa-vitana type, wherein the first course of four triangular stones, kōnavaṭṭas, were arranged over the beams in rhombus shape. Similiary, the second course of four slabs chadaravatta were formed into a square over which the central roof slab was placed. Probably, this type of roofing was designed to reduce the unwanted load, instead of placing heavy stones, for spacious spans of the garbhagriha and arthamandapa. This arrangement also gave an impressive look to the visitors. In case of shorter spans, flat roofings were opted for, often with a single slab. In some cases, the roof was arranged in an iverted bowl shaped, cusped and coffered central ceiling. The plan and moulding of the ceilings such as the adhōpadma, figure bearing belt, teeth course and the central padmakesara and drop are noteworthy. Such an arrangement has been noticed at Palampet,[123] Jangaon,[124] Mantheni and Chandravalli[125] temples. This type tallies with the description of the construction of roof in the Vāstuvidya,[126] a medieval text. Over the uttaram layer, on the outside, massive and ornamental eave slabs called Kapota, projecting beyond the plinth (roughly 5'-0 to 7'-0 in width), were arranged all around. To prevent the cornice from falling down by its own weight, a layer, vyāla, was placed as counter weight and sometimes, a parapet wall containing śālāgāras was also provided for, on the inner edge of the kapota as noticed at Palampet,[127] Pangal[128] and Pillalamarri.[129] The functional aspect of the kapota layer was not only to drain off the rain water but also to serve as horizontal bond which sealed the hearthing portion in between the inner and outer walls of the temples. The roof slabs of the temples at Palampet, Ghanpur, Jakaram and Ramanujapur are of pink coloured medium grained Chelvai sand stone with silicious matrix, and for the temples at Katakshpur, Hanumakonda, Kothapalli, Nidikonda and Nagulapadu, it is granite stone [Map XI & Chart VII D]. The visible bottom sides of the slabs were well-dressed and polished, while the other side was left undressed and kept as it is and joined together by lime mortar on top side.

Every stone of the ceiling was carved separately and fitted together temporarily on the ground. Then the stones were hoisted upon to the roof and arranged in position so that they were interlocked. The designs were complex and a great deal of skill and patience must have been required to produce and finish them.[130] The roof concrete of good resistance was laid over with a mixture of bricks, lime and pebble. While dismantling of roof concrete at Ramanujapuram[131] and Jakaram,[132] it was observed that brick masonry in lime mortar was constructed as a level course upto the vyāla layer and finally, it was sealed with lime concrete using brick bats and small pebbles.

After the construction of the temple upto the roof level, the vimāna portion either, stepped pyramidal or in the Dravidian style with kūtakōstās. was started as we notice at Palampet.[133] During this period, the vimanas were constructed both in stone and brick. Temples with stone sikhara are few at places like Palampet, Panagal [Map XI & Plate XXIV], and Nagunuru.[134]

In addition to the temples, separate mandapas were also constructed during the period, based on the trebeated system, in which there was the use of columns and beams in short spans. The individual pillared mandapas constructed in this system have been noticed at Hanumakonda, Aihole, and Ghanpur.[135] The contemporary Hoyasalas had also constructed these mandapas



DISTRIBUTION OF STONE MONUMENTS

PERIOD WISE

at Belur, Halebid and Somanathpur in this system.[136] The architects of the period also knew the technique of building double storeyed mandapas. Following the centre line method, the pillars of the upper storey were positioned on the same alignment of the ground floor pillars. The double storeyed mandapas of the period have been noticed at Mallesvaram,[137] Duddeda,[138] " Bandaramesvarapalli,[139] and Ghambhiraopet[140] in sub-region A; and Panagal [Plate XXIV] and Kodavatur[141] in sub-region B [Chart VII D, 20, 5, **3,** 6, **26, 15].**

Though the technique of erecting free standing torana was initiated during 11th century as seen at Mallesvaram[142] and Vallala[143] in sub-region A, it was improved during 13th century A.D. The toranas at Warangal and Ainole[144] were arranged with double vertical pillars. On the top of the pillars the lintel beam, in three pieces of stone was arranged over which a decorative Makara Torana was placed as counter-weight. Single pillar Toranas at Hanumakonda,[145] Ramagundam[146] and Kolanupaka[147] were provided with single lintel **[Chart VII D, 9, 28, 16].**

Enclosing the temples and mandapas the architects of the period constructed prakaras with neatly dressed stone slabs in single or double courses and decorated them with a coping stone. The foundation to the prākāram wall was provided with massive dressed slabs with 3'-0 to 4'-0 in width. The prakaras at Ramanujapur[148] and Bandarameswarapalli[149] have the best examples of the maṇḍapa-dwāras. The primary purpose in erecting a prakara wall round a religious edifice was that of protecting it from entry into its precincts of undesirable agents like cattle or any enemy. The prakaras of the period range from 5'-0 to 12'-0 in height and 3'-0 to 4'-6" in thickness. They were constructed with huge well-chiselled blocks of stone. The compound wall at Palampet was constrcuted with double layers of dressed blocks of stone, some of which measure 21'-0 x 3'-6" x 3'-6". They fitted each other in such a way that even a small pin could not be inserted. The top stone was dressed with coping for protection against the rain water. The space between the two layers of the compound wall was filled only with earth. The architectural stability and the artistic excellence of the prākāra walls of the period have been extolled in an inscription found at Kondaparthi dated to 1241 A.D.[150] It is of absorbing interest to note that in some cases, apart from the stone prakaras. massive earthen embankments have been found raised round the temple complexes to safeguard them. Examples of this type were found at Ghanpur, Katakshapur and Kondaparthi in sub-region B **[Chart VII D, 7, 14, 17].**

Each component of the temple was so technically designed as to serve both a functional and decorative purpose. For example, the bracket figures were designed not only to receive the superimposed load, but also to add aesthetic grandeur to the structure on the whole. Bracket figures were provided to support the corresponding beams and had been carved with human and animal figures, madanikas or vyālas.[151] The bracket figures have been seen employed at Palampet,[152] Ghanpur,[153] Jangaon[154] and Mantheni[155] in sub-region A and at Tripurantakam[156] in sub-region B.

Regarding load distribution, an important factor in building technology, the architects had been careful to design their structures to be distributed on the temple walls and pillars. In some cases, load was laid on the door frames, which resulted in the breakage of the lintels and collapse of the door frames as has been noticed at Jakaram[157] and

Ghanpur.[158] As per the load distribution calculations, the main columns at Ramappa temple at Palampet, with a spacing of 4.75 mtrs, carried a maximum load of 45 tonnes. This rested directly on floor beams with a cross section of 90 x 40 cm. In turn, the floor beam rested on the sand filling. It is noteworthy, that with its superimposed load, its bending stress went upto 180 kg/sq.cm. against its usual bending stress of 110 kg/sq.cm on non-uniform section of the floor slabs.[159] This is the reason why they have succumbed to heavy pressure and have broken. The observation of the distribution of load on four inner columns of the temples like the Ramappa temple at Palampet, clearly shows due to the high intensity of the load transmitted, it collapsed, once it went above the usual stress permitted.

While dismantling the temple at Nidikonda,[160] it was observed that the total load of the inner walls of the temple which consisted of the roof, beams, and the self weight of the walls was concentrated over the inner floor slabs of the garbhālaya and arthamandapa. The load of the rangamandapa was received by the four central pillars which concentrated on the floor slabs that corresponded to the floor level of the temple. The load of the prastara. padavarga and adhistana was transmitted on the adhārasila. corresponding to the floor level of the pradaksinapatha[161] as noticed at Nidikonda.

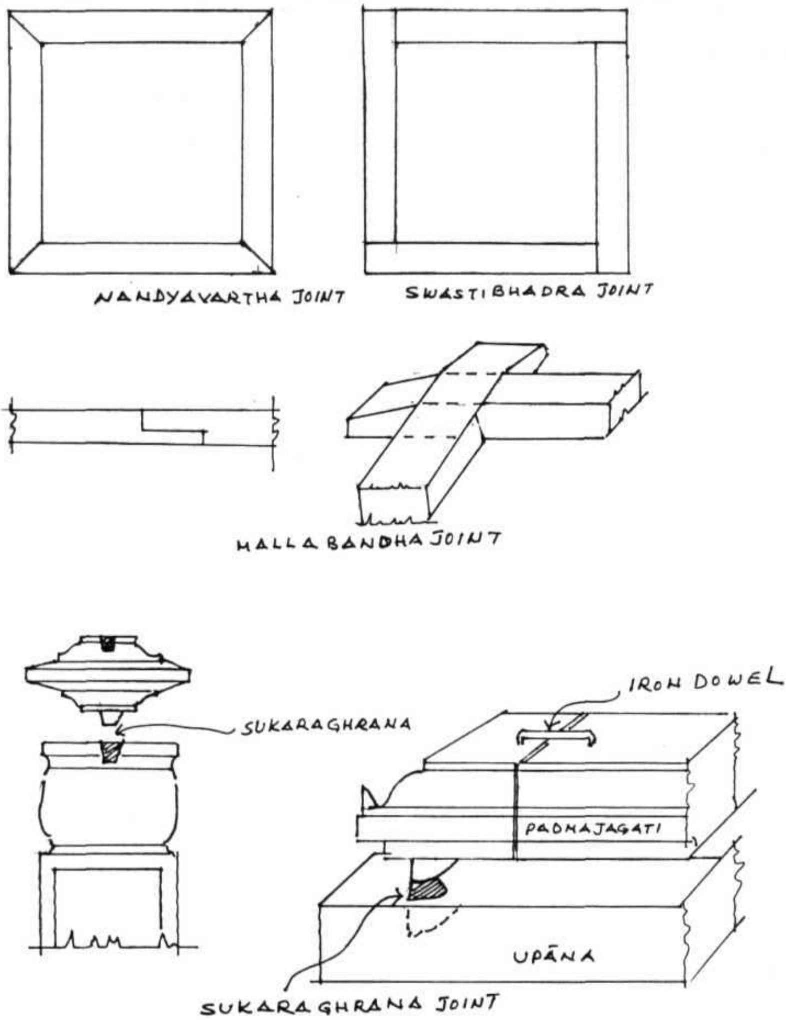
The architects here provided deeper foundations to the outer wall when compared to the inner walls of the temple. The technical aspect to note here is that, the two vertical distributing load points transmitted the loads directly to the sand bed, downwards as well as in the lateral directions.

The important technical device employed here was the balancing of loads by providing massive retaining walls. The inner retaining wall of the adhistana acted as a curtain wall to stop the outward thrust that emnated from the inner wall and facilitated that the load be carried smoothly and directly to the ground. Similarly, the outer retaining wall or pradaksināpatha played a major role in transmitting the entire load of the superstructure to the foundations arresting the lateral pressure from the ādharaśila and the rangamandapa. The entire load of the structure was balanced in equilibrium, over the compact sand bed and it was achieved by their perfect method of the joinry of massive stones.

The builders were successful in the joinry technique of the massive stone slabs **[Figure 13].** Heavy and massive slabs were used in order to minimise the number of joints. The joints of the exposed faces, both vertical and horizontal, were chiselled in such a manner that even a thin fibre could not pass through them. As mentioned earlier the joint was cramped with iron dowels. The architectural skill and workmanship of the architects of the period particularly in stone joinry, dressing and construction of temples has been elaborately described 1n the Kondaparti[162] inscription of Ganapatideva's reign. It is mentioned that the prākāra around the trikuta temple at Kondaparti was constructed with blocks of stones closely fitted and uniformly chiselled and it appears to have been hewn out of a single huge stone block. It seems that the architects followed certain guidelines prescribed in the Silpa and Agama texts in the joinry of beams, layers and pillar accessories.

The corner stones of each horizontal layer were arranged in the form

FIGURE 13



Period IV:Types of joinry in stone Monuments Sub-region B of a nandvāvartha[163] joint, i.e., the stone placed in the east was to project towards the south and likewise. In some cases the stones of the horizontal layers and the accessories of the pillars, i.e., kudam, phalika-padma, podika were arranged in a sukaraghrāna[164] joint. In this case the upper stone would have a triangular bulb/projection whereas a suitable groove would be dressed to the lower one, like a socket and cylinder, also called as boar-snout system. The temple vargams at Nidikonda, the rangamandapa pillars at Palampet, Hanumakonda, Jakaram and Ramanujapuram were given such treatment. Sometimes the corner beams were provided with mallabandha[165] type of joint as seen at Nidikonda, Jakaram, Katakshapur, Ghanpur and Palampet temples. This is also called as the halved joint because the ends of the stones at joint were cut half horizontally and fixed.

At Nidikonda[166] it is also observed that a few granite slabs, heavy in size, were planted vertically at the inner corners of the layers at plinth level. A trial trench below the lower most layer revealed the occurrence of a compact sand bed mixed with stone chips to a depth of 2'-6" and exclusively with sand to a depth of 2'-0, below which a layer mixed with sand and morrum was continued in the foundation pit, revealing a well planned practice of laying foundations known from the 10th to 14th centuries A.D.

The temples at Mogilicherla[167] and Somasila[168] were constructed in sandhara[169] type with closed pradaksināpathas and without latticed windows by the side of the vertical door frames. Later, nirandhāra[170] type of temples were constructed during the period, having half curtain walls called the Kakshāsanas or asanapattis[171] on the adhistanas with a provision for latticed windows on the door frames. This facilitated the reduction of the self weight of the door frames and also allowed sufficient light into the sanctum sanctorum. Such windows were arranged on the door frames of the arthamandapa and rangamandapa walls as seen at Jakaram in sub-region B and Mantheni in sub-region A.

The architects of the medieval period exhibited their skill and mastery in maintaining architectural refinement, unity and compatibility in the spatial organisation of temples. The classical example of this type is the Thousand Pillared temple at Hanumakonda. In the distribution of the principal architectural members, viz., the temple proper, nandi pavillion and the mandapa. Besides these units, other structures like pachanālaya the kitchen, beautifully designed well called Pushkarini, a small unicelled shrine and a pillared mandapa were also judiciously distributed around the main temple.

Certain drawbacks in building technology of the period have been observed by us. The detailed investigations conducted at different temples of the period in sub-region B have revealed that the architects of the period relied on sand box method for laying the foundation. Further, the load bearing walls and columns were directly constructed on the floor slabs which were resting on the sand box, without taking the foundations till the hard strata was met.[172] However, taking an overall view of the various technical aspects while dismantling the temples[173] constructed during the 11th-13th centuries A.D., it needs to be concluded that the architects possessed high standards of technical skills, in building massive and magnificient religious edifices.

The above discussion leads us to conclude that stone as a building material was selected for its strength and stability right from Period I onwards and its use was prolific during the Period II in almost all the sub-regions particularly in the construction of religious edifices such as stūpas, vihāras and temples, as also in their accessory units. Stone technology proved to be an improvement when compared to mud and brick technologies. It also substituted the rock-cut technology since the latter could only be confined to hilly areas or where suitable rocks were available. Foundations, basements, floorings of the early stupas, pillars, beams and roofs of the mandapas all came to be constructed with stone. Rubble stone was used for foundations and filling the inner core of the stūpas as noticed at Dhulikatta in sub-region A, Nagarjunakonda in sub-region B, Thotlakonda and Bavikonda in sub-region C. Most of the brick stupas were encased with lime stone panels joined closely. The stūpas at Dhulikatta, Nagarjunakonda, Amaravati, Chandavaram, Ghantasala, and Nandaluru, have been built with lime stone slabs as casings to the outer walls, a technique employed to arrest the entry of rain water into the structure. Railing of the stūpa at Amaravati was built with granite stone whereas at Thotlakonda the stone was khondalite. The early Buddhist mandapas at Guntupalli, Ghantasala, Nagarjunakonda were built with lime stone pillars in contrast to the local khondalite ones, as noticed at Bavikonda and Thotlakonda. The pillars were erected on a well laid foundation of stones in the 'underpinning technique' and the basements were encased with brick as seen at Chandavaram. In case of the building of the vihāras. stone was employed for foundations below the ground level, affording structural stability; a development 1n building technology of the period when compared to the ones which were built directly on the ground. The brick walls of a vihāra at Nandaluru were also encased with shale stone. Pathways were laid with dressed stones which led buttresses on either side. The technology of building the railing consisting of upright pillars which were connected by crossbars inserted into the mortices were also employed to enclose a Saivite linga at Gudimallam, and stone was invariably used for cult objects in Brahmanical temples during Period II.

Above the sloped roof of the mandapas. a thick mixture of lime concrete was laid to arrest the seapage. Another notable innovation was building the double storeyed mandapas in plumb and centre line method with the help of an earthen ramp. This was initiated at Panchalingala. With this knowledge, the sthapathis of the period from 9th century A.D. onwards built the stone temples in a new and distinct style with two storeys as in the case of all the pañchārāmas in Andhradesa.

It was during the Period IV that temples were prolifically built with stone technology all over Andhradesa. Brick was also used to build the sikharas above the stone structures. More elaborated mandapas. temples with twins and triple cells and even five celled ones under one common roof began to be built. Massive toranas. and prakaras have also been built using heavy blocks of stone quarried nearby. An important feature of the building technology consisted of sand box foundations for the stone temples. All the sides of the sand box were revetted with massive stone slabs, which served as retaining walls also called as upapeeṭhās that have been found at Hanumakonda, Nidikonda, Palampet, etc. Floors were also laid with stones. The walls had two layers whose hearting portion was filled with mud mixed with stone chips. No binding material was used and grip was ensured on the top of each layer by providing vertical grooves so as to fit in the stone bulbs carved on the bottom of the layer that came above the previous one as observed at the Nidikonda temple.

From the beginnings of Period III stone was used to build compound walls around the brick temples as at Gummadam. The same was employed for the pranālas as seen at Siddhesvaram and as a level course on the basement as noticed at Keesaragutta. These are significant developments in building technology and one can notice a slow transition from brick to stone. From the 7th century A.D. onwards, stone was used exclusively from foundations to the finial. First experiments in building the temples in this way has been observed at Alampur in sub-region A and Pondugula in sub-region B using red sand stone and shale stone respectively. Foundations were laid to a depth of 7.45 metres and filled with shale stone slabs alternated by compact earth. The depth of foundation and filling varied from temple to temple according to the load calculation of a particular portion as seen at Alampur and Papanasi group of temples. Single and double course walls were employed. Stones in both horizontal and vertical layers were cramped with iron dowels to keep the layer monolithic and this was an innovation in building technology of the period. Since the use of stone was in an experimental stage, the sthapathis built the walls with great basal width following the brick traditions, a feature found at Pondugula temple. Another point of engineering which speaks of the sound technological knowledge of the sthapathis was the balanced distribution of the load of the superstructure, i.e., vimana to the four central pillars arranged in the garbhagriha. a special feature noticed at Alampur and its suburbs. The roof slabs were plain in case of Alampur temples for the garbhālayas whereas they were corbelled at the Mukhalingam temples.

In case of most of the temples built between 12th-13th centuries A.D., the load bearing and receiving components were of dolerite stones. This can be seen at temples of Ghanpur, Kusumanchi, Palampet and Warangal. To ensure sufficient light inside the temples in the case of closed mandapas, stone windows were provided to the walls and on either side of the door frames of the arthamandapas. Perforated jallis with gonetra and swastika design have been found at Jakaram, Mantheni, Ramanujapuram and at a good number of other temples. The arrangement of tiered roof slabs diagonally for spacious spans speaks of the sound knowledge in structural engineering. Brick technology was also put to use to build the vimānas to reduce the unwanted load over the roofs of the garbhagrihas, a feature that has been noticed at Palampet, Pillalamarri and Chebrolu. Water seapage was overcome by arranging the lofty and wider eve slabs to drain out the rain water and the roof was laid with lime concrete. A thick concrete of 2'-0 in depth which was dismantled by us at Jakaram and Godisala temples indicates its prolific use. The sthapathis had employed different joinry methods for joining the various architectural members. All the above achievements are testimonials to the technological expertise of the traditional builders of the temples who were well-trained in temple building activity right from the selection of the site to the concecration of the temple, following the prescriptions of traditional texts and treatises on temple building.

FOOTNOTES

1. K.R.Srinivasan, Temples of South India. Delhi, 1972, p.14.
2. Percy Brown, Indian Architecture (Buddhist and Hindu Periods), vol.1, Bombay, 1965 (5th edn), p.8.
3. A.H.Longhurst, 'The Buddhist Monuments at Guntupaalli in Krishna District', ARASI (Southern Circle). 1916-17, Madras, pp.30-36.
4. V.V.Krihsna Sastry, et al, Thotlakonda (A Buddhist site in A.P.), Hyderabad, 1992, p.27.
5. ARAP. 1983-84, Pl.12.
6. Al, no.16, pp.68-70.
7. T.V.G.Sastry, Excavations at Vaddamanu. Hyderabad, 1984, p.3.
8. M.H.Kuraishi, 'Trial excavations at Alluru, Gummadedurru and Nagarjunakonda, ARASI. 1926-27, Calcutta, 1930, pp.152-156, 184-190.
9. Percy Brown, Op. Cit.. 1965, p.7.
10. D.Barret, Sculpture from Amaravati in British Museum. London, 1954, p.35.
11. Percy Brown, Op. Cit. . 1965, p.38.
12. IAR, 1973-74, p.4.
13. S.P.Gupta, The Roots of Indian Art. Delhi, 1981, p.4.
14. Percy Brown, Op. Cit.. 1965, p.37.
15. IAR, 1983-84, p.7.
16. Percy Brown, Op. Cit.. 1965, p.37.
17. ARAP. 1976-77, pp.17-24.
18. T.V.G.Sastry, Op. Cit.. 1984, p.4.
19. M.W.Meister (ed.), A.K.Coomara Swamv's Early Indian Architecture. Delhi, 1992, p.15.
20. Visuddhimagga. 354.
21. V.V.Krishna Sastry, et al., Op. Cit.. 1992, p.47.
22. S.P.Gupta, Op. Cit., 1981, p.44, Fig.18.

23. T.V.G.Sastry, Op.Cit.• 1984, p.4.

24. Debala Mitra, Op. Cit. • 1971, p.213.

25. EI, vol.XXVII, p.3.

26. Debala Mitra, Op. Cit.. 1971, p.221.

27. R.Subrahmanyam, Op. Cit.. 1964, p.29.

28. ARAP, 1976-77, pp.17-24.

29. R.Subrahmanyam, Salihundam: A Buddhist Site in A.P.. Hyderabad, 1964, p.29.

30. H.Sarkar, Op. Cit.• 1966, p.33.

31. ARAP. 1976-77, pp.17-24.

32. V.V.Krishna Sastry, et al., Op. Cit.. 1992, p.40.

33. ARAP. 1993-94 (typed report).

34. N.Jitendra Das, The Buddhist Architecture in Andhradesa. Delhi, 1993, Pl.XXI.

35. H.Sarkar, Op. Cit. . 1966, p.93.

36. N.S.Ramachandra Murthy, Op. Cit., 1981.

37. T.N.Ramachandran, 'Nagarjunakonda', MASI. no.71, Delhi, 1953, pp.4-6.

38. Ibid. 1953, pp.4-6.

39. R.Subrahmanyam, Op. Cit.. 1964, p.30.

40. H.Sarkar, Op. Cit.. 1966, p.33.

41. JAR, 1983-84, p.7.

42. V.V.Krishna Sastry, et al., Op. Cit. . 1992, p.59.

43. Ibid, p.59.

44. R.Subrahmanyam, Op. Cit.. 1964, p.31.

45. I.K.Sarma, The Development of Early Saiva Art and Architecture. Delhi, 1982, p.52.

46. S.P.Gupta, Op. Cit.. 1981, pp.44-46.

47. I.K.Sarma, Op. Cit.. 1982, p.48.

48. T.V.G.Sastry, Veerapuram: A Type Site for Cultural Study in Krishna Valley. Hyderabad, 1984, p.42.

49. I.K.Sarma, Op. Cit.. 1982, p.138.

50. R.Subrahmanyam, 'Brahmanical Structures at Nagarjunakonda', Itihas, vol.VIII, no.1, Hyderabad, 1981, pp.13-27.

51. Ibid. p.16.

52. Ibid. 1981, pp.13-27.

53. Ibid. 1981, pp.13-27.

54. I.K.Sarma, 'Brahmanical Architecture during the Satavahana Period in Andhra', Itihas. vol.VIII, no.1, 1981, p.37.

55. Ibid. 1981, p.38.

56. ARAP, 1982-83, p.24.

57. I.K.Sarma, 'New Lihgt on Vengipura: Excavations at the Ancient Historical City of Andhradeśa', Puratattva. no.17, Delhi, 1988, pp.15-21.

58. ARAP. 1971-72, p.5.

59. Myself and Sri Gadiyaram Ramakrishna Sarma of Alampur, have opened the plinth of a deprotected and dilapidated Chalukyan temple in our survey during April-May, 1992 to observe its foundation below the ground level.

60. V.H.Joshi, 'Ancient Indian Foundation Engineering for Monuments' in Indian Geotechnical Conference, vol.1, Roorkee, 1985, pp.529-593, However we have a very interesting discussion on foundations of ancient religious buildings made by Debala Mitra in the early 1970's, See her 'The Relics Sagrahawa: A study of the Foundation Deposits and the Istikanyasa', JAHRS. vol.XXXIII, Hyderabad, 1973-74, pp.4-5.

61. N.C.Ghosh, IAR, 1982-83.

62. I.K.Sarma, 'Alampur Temples: Rare Evidences on Constructional Modes and Concecrational Rites' in A.V.N.Murthy and I.K.Sarma (eds), Sri Ramachandrika (Prof. O.Ramachandriaya Festschrift). Delhi, 1993, pp.352-368, Fig.23 and 24.

63. Ibid, p.356.

64. Ibid. pp.357-358.

65. B.R.Prasad, Op. Cit., 1980, p.90.

66. R.Subrahmanyam, Op. Cit.. 1981, pp.13-27.

67. ARAP. 1982-83, pp.24-25.

68. This feature has been noticed by me at the time of dismantling a twin temple connected by an 'L' shaped front Mandapa, datable to the 7th century A.D, The temple was built on the left bank of the river Tungabhadra one kilometre away from the main temples at Alampur, See E.Sivanagi Reddy, 'A note on the dismantling of Picchukagullu group of temples datable to the 7th century A.D. at Alampur', an unpublished typed paper submitted for inclusion in the Annual Report of the Deptartment of Archaeology and Musuems, Hyderabad for the year, 1993-94.

69. M.R.K.Sarma, Temples of Telingana, Hyderabad, 1972, p.78; Vijayaditya's inscription dated 713 A.D. records the construction of a faultless enclosure to the temples at Alampur by Iśānāchārya, a Pontiff. See also £1, vol.XXXV, pp.121-124.

70. B.R.Prasad, Chalukyan Temples of Andhradesa, Delhi, 1983, p.12., Idem, 'Sivanandiswara Temple at Kadamarakalva', JISOA, vol.VIII, pp.27-32;

71. Idem, 'Rastrakuta Temple at Bhavanasi Sangam, AA, Vol.XXXIV, no.2, pp.212-221.

72. B.Mastanaiah, Mukhalingam Temples. Delhi, 1978, p.30.

73. B.R.Prasad, Op. Cit., 1983, pp.26-29.

74. E.Sivanagi Reddy, 'Padi Satābdāla Panchalingala', Andhra Bhoomi Daily (Kurnool Supplement), date , vol. p.4.

75. Ibid, p.4.

76. A.Gurumurthy, The Cuddapah District Temples. Madras, 1990. pp.15-20.

77. Ibid. p.21.

78. B.R.Prasad, Op. Cit.. 1980, p.62.

79. N.S.Ramachandra Murthy, Personal Communique.

80. B.R.Prasad, 'Vengi Chalukyan Temples, in V.V.Krishna Sastry (ed.), Archaeology of Andhra Pradesh. Hyderabad, 1987, pp.41-42,

81. Ibid. p.42.

82. Y.Gopala Reddy, The Ghanpur Group of Temples. Hyderabad, 1985, p.6.

83. E.Sivanagi Reddy, and B.Subrahmanyam, 'A Unique Pañchakūṭa Temple of Kakatiya Period at Ramanujapuram, in S.N.Rao (ed.), Cultural Heritage of the Kākatiyas. Warangal, 1993, pp.47-51.

84. E.Sivanagi Reddy, 'The Malleswaram Group of Temples', PAPHC. 14th Session, Warangal, 1992, p.90.

85. K.V.Chalam, 'The Temples of Kusumanchi', Itihas. vol.XI, no.1, Hyderabad, 1983, pp.119-128.

86. E.Sivanagi Reddy, B.Subrahmanyam, Op. Cit.. 1993, p.47.

87. G.Yazdani, Early History of the Deccan. vol.1, pt.VIII. Oxford, 1952, pp.27-29.

88. S.Gopala Krishna Murthy, The Sculpture of the Kakatiyas. Hyderabad, 1964.

89. M.Rama Rao, Select Kakatiya Temples. Tirupati, 1966.

90. M.R.K.Sarma, Op. Cit.. Hyderabad, 1972.

91. K.R.Srinivasan, Op. Cit.. Delhi, 1972.

92. B.R.Prasad, Art of South India. Andhra Pradesh. Delhi, 1980.

93. C.Prasada Rao, The Kakatiya Sculpture. Hyderabad, 1987.

94. J.Ramanaiah, Temples of South India. Delhi, 1989.

95. E.Sivanagi Reddy and B.Subrahmanyam, 'Kākatiyula Kalāsidhilalu-1: Nidikonda Devalayamu (Telugu)', Aradhana. vol.32, no.9, Hyderabad, 1987.

96. M.Pandu Ranga Rao, Geo-Technical Appraisal and Evaluation of Kakatiya Monuments. Warangal, 1991.

97. E.Sivanagi Reddy and B.Subrahmanyam, 'Materials and Techniques of the Kakatiya Temples', Paper presented at a National Seminar on Art and Architecture of the Kakatiyas. 17-19, November, 1991, Telugu University, Srisailam.

98. M.Pandu Ranga Rao, Op. Cit.. 1991, p.33.

99. S.Kramrisch, The Hindu Temple. vol.1, Calcutta, Reprint, Delhi, 1976, p.121.

100. Brihat Saṁhita. L.11, 90-92; Bhavishya Purāna. Ch.CXXX, 45-46.

101. S.Kramrisch, Op. Cit.. 1976, p.14.

102. Īśānasivagurudeva Paddhati. III, Ch.XXVI, 40-41.

103. Tantrasamucchaya. pt.I. 1.59.

104. Kasyapa Silpa. IV.19; Tantra Samucchaya. I. Ch.I, 24-81.

105. Ibid. II, XII.3.

106. P.K.Acharya, Architecture of Mānasāra. Manasara Series, vol.Iv, (2nd Edition), Delhi, 1980,, pp.109-121.

107. Bruno Dagens, Mayamata. Premier Partie, Pondicherry, 1970, Chapter XII.

108. See Raghunatha Bhattaraya, (ed.), Marīchi Saṁhita. Madras, 1927, Chapter 6. (Jalāntam Śilāṁtam vā khanitvā, śalyāpōhya, Valukābhirāpūrya, Hastipādena ghaṭṭam kritvam) and also the details of the foundations are also dealt in isana Sivagurudeva Paddhati as follows:

"The depth of the foundation pit should be equal to the height of a man standing with raised hands,or should be dug to the rock-bottom or the water level according to the geo-physical conditions of the site, After the pit is dug, it should be filled with pure earth, 8" high; on this layer another one is placed of one cubic height which is composed of layers of strong stones each embedded in wet earth and separated one from the other by sand and earth; it is moistened with water, trodden by elephants and levelled with heavy wooden stampers. Then the temple plinth is started".

109. E.Sivanagi Reddy and B.Subrahmanyam, 'Kakatiyula Kaḷāsidhilalu-3: Jakaram Sivālayamu (Telugu)', Arādhana. vol.36, no.6, June 1991.

110. E.Sivanagi Reddy and B.Subrahmanyam, 'Kakatiyula Kaḷāsidhilalu-2: Pañchakūtālayamu, Ramanujapuram', Aradhana. vol.36, no.1, January, 1991.

111. Gerald Colas, 'Some Remarks about the Construction of the Temple according to Ma rich i samhita', SVUOJ, vol .XXI-XXII, Jan-Dec, 1978-79, Pt.1-4, pp.43-50.

112. K.V.Soundara Rajan, 'Tamil Temple Architecture and Art', Marg. vol.XXXIII, no.2, 1990, p.16.

113. Andreas Volwashen, Living Architecture-India. Calcutta, 1969, p.181.

114. Ibid. p.180.

115. Ibid. p.181.

116. Kirit Mankodi, 'Scholar Emperor and a Funerary Temple, Eleventh Century Bhojpuri', in Vidya Dehejia (ed.), Royal Patrons and Great Temple Art (Marg), Bombay, 1988, pp.101-112.

117. A.Boner, et al, New Light on Sun Temple at Konark. Delhi, 1972, p.83.

118. I have dismantled this Kakatiya Temple during 1983-84 because of its dilapidated condition.

119. M.Pandu Ranga Rao, Op. Cit. 1991, p.124.

120. E.Sivanagi Reddy and B.Subrahmanyam, Op. Cit.. 1991, p.17.

121. M.Pandu Ranga Rao, Op. Cit. 1991, p.102.

122. P.K.Acharya, Op. Cit.. 1980, p.181.

123. M.R.K.Sarma, Op. Cit.. 1972, p.196.

124. J.Ramanaiah, Op. Cit.. 1989, p.120.

125. Ibid. p.108 & 125.

126. P.O.Sompura, 'The Vastuvidya of Viśwakarma', in Pramod Chandra (ed.), The Studies in Indian Temple Architecture. Varanasi, 1975, pp.47-56.

127. B.R.Prasad, Op. Cit.. 1980, p.182.

128. M.Rama Rao, Select Andhra Temples. Hyderabad, 1970; Op. Cit.. 1966, Pl.XXXVIII.

129. B.R.Prasad, Op. Cit.. 1980, p.182, and also in M.Rama Rao, Op. Cit., 1966, p.XL.

130. V.Dehejia, Op. Cit.. 1978, p.63.

131. E.Sivanagi Reddy and B.Subrahmanyam, in Aradhana. vol.36, no.6, June, 1991, p.

132. E.Sivanagi Reddy and B.Subrahmanyam, in Aradhana. vol.36, no.1, January, 1991, p.

133. M.R.K.Sarma, Op. Cit. . 1972, p.120.

134. J.Ramanaiah, Op. Cit.. 1989, pp.108-116.

135. Y.Gopala Reddy, Op. Cit. . 1985, p.6.

136. S.K.Maity, Masterpieces of Hoysala Sculpture. p.8.

137. E.Sivanagi Reddy and B.Subrahmanyam, 'Okanāṭi Agastheśwarame Neti Malleswaram', Eenadu (Mahboobnagar District Special). 23rd March, 1991. p.4.

138. Personal Communique with G.Venkata Ratnam, Epigraphy Assistant, Department of Archaeology and Museums, Hyderabad.

139. P.Brahmachary, 'Srirajeswaralayam- Bandarameswarapalli', Saptagiri. vol.21, no.7, 1990, p.11.

140. J.Ramanaiah, Op. Cit.. 1989, p.141.

141. Personal Communique with N.Rama Krishna Rao, Asst.Director, Archaeological and Museums Department, Warangal.

142. B.R.Prasad, Op. Cit.. 1980, p.144, Pl.44.

143. Personal Communique with Dasarath Reddy, President, Youth Association of the Village.

144. S.Gopalakrishna Murthy, Op. Cit.. 1964, p.30.

145. Ibid. 1964, p.30.

146. J.Ramanaiah, Op. Cit. 1989, p.143, Pl.45.

147. S.Gopalakrishna Murthy, Op. Cit.. 1964, p.30.

148. E.Sivanagi Reddy and B.Subrahmanyam, in Aradhana. vol.36, no.1, January, 1991.

149. P.Brahmachary, Op. Cit. . 1990, p.

150. Hyderabad Archaeological Series. no.13, pp.16, ff. V.42.

151. Christopher Tadgel, The History of Architecture in India. Delhi, 1990, p.138.

152. Y.Gopala Reddy, 'Salient Features of the Kakatiyan Style of Architecture', in V.V.Krishna Sastry, (ed.), Op. Cit.. 1987, p.45.

153. Y.Gopala Reddy, 'Ghanpur Group of Temples', JAHRS. vol.XXIX, pp. 27-29.

154. J.Ramanaiah, Op. Cit., 1989, p.120, Pls.99 & 100.

155. Ibid. Pl.104.

156. Y.Gopala Reddy, 'Madanikas of Palampet', JOI, vol.XXIII, no.3, March 1974, pp.219-230.

157. E.Sivanagi Reddy and B.Subrahmanyam, in Aradhana. vol.36, no.6, June, 1991.

158. Y.Gopala Reddy, Op. Cit. . JAHRS. vol.XXIX, pp.27-29

159. M.Pandu Ranga Rao, Op. Cit.. 1991, Appendix, 5.8.1, pp.119-122.

160. The Temple at Nidikonda in Jangaon Taluk of Warangal District was dismantled in 1983, under my supervision, It was thoroghly documented from the roof to the plinth level.

161. E.Sivanagi Reddy and B.Subrahmanyam, Op. Cit. . 1991, p. 15.

162. P.V.P.Sastry, Op. Cit.. 1978, p.300 (Prākārōjavati Trikūtamabhitastāt tena Nirmāpitah Suślistaih Kramaśirshakairupachito Nīlōpalaih kalpitah Yatchalakshita saṅdhi bandha Kadhane dekaśila Takshakaih Sam Takshya Evamahiyasam Iva silām yatnāt samuttanithah). and also See N. Venkataramanaiah, Inscriptions of Andhra Pradesh. Warangal District. Hyderabad, 1974, p.198.

163. P.K.Acharya, Op. Cit.. 1980, p.198.

164. Ibid. 1980, pp.178-179.

165. Ibid. 1980, pp.178-179.

166. E.Sivanagi Reddy and B.Subrahmanyam, Op. Cit., 1991, p.16.

167. S.Gopalakrishna Murthy, Op. Cit. 1964, p.11.

168. Bruno Dagens, Entre Alampur et Srisailam, Tome I, Pondichery, 1986, p.320.

169. T.V.Mahalingam, Studies in the South Indian Temple Complex. Dharwar, 1970, p.14.

170. Ibid. 1970, p.14.

171. Y.Gopala Reddy, 'The Asanapattis in Kakatiya Temples', in D.Handa (ed.), Ajayasri, (Ajayya Mitra Sastry Felicitation Volume), vol.1, Delhi, 1989, p.

172. M.Pandu Ranga Rao, Op. Cit.. 1991, p.310.

173. The temples at Nidikonda, Jakaram, and Ramanujapuram have been dismantled under my supervision by the Department of Archaeology and Musuems, Hyderabad, during the years 1983, 1989 and 1990.

CHAPTER VI: THE HUMAN FACADE

CHAPTER VI THE HUMAN FACADE

The monumentality of structures has so overawed us that scholars often forget to discuss the people who worked in various capacities to make the buildings. In our view they are integeral to understanding the form particular buildings take and therefore, are essentially reflected in the facade of the building. At several levels the human mind and labour is indispensable for construction work to be launched and successfully completed. Some works dealing with artists and art activity are available for India as a whole[1] examining the role played by various categories of skilled and unskilled labourers and their efforts in the planning and construction of buildings. At the regional level, for Andhradesa in particular, no comprehensive study has been taken up throwing light on the human hand and the creative spirit behind the construction of monumental buildings. It is implicit that without the technical skills of craftsmen and labourers even simple monuments cannot be built. This neglect in existing historiography can partly be explained by the fact that in the Indian context the buildings rarely carry information or names of their builders. Therefore, our present task in this chapter is to cull data from various literary and inscriptional sources, often fragmentary in nature, to reflect on this aspect of building technology as well.

It can be suggested that right from protohistoric times some specialised social groups have been involved in construction work. From the early historic period, texts inform us, that they were known as ṡilpins who played an important role in different kinds of building activity. We have used some inscriptional evidence to substantiate the literary evidence of the period under study to write about the people behind building construction in early Andhradesa.

In Andhradesa evidence of the earliest stone cutting and carving activity began during the late protohistoric times as reflected in the statue menhirs and anthropomorphic figures of the megalithic period. The statue menhirs[2] were carved representing male and female figures and were erected in front of the dolmens as noticed prolifically in the Warangal and Khammam districts of the present day state of Andhra Pradesh. Anthropomorphic figures[3] were with round heads and shoulders carved outward as found in the Chittoor and Ananthapur districts of Andhra Pradesh.[4] These early pieces of evidence prove beyond doubt the activities of sculpting figures, out of hard stone began during the late phase of the protohistoric times in Andhradesa. On the other hand, at an all India level, we have literary references to the term Silpin or craftsman mentioned in the Vedas, datable to around 1000 B. C.[5] The earliest reference to the word śilpa also occurs in the Saṁhitās[6] and Brāhmaṇās. The term śilpa in these early contexts has a wide connotation and includes various crafts, skills and occupations. There are references in the Vedas to taksaka for carver, rathakara for chariot maker, and karmāra for blacksmith. It has been pointed out that when stone came into use the taksakas of Vedic times transformed and developed their techniques which helped in the growth of this activity.[8]

The Buddhist texts also enumerate various professions. The Majjima Nikāya,[9] the Dīgha Nikava,[10] the Mahāvastu[11] and the Milindapanho[12] have long lists of occupations which indicate organisation of craftman's guilds. The Arthasastra on the other hand, elaborates these details and gives useful information regarding the various types of artisans engaged in building activity during the Mauryan period. Vardhaki to mean a "Chief Architect" is mentioned for the first time in the Arthaśāstra.[13] For Andhradesa the earliest evidence for craftsmen is found in the epigraphs of the Satavahana period which have expressions like Śilākarmāṅta or Sailakarma[14] indicating that these terms come to denote the activity commonly known as 'stone work'. Later with specialisation, the sculptors came to be described by such words as rupakara. sailavadhaki. āveśanin and rūpadaksa.[15]

Among the artists and artisans of authority, navakarmikas[16] and avesanin[17] figure prominently. The Cullavagga[18] specifies rules regarding the eligibility of monks in supervising the building work. It is significant that even in a religious order like the sangha. acquiring of technical skills for construction work was considered important and relevant. On the basis of skill and proficiency the technicians were selected by a group of elder monks from among the monks located aat paarticular viharas. Most of the monks thus selected had probably been artists or skilled workers before they took to being monks. Repairs of a building or construction of a new vihāra or residential building was called navakamma. The Buddhist saṅgha used to select a monk proficient in building activity to look after the navakamma and he was called a navakarmika.[19] The Milindapanha specifically refers[20] to a 'city architect' who laid out and raised a city. The Mahāvaṁśa[21] refers to an Iṭṭakāvadhaki or a brick mason. The Mahavastu refers to various classes of artists and their fields of specialisation and in this text the sthapathi and sutrakara are mentioned as architects.

In the context of our study though there are no early literary indicators, copious references to si loins are found mentioned in the earliest inscriptions of Xndhradesa. These echo the information discussed above from early literature given the large number of buildings with Buddhist affiliation discussed in the foregoing chapters. These references to skilled workmen are significant as they indicate that a high degree of specialisation was in vogue during the early historic period.

Stone workers were called śilavaddhakis[22] in the Nagarjunakonda inscriptions. The Jaggayyapeta inscription mentions an āvesanin, the foreman among the artisans who was associated with the making of five āvaka[23] pillars on the eastern gate of the Maha Chaitva at Velagiri. An inscription from the Godavari district datable to the 6th century A.D., records the grant of the village of Kattacheruvu by Prithvimula to his son Harivarma, who in turn, granted the same to a superintendent of renovations (cf.Navakarmavyāpāra=adhikrta) living in the Mahāvihāra built by the king on the top of the hill in Gunapasapura.

A label inscription in 4th-5th century A.D. characters reading Tuluchuvāṅru, meaning rock carvers, scoopers, engravers or quarrymen has came to light from Keesaragutta near Hyderabad. Certain silpins had place names prefixed to their names denoting the proper place they hailed from. One such example is Kuravadi Achārlu whose name we came across in the following inscription. On the pillars, in the verandah of the caves at Bhairavakonda,[26] it is mentioned that the cave temples were excavated by silpins called Sri Velugunta Acharlu and Kuravadi Acharlu respectively. On palaeographic grounds these inscriptions have been dated to the 6th-7th centuries A.D.

It is the Chalukyan architects who, for the first time, experimented with structural temples in Andhradesa. From the seventh century A.D. onwards, we have numerous inscriptional references to the building of temples and to their donors and architects. A record dated to 713 A.D. found engraved on the fort wall built on the left bank of the river Tungabhadra at Alampur[27] during the regnal period of king Vijayaditya, reports the construction of the above enclosure wall, prakara by Iśanaśivāchārya, probably a silpi. Some inscriptions throw more light on how śilpins were socially and economically organised. Architects seem to have had their professional or caste guilds. Inscriptions from the Palnadu area of Guntur district inform us about a famous family of architects who built some temples in the area. They were first mentioned in an inscription from Aingaripalem, written in Telugu-Kannada characters of the 7th century A.D. It states that the temple Jalapesa was built by one Kalgarābharaṇāchārya.[28] In the Madugula[29] village near Aingaripalem another inscription datable to the same period states that the architect was known as the pañcharathapriya.

Interestingly, a number of label inscriptions reading Sri Utpattipidugu in Telugu-Kannada characters datable between the 6th to the 10th century A.D. have come to light from various places in early Andhradesa. These labels are found engraved in caves, on architectural members of the structural temples and on the boulders in the vicinity of temples. Thus they have been noticed in the caves of Akkanna Madanna at Vijayawada,[30] in a Siva temple at Satyavolu,[31] on the right door jamb of a small shrine in the Nageswara temple at Prathakota,[32] on a boulder in the fields near the village Satanikota,[33] on the outer wall of the Rama shrine at Mahanandi, on a pillar in the Jogulamba temple at Alampur,[34] on a dwajasthambha of the Chennakesava temple at Undrukonda,[35] and very recently, the label was discovered from the caves of Regonda in Warangal district.[36] Of these labels, those from Vijayawada, Satyavolu, Prathakota, Undrukonda and Regonda areas were associated with a line drawing of an instrument [Figure 14]. The tip of the instrument was conical in projection and this was placed on a small disc. The small disc in turn, was soldered to a big disc and the latter was depicted with a battle axe in its bulge. The disc was fixed to a metallic rod, which in turn had a line of sketches in the center and at the end. The rod had a handle fixed for the fist to operate the instrument on rock or stone. This common label literally means Pidugu, i.e., the thunderbolt, for creation or Utpatti caused by Sri, an honorific of the head of the artisans. The purport here could be that this is the creation of the office of the artisans or sculptors. The representation of the object or instrument was similar in most cases and hints at the fact that it was used for scooping the blocks of stones out of the hillock for the excavation of caves at Vijayawada or chiselling pillars, beams and door frames in the case of the temples mentioned above. The inscription from Satanikota[37] hints at the probable use of red sand stone out of the rocksheet in the fields for the construction of important religious establishments nearby. The label[38] is also inscribed at Alampur suggesting that the Alampur temples were built out of this rock as the local tradition holds.

In our epigraphical survey we noticed for the first time a term, namely, Saraswatīgana. This probably alludes to another guild or group of

FIGURE 14

1. Vijayawada, Inscription on the floor of Akkanna-Madanna caves;

2. Sattevolu, Giddalur Taluq, Siva Temple Inscription;

Linear drawing of an instrument found along with the label 'Sri Utpattipidugu'

(Reproduced from N.Mukunda Rao, 'Sri Utpattipidugu' in C.Margabandhu et al (eds.), Indian Archaeological Heritage (K.V. Soundara Rajan Felicitation Volume), Vol.I, pt.I, Delhi, 1990. Pl.38.1)) architects/sculptors and was noticed in an epigraph inscribed on a pillar in the mandapa[39] of the Chalukya Bhimavaram temple in the East Godavari district. In this eulogical inscription, datable to 1097 A.D., it is mentioned that Silpi Viddhachari and his brother Mallachari were bees at the feet of the saraswatīgana (cf. Saraswatīgana pādapaṅkaja bhramara) along with other titles such as Birudamani darpana, Birudamani Nirghāta and Saraswatīgana manōranjana, i.e., pleaser of the hearts of SaraswatTgana. This is an unique inscription that mentions[40] the guild of sculptors called Saraswatīgana. Many scholars have researched on the guilds of Andhradesa but their works do not mention this particular guild. A similar reference is however, noticed from the contiguous region of Karnataka. The late Chalukya and Hoyasala records mention the term SaraswatTganadasa meaning as a guild of the servants of Goddess Saraswati.[41] Settar in this case opines that the Saraswatīganadāsa seems to have confined their activity to the later Chalukyan area. The Bhimavaram[42] inscription tallies with the description of a Posavur inscription which mentions that Padmōja, a Chalukyan artist, speaks of himself as a bee at the lotus feet of the SaraswatTgana (cf. Saraswatīgana pādapaṅkaja bhramara). Further, the honorific titles of Viddachari and Mallāchāri mentioned above and the suffix achari to their names also leads us to conclude that Bhimavaram had an office of artists of high order particularly experts in temple building activity in medieval Andhradesa.

Later medieval inscriptions of Andhradesa also provide information on the guilds of architects and sculptors often called Pañchānamvāru.[43] This term clearly stands for the artisan groups of braziers, blacksmiths, carpenters, goldsmiths and stone carvers whose origin has been traced to the legendary Viśwakarma. In Karnataka these five artisans were known as Panchāla[44]. Inscriptions from Bhimavaram,[45] Panchadharla,[46] Simhachalam,[47] Srikakulam,[48] and Amaravati[49] refer to them variously as Panchahanamvaru or Pañchānamvaru, Pañchāli, Panchanu and Pañchādi. The Amaravati inscription informs us that the sculptors community had its own assembly with Pendota as their head-quarters near Dharanikota.[50] The Bhimavaram inscription mentions one Kase Surachari who belonged to the Panchanamvaru which was probably a guild of artisans of five different groups in which the sculptors and architects were also a part. A record from Nagulapadu dated to 1303 A.D. mentions that the pañchānamvāru took part in village administration along with 18 samayas[51]

An inscription dated to 1261 A.D. from Tripurantakam[52] mentions that Visveswara Siva established the temple of Viśveśwara, a Sanskrit college, a matha, a choultry, a maternity and general hospital and the persons responsible for the construction of the above structures were called the Sthapatis who were well-versed in the five types of professions, viz., the stone cutters, the carpenters, the braziers, smiths and potters (cf. Suvarna tāmbra pashāna karunapita śilpinah).

The aspects of understanding aesthetics, form, environment and design of both religious and secular buildings was an essential part of training of architects in ancient India. The foregoing study also reveals that the śilpins well versed in the subtlties of the religious philosophy and rendered into the buildings the implications of the cosmic life. The early śilpins were creative and the skillful bearers of a deep religious experience and realization, which enabled them to translate the reality behind the appearance into form. In this sense they had to be philosophers, ritual practitioners and artists all put together in one person. Unlike a modern architect who is a mere executant, the ancient sthapati was not solely a designer, but both designer and executant. The stapati was not just an architect, he had to be knowledgeable in other arts and crafts. Often, he was also a painter, metalsmith, an ivory carver, a sculptor, a jeweller or a scribe. In other words, they had to have the sensibility of understanding technical aspects of other crafts. They were also involved in deciding the selection of the site and materials to be used for the buildings constructed by them. In this context their knowledge of the natural sciences and mathematical sciences had to be sound. There was thus a total concept of knowledge that had to be acquired by the trained architects. Ramraz[53] who was the first scholar to research on indigenous traditional Silpa texts writes: "our architecture, sculpture and painting have been for ages confined to a class of people known as śilpins who were not mere builders of different structures but they were scientists and technologists of exceptional wisdom and talents".

Ancient tradition holds the following mythical geneology of the śilpins. In the Mahabharata, Viśwakarma, the son of Prabhasa, is described as Silpa Prajāpati, meaning the foremost among the artists (cf. Viśvakarma[54] mahābhaaga jajne Silpaprajāpatih).[55] According to the Manasara, their origin was "from the four faces of Brahma, the creator of the universe, originated in sequential order, the heavenly architect Vis'wakarma, Maya, Tvashtr and Manu. Their four sons in turn were called the sthapati, sutragrahi, vardhaki and takshaka". Viswakarma is said to be the engineer of the gods, amaravardhaki.[56] It is also said that Viswakarma wrote a treatise on art and architecture called Viśwakarmaprakāśa. He was, over a period of time, deified and even today 1s being worshipped by artisan communities in most parts of India.[57] This tradition was well-known in early regarding the origin, the Macherla[58] epigraph dated to 1111 A.D., mentions that Viśwakarma, the son of Brahma, was the progenitor of the architects. The ancient texts on architecture substantially discuss the conceptual background, ethos and values of the architects and how each of them was to try and establish a relationship between the metaphysical aspects and material forms in the different structures to be built by them. According to Ganapati Sthapati architects had to communicate their values through a considered organisation of the various spaces thus making vastu and vastu.[59]

Vāstuvidya, while enumerating the qualification and knowledge of the sthapati, explains that he must be proficient in all sciences. He was to be a mathematician, historian, geologist, geographer and above all, was to possess a sound knowledge in the science of architecture. In order to select suitable wood, he was also to know botany. For testing of building materials and for combination of paints he was required to have an aquaintance with chemistry and allied sciences. Similarly, a knowledge of the climate and weather of the locality where a house, temple or any other structure was to be built was essential. In addition to these, he was to be intuitive and have foresight to calculate and decode everything very quickly.[60] In one instance it is described that Chitnaka, the famous sculptor of Chandella Kingdom, was master of the entire range of śilpa literature[61] (cf. Sakalaśilpa Vidyākuśalas Chitnakas tasyōyam). Ravi, the architect of the early Chola temple at Tiruvothyur, was proficient in the theory and practice of several texts on architecture and art.[62]

We have no clear reference to the wages or salaries paid to the silpis or sthapathis. However, we have a small piece of information regarding the payment of silpins was made in cash (cf. dravyoparanam kinchit Sarvada sarvaśilpinam)[63]. Like other services in the medieval society of the times, in a majority of instances they were remunerated in land or kind. Infact, there are instances to indicate that the śilpins were given maintenance grants like other professional groups, namely the dance masters, singers and others. The payment depended upon the personal resources of the patron and the size of the project undertaken by the śilpins. No doubt, the payments excluded the cost of the building material which was supplied by the donors or patrons. We have many references to gifts and grants of lands to the temple builders and sculptors. At times they were given a high position even in the royal service. The sculptors and architects were also honoured by royalty. In the Ramayana[64] it is mentioned that the court of Rama was adorned with intellectuals in philosophy, interpreters of law, sculptors, architects and painters. Bana describes in the Harshacharita. that Prabhakara Vardhana honoured the Sūthradhāris by offering garlands, apparels and sandal smear before he set them on the beautifying of the royal palaces on the eve of the marriage of Rajyasn.[65] Dhanapala in Tilakamañjari says that honouring of sculptors and painters was part of the ritual before commencement of their works.[66] Śilparatna a late śilpa text, reiterates that the honouring of the proficient in the different art like architecture, sculpture, painting, metal and wood work was important.[67] (cf. tasmad esha sada pūjya sthapatyadichatustayah).

In the data from Andhradesa we have considerable information on the aspects of their remuneration. An inscription dated to 1104 A.D. records the gifts of land to the mason, Kase Moju who built the temple of Swayambhudeva at Valiveru[68] with the mason also undertaking to attend to the repairs of the temple from time to time. Another record dated to A.D. from Macherla[69] mentions some gifts of lands at Kambampadu made by several people to the architect entitled śilpikāchārya Tippoju who constructed the Aditya temple at Macherla. The Kopparam inscription dated to 1115 A.D of Kannarachodadeva, the minister of Mara, made gifts to śilpis. Eriyachari, Maracharya, Prōlāchārya and Kondacharya for excavation and construction of the tanks and temples at the said village.[70] An inscription dated to 1144 A.D. from Parada[71] in Nalgonda district, records that some land was gifted to śilpins Betoju and Neriyamoju who constructed the local temples and tanks under the supervision of Mahesvara Surebhatlu. The Guntur inscription of the 1158 A.D states that a certain Pāṇḍyarāju built the Agasthyesvara temple at Guntur along with a mandapa. parivara shrines, prākāram and gopura under the supervision of a certain śilpikāchārya.[72]

The Malkapuram[73] inscription dated to the 12th century A.D. informs us that si l pi acharyas. Guḍḍōju, akkasala Bayyoju, kase An6ju, Annapōju and Ponnoju were gifted with some lands for construction of the Viśvanātha temple at Malkapuram. In the Ganapavaram[74] inscription dated to the regnal period of Kulothunga Rajendrachola, the villagers granted a piece of land to the temple builder akkasala Kāmōju, son of Kapoju. An inscription from Jalalpuam[75] dated to 1202 A.D. registers a gift of one marturu of land to sutradhari Kāse Mallōju. Sūtradhāri Bomalaya[76] is mentioned as one of the permanent staff members of a temple at Mukkamala in Guntur district in an inscription[77] dated to 1208 A.D. The Durgi inscription of Namadeva Paṇḍitha, dated to 1251 A.D. records that the śilpi Kāḍōju responsible for the construction of the Vankesvara temple along with subsidary shrines, was gifted with some lands at the time of the concecration of the image Vankesvara at Dugyapaṭṭaṇa. The Yadavalli[78] inscription dated to 1257 A.D. records land gifts to the kāse people, viz., Gangoju and Anamōju for the construction of mukhamandapa of the Swayambhu temple of the village. The Mallavolu[79] inscription dated to 1280 A.D. records that Chamaya Nayaka, the bodyguard of Prataparudradevarāya made gifts to kāse Padoju and Nagoju for constructing the Samiswara temple and carving of stone pillars respectively. We have also information that the artisan community, i.e., the Panchanamvāru had to pay a tax called Pañchāli which was levied by the state authorities.

The above information leads us to conclude that in most cases donors had gifted only lands to the artisans. The donors were wealthy individuals, the community as a whole, nobles, ministers and people of the royal family. The donee artisans belonged to different categories located in hierarchy i.e., kase. ordinary. stone cutters, śilpins. sculptors, sutradharis. supevisors or śilpikachāryas. the chief architects engaged in various stages of temple building activity. The artisans of distinction and high order were paid more than these in the supervisory category who were inturn, paid more when compared to ordinary stone cutters. In case of payment, it appears that the individual donors met the expenditure from thier own resources, whereas, there are also instances that funds were collected by soliciting contributors from the entire village for completing certain projects.

Regarding the training of the śilpins. they seem to have received their education from their family members by oral transmission of the texts or, from the teachers of their community in *śilpaśālas.* at their houses or, in places situated elsewhere. Most of the *sthapathis* of the present generation have also received their training from their parents and elders of their family at their own houses. The son begins to help his father as soon as he can and in the process he learns the art or craft. The knowledge of the father is thus to be transmitted to the son. The son then leaves his father for a few years for apprenticeship under some expert *sthapati* to learn more.[81]

We have some literary references to the existence of *silpasalas.*[82] The *Brahmavaivarta Purāna* mentions a *śilpagrha*[83] and the commentory of Kulluka on Manu describes a *śilpageha.*[84] The *Kāmasutra* has the information that persons of taste who practice *śilpa* in their houses, used to have such workshops. *Silpaśāla* also finds mention in the *Mayamata.* Some *silpins* appear to have been trained in many branches of this profession. They could for instance, engrave inscriptions, sculpt idols, make jewellery and construct temples and *mandapas.* For example, *akkasala.* Kamoju son of Kapoju was a jeweller by profession and caste but he had also built a temple at Ganapeswaram.[86] Regarding the qualifications and expertise of *silpis* it is mentioned in a Macherla epigraph[87] dated to 1111 A.D., that the *acharyas* of the family of *śilpikāchārya* Tippoju were experts in cutting *lingas.* in preparing images, in buildings mansions, in grasping geometry and in using all kinds of implements. The same epigraph further records that Tippoju was a great expert in experimenting in new devices of temple building. Other members of his family, Banachari, Nagachari, Potana were also experts in building four types of *prasadas.* Another set of *sutradharis* mentioned in this record are Halapoju, Bikkoju, Navoju and

T1pp5ju who were experts in selecting suitable sites (cf.Vāsthukshetravidah) for construction of temples. A record from Avanasi in Tamilnadu mentions that the architects carried out ten types of duties (cf.daśa-kriya).[88]

The literary texts also describe the all encompassing nature of silpins training. According to the Manasāra,[89] the Sthapathi must be well-versed in all sciences.[90] The Vasthuvidya, a 12th century A.D. śilpa text enumerates that the sthapathi must know mathematics, history, drawing, painting, geography and should posses deep knowledge in the science of architecture. The texts at the same time also gives us the various specialisations of craftsmen. The sutragrahi according to Manasara should posses general knowledge in all sciences and he must be an expert in measuring accurately.[91] The vardhaki[92] was supposed to have the expert knowledge in practical sciences with specialisation in painting.[93] The takshaka[94] was to be an expert in wood carving. The same text also says that all the artisans should work within the framework of textual tradition pertaining to architechture (cf.Kurvanti sastradesena vastu vastu prayatnatah) and the sthapathi is said to direct and guide the remaining three catagories (Tribhyōgururitismrtah) of artisans mentioned above.

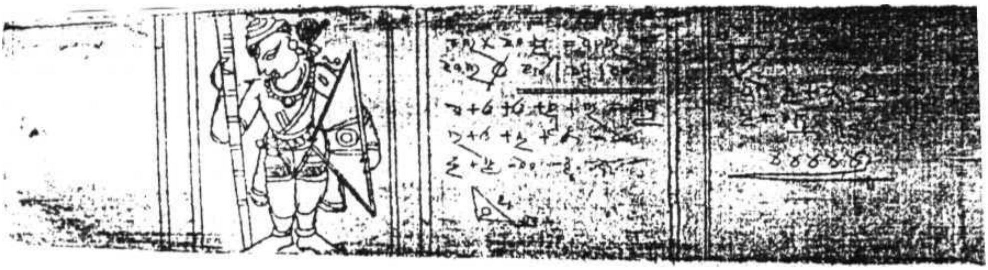
That these literary traditions were practised is known to us from some epigraphical references. In one of the labels, there is mention of the office of the sculptor. This is reported from the temple Mahanandi in Kurnool district, datable to 7th-8th centuries A.D. The inscription informs us that Prithivibhima was employed in the service of Kamiya who was head of the office of the sculptors Śri Utpattipidugu. The Satanikota inscription refers to the architect Arjunan, with the title Lokasılabhima, a follower of Malleswara kalamukha sect who was 1n the service of the office of Sri Utpattipidugu[95].

The masons and sthapathis used implements such as scale, string or rod, hammers and chisels. The scale was an instrument used to measure and played a vital role in building technology. The traditional architect had their own system of scales such as talam, vitasti, kishku, hastam, danda and rajju which were all used for specific purposes. These measures were derived from the smaller angula, that is, inch which inturn, had its origin form the paramanu, the atom. The ancient saints are said to have converted this atom which symbolised the subtle form of time and space which was called ākāśa.

The rajju, rope or string was first used in making the sulva altars of Vedic origin. Later on, according to Debiprasad Chattopadyaya, the rajju might have been used by the architects for making the ground plans of the early brick structures. This rajju was also called as sutra and was appropriately linked to Brahma sutra by the silpins. A Vardhaki kasta 'i.e., measuring rod or danda is also mentioned in the texts[96] as a tool that was commonly used by the architects **[Figure 15].**

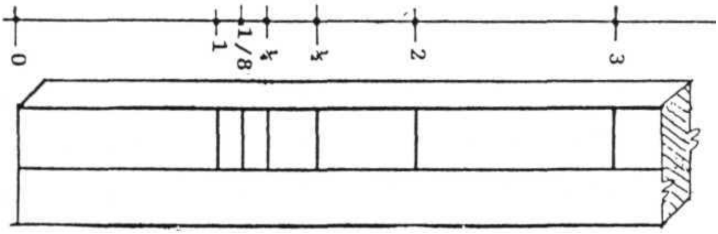
Besides the above, the sthapathis tools and implements consisted of a large number of chisels and hammers of varied sizes depending on the work. To remove the unwanted stone to make a required block or **sculpture, they** used five kinds of chisels namely, vettappu thievu, arappāśam, palmunai and vettirimbu. Vettappu was a heavy chisel used only to remove chunks of a stone slab. Thievu chisels were sharp and had pointed working edge and

FIGURE 15



(a) An Architect with a measuring rod and a set-square depicted on a Palm-leaf Manuscript.

(Reproduced from A.Valwashen, Living Architecture-India, Calcutta, 1969, p.54)



ONE EIGHTH OF THE ACTUAL SIZE OF KISHKU HASTAM

(b) A Scale according to Manangula,

(Reproduced from V.Ganapati Sthapati, The scale. Madras, 1993, p.10) were used for fine chiseling. Arappasam was another type of chisel with flat and sharp working edge used for chiseling the uneven surface of stones. Palumunai type of chisels had flat bottom with many chisel points used for chiseling even surfaces of the stone. Over a flat rectangular or square working surrface, several diagnol grooves were cut, yeilding several sharp edges or points, each one corresponding to the sharp, pointed end of the chisel. Depending upon the closeness of the grooves across the working surface of the chisel the Palamunas were called by different names such as Perumuna, Serumuna, Perum sannam, Sannam and Ravasannam. The Perumuna was the first and contained only a few grooves used for the first line of dressing. The others contained more grooves than the perumuna and were used for smooth furnishing of temple vargams and for icons as well. The last one was a heavy chisel with flat sharp edge called vettrimbu, which was used in the cutting of the grooves in the palmuna. This clearly indicates that the working craftsmen were known by the tools and instruments they used indicating a high level of specialization.

As understood from the inscriptions, some of the silpis were prefixed by the term kase, meaning the stone cutter who are considered the lowest in the rank of workers. In terms of hierarchy, Kasacharya was the head of stone cutters or quarrymen. Other groups placed in a hierarchy were silpi, the stone cutter or carver, Silpikacharya head of the stone carvers and Sutradhari the supervisor of building works with a measuring string sutra in his hand. The sthapathi was the chief supervisor of and master architect. Usually, the names of the craftsmen were prefixed by silpi or sutrardhari and at times, suffixed by Oju. A fragmentary inscription in the 9th century A.D. characters from Sangameswaram[97] mentions the name of a silpi as Yōgaju Kaśyāchārya. the suffix Kaśyāchārya meaning the head of the kāśe community is noteworthy. Kāśes. the stone workers were also mentioned in an inscription issued in the 13th regnal year of Vishnuvardhana Maharaja from Chalukya Bhimavaram.[98] A certain Kaśachari[99] by name 'Mummadi Linga Bathudu' was mentioned to have carved a Vaishnava idol at Ganapesvaram in Krishna district.

From literary texts we get a clearer idea about the hierarchy of artisan groups. Thus, one of early references in the Manusamhita[100] fixes up a hierarchy of artists of the building activity and mentions sthapati. master architect, sūtragrāhi. surveyor-designer, taksaka. sculptor, carpenter. The Manasara[101] mentions architects as, Sthapati. Sūtragrāhi. Vardhaki and taksaka. The same work accords to the Sthapati a rank of 'the Director General' and 'consulting architect' and Sūtragrāhi. a status of 'supervisor' over Vardhki and Taksaka. The Samarāngana Sutradhara[102] of Bhojadeva describes the qualifications of a śilpi. sthapati sutragrāhi. taksaka and vardhaki.

We next turn to discuss the status of these artisans in early Āndhradeśa. The word status signifies the regard accorded to artisans in a society as the basis of the importance attrirbuted to the part played and the recognition of the position with reference to the income they enjoyed.

The low status assigned to the artisans by Manu seem to have considerably altered by about the 8th century A. D. Architects, not only needed to sculpt, build temples, but were also responsible to begin the layout of new townships. In the planning of a city or a village the śilpi was to take a comprehensie view of the whole, lay out the streets, the plots for construction of dwelling places, water reservoirs and defence buildings. He always assigned the first and foremost place to the temple for the temple was considered the centre of the social unit as life is to the body that it contains. The inscription from Tellapur[104] records the laying foundation of the township of Telungānapura together with wells, and mango groves by the architects namely, Pochoju, Mallōju and others. Silparatna,[105] a medeival treatise on achitecture enumerates that in constructing vimānas, gōpuras, choultries, houses and digging wells and temple tanks, people of Viswakarmakula should be employed and people of other communities should not be employed for above works because Viśwakarmas were experts in building technology.

Some of the Silpins seem to have won the favour of the ruling kings and generals and earned positions of considerable distinction. The famous blacksmith Nukāndi, Surana of Viswakarmakula, and Ḍākaremi Surāchari alias Vīrarājendra Chōlāchāri, are some of the examples. Apart from the architects, the artisans also participated in the royal sevices. In an inscription from Nadendla[106] dated 1141 A.D. there is a reference to the family of Viswakarma. The famous blacksmith Nūkāndi son of Kutandi was in the service of the Velanāti chief, Kulothunga Choda Gonka and bore the title Karmarabharana which means "an ornament among blacksmith". Another inscription from Chebrolu[107] states that, Surana, of the Viswakarma kula, son of Kannoju and Prolama, served the King Yerramanda who was a subordinate of the Chola king Kulothunga I. Surana as a general of the army rendered invaluable services to king Yerramanda in checking the western Chalukya depradation of his territory and was rewarded with the position of the Chief Minister. There are two Tamil inscriptions,[108] inscribed on stone at Daksharama by the scribe named Surachari alias Vīrarājendra Chōdāchari of Ḍākaremi. It will be evident from his name that he was the official scribe and he must have obtained the surname from Vira Rajendra Chola(1163-1170 A.D.), the reigning monarch in whose time he rose to prominence. The name of the scribe is written in Telugu script. This information also denotes the status of Śilpis in social and administrative hierarchy.

The boundaries of kingdoms or, the change of dynasties formed no barriers to their movements. Reference to the architects who migrated from one place to another for constructing temples or sculpting idols are also available in the epigraphical sources. They, in all probability, acquired fame in their particular profession and were therefore, sought after by other communities. An inscription from the eastern gateway of the courtyard of the Virupaksha temple mentions that the Sūtradhāri Gunda constructed it for Lokamahadevi.[109] The occurence of the name Gundaya as the sculptor of the Vengi court (cf. Vengināṭṭu Velanādu Gundaya) inscribed on a dwārapala sculptor of Bejawada, has something to suggest about the migration of artisan families from one kingdom to another in quest of royal favour and patronage. It is also well known that when the Chālukyan king Vikramāditya II conquered Kanchi, he took some Tamil architects with him and got the temples constructed at Badami and Pattadakal.[110] Another artisan Cattara Revadi Ovajja belonged to the guild of Sarvasiddhi Acharva of South India and he was said to be the builder of the Lokesvara temple at Pattadakal.[111]

There is evidence to suggest that the architects from Gundikarru and Dakaremi migrated to work in Kurnool and Nellore districts. In an inscription from Sangamesvaram in Kurnool district, it 1s stated that the temple of Nakaresvaradeva in the village was built by Nadipi Yovoju,[112] son of Gundikarti Doyuri Achari or the master silpi of Doyuru in Gundikarru. According to Venkata Ramanayya,[113] this Gundikarru was situated in south-western corner of Guntur district which falls in the northern corner of the present day Prakasam district in Andhra Pradesh. A recent study made by S.V.Padigar[114] reveals that a guild of craftsmen working at Badami from the commencement of the Chalukyan rule comprised of craftsmen who migrated from Eeleswaram of Nalgonda district in Andhra Pradesh. Likewise, the names Chalukya Sundarāchāri, Vīrarājendra Chōlāchāri of the inscriptions denote that there was mobilisation and migration of sculptors from one place to another during the early medieval period.

Some inscriptions from the contiguous regions of Tamilnadu and Karnataka are forthcoming which furnish similar kind of information. The inscriptions from Tamilnadu of the regnal period of Kulothunga Chola I and Rajendra Chola mention the name of an architect as Chandrashekara Ravi who built the Mahadeva temple at Purisai and renovated the temple at Thiruvotriyur respectively.[115] These inscriptions further inform that the architect Ravi was known by the titles Cholendra Simhāchāri and Veerachola Tachchan thererby denoting that architects were given the titles after the names of the king or, the dynasty whom they were serving. A similar evidence comes from Karnataka in which an inscription of the Hoyasalas refers to the architect having a title of Poyasalachari after the Hoyasala dynasty.[116] An inscription datable to the 11th century A.D. from Bhimavaram[117] East Godavari district of Andhra Pradesh refers to one sculptor-architect by name, Chalukya Sundaraya Achari. From his name and prefix one can suggest that Sundarayachari might have migrated to Andhradesa from Karnataka and vice-versa also from Tamilnadu. The prefix Chalukya seems to have been offered by the royal people for his position held in the service of the Chalukyan kings. It can also be suggested that the guild of sculptors known as SaraswatTgana mentioned in the Chalukya Bhimavaram inscription[118] could have been the same guild known in Karnataka probably with a branch at Bhimavaram looking after the constuction of temples. It is also possible that the persons mentioned in this epigraph might have migarted from Karnataka to Bhimavaram but were still affiliated to the Karnataka office.

The above survey reveals that we have some early references to artisans engaged in the building activity from the 3rd century B.C. onwards as seen in the early literary works on an all India level. These were known by several appelations as Si1pi. Takshaka and Vardhakis. The early epigraphs also contain references to the above and their heirarchy. From the 7th century A.D. onwards on the basis both literary and epigraphical sources, a clear line of heirarchy was marked among the various catagories like Kase stone-cutter on the one hand, and to the śilpāchārya the chief architect on the other. The artisans were organised into craft guilds called Sri Utpattipidugu. Pañchānamvāru and SaraswatTgana. Inspite of the useful functions which these artisans have offered in society, their status was always low in a society dominated by the priestly and millitary classes. However, it was from 10th-11th centuries A.D., onwards that these expert social groups were given prominance in the royal courts also. These builders of different ranks were given lands as their remuneration by individuals, communities and people of authority. Many of these architects migrated to distant places. Thus the people who were specialised in various crafts were responsible for raising monumental edifices backed by financial resources of their patrons right from early historic to early medieval times in Āndhradeśa.

FOOTNOTES

1. R.N.Misra, Ancient Artists and Art Activity. Simla, 1975, pp.1-2.

2. E.Siva Nagi Reddy, 'Statue Menhirs of Proto-historic Andhra', a paper presented at XVIII session of AP History Congress, Tenali, 8-9 January, 1994 (Typed), p.1.

3. K.P.Rao, 'Beginnings of Sculptural Art in South India', PIHC, 53rd session, Warangal, 1993, pp.664-671.

4. A.Murali, The Megalithic Culture of Andhra Pradesh: A Study (with special reference to Anantapur District), Ph.D. Thesis, (unpublished), Sri Krishna Devaraya University, Anantapur, 1992, pp. 177-201.

5. TaittirTva Saṁhita. 1.2.2.1.

6. Satapatha Brāhmana. 14.9.9.33.

7. Rg Veda. X.72.2.

8. R.N.Misra, Op Cit.. 1975, p.4.

9. Majjima Nikava. 1.85.

10. Dīgha Nikava 1.51.

11. J.J.Jones, (tr.), Mahavastu. Vol. III, London, 1949-56, p.112.

12. Miliñdapanha. 331.

13. Arthasastra. IV. 1.65; 2-8.

14. Lüders list, nos.350 and 687.

15. R.N.Misra, Op. Cit.. 1975, p.10.

16. Lüders List. no.154; EI, Vol.XX, p.17.

17. Lüders List. no.1202.

18. I.B.Horner, (tr.), Book of Discipline. (Vinaya Pitika. 5 volumes), London, 1949-69, p.204.

19. Miliñdapanha. 330.

20. Referred in W.Gieger, Culture of Cylon in Medieval Times. London, 1960, p.92.

21. J.J.Jones, (tr.), Op. Cit.. 1949-56, Vol.III, p.444.

22. EI, Vol.XX, pp.22-23.

23. Luders List. no.1202.

24. N.Venkata Ramanayya, (ed.), Report on Epigraphy for 1965, Hyderabad, 1968, Ins. no.8.

25. ARAP, 1982-83, p.22.

26. SII, Vol.X, no.47, pp.18-19 and 54.

27. II, vol.11, p.8.

28. K.Sundaram and B.Mastanaiah, 'Ayyamgaripalem Stone Inscription of Kalagarābharana', EA, vol.V, p.33.

29. ARE for 1937, no.340.

30. N.Mukunda Rao, 'Sri Utpattipidugu' in C.Margabandhu et al (eds.) Indian Archaeological Heritage (K.V.Soundara Rajan felicitation Volume) Volume I, pt.1, Delhi, 1990, pp.323-328.

31. Ibid. p.324.

32. Ibid. p.324.

33. Ibid. p.325.

34. Ibid. p.325.

35. Ibid. p.326.

36. E.Siva Nagi Reddy, 'Recent Discoveries in Painted Rock-shelters of Pre and Proto-historic Andhra', a paper presented at XVIII, session of A.P. History Conqress. Tenali, 8th-9th January, 1994, (typed), p.2.

37. N.Mukunda Rao, Op. Cit. 1990, p.323.

38. Ibid. p.324.

39. E.Siva Nagi Reddy 'Saraswathīgaṇa : New Epigraphical Evidence of a Guild of Architects from Medieval Andhradesa', a paper presented at the 3rd National Seminar on Silpaic Tradition in Ancient India. held at University of Mysore, Mysore, January 28-31, 1994, conducted by the Academy of Art and Architecture, Mysore. Also see S11. Vol.V, Inscription no.64 which reads :

1. swastisri srimathu bhirudarivari (minni) kotti

2. Saraswatīqana pādapa

3. ñka.ia bramara bhiruda sikhāmani bhiruda vidda

4. ma bhirudamani darpana bhiruda Nirghāta Saraswathi

5. qana manoraniana Srimathu Viddhachari Prasasthi

6. Viddāchāri Tammundu Mallā Chari (ma) tti trinetra

7. Prā (gma) dabhirudagala graha sthambha biruda

8. tta sangrama Jātralatākarmadasi Srimathu Malla

9. Chari Prasasthi.

40. Guilds in Medieval Andhradesa have been studied by K.Sundaram, in his studies in Economic and Social Conditions of Medieval Āndhradeśa. Machilipatnam, 1975; Y.Gopala Reddy, 'The Trade Guilds in the Age of the Kakatiyas of Warangal', pp. 1-28 (off-print article); B.Rajendra Prasad, Art of South India : Andhra Pradesh. Delhi, 1980, p.85; P.S.Kanakadurga, 'Role of guilds in the promotion of Trade: The Kakatiya Period, PSIHC. 6th Session, Hyderabad, 1986, pp.143-150; P.Chenna Reddy, Guilds in Medieval Andhradesa. Delhi, 1990 and N.Mukunda Rao, 'Pañchānamvāru-Pañchāli' Itihas. Vol.XVIII, no.2, Hyderabad, 1993, pp.35-42.

41. S.Settar, The Hoysala Temples. Volume I, Dharwar, Delhi, 1992, p.87.

42. EC, Vol.VII, 1904, Ins.no.1080, Sloka 293 of the Inscription which reads : Saraswatīgana padapañkaja bramara.

43. K.Eswara Dutt, Inscriptional Glossary of A.P.. Hyderabad, 1967, p.172.

44. S.Settar, Op. Cit.. 1992, pp.86-87; EC, Vol.IX, 1905, Bn.12.

45. SII, Vol.V, no.158.

46. Ibid. Vol.VI, no.666.

47. Ibid. no.1179.

48. Ibid. Vol.V, no.1168.

49. Ibid. Vol.VI, no.219.

50. N.Mukunda Rao, Op. Cit.. 1993, pp.35-42.

51. CTI, Vol.11, no.3.

52. SII, Vol.X, no.395.

53. Ramraz's letter to Richard Clark, see Ramraz, Essay on the Architecture of the Hindu. Varanasi, 1972 (Reprint), p.xii.

54. Mahabharata. I.66.28-38

55. Manasara. Chapter II.

56. Matsyapurāna. Ch.V. 11.54-6.

57. B.B.Dutt, Town Planning 1n Ancient India. Delhi, 1977, p.4.

58. SII, Vol.X, no.66, pp.190-194.

59. V.Ganapati Sthapati, The Scale. Madras, 1993, pp.5-7.

60. P.K.Acharya, A Dictionary of Hindu Architecture. Delhi, 1979 (Reprint), pp.710-726.

61. C.Siva Rama Murthy, The Painter in Ancient India. Delhi, 1978, p.22.

62. Ibid, p.22.

63. Mahabharata. II.5-118.

64. Ramāyana. VII.94.9-10.

65. Harshacharita. by Bana with Commentary of Sankara, Bombay, 1918, p.142.

66. Tilakamañjari. by Dhanapala, Kavyamala Series, Bombay, 1903, p.54.

67. Silparatna. by Srikumara, Trivandrum Sanskrit Series, no.75, Trivendrum, 1922, p.22.

68. SII, Vol.X, no.22.

69. Ibid. no.66.

70. Ibid. no.74.

71. P.V.P. Sastry, (ed.), Inscriptions of Andhra Pradesh Nalgonda District. Hyderabad, 1993, Ins. No.48, pp.129-132.

72. SII, Vol.X, no.144.

73. Ibid. no.396.

74. Ibid. no.122.

75. P.V.P.Sastry, (ed.), Op. Cit.. 1993, Ins. no.72, pp.199-207.

76. SII, Vol. X, no.247.

77. Ibid, no.334.

78. Ibid. no.359.

79. Ibid. no.451.

80. N.Mukunda Rao, Op. Cit.. 1993, p.39.

81. Census of India 1961. Vol.IX, Madras, Part VII. A-V, (Handicrafts and

Artisans of Madras State) Madras, 1964, pp. 47-64, Appendix III, Statements of Prominent Sthapathis.

82. A.M.Sastry, India As seen in The Brihatsamhita of Varāhamihira, Varanasi, 1969, p.

83. M.Williams, A Sanskrit English Dictionary, Madras, 1987 (Rp), S.V.

84. Kāmasūtra, I.4.4.

85. Mayamata, Ch. LXVIII, 50.

86. SII, Vol.X, no.122

87. Ibid, no.66.

88. Referred to by T.Venkateswara Rao, Local Bodies in Medieval Andhra, Hyderabad, 1987,, p.152.

89. P.K.Acharya, Op. Cit.. 1979, p.710.

90. Vastuvidya. I.12-15.

91. P.K.Acharya, Op. Cit.. 1979, p.711.

92. Ibid, p.711.

93. Ibid, p.711.

94. Manasāra, Chapter I.

95. N.Mukunda Rao, Op. Cit. 1993, p.326.

96. V.Ganapati Sthapati, Synthesis of Science and Spirituality in Vastu Śilpa Tradition. Madras, 1993, p.21.

97. N. Venkata Ramanayya, (Ed), Report on Epigraphy in Andhra Pradesh for 1966. Hyderabad, 1966, Ins. no.20.

98. SII, Vol. V, no. 71

99. Ibid. no. 951.

100. Manusamhita. IV. 47-48.

101. P.K.Acharya, Op. Cit.. 1979, pp. 709-729.

102. Samarānganasūtradhāra. Ch. 44.

103. G.Buhler (Tr), 'The Laws of Manu' SBE, Vol.XXV, Oxford, 1986 (Rp), p. 238.

104. N.Mukunda Rao, Personal Communique.

105. Silparatna. Chapter 29.

106. SII, Vol.X, no.673.

107. Bhārati. Vol.36, no.2.

108. T.N.Subrahmanian, 'Two Tamil Inscriptions of Kulothunga Chola I - from Draksharamam', EA, Vol.1, pp.15-30.

109. C.Sivarama Murthy, Early Eastern Chalukyan Sculpture. Madras, 1947, pp.26-27.

110. IA, Vol.X, p.169.

111. Ibid. p.170.

112. AREAP for 1966. Hyderabad, p.49.

113. N.Venkata Ramanaiah, 'The Kurkyala Inscription of Jina Vallabha', EA, Vol.11, p.25.

114. S.V.Padigar, 'Craftsman's Inscriptions from Badami : Their Significance' in Ratan Parimoo et al (Eds), Ellora Art and Architecture. Delhi, 1992, pp.388-405.

115. Census of India. 1961, Vol.IX, Part VII, A.V., Madras, 1964, P.5.

116. EC, Vol.VI, 1901, Mg.13.

117. £11, Vol.V, no.80.

118. IA, Vol.X, p.169.

RECAPITULATION AND CONCLUSIONS

RECAPITULATION AND CONCLUSIONS

The descriptions of the various buildings and their fragments in terms of their technical evolution made in this dissertation would suggest that space in early Andhradesa had been organised in such a way so as to include secular, political, burial and religious buildings which were connected to the daily private and public life of the people. These spaces were organized by a group of technologists called <u>śilpins</u> who were trained in not only technical procedures undertaken by various grades of professional craftsmen, but as Coomaraswamy puts it, they also had: "mental visualization and identification of conciousness with the form evoked, ...".[1] This study has aimed at looking at the details of building traditions which were bound by the injunctions of custom and spiritual concepts as have been found in the various extant buildings. Without emphasizing on the perception of the traditional building practitioners these buildings would appear without the subjective meanings of their context.

The main purpose in the dissertation has been to document the traditions of building technology as available within the pan-Indian development of these traditions by highlighting the different levels of building technology in various historical periods in the geo-cultural entity delineated by us as Andhradesa. The study has opened up new horizons in the rich traditions and practices of building technology that

1. Anand K.Coomaraswamy, The <u>Transformation</u> of <u>Nature</u> in <u>Art</u>, Dover Publications, New York, 1934, p.166.

had existed in raising both simple and sophisticated structures and it is interesting to note that both types had co-existed in almost all the periods of our study. The structures of every day use denoted different aspects of the collective endeavours and experiences, resources and ideologies that nurtured and guided the artisans in society. The evolution of these aspects, it has been observed by us, were not static though their evolution has to be seen within the specific context of a historical and geographical space that our study embodies. Indeed, this specificity was determined to a large extent both by geographical and historical factors.

In introducing the dissertation it had to be explained that technological skills were available to only a few specialized groups of artisans, skilled and unskilled workers whereas, powerful social groups had resources for undertaking the construction of monumental buildings. However, what was important to highlight in the context of India was that traditional knowledge about building technology was brought forth in existing historiography through techniques of conservation and building maintenance that was revealed to us in the coloinal period. Therefore, a highlighting of the meaning of science and technology in both the western and Indian intellectual traditions was thought necessary to do at the outset. The aims and methods of how the Evolution of Building Technology in Early Andhradesa was to be organized was also done in this Introduction.

Chapter I began with a detailed explanation of the context of the present study in terms of existing writings on the subject **[I.1: Interpretative Space]**, the geo-cultural background **[I.2: Geographical Space]**, and the chronological framework **[I.3: Historical Space]**. The review of the writings on the monuments of the pre-independent period revealed that initially these were travellers' perceptions and consisted of some notes on the form of architecture of the extant buildings. A considerable change was observed in the writings that emerged from the middle of the 18th century in which Indian monuments began to be perceived against their material background though the emphasis continued to be on the form only. A further change was observed in the writings on monumental buildings from the 19th century by both Western and Indian scholars who began to be concerned about giving some technical details of the monuments. The study of indigenous traditions initiated by Ramraz was very helpful in this regard and though British administrators began in earnest a listing and descriptions of monuments in their outward manifestations, they now could not do so without consultation with the living traditional architects. We observed that the South Indian monuments received little attention upto the latter half of the nineteenth century though the Archaeological Survey of India was established for the purpose of listing and documenting historical monuments on an all India basis. It was only during the 20th century that the administrator-scholars started writing on new monuments at a regional and local level.

Several significant contributions in studying the South Indian monuments were, however, made by scholars from the early twentieth century onwards. At the same time, a good number of śilpa texts were published during the early half of the twentieth century opening new vistas of knowledge into aspects of traditional methods of building and on their terminology. The writings of scholars like A.K.Coomaraswamy began a significant trend to not only document the material context of the buildings but also highlight its intellectual achievements, aesthetic values and inward manifestations. Stella Kramrisch and P.K.Acharya made commendable efforts to describe Indian religious buildings supported by the perceptions of the indigenous texts. It was, however, noted by us that the monuments of Andhradesa received a little attention during the first half of the twentieth century from this perspective.

In the works of the post-Independent period monuments were prolifically studied by both Western and Indian scholars with special attention to the regional context. Some aspects of building technology formed part of the discussion in the works that emerged from the 1970's onwards. Our review of these works also revealed that techniques of how religious buildings were made received maximum attention whereas the simple housing structures and even forts had been sparsely discussed from the technological point of view. This review further established that no singular study with a focus on building technology of different types of buildings in the context of early and medieval Andhradesa had been undertaken clearly establishing a space for our endeavours in the present dissertation.

In **Section I.2** we attempted to locate the historical buildings against the geographical background to study building technology by dividing the area of study into four sub-regions dileneated as A, B, C and D. The geographical locale of the Andhradesa as delineated in our study had no rigid boundaries over time. Therefore, we noted that the present day linguistic boundaries of the state of Andhra Pradesh were too restrictive. Since a number of changes took place in shaping the cultural identity of this region right from the early historical times, we attempted to highlight these as could be culled from ancient and medieval literature and epigraphs. The nineteenth century definition of Sir Greirson who defined Andhradesa based on its linguistic affiliation to the Telugu language indicated for us that the cultural boundaries of a region had to take into account areas of bilinguilism also. Further, these boundaries also coincided with important geographical boundaries which we highlighted to take a more flexible, at the same time, contained geographical space for the present study. This was followed by dividing the broad geographical area of our study into four sub-regions which helped us highlight the topographical differences in each of these sub-regions. Different types of buildings built in various materials that were available only in a particular sub-region was possible to contextually place in the present survey. In this way technological variations of the adjacent areas to Andhradesa could also be taken into account. This survey study further enabled us to locate the possible old landscapes against a physiographical background that necessarily looked at its relationship with the present day surviving monuments and buildings. In the next **Section [I.3]**, the period of our study was divided into a four period classification delineated as Period I, II, III and IV for understanding the evolution of building technology in the context of historical space as interpreted by different scholars. It is now recognized in history writing that changes occured in the political, social, economic and ideological spheres and these are to be studied in an integerative manner. Thus we highlighted the views of scholars in this regard to emphasize that from time to time socio-political, socio-economic and socio-ideological changes form a necesary backdrop for understanding their impact on the evolution of building technology.

The **Chapter** on **Secular Space [II]** focussed on habitation and public utility structures especially those pertaining to irrigation networks. We began with how proto-historic people had lived in man-made pits cut into the ground during the early neolithic period and then moved on to the plains and built simple houses. The Neolithic-Chalcolithic people realised the need for some public utility structures. Of these, a pathway for communal use laid for the first time, as noticed at Ramapuram in sub-region D, forms the first public utility structure in the proto-historic context denoting a collective effort. During the megalithic phase, houses began to be built with non-perishable materials such as stone. This was possible since they knew the use of iron technology for quarrying and dressing the hard stone. Overall, during both these phases of human habitation circular and rectangular houses were built with wattle and daub and mud walls and thatched roofs supported by wooden posts. This type of house is still built in most parts of the forested and coastal areas of present day Andhra Pradesh. Significant developments in the building technology of this phase was the considered paving of floors with stones to arrest dampness, construction of platforms to keep utensils, the building of granaries to store food grains and the building of enclosure walls for safeguarding the habitation. Evidence of the use of sun dried bricks for habitation buildings have been found recorded for the first time at Gandluru belonging to this phase.

Period II was characterized by the emergence of State and urbanisation. These changes taken together resulted in raising sophisticated buildings for the rulers and the rich whereas simple structures for the common people continued to be built. The wattle and daub walls of the earlier period were perfected as mud walls, and in some cases, these were replaced with well-burnt brick walls. The rooms made were bigger and began to be partitioned with verandahs on the front side being provided. The floors were paved with bricks and stones tiles and were used for roofs though thatched roofs also continued to exist. Most of the early historical settlements were connected by well-laid out roads meant for inter- and intra-settlement communications. Another landmark in the history of building technology of the period was drawing water from wells sunk into the ground which were built with bricks sometimes, lined with terracotta rings. These were located very close to the habitations. Concealed and open drains and sewage lines were laid and connected to pits cut into the ground and also lined with terracotta rings. All these aspects denote that town-planning of the period developed along with improvements in building technology.

Surplus in agriculture resulted in the proliferation of various crafts. To house these, workshops were built both in stone and brick. Public utility structures included theatres, stadia, bathing ghats and roads. The present study also corroborates the archaeological evidence of the plans and types of sophisticated buildings with the literary descriptions and sculptural panels of the period. The builders were experts possessing sound knowledge in building technology that they provided built-in space to the people in accordance to their needs. The discussion in this Chapter also aimed at locating the existence of the traditions of building simple structures with naturally available ecofriendly material for which there are no written records. This is one period in early Andhra history when data on these dwellings is available to a considerable extent.

We explained the reasons for the absence of habitation and public utility structures for Period III in terms of the collapse in stable empires, urban decay and decline in trade. We further noted that most of the habitation structures of the period were superimposed by later day occupations in contrast to the surviving examples of the religious structures for the same period. In this regard, therefore, a study of simple housing structures became difficult. Wherever possible the use of literary and inscriptional sources indicated for us the continuing traditions of building technology and materials used for construction. In these circumstances to analyze the level of technology systematically on the basis of extant material evidence was not possible. This lack also raises pertinent questions about the nature of medieval archaeology in India and questions of site definition in this regard since archaeologists have hitherto mainly concentrated on a study of temple sites. Period IV in Andhradesa was characterised by a revival of urban centres and market towns, expansion of agricultural settlements and the unification of minor Kingdoms into a single political unit under the rule of the Kakatiyas. Nonetheless, we only have a solitary example of a public utility structure which was noticed at Motupalli built with bricks with its walls plastered. Post-holes in the structure and the remains of tiles denote that the structure did not show any significant change in technology as observed in the earlier examples. As mentioned above the absence of evidence for common dwellings is marked for this period too and, further, the nature of habitation buildings for this period was heavily dependant on descriptions found in epigraphs and literature.

In Chapter II.2, we have discussed the building technology of the irrigation structures which were financially supported for construction by both the State and private individuals. This support was mainly linked to an improvement in agricultural production. Though the earliest Brahmanical literature provides us considerable information on the terminology and types of the irrigation structures, in Andhradeša we have the extant archaeological remains of man-made irrigation structures from the last phase of Period I only in the form of large tanks as noticed at a good number sites in sub-regions A and B. It was only from Period II onwards that literary and epigraphical sources speak much about these structures in terms of their technical aspects. For sites located on the hills, the people scooped the hill surfaces into cisterns so as to store the rain water. A channel meant for irrigation was excavated at Nagarjunakonda in trapezoidal section much like how present day irrigation canals are being excavated.

A significant achievement made by the technologists in planning tanks on hills by scooping the rock was made in Period III. Here the scooped tank also had a masonary dam besides as underground channel for discharge of excess water using rock-cut technology. This was an advanced technique used to tap the rain water and its durability for future use is marked by the fact that 1t is used even today. In Period IV, large number of lakes with massive earthen bunds designed with spillways resembling the modern dams have been discussed by us. The present study has thus revealed that tanks and dams, often lying between two hills were judiciously located during the Kakatiya period. The literature and epigraphs of the period also mention the criteria for selecting suitable sites for water control systems. The massive dams were built by the financial support rendered by royalty and, on the other hand, minor irrigation works were taken up by the local rulers and wealthy individuals. The study thus explains that most of the people preferred to build medium scale irrigation works in various geographical zones. This should be a lesson for today's engineer because major dams today threaten many ecological areas and cause more damage than benefit.

While studying the building technology of the defence structures in the Chapter on Political Space [III], we have argued that fort making was primarily related to the nature of the State and the political ideology. Infact, these have been built only after the emergence of full-fledged State though we have evidence of people defending settlements by erecting barricades even in pre-State society. Therefore, it was in Periods II and IV that strong states operated their defence mechanism through the forts builts in various material like mud, brick and stone. Most of the forts in Period II were built on the plains. These were circular on plan built in mud which were later perfected by brick revetments.

Though Period III of our study saw political disintegration, some new techniques were evolved among which mention can be made of a rock-cut fort at Gandharikota, forts built in water called Jaladurgas at Divi and Kolleru and finally, forts built of wood called Bōyakottams. The last category of forts were built by a tribe called the Bovas who had controlled some areas around the present day Nellore district. They built their strongholds using simple and primitive technology with wood as building material inspite of its malleable nature. The study also finds that both sophisticated and simple technologies existed side bv side and the availability of resources played a vital role in shaping the defence structures.

In Period IV, as State once again became strong as a result of the political unification of entire Andhradesa, many defence structures were built and the operation of defence mechanisms also became sophisticated. Small sized forts continued to be built by the local Chieftians. The contemporary literature offered valuable information on the importance of the defence structures, their types and how they were to be built. With resources and a strong political ideology of centralization, the building technology of defence structures reached its climax during this period. One can observe these features of development at the Warangal Fort where the fort was built in three concentric circles. The outer most ones were of earthen material and the innermost one was built with stone. The provision of deep moats, guard rooms, gateways, and battlements on the fort wall speak of the defence strategies in medieval times. Thus Period IV can be assessed as a culmination of resources, technology, ideology and management of manpower in making these massive defence structures in Andhradesa.

Chapter IV embodies a discussion on the building technology of various types of funerary structures built in areas outside the habitation called burial space. These are found only in Period I of our study as later burial practices in early India changed considerably. The dead were buried below the ground due to the fact that decomposition of the mortal remains had to take place in the first stage. To commemorate the dead people built structures above the ground. In the earliest examples simple and primitive technology was used in making pit circles. Later these were perfected by filling the cairn around the burial. As the megalithic society, often called a Chiefdom society, became complex certain professional craft groups emerged. Hundreds of stone cutters and dressers, besides ordinary labourers, were put to task in the erection of the huge stones for funerary structures called dolmens, denoting a collective effort and organisation of the personnel. The shapes, sizes and types of funerary structures were largely effected by the geology of the region.

The study in this Chapter emphasizes that the megalithic people were the first to use iron technology and this made it easier for them to extract stone to erect the massive funerary structures. Some of these early techniques of working on rock became part of the collective knowledge that made possible construction of stone monuments particuarly stupas and śilāmandapas in Period II. Infact, it would be appropriate to conclude that many of the traditions that were effectively used to scoop rock and cut hard stone were learnt in megalithic society and perfected in later periods.

In the Chapter on Religious Space [V], the structures which were built for religious purposes have been dealt with under three sections: rock-cut, brick and stone monuments. The study reveals that man used natural caves to live in during the pre- and proto-historic periods. The importance of caves because of their calm and secluded nature soon came to be preferred for religious pursuits. A further increase in the value of these caves for religious recluses led the making of artificial caves by cutting into the rock at several places in Period II. Cutting the rock was initiated during the 3rd-2nd centuries B.C. by the Buddhist patrons to facilitate the monks in offering worship and also for their stay. The followers of Brahmanical sects also excavated some of them in Period III. The rock-cut technology became minimal in Period IV, and was soon discontinued as structural monuments began to be built prolifically in both brick and stone throughout Andhradesa.

We have pointed out in our study [V.1] that rock-cut technology was initially influenced by techniques used in the caves in Bihar and then by those followed in the western Indian examples. Cut-out monoliths were also made for religious purposes. We have also discussed the process of making rock-cut monuments and the probable techniques used based on the evidence coming from some unfinished caves. Rock-cut technology was basically effected by the increase in wealth and availability of a group of experts in cutting the rock and finally, the patronage of the royalty, the local Chiefs and the merchant class. In our opinion, the main reason for developing such permanent structures, even though the technology was difficult, was the experience of the past in which most of the then wooden structures were effected by weather and prone to quick destruction. In the initial stage the rock-cut monuments were excavated in the wood-carvers technique. However, it is significant to note that rock-cut technology co-existed with the continued use of wood for ordinary housing and the use of brick for both simple and monumental structures.

The study of the Brick Monuments [V.2], indicates that during the early phase of Period II, the rock-cut technology gave way to brick technology because of the fact that rock-cut technology was only useful in the hilly areas thus restricting the scope of distribution of religious structures. With the advent of brick technology religious monuments could be built on both the hills and plains. The brick monuments included Buddhist stupas. chaityas. vihāras and Brahmanical temples. Bricks, square, rectangular and wedge shaped were used. The technique of plastering with lime mortar was innovated upon during Period II. Brick technology was in use upto Period IV but on a limited scale when compared to Period II probably because of the problems of their maintenance and their short span of life. The study further revealed that the architects of these structures possessed sound knowledge in structural engineering which included the design of walls according to their load bearing capacity and strength of materials and most of these above techniques are found in use even today.

The major results of our study in Stone technology [V.3] reveal that stone as a building material was used on a large scale in raising the sepulchral monuments during the megalithic phase of Period I. This provided a fund of knowledge for its subsequent development in the early historic period. It was used along with brick in many cases. It was only from Period III onwards that stone became the principal building material and was used to build massive structural religious edifices. The development in quarrying technology and the ideology of building permanent structures led the Kings, Queens, Ministers and certain wealthy individuals to undertake the construction of temples and mandapas. The stone technology was continued in Period IV also and stone monuments were built prolifically in the whole of Andhradesa. During this period, a number of experiments in stone technology such as fine methods of quarrying, improving transportation techniques for carrying monolith members, dressing and joinry methods, and skills in putting up scaffolding for construction

were perfected. Inspite of these developments certain drawbacks have been identified in terms of the selection of stone in certain cases which had minimum load bearing capacity, the sand box foundations below certain temples and the irregular joints in the horizontal layers of certain temple walls. However, we observe in our study that the sthapatis were well-**trained** and taught with traditional science of building various structures right from the selection of site to the erection of temples with proper planning to minimise the expenditure and offer longevity to the structures. All types of stone namely limestone, granite, sand stone, khondalite, shale and basalt were used according to the geological deposits of the various sub-regions. The study also leads us to conclude that the technique of using stone for longevity was best assured in free standing stone built structures and it is proved that most of the structures that have been built in stone are found to be intact whereas the earth, brick and rubble walled structures have partially or totally crumbled. In the recent earthquake that rocked some parts of **Maharashtra** and raised to the ground all recent housing structures, it was found that only a medieval stone made temple was still standing on the ground. It is clear that stone, of all the materials offered more life and withstood the vagaries of nature for several centuries leaving behind monuments which enshrine the human skills **involved** in making them.

In this study we had also made effective use of maps and charts to show distribution of different types of buildings/monuments and the various structural elements that went into constructing them. We now highlight below some of these conclusions which take into account developments across various periods and sub-regions of study. This has enabled us to assess the major technologies related to building materials that were developed across various periods and used on different types of buildings that have been discussed by us in separate chapters above. We have deduced this against the distribution pattern of buildings in their sub-regional context.

A maximum number of habitation buildings were found located in sub-regions A, B and C in Period I. In the subsequent Period II, they were only concentrated in sub-regions A and B. In Period III and IV, was an absence of archaeological evidence on these buildings for all the sub-regions. It is interesting to note that there was no large scale evidence for public utility structures for all periods and sub-regions. There was a solitary evidence of a pathway reported only from sub-region D in Period I. In Period II, there was an increase of such structures which were reported in terms of bathing ghats, roads, rest houses, a stadia and an amphi-theatre but all there were known from sub-region B only. In Period III and IV, public utility structures have been reported from sub-region A and C in the form of mathās and a customs house, respectively. Irrigation structures have been reported from sub-region A in Period I, and Period II. Only a few of them few have been located in other sub-regions. In Period III sub-region D saw a maximum number of irrigation structures whereas in Period IV a few of them were found located in sub-region A, with a maximum number of such structures noticed in sub-region B.

We did not have evidence of defence building during Period I in any sub-region because this period characterized as a pre-state society. In the subsequent period, i.e. Period II, defence buildings were distributed equally in sub-regions A, B and C whereas only a solitary example came from sub-region D. During Period III, sub-regions B and D were distributed with few defence buildings in contrast to their prolific occurrence in the other two sub-regions. These buildings were equally distributed in sub-regions A, B and C in Period IV. Their number however, was less in sub-region D for this period.

The evidence for funerary structures was available to us only for Period I. All types of funerary structures, i.e., pit burials, stone circles, rock-cut, cist burials, dolemns, menhirs, avenues and alignments were found located only in sub-region A, Rock-cut burials, avenues and alignments have been absent in sub-region B, whereas in sub-region C only three types of burials namely, pit burials, stone circles and rock-cut burials have been reported. In sub-region D, pit burials, stone circles, cist burials and dolmens were found located. Rock-cut burials were found located in sub-regions A and C only.

The first and foremost monumental structures discussed by us were the rock-cut monuments which were built in Āndhradeśa from Period II onwards. These monuments were excavated in the form of chaitvas. stupas and viharas prolifically in sub-region C and the best example of this was known from sub-region B. During Period III rock-cut monuments were mainly in the form of Brahmanical temples distributed in sub-regions A, B and C. No rock-cut monument has been reported from sub-region D for all the periods.

Brick monuments were built prolifically in Period II on the plains and hills in sub-regions C and B whereas their number was less in sub-regions A and D. In Period III they have been are found in the form of Brahmanical temples in sub-regions A and B only. In Period IV these monuments were absent in sub-region A and D in while a few of them have been found in sub-regions B and C.

Stone monuments were built in the form of Buddhist and Brahmanical structures from Period II onwards found distributed in sub-regions A, B and C. In Period III these monuments were found in sub-region also. In Period IV, there was a culmination in the building of stone monuments and they were found in almost all the sub-regions. . . ,..

The above distribution of different types of monuments in sub-regions can, in some cases, be suggested on the basis of the availability of raw material used to build them. For example, in Period I, it has been observed that funerary structures, i.e., pit and stone circles were found located in all most all sub-regions, whereas rock-cut burials were found only in sub-region A in the proximity of rocky areas. In the sub-region C because of its sandy, loamy and clay soils funerary monuments such as dolmens, menhirs and avenues were not found as the geology of the area made it impossible to have raw materials for such large structures. Similarly, in Period II, rock-cut monuments have been found located in the regions where natural rock deposits were available.

In Period III it has been observed by us though brick monuments were found in almost all sub-regions, it was only 1n sub-regions A and B that stone was also used along with brick. During this period due to the :oncentration of resources in the hands of local elites they also invested in strneghtening brick monuments. Thus, stone extracted from the nearby quarries was used in those sub-regions where it was locally available. For example, stone monuments have been found prolifically distributed in southern parts of sub-region A, south-western part of sub-region B, northern part of sub-region D as sandstone quarries were found located in these sub-regions. In sub-region C stone monuments were located only in northern part because of the availability of sandstone in that area. In Period IV several of stone quarries became known in almost all the sub-regions. The only use of brick in stone temples of this period was for the <u>śikharas</u> of the temples. Stone was also rampantly used for irrigation structures for lining the inner sides of tank bunds and for sluices and canals in a few cases.

In many other cases different varieties of stone were used in the same sub-region. For instance, it has been noticed that in Period II. Kondalite stone was used for religious buildings in sub-region C only. However, limestone was used to decorate the Buddhist sturctures in all sub-regions, though it was not a local material and had to be transported to distant places from sub-region B. On the other hand, it was noticed that granite stone was preferred for Buddhist monuments in sub-region B particularly for railing and flooring. In Period III, 1t was noticed that granite and sanndstone became common materials for building Brahmanical temples in sub-regions A, B and D since they were available in large quantities. Shale stone was however, used in the southern part of sub-regions A, B and C and the norther part of sub-region D as these areas were rich in its deposits.

The most common building material used over all Periods and for different types of buildings in all sub-regions was mud. It has been observed that mud was invariably used for habitation buildings and irrigation structures in Period I and Period II. It was used in particular for raising walls and laying floors. In the case of monumental buildings it was used to fill the core of the Buddhist structures. Its most continuous use was as a binding material 1n brick structures. This was later replaced by the use of lime. In Period III for instance, mud and lime came to be used together as binding materials for all kinds of buildings like habitations, public utility, defence and religious ones. In Period IV, only lime mortar was used for construction of all types of structures as it was now realized that it offered the greatest durability as a binding material. Brick was another building material prolifically used for all types of habitation, public utility, defence and religious structures in Periods II, III and IV with the exception of defence buildings during Period IV. Though stone was used right from Period I onwards as in the case of its use for funerary structures, its use was more prolific in the case of temples and defence structures during the Periods III and IV. In some cases it was found suitable to raise habitation, public utility, defence, and religious structures in the all the periods.

The change in the use of building material from one media to the other it has been observed by us meant that technological innovations were often being made. For example, frequent repairs of mud floors led to the use of lime for flooring. This was further perfected in lime concrete which the people found more durable and it provided longevity for the structure. The earlier mud stūpas began to be encased with brick and stone to keep the structure intact so that it could withstand the vagaries of time. Similarly, the earlier use of thatched roofs which were prone to leaking during the rainy season had to be innovated upon and leak proof. Therefore, roofing material such as tile were discovered. Tiles began to be used to cover the roofs of habitation and rligious building from Period II to IV. The case of perfecting floorings was similar and the earlier use of mud and lime for floors was innovated upon to make better floorings by paving them with brick and stone. Not all materials were found in a natural state. A knowledge of combining several raw material was also needed. This was particularly needed for making bricks. A proper mixing of mud with various ingredients had to be perfected. In some areas the mud was gritty, hence fine bricks could not be made. Therefore, the technology of brick making gradually evolved. Similarly, rock-cut technology was preferred in the areas where soft rock was available. However, cutting of stone was ultimately mastered in almost all varieties and used according to its availability.

The study also revealed that there was a co-existence of various technologies applied to building different types of structures across various periods. Though the earlier techniques were simple, they survived for a long time as they were techniques and new innovations were made in them from time to time. For example, though brick had been invented mud walls continued to be used and even today they are used because they provide a cool environment for living purposes in a hot climate. Similarly, even though the technology to make large irrigation structures was known 1n society small irrigation structures in the form of reservoirs and dams built exclusively using simpler and more feasible techniques were preferred. Hence, even today the small check dams are still in operation at various places. Some of these time tested techniques have survived not only because they were found useful by society but also because they defied centralization. In other words, local communities werre able to decide on the use and execution of these simple technologies. Scholars tend to suggest that this implies no change in society and technology. On the contrary, we would like to emphasize that there was a co-existence of simple and sophisticated technologies. Infact, there was an increase in the knowledge of making sophisticated tools over a span of time and this resulted in offering better plans and building materials which furthered the existing fund of knowledge in building technology. This was clearly apparent in terms of the multiplicity of skills known to the people of early Andhradesa. The technology at the end disposal of the common people who used it for their every day living co-existed with sophsiticated technology used to make monumental buildings which were built by elites and wealthy people.

In our last chapter of study we discussed the relationship of men involved in building various structurres and their skills in terms of their organization, patronage and training. Though they were organized into guilds or craft organizations their talents and they were allowed to be creative. Contrary to existing generalizations inscriptional data showed that individual talents were recognized and they were given suitable positions in the royal service. Most buildings right from early historical times to medieval times did not contain the names of the architects or engineers who built them. In our case study of Andhradesa we have a few instances of the names of the architects who were credited with the sthapatis job they did. Thus for instance, we are told that Bhiravakonda rock-cut caves in sub-region B of our study were excavated by two śilpins. namely, Kuruvadi Acharlu and Velugunta Acharlu in a label inscription found

engraved on **the walls of these caves. It was further** noted by us that these specialized social groups **were** supported by society as a whole and received donations in the form land grants from different sections in society. They were usually trained in the family skills over generations and therefore, there was a concentration of this knowledge in the hands of a relatively few professional experts. Thus the evolution of building technology had a lot to do with how this knowledge was conserved and transmitted orally and practically over generations. Infact, it can be suggested that the fund of knowledge that accrued from generation to generation enabled the technology to remain dynamic. Most of the buildings described by us had a functional and practical efficacy which gradually evolved over time. However, it must be concluded that though the ṡilpins and sthapatis were technologists, they were also given training in art and aesthetics which had strong roots in a metaphisical value system that enabled them to have a stable perspective in which to develop their skills.

Thus it can be concluded that our study basically looked at the collective contributions made to the evolution of building, technology of India's past. The particular case study of Andhradesa highlighted this at a micro level. We have argued that though this can be described from the available written traditions, the built-in spaces that have survived in the archaeological record offer far more specific information on the subject. This interestingly highlights the continuity of certain technical skills while underlining that changes also took place. The rich written sources can only be used to corroborate the building technology of monumental structures. An important contribution of our study was to identify those **aspects** of simple technology used in the construction of ordinary **structures** which form a valuable part of our collective technological knowledge that is hardly written down in texts. This could only be gone into by not neglecting the partial and fragmentary pieces of archaeological information especially those that were found in the proto- and early-historic context. In this regard our study has revealed that medieval archaeology not only within Andhradesa, but in India as a whole has neglected undertaking work on site excavations other than those where major temples are located. We were further able to move away from understanding aspects of building technology only in terms of the contributions made by political and religious elites as we did not argue within a pattern of narration confined by dynastic or sectarian history. Though some of the buildings do reflect religious creeds, they more emphatically and explicitly reflect skills that went into making them, and in turn, are clothed with the contemporary social ethos and environ in which they stood.

Indian material evidence is used, often in fragments, to explain orderly achievements of an ancient civilization. We would like to submit that our attempt at a descriptive and historical account of the evolution of building technology cannot be explained by being excerpted out of the total context. Infact, we hope that this study will enable future scholars to more fully reconstruct and understand this context whose significance at present is often marred by us merely treating its manifestations as archaeological and historical sources of information.

BIBLIOGRAPHY

BIBLIOGRAPHY

I. BOOKS IN INDIAN LANGUAGES

(a) Sanskrit

Adharvaveda. V.1.11-376.

Aitareyabrāhmana. V.11.8.

Amarakoša. Sivadata (ed), Bombay, 1915.

Anargharāghava. Act V.11.133.

Arthaśāstra. Bk.II.120; III.18; IV.1.65, 2.8.

Aṣṭādhyāyi, Ch.II. 1-129; IV.2-31; VI.2-34.

Aśwalāyaṇa Gṛhyasūtra, Bk.I, 12-13.

Atharvaveda. Whitney's (tr), Cambridge, 1905.

Baudhāyana Pitrmedha Sutra. III.1.4.18.

Bhagavata Purāna. V.19, 51.17.

Bhavishyapurāna. Ch. CXXX, 45-46; XXXI, 33.

Brhatsaṁhita. LII, 90-92; LV.2.

Chāndōgyōpanisad. 5.1.1.

Charakasaṁhita. Indriyasthana, 29.

Daśakumāra Charitra. III.9.

Kamasutra. 1.4.4.

Kāmasūtram With Jayamangala Vyakhyana. Banaras, 1929.

Mahabharata. Sabhaparva, II.37.73.

Manusmrthi. VIII.70 and 75-76.

Markandeva Purana. X.50; LVII. 48-49.

Matsya Purāna. Ch.V. 11.54-6.

Naradasmrti. XI, 18-20.

Ramayana Kishkindhakanda, IV.41.

Rg Veda. X.72.2; XVIII.11-13.

Rg Veda Saṁhita. Bhattacharya, S.S. (tr), Aunda, Satara, 1912.

Sankhyavana Srautasutra. XV.

Satapatha Brahmana. VI.1.2.2-9; XIII.8; XIV, 9.9.33.

Siddhodvaha of Nrsiṁha. P.V.P.Sastry (ed.), Hyderabad, 1968.

Sūkthimukthāvali of Jalhana. G.O.S.No. LXXXII, Baroda, 1938.

TaittirTya Brahmana. 118-96.

Taittirīya Saṁhita. 1.2.2.1; VI.2.9.4.

Vātsyāyana's Kāmasūtra. Adhinārāyaṇa, T.P. (ed.), Madras, 1966.

(b). Pali and Prakrit

Anguttara Nikaya. IV, 101, 106, 107.

'Cullavagga', Horner, I.B. (tr), SBB, Vol. XX, London, 1952, p.204, 241.

Dīgha Nikaya, 1.51; 1.61; II.46.

Gāthāsaptaśati. 490.

Jataka. Vols. I-VI, Cowell, E.B. (ed.), London.

Mahāvagga. I.22.18.

Mahāvaṁśa. Gieger, T.W. (tr), London, 1960, Ch. 19.18-28; 30.12-13.

Mahāvāstu. Jones, J.J. (tr), Vol. III, London, 1949-56.

Majjima Nikaya. 1-85.

Miliṅdapanha. 62, 330, 331.

Samyutta Nikāya. II.182.

Suttanipāta. V.1019.

Vinaya Piṭaka, 3.43.

Visuddhimagga. 354.

(C) Telugu Works

Laxmi Ranjanam, K. (ed.), Siddhesvara Charitra. Hyderabad, 1969.

– Pratapa Charitra. Tanuku, 1969.

Sastry, Prabhakara, V. (ed.), Krīdābhirāmam. Hyderabad, 1960.

Sastry, P.V.P., Kakatiya Sasana Sāhityam. Hyderabad, 1981.

Surayya and Gopalakrishanaiah (eds.), Ketana's Andhrabhāshābhūshanam. Tenali, 1953.

(D) Silpa Texts.

Aparājita Prchcha. Baroda, 1956.

Īśāna SivaqurudevaDaddhati. I.667-70; III, Ch.XXVI, 40-41.

Kāsyapaśilpa. IV.19.

Manasāra. Ch.I.

Marīchi Saṁhita. Raghunatha Bhattacharya (ed.), Madras, 1927, Ch.6.

Mayamata. Bruno Dagens (ed.), Pondicherry, 1971.

Prāsādamañjari. Sompura, P.O. (ed.), Palitana, 1965.

Samarāngana Sutradhara of Bhōja. Agrawala, V.S. (ed.), Baroda, 1966.

Silparatna. Ch. XIV, 58-75; Ch. XXIX.

Tantra Samuchchaya. Mallayya, N. (ed.), Trivendrum, 1958.

Vāstuvidya. I.12-15.

Viswakarma Vastu Sastra. Ganapathi Sastry, T. (ed.), Tanjore, 1958.

II. INSCRIPTIONS AND COINS.

Allan, J., Catalogue of Coins of Ancient India, London, 1936.

Butterworth, A. and Chetty, V.V., A Collection of the Inscriptions Copper Plates and Stones in thg Nellore District. Part I, 1990 (Reprint).

Eswara Dutt, K., Inscriptional Glossary of A.P.. Hyderabad, 1962.

Ramesan, N., Copper Plate Inscriptions of Andhra Pradesh Government Museum. Vol. I, Hyderabad, 1962.

Krishna Sastry, V.V., Roman Gold Coins : Recent Discoveries in Andhra Pradesh. Hyderabad, 1992.

Sankaranarayana, S., 'Two Vishnukundin Charters from Tummalagudem', EA, Vol.11, pp.4-20.

Sarma, I.K., 'Some More Inscriptions from Amaravati Excavations and the Chronology of the Mahastupa', JESI. No.1, Mysore, 1974, pp.60-74.

– Coinage of the Sātavāhana Empire. Delhi, 1980.

Sastry, B.N., Mukhalingam Devālaya Charitra Sāsanamulu. Hyderabad, 1985.

Sastry, P.V.P., 'Coins of Simuka Satavahana Discovered', APJA. Vol. I, pt.1, p.15.

– Inscriptions of Andhra Pradesh. Karimnagar District. Hyderabad, 1974.

– Select Inscriptions of A.P.. Hyderabad, 1977.

-- Inscriptions of Andhra Pradesh. Nalgonda District. Hyderabad, 1993.

Senart, A., 'The Inscriptions of the Caves at Karle', EI, Vol. VIII, p.66.

Sewell, R., Historical Inscrptions of South India. Madras, 1872.

Sircar, D.C., Indian Epigraphical Glossary. Delhi, 1966.

– Select Inscrptions. Vol. I, Calcutta, 1970.

Subrahmanyam, R., The Guntupalli Brahmi Inscription of Khāravela. Hyderabad, 1968.

Subrahmanyam, T.N., 'Two Tamil Inscriptions of Kulothunga Chola I from Draksharamam', EA, Vol.1, pp.15-30.

Sundaram, K. and Mastanaiah, B., 'Ayyangaripalem Stone Inscription of Kalagarābharaṇa', EA, Vol. V, p.33.

Venkata Ramanayya, N. (ed.), Report on Epigraphy for 1965. Hyderabad, 1968.

– 'The Kurkyala Inscrption of Jina Vallabha', EA, Vol. II, p.25.

III. ARCHAEOLOGICAL REPORTS

Allchin, F.R., Pikhlihal Excavations. Hyderabad, 1960.

– Utnoor Excavations. Hyderabad, 1961.

Dhawalikar, M.K, Sankalia, H.D. and Ansari, Z.D., Excavations at Inamgoan. Vol.1, pt.1, Pune, 1988.

Ghosh, N.C., Satanikota Excavations: 1977-80. Delhi, 1986.

Khan, A.W., A Monograph on Yeleswaram Excavations. Hyderabad, 1963.

Khureishi, M.H., 'Trial Excavations of Alluru, Gummadidurru and Nagarjunakonda', ASIAR: 1926-27. pp.5-10.

Krishnam Raju, G. , 'Excavations at Belum Caves', ARAP. 1982-83, p.15.

Krishna Sastry, V.V., Subrahmanyam, B. and Ramakrishna Rao, N., Thotlakonda (A Buddhist site in Andhra Pradesh), Hyderabad, 1992.

Longhurst, A.H., 'Excavations at Nagarjunakonda', ASIAR: 1927-28. 1931, pp.43-121; 1928-29, 1933, pp.110-104; 1929-30, 1935, pp.144-151.

— 'The Buddhist Monuments at Guntupalli in Krishna District', ARASI. (Southern Circle), 1916-17, Madras, pp.30-36.

Nigam, M.L., Excavation Report of Two Megalithic Burials at Hashmathpet, Hyderabad. Hyderabad, 1978.

Prasad, N.R.V., 'Excavations at Chagatur', ARAP. 1978-79,

-- 'Excavations at Kandi', ARAP. 1982-83, p.11.

— Bavikonda A Buddhist Site in North Coastal Andhra. Hyderabad, 1994.

Ramachandran, T.N., 'Nagarjunakonda; MASI. No.71, Delhi, 1953, pp.4-6.

Ramachandraiah, O. and Subrahmanyam, B.R., 'Jami', JAHRS. Vol.XXXV, 1975-76, Hyderabad, 1976, p.373.

Ramachandra Murthy, N.S., 'Excavations at Nandaluru', Dept. of Archaeology and Museum, Hyderabad, 1981 (Unpublished Report).

Ramakrishna Rao, N., 'Explorations around Gandhian kota', ARAP. 1990-91, (Cyclostyled), pp.11-16.

Rea, A., 'Excavations of Amaravati', ASIAR: 1905-06. 1909, pp.116-119.

— 'Buried Jaina Remains at Danavulapadu; ASIAR: 1905-06. pp.120-127.

— 'Ancient Village Site at Peddamudiyam' ASIAR: 1905-06. pp.128-130.

'A Buddhist Monastery on Ramathirtham Hills, Vizagapatnam District', ASIAR: 1910-11. pp.70-80.

Sastry, T.V.G., Brief Results of the Excavations at Veerapuram. Hyderabad, 1981.

~ Veerapuram - A Type Site in Krishna Valley. Hyderabad, 1984.

— Excavations at Vaddamanu in Krishna Vallev. Hyderabad, 1954.

Seshadri, M., Excavations at T.Narsipur. Mysore, 1971.

Subrahmanyam, B., 'Excavations at Majeru in Krishna District', ARAP. 1992-93 (Cyclostyled), pp.11-15.

— 'A Report on the Excavations at Dantapura', Department of Archaeology of Museums, Hyderabad, 1993, p.2 (Typed).

Subrahmanyam, B.R., 'Excavations at Gandlur', ARAP. 1982-83, Hyderabad, 1985, p.45.

Subrahmanyam, R., Salihundam : A Buddhist Site in Andhra Pradesh. Hyderabad, 1964.

Wheeler, R.E.M., 'Brahmagiri and Chandravalli', Al, no.4, 1947-48, pp.180-310.

— 'Harappa-1946: Defence and Cemetary', Al, No.3, 1949, pp.61-74.

Yazdani, G., 'Excavations at Kondapur (c. 250 B.C.-250 A.D.)', ABORI. Vol. XXII, 1941, pp. 171-185.

IV. DICTIONARIES. CENSUS REPORTS. GAZETTERS AND ENCYCLOPAEDAE

Acharya, P.K., An Encyclopaedia of Hindu Architecture. Manasara Series, Vol. VII, London, 1946.

— A Dictionary of Hindu Architecture. Delhi, 1979 (Reprint).

Census of India. Vol.IX, Madras, Part VII. A-V, (Handicrafts and Artisans of Madras State), Madras, 1964, pp.47-64, Appendix-Ill, Statements of Prominent Sthapathis.

Encyclopaedia Britannica. Vol.3, p.452.

The Geographical Encyclopaedia of Ancient and Medieval India. Varanasi, 1967.

Grierson, G.A., Sir, Linguistic Survey of India. Vol.IV, Delhi, 1967, (Reprint from the Ist edition, 1903).

Ghosh, A. (ed.), Encyclopedia of Indian Archaeology. Vol. I, Delhi, 1989.

Hawkins, M., Jyoce, The Oxford Large Print Dictionary (Based on the Oxford Paperback Dictionary, Third Edition), Oxford, 1989, p.733.

International Encyclopaedia of the Social Sciences. Vols. 15-17, New York, 1972. p.572.

Miester, M.W. and Dhaky, M.A., (eds.), Encyclopaedia of Indian Temple, Architecture. Varanasi, 1986.

Monier-Williams, M., Sanskrit-English Dictionary. Oxford (First Edition, Oxford, 1899) Indian Reprint, Madras, 1987.

Report on the States Reorganisation Commission. 1955.

Upasak, C.S., Dictionary of Early Buddhist Monastic Terms. Varanasi, 1975.

V. **BOOKS AND ARTICLES**

Acharya, P.K., Indian Architecture. Allahabad, 1927, (First edn.) Patna, 1979 (Reprint).

— Architecture of Mānasāra. Manasara Series, Vol. IV, (2nd edn.), Delhi, 1980.

Agrawala, V.S., India As Known to Pānini. Varanasi, 1933

— Studies in Indian Art. Varanasi, 1933,

Ahmed, K.M., 'Preliminary Excavations at Pre-historic Site Near Janampet', ARADN. 1940-41,p.13.

— Phanigiri Boudhārāma Sidhilālu. (Telugu), Hyderabad, 1950.

Ali, Yaqub, Hayathi - Usmani. Hyderabad, 1936.

Allchin, F.R., Neolithic Cattle Keepers of South India. Cambridge, 1963.

Allchins, B.& R., The Rise of Civilization in India and Pakistan. Delhi, 1983.

Andrzejeuski, S., Military Organisation and Society. London, 1954.

Anuradha, V., 'Temple as a Social Service Organisation in Medieval India', PAPHC. 3rd Session, Vijayawada, 1978, p.55.

Ayyar, K.R.V.R., 'Medieval Trade, Craft and Merchant Guilds in South India', JIH, Vol XXV, 1947, pts. 1-3, p.277.

Banerji, N.R., Iron Age in India. Delhi, 1969.

Barret, D., Sculpture from Amaravati in British Museum. London, 1954.

Barua, B., Barhut. Vol.III, Calcutta, 1937.

Beal, S., Buddhist Records of fcn£ Western World. Delhi, (2nd Edn.), 1983.

Begley, Vimala, 'From Iron Age to Early Historical in South Indian Archaeology', in Jerome Jacobson (ed.), Studies in the Archaeology of India and Pakistan. New Delhi, 1986, p.301.

Behera, K.S., 'Palm-leaf Manuscript on the Architecture of Konark Temple', ABORI Vol.LVII, pts. I-IV, pp.176-180.

Beker, A.R.H. and Mark Billinge (eds.), Period and Place. Research Method in Historical Geography, Cambridge University Press, Cambridge, 1982.

Betai, R.S., A Reconstruction of the Original Interpretation of the Manusmrti. Ahmedabad, 1970.

Bhandarkar, R.G., The Age of Imperial Unity. Vol. II, Bombay, 1965.

Bhattacharya, K.K., 'Conditions of the Emergence of Architecture', in B.M.Pande and B.D.Chattapadhyaya (eds.), Archaeology and History. Vol.1, Delhi, 1987, pp.11-17.

Bhattacharya, S., 'Land, Soil, Railfall Irrigation in Artha Sastra of Kautilya', IESHR. 1978, p.217.

Boner, A. and Sharma, S.R., New Light on Sun Temple of Konark. Delhi, 1972.

Brahmachary,P., 'Srirājeśwarālayam Bandarameśwarapalli', Saptagiri. Vol. 21, no.7, 1990, p.11.

Brandes, F., On History (tr. Sarah Matheus), Chicago, 1980.

Bride Surgeon General, 'Archaeology', JRAS. Vol. XXI, 1887, p.694.

Brown Percy, Indian Architecture (Buddhist and Hindu Periods), Vol.1, Bombay, 1948.

Buhler, G. (tr.), 'The Laws of Manu', SBE, Vol.XXV, Oxford, 1986 (Reprint),

Burgess, J., Notes on Amaravati Stupa. Madras, 1882.

– The Buddhist Stupas of Amaravati and Jaggayyapeta. London, 1887.

Butcher, Karl, W., Environment and Archaeology. Chicago, 1974.

Campbell, C., Specimens of Languages of India including those of aboriginal tribes of Bengal. the Central Provinces and the Eastern Frontier. 1874.

Campbell, G.B., Human Kind Emerging. Bostal, 1982.

Carr, E.H., What is History ?. Penguin Books, 1964 (Reprint edn. 1985).

Chakravarti, D.K., 'Ideas and Discoveries in Indian Archaeology : Till the Middle of the Nineteenth Century', IHR, Vol.V, no.1-2, 1978-79, p.96.

-- 'The Beginning of Iron in India', Antiquity. Vol.L, 1976, pp.114-124.

– A History of Indian Archaeology. Delhi, 1988

Chakravarti, M.H., 'Madala Panji', JASB. Vol.IV, no.2, NS, p.322, Appendix.

Chalam, K.V., 'The Temples of Kusumanchi', Itihas. Vol.XI, no.1, Hyderabad, 1983, pp.119-128.

Champakalakshmi, R., 'Growth of Urban Centres in South India: Kudamukkupalaiyarai, the Twin City of the Cholas', SIH, Vol.21, 1979, pp.1-29.

-- 'The Drāvida Style of Architecture: A Historical Perspective', Indian Horizons. Vol. XXXI, no.2, 1982, p.7.

– 'Urbanisation in Medieval Tamil Nadu', in S.Bhattacharya, and R.Thapar (eds.), Situating Indian History. Delhi, 1986, pp.34-76.

– 'Urbanisation in South India: The Role of Ideology and Polity', Presidential address, IHC, reprint, 47th Session, Srinagar, 1987, pp.27-44.

'Urban Process in Early Medieval Tamil Nadu', Occassional Paper Series no. 3, Urban History Association of India, Amritsar, 1990, pp.1-17.

Chandramouli, V., A Study of Microlithic Culture and Rock Paintings at Kethavaram. Kurnool District. M.Phil dissertation (Unpublished), University of Hyderabad, Hyderabad, 1986.

Chandra Reddy, G., 'Rock-cut Buddhist Monuments of Karukonda', PAPHC. Vol.12, 1988, pp.46-49.

Chattopadhyaya, B.D., Coins and Currency System in South India. A.D. 225-1300, Delhi, 1977.

'Urban Centres in Early Medieval India: An Over View', in S.Bhattacharya and Romila Thaper (eds.), Situating Indian History. Delhi, 1986, pp.8-33.

– 'Transition to the Early Historical Phase in the Deccan : A Note' in B.M.Pande and B.D.Chattopadhyaya (eds.), Archaeology and History. Vol.11, Delhi, 1987, pp.727-732.

– The Making of Early Medieval India. Delhi, 1993.

Chattopadhyaya, D., History of Science and Technology in Ancient India. Calcutta, 1986.

Childe, V.G., 'Megaliths', Al, Vol. 4, 1947, p.5; Man Makes Himself. New York, 1951.

~ What Happend in History 2, (Reprint edn.), 1967.

Classen, J. and Skalnik, P. (eds.), The Early State: Theories and Hypothesis. The Hague, 1981.

Colas, G., 'Some Remarks about the Construction of Temple according to Marfchfsamhita', SVUOJ, Vol.XXI-XXII, pts.1-4, pp.43-50.

Coomaraswamy, A.K., 'Indian Architectural Terms', JAOS, Vol.XLVIII, 1928.

— 'Symbolism of Dome', IHQ, Vol.XIV, 1938, pp.1-56.

-- La Sculpture de Barhut, pl.XXVI, fig.67.

Cranstone, B.A.L., 'Environment and Choice in Dwelling and Settlement : An Ethnographical Survey', in Peter J. Ucko, Ruth Tringham and Dimbleby (eds.), Man Settlement and Urbanism, London, 1972, p.487.

Dagens, Bruno, Entre Alampur et Srisailam, Pondicherry, 1984, Tomes I and II.

Dasarathi, S., 'Numismatic References in Nannaya's Mahabharata', PAPHC, 10th Session, Guntur, 1986, p.177.

Datta Sanjukta, 'A Note on Udakabandha', PIHC, 53rd Session, Warangal, 1992-93, pp.676-679.

Davids, T.Rhys, 'Buddhist-suttas', SBE, Vol. XV, p.93.

Davids, T.Rhys and Bushells (eds.),On Yuan Chwang's Travels in India, Vol. I, London, 1904-05.

Davids, T.Rhys and S.Zan Aung, The Points of Controversy. Oxford, 1915.

Davids, T.Rhys, Buddhist India. London.

De Gregory, Thomas R., A Theory of Technology. Ames, Iowa, 1985.

Dehejia, V., Rock-cut Temples of India. London, 1985.

-- Looking Again at Indian Art. Delhi, 1978.

Denicke, D., 'Applied Historical Geography and Geographies of the Past: Historico-Geographical Change and Regional Process in History', in Beker A.R.H., and Billinge, M., (eds.), Period and Place. Research Method in Historical Geography, Cambridge, 1982, pp.

Deo, S.B., Problems of South India Megaliths. Dharwar, 1973.

'Some Aspects of Megalithic Technology[1], in Madhu: Recent Researches in Indian Archaeology and Art History. (M.N.Deshpande Festscrieft), Delhi, 1981, p.33.

Desai, P.B., Jainism in South India. Appendix B, no.47, pp. 37-75.

Deshpande, M.N., 'The Rock-cut Caves of Pitalkhora in the Deccan', AI, no.15, pp. 66-93.

Dhavalikar, M.K., 'A Plough Coulter from Brahmagiri, India', Antiquity. Vol. XLII, 1968, pp. 137-138.

Cultural Ecology of the Chalcolithic Maharashtra', in S.B.Deo and K.Paddayya (eds.), Recent Advances in Indian Archaeology. Poona, 1985, p.141.

Digby Simon and Harle, J.C., 'When Did the Sun Temple Fall Down', SAS. Vol.1, 1987, pp.1-17.

Dikshitar, V.R.R., 'Dasabandha', JIH, Vol.III, 1934, p.174.

Dubreuil, J., Dravidian Architecture. Madras, 1917.

Dutt, B.B.. Town Planning in Ancient India. Delhi, 1977.

Dutt, N., Early Monastic Buddhism. Calcutta, 1941.

Elliot David and Elliot Ruth, The Control of Technology. London, 1976.

Eswaradutt, K., Historical Geography of Ancient Andhra. Hyderabad, 1962.

Farrington, I.S., 'The Archaeology of Irrigation Canals with Special reference to Peru', WA, Vol. II, no.3, p.287.

Firth, R., 'Mori Hill Forts', Antiquity. Vol. I, p.68.

Firtz, John M., Michell, G. and Nagaraja Rao, M.S., Royal Centre at Vijayanagaram Preliminary Report. Melbourne, 1984.

Flannery, Kant, V., 'The Origins of the Village as a Settlement Type in Meso-America and the near-East : A Comparative Study', in Peter J.Ucko, et al (eds.), Man Settlement and Urbanism. London, 1972, pp. 23-53.

Frank Perlin, 'The Material and the Cultural: An Attempt to Transcend the Present Impasse', MAS, Vol. 22,(2), 1988, pp.383-416.

Fraser, D., Village Planning in the Primitive World. London, 1968.

Fried, M.H., 'Warfare, Military Organisation and Evolution of Society', Anthropologica, 3, pp.134-147.

– Evolution of Political Society. New York, 1967.

Ganapati Sthapati, V. (ed.), Vāstupurusha. Vol.3, October, 1993, p.6.

– Synthesis of Science and Spirituality in Vastu Śilpa Tradition. Madras, 1993.

Ganguly, D.C., The Eastern Chalukyas of Vengi. Calcutta, 1960.

Geoffery Scott, The Architecture of the Humanism. London, 1961.

Ghosh, A., The City in Early Historic India. Simla, 1973.

— 'The Architectural and Artistic Heritage of India', in S.K.Maity and Upendra Thakur (eds.), Indological Studies. (Prof. D.C.Sircar Commemoration Volume), Delhi, 1987, pp.125-130.

Ghosh, Binoy, Primitive Indian Architecture. Calcutta, 1953.

Gieger, W., Culture Cylon in Medieval Times. London, 1960.

Gilbert, E.W., 'Geography and Regionalism', in Taylor Griffith (ed.), Geography in the Twentieth Century. London, 1953.

Gill, T.G., 'Architectural Expressions', in A.P.Kanvinde (ed.), Seminar on Architecture. Delhi, 1959, p.28.

Goldschmidt, W., Han's Way: A Prepare to the Understanding of Human Society. New York, 1967.

Gopalachary, K., The Early History of the Andhra Country. Madras, 1976.

Gopala Krishna Murthy, S., The Sculpture of the Kakatiyas. Hyderabad, 1964.

Gopala Reddy, Y., 'Ghanpur Group of Temples', JAHRS, Vol.XXIX, pp.27-29.

— 'Agriculture under the Kakatiyas', Itihas. Vol.1, no.1, 1973, pp. 59-62.

-- 'Madanikas of Palampet', JOI, Vol.XXIII, no.3, March, 1974, pp.219-230.

— The Ghanpur Group of Temples. Hyderabad, 1985.

— 'The Territorial Division of Kakatiyan Age', JAHRS. Vol.XXXV, 1987, p.397.

— 'Salient Feature of the Kakatiyan Style of Architecture', in V.V.Krishna Sastry (ed.), Archaeology af Andhra Pradesh. Hyderabad, 1987, p.45.

— 'The Asanapattis in Kakatiya Temples', in D.Handa (ed.), Ajayaśri (Ajaya Mitra Sastry Felicitation Volume). Vol.1, Delhi, 1989.

— A Comprehensive History of Andhra. Hyderabad, 1990.

Guha, J.P., India in Seventeenth Century. New Delhi, 1976.

Gunnel, G.J., 'The Technocratic Stage and the Theory of Technology', Technology and Culture. Vol.23, 1982, p.327.

Gupta, S.P., The Roots of Indian Art. Delhi, 1981.

Gurumurthy, A., Cuddapah District Temples. Madras, 1989.

Gururaja Rao, B.K., 'Socio-Economic Life in Proto-historic Karnataka', in A.V.N.Murthy and B.K.Gururaja Rao (eds.), Rangavalli: Recent Researches in Indology, (S.R.Rao Felicitation Volume), Delhi, 1983, pp.59-62.

Gyan Prakash, 'Post Orientalist Histories of the Third World: Perspectives from Indian Historiography', CSSH. Vol.32, no.2, 1990, pp.356-387.

Haimendorf, C.V.N., Chenchus Aboriginal Tribes of Hyderabad. London, 1942.

Hall, K.R., Trade and State Craft in the Age of Cholas. Delhi, 1980.

Hanumantha Rao, B.S.L., 'Sources of Andhra History', in S.P.Sen (ed.), Sources of History of India. Vol.1, Calcutta, 1978.

-- 'The Boyas in Medieval Andhra History', JAHRS. Vol.XXXVIII, pt.IV, Hyderabad, 1987, pp.77-92.

— 'Formation of Social Groups in Andhra', PAPHC, 13th Session, Srisailam, 1989, p.9.

— Religion in Andhra. Hyderabad, 1993, (Reprint).

Hawkins, Gerald, S., Stone Henge Decoded. Fontana, 1972.

Hawkes, J., and Woolley, L. (eds.), History of Mankind. Vol.1, pt.1, UNESCO Series, 1960.

Hazra, R.C., Studies in the Puranic Records. Delhi, 1975.

Hendry, A.W., Load Bearing Brick Work Design. Chinchester, 1987.

Henig, R.M., 'Where Surgery Meets the Souls', The Washington Post Book World. Vol.13, no.16, 1983.

Heitzman, J., 'Ritual Polity and Economy: The Transactional Network of an Imperial Temple in Medieval South India', JESHO. Vol.XXXIV, 1991, pp.25-26.

— 'State Formation in South India, 850-1280', IESHR. Vol.XXIV, no.1, 1987, p.59.

'Early Buddhism Trade and Empire', in Studies in Archaeology and Palaeoanthropology of South Asia. AIIS, 1984.

Horner, I.B. (tr.), Book of Discipline. (Vinaya Pitaka, 5 Volumes), London, 1959-69.

Hunt, E.H., 'Hyderabad Cairn Burials and their Significance', JRAI. Vol.54, 1924, p.140-156.

– 'Hyderabad Cairns and their Significance', JRAI. Vol.24, p.140.

Hutton, J.H., 'Nagachank Cornaments of South Indian Affinities', Man. Vol.XXVI, 1926, p.223.

Hymavathi, R., 'Medical Facilities under the Kakatiyas', S.N.Rao, (ed.), The Cultural Heritage of the Kakatiyas. Warangal, 1993, p.77.

Indu Inderjit, Science fif Symbols. New Delhi, 1977.

Ingholt, H., Gandhara Art in Pakistan. New York, 1957.

Irwin, John, 'The Axial Symbolism of the Early Stupa an Exegesis', in A.L.Dallapiccola (ed.), The Stupa its - Religious. Historical and Architectural Significance. Wiesbaden, 1980, pp.12-28.

Jain, Jyothindra, 'Parallel Structures', in Kapila Vastyayan (ed.), Concepts of Space Ancient and Modern. Delhi, 1991, p.341.

Jawaharlal, G., 'Aggalayya: The Great Royal Physician of 10th Century A.D.', PAPHC. 16th Session, Karimnagar, 1992, p.59.

– Jainism in Andhradesa (as Depicted in Epigraphs), Hyderabad, 1994.

Jha, D.N., 'Temples as Landed Magnets in Early South India (c. A.D. 700-1300)', in R.S.Sharma and V.Jha, (eds.), Indian Society: Historical Probings. Delhi, 1974, pp.202-216.

Jitendra Das, N., The Buddhist Architecture in Andhradeśa. Delhi, 1993, pl.XXI.

Joshi, V.H., 'Ancient Indian Foundation Engineering for Monuments', in Indian Geotechnical Conference. Vol.1, Roorkee, 1985, pp.529-593.

Kali, O.C., The Cave Temples of India, London, 1971.

Kanaka Durga, P.S., 'Inter-State Trade during the Kakatiya Period (A.D. 1000-1300)', QJMS. Vol.LXXVII, pp.17-31.

Kane, P.V., History of Dharmasastras. Vol.VI, Poona, 1953.

Kaw, R.N., 'The Neolithic Cultures of Kashmir', in D.P.Agrawala and D.K.Chakravarthi (eds.), Essays in Indian Protohistory. Delhi, 1979, pp.219-228.

Keis, G., 'Archaeological Finds', JHGS. Vol.11, pt.I, 1934, pp.12, 36, 76-82.

Kesarawani, A., 'Harappan Gateways: A Functional Reassessment', in B.B.Lal and S.P.Gupta (eds.), Frontiers of the Indus Civilization. Delhi, 1984, pp.63-73.

Khan, A.W., A Monograph on the Early Buddhist Stupa at Kesanapalli. Hyderabad, 1964.

Khanna, Madhu, 'Art and Meditation', in B.N.Saraswati, S.C.Mallik and Madhu Khanna (eds.), Art - the Integral Vision (A Volume of Essays in Felicitation of Kapila Vatsyayan), Delhi, 1992, p.136.

Knudson, S.J., Culture in Retrospect. Chicago, 1978.

Kramrisch, S. , The Hindu Temple. 2 Vols., Calcutta, 1946.

'Space in Indian Cosmogony in Architecture', in Kapila Vatsyayan (ed.), Concepts of Space Ancient and Modern. Delhi, 1991.

Krishna Kumari, M., 'An Analysis of the Political Structure in Medieval Andhra Kingdoms', PAPHC. 12th Session, Anakapalle, 1988, p.75.

Krishna Murari, K., The Chālukyas of Kalyāna. Delhi, 1977.

— Mirrors of Indian Culture. Delhi, 1982.

— Early Indian Secular Architecture. Delhi, 1987.

— 'Early Recreational Architecture', in A.V.N.Murthy and I.K.Sarma (eds.), Rāmachandrika. (Prof. O.Ramachandraiya Festschrift), Vol.11, Delhi, 1993, pp.257-262.

Krishna Prasad Babu, J., 'Social and Economic Change (A.D. 400-700)', in Aloka Parasher-Sen (ed.), Social and Economic History of the Deccan - Some Interpretations. Delhi, 1993.

Krishna Rao, B.V., History of the Eastern Chalukyas of Vengi. Hyderabad, 1973.

Krishna Sastry, V.V., 'Keesara - A Capital of Vishnukundins', APJA. Vol.1, no.1, 1970, p.101.

— The Proto and Early Historical Cultures of Andhra Pradesh. Hyderabad, 1983.

— An Introduction to the Study of Indian History. Bombay, 1985, (Reprint).

Koti Reddy, A.V., History of Modern Andhra. Hyderabad, 1986, (Reprint).

Kulkarni, R.P., 'Engineering in Ancient India', VKP, Vol.12, no.1, Madras, 1983.

Kulke, H., 'Royal Temple Policy and the Structure of Medieval Hindu Kingdoms', 1n A.Eschmann et al (eds.), The Cult of Jagannatha and the Regional Traditions of Orissa. Delhi, 1978, p.127.

'Fragmentation and Segmentation Versus Integration Reflection on the Concepts of Indian Feudalism and the Segmentary State in Indian History', SIH, Vol.V, no.2, 1982, p.21.

Lal, B.B., 'Sisupalgarh - 1954', AI, no.5, pp.62-105.

Law, B.C., Geography of the Early Buddhism. Calcutta, 1973.

— Historical Geography of Ancient India. Delhi, 1976.

Lawrence, Leshnik, S., South Indian Megalithic Burials: The Pandukal Complex, Weisbaden, 1974.

Lokta, A.J., Elements of Mathematical Biology. New York, 1956.

Mackenzie, W.C., C.C.Mackenzie - First Surveyor General of India. London, 1952.

Mahalingam, T.V., Studies in the South Indian Temple Complex. Dharwar, 1970.

Maity, S.K., Masterpieces of Hoyasala Sculpture. Delhi, 1978.

Mangalam, S.J., Historical Geography and Toponomy of Andhra Pradesh. Delhi, 1986.

Malville, J.M., 'Astrophysics, Cosmology and the Interior Space of Indian Myths and Temples', in Kapila Vatsyayan (ed.), Concepts of Space Ancient and Modern. Delhi, 1991, p.128.

Mankodi, K., 'Scholar Emperor and a Funerary Temple 11th Century Bhojpur', Mara, Vol.XXXIII, no.2, 1990,

Manzoor Alam, 'The Historic Deccan: A Geographical Appraisal', in V.K.Bawa (ed.), Aspects of Deccan History. Hyderabad, 1975, pp.16-27.

Margabandhu, C, The Archaeology of the Satavahana Kshtrapa Times. Delhi, 1986.

Martin, R.D., 'Concepts and Human Territory', in Peter J.Ucko, Ruth Tringham and W.Dimbleby (eds.), Man Settlement and Urbanism. London, 1972, p.442.

Mastanaiah, B., Mukhalingam Temples. Delhi, 1978.

Mazumdar, B.C., 'The Matsyapurāṇam', SBE, Vol.1, Delhi, 1965, pp.226-229.

McCrindle, Ancient India. Delhi, 1926.

Mellaart, J., Earliest Civilizations of the North East. London, 1965.

Meringer, J., History of Religion: The Gods of the Prehistoric Man. (Eng. tr.), London, 1960.

Michell, George, 'City as Cosmogram: The Circular Plan of Warangal', SAS, no.8, 1992, pp.1-18.

Middleton and D.Tait, Tribes Without Rulers. London, 1964.

Mitra, Debala, 'The Relics of Sagrahawa: A Study of the Foundation Deposits and the Isṭikanyāsa', JAHRS. Vol.XXXIII, Hyderabad, 1973-74, pp.4-5.

— Buddhist Monuments. Calcutta, 1971.

Meister, M.W. (ed.), A.K.Coomaraswamy's Early Indian Architecture. Delhi, 1992.

Miller, R., 'Water Use in Syria and Palestine from the Neolithic to the Bronze Age', WA, Vol.11, no.3, p.333.

Misra, R.N., Ancient Artists and Art Activity. Simla, 1975.

Mitter, P., Much Maligned Monsters. Oxford, 1977.

Mohapatra, R.P., Udayagiri and Khandagiri Caves. Delhi, 1981.

Mukherjee, A.B., 'Successors of Cultural Landscapes in Telangana Reddi Villages', IGJ, Vol.XXXIX, 1964, p.42-58.

Mukunda Rao, N., 'Sri Utpattipidugu', in C.Margabandhu et al (eds.), Indian Archaeological Heritage (K.V.Soundara Rajan Felicitation Volume), Vol.1, pt.1, Delhi, 1990, pp.323-328.

— 'Panchanamvaru - Pañchāli', Itihas. Vol.XVIII, no.2, 1993, pp.35-42.

Murali, A., The megalithic Culture of Andhra Pradesh: A Study (with Special Reference to Anantapur District), Ph.D. Thesis (Unpublished), Srikrishna Devaraya University, Anantapur, 1992, pp.177-201.

Murthy, K.R.K., Socio-Economic Conditions in Medieval Andhradeśa. Tirupati, 1987.

Murthy, M.L.K., 'A Late Pleistocene Cave Site in Southern India', PAPS. Vol.118, no.2, 1974, pp.196-230.

'Environment, Royal Policy and Social Formation in the Eastern Ghats, South India, A.D. 1000-1500', Presidential Address, PIHC. 53rd Session, Warangal, 1992-93, pp.615-637.

Nag Choudhary, B.D., Technology and Society. Simla, 1979.

Nagaraja Rao, M.S., The Proto Historic Cultures of Tungabhadra Valley. Poona, 1971.

Nagaraja Rao, M.S. and Malhotra, K.C., The Stone Age Hill Dwellers of Tekkalakota. Poona, 1965.

Nagaraju, S., Buddhist Architecture of Western India. Delhi, 1981.

Nagaswamy, R., 'The Brihadisvara as Paramākāśa', in Kapila Vatsyayan (ed.), Concepts of Space Ancient and Modern. Delhi, 1991, p.299.

Nanda Kishore, K., 'Hydraulic Agriculture 1n Peninsular India c.300 B.C.-1300 A.D.', PIHC. Waltair Session, 1979, p.211.

Nandi, R.N., 'Growth of Rural Economy in Early India', Presidential Address, PIPHC. 44th Session, Annamalainagar, 1984, pp.1-72.

— Social Roots of Religion in Ancient India. New Delhi, 1986.

Narasimhaiah, B., Neolithic and Megalithic Cultures in Tamil Nadu. Delhi, 1980.

Narasimha Rao, B., 'Kālāmukhas in A.P. upto 10th Century A.D.', PAPHC. 3rd Session, Vijayawada, 1978, pp.29-31.

Norbek Edward, 'Anthropological Views of Religion', in J.C.Fever et al (eds.), Religion in Philosophical and Cultural Perspective. Delhi, 1971, p.419.

Padigar, S.V., 'Craftsman's Inscriptions from Badami : Their Significance' in Ratan Parimoo et al (eds.), Ellora Art and Architecture. Delhi, 1992, pp.388-405.

Pandu Ranga Rao, M. et al, Geotechnical Appraisal and Evaluation of Kakatiya Monuments. Warangal, 1991,(cyclostyled report).

Pant, Susheela, The Origin and Development of Stupa Architecture in India. Varanasi, 1976.

Parasher-Sen, Aloka, 'Mechanics of Trade and Historical Change in the Mid-Godavari Valley c.200 B.C.-200 A.D.', PAPHC, 10th Session, Guntur, 1986, pp.26-33.

— 'Social Structure and Economy of Settlements in the Central Deccan 200 B.C.-A.D.200)' in Indu Banga (ed.), The Citv in Indian History. Delhi, 1991, p.46.

(ed.), Social and Economic History of the Deccan-Some Intepretations. Delhi, 1993.

Piggot, S., Ancient-Europe. Edinburgh, 1965.

Platt, R.R. (ed.), India: A Compendium. New York, 1962.

Pramod Chandra, The Study of Indian Architecture. Varanasi, 1975.

Prasad, O.P., 'Trade in the Growth of Towns: A Case Study of Karnataka (600-1200)', PIHC. 40th Session, Bombay, 1980, p.154.

Prasada Rao, C, The Kakativa Sculpture. Hyderabad, 1987.

Pratap, D.R., Tribes of Andhra Pradesh. Hyderabad, 1975.

princep, J., 'On the Edicts of Priyadasi of Asoka', JASB. Vol.VII, 1838, pp.219-220.

Raghavachari, K., 'Dharanikota and its Western Contacts', QRHS, Vol.XII, 1972-73, pp.167-170.

Raghavacharyulu, K., 'The Term Andhra and Early References There to', JAHRS. Vol. X, 1936-37, p.114.

Rajan Gurukkal, 'Aspects of Reservoir Systems of Irrigation in the Early Pandya State', SIH, Vol.11, no.2, pp.159-162.

Rajendra Prasad, B., 'Śivanandiśvara Temple at Kadamara Kālva', JISOA. Vol.VIII, pp.27-32.

'Rastrakuta Temple at Bhavanasi Sangam', AA, Vol.XXXIV, no.2, pp.212-221.

~ Art of South India : Andhra Pradesh Delhi, 1980.

– Chālukyan Temples of Andhradesa. Delhi, 1983.

– 'Vengi Chalukyan Temples' in V.V.Krishna Sastry (ed.), Archaeology of Andhra Pradesh. Hyderabad, 1987, pp.41-42.

Raju, D.R., Stone Age Huner Gatherers (An Ethnographic Study of Cuddapah District), Pune, 1989.

Ramachandra Rao, C.V., 'The Kākatiya Polity, Economy and Society', PAPHC, 14th Session, Warangal, 1990, p.61.

Ramachandran, T.N., Buddhist Sculptures from a Stupa near Goli. Madras, 1929.

– 'Nagarjunakonda', MASI. no.71, Delhi, 1938.

Ramachandra Murthy, N.S., Forts in Ancient and Medieval Andhra : A Study. Ph.D. Thesis, (Unpublished), Karnataka Uniiversity, Dharwar, 1981.

– 'Art and Architecture of Karimnagar District', PAPHC. VII Session, Warangal, 1983, pp.2-3.

Rama Mohan Rao, K., Early History of Andhradesa from the fall of the Śatavāhanas to the rise of Eastern Chālukyas. Ph.D. thesis (Unpublished), Karnataka University, Dharwar, 1981.

Raman, K.V., 'Coomaraswamy on Early Indian Architecture', in K.K.Dasgupta (ed.), Ananda Coomara Swamy - A Centenary Volume. 1981, p.49.

Ramanaiah, J., Temples of South India. Delhi, 1989.

Ramraz, J., Essays on the Architecture of the Hindus. London, 1834.

Rama Rao, M., Select Kakatiya Temples. Tirupati, 1962.

– Early Chalukyan Temples of Andhradesa. Hyderabad, 1964.

— Temples of Kalinga. Tirupati, 1962.

— 'Temples of Srisailam', JAHRS. Vol.XXVI, pp.103-104.

Rama Swamy, N.S., A Monograph on Temples of Mukhalingam. Hyderabad, 1976.

Ramesh Chaudhary, A., Andhra Pradesh. New Delhi, 1979.

Rami Reddy, V., The Prehistoric and Protohistoric Cultures of Palvoy, South India. Hyderabad, 1974.

Ramudu, M., 'Tank Irrigation Under the Rayas of Vijayanagara : Some Theoretical Considerations', PAPHC 13th Session, Srisailam, 1989, pp.76-79.

Randhawa, M.S., A History of Agriculture in India. Vol. I, Delhi, 1980.

Rao, K.P., Deccan Megaliths. Delhi, 1988.

— 'Beginning of Sculptural Art in South India', PIHC, 53rd Session, Warangal, 1992-93, pp.664-671.

Rao, S.K., Prehistory of Srikakulam Region : An Ethnoarchaeological Study. Ph.D. Thesis, (Unpublished), Andhra University, Waltair, 1988.

Rao, S.R., 'Dock and Wharfs in A.Ghosh (ed.), Encyclopaedia of Indian Archaeology. Vol. I, Delhi, 1989.

Ratnagar, S., Enquiries into Political Organisation of Harappan Society. Pune, 1991.

Ray, Amita, The villages, Towns and Secular Buildings in Ancient India. Calcutta, 1964.

'Beginning of Urbanisation in Andhradeśa', in J.S.Grewal and Indu Banga (eds.), Studies in Urban History, Amritsar, 1978, pp.29-42.

— Life and Art of Early Andhradesa. Delhi, 1983.

Ray, H.P., Monastery and Guild. Delhi, 1986.

Rea, A., South Indian Buddhist Antiquities. Madras, 1994.

— Chalukyan Architecture. Madras, 1896.

Renfrew, C., Approaches to Social Archaeology. London, 1984.

Richards, F.J., 'Geographic Factors in Indian Archaeology', IA, Vol.LXII, 1962, p.20.

— Mughal Administration in Golconda. Oxford, 1975.

Ronald Inden, 'Orientalist Constructions of India', MAS, Vol.XX, no.3, 1986, pp.401-406.

Rosin Thomas, R., 'The Tradition of Ground Water Irrigation in North Western India', Human Ecology. Vol.XXI, no.1, 1993, p.54.

Rowlands, M.J., 'Defence as a Factor in the Organisation of Settlements', in Peter J.Ucko, Ruth Tringham and W.Dimbleby (eds.), Man Settlement and Urbanism. London, 1972, p.447.

Roy, S., The Storv of Indian Archaeology. Delhi, 1961.

Ruth Tringham, 'Territorial Demarcation of Prehistoric Settlements' in Peter J.Ucko, Ruth Tringham and W.Dimbleby (eds.), Man Settlement and Urbanism. London, 1972, p.447.

Sihlins, M.D., Tribesmen. Prentice-Hall, 1968.

Sanjiva Rao, I., 'Rasasiddhas of Alampur', BIIH. Vol.XIII, p.40.

Sankalia, H.D., 'Regional and Dynastic Study of South Indian Monuments', ABORI. Vol.XXI, 1941, pp.213-228.

— The Godavary Palaeolithic Industry. Delhi, 1952.

— Aspects of Indian History and Archaeology. Delhi, 1977.

Sankara Narayana, S., The Vishnukundins and Their Times. Delhi, 1977.

Sankara Sastry, V., Buddha Jayanti Special. Jaggayyapet, 1956.

Sarkar, H., Studies in Early Buddhist Architecture of India. Delhi, 1966.

'A Study of the Adhisṭānas in Early Temples of Andhra Pradesh', JAHRS, Vol.XXV, 1975-76, pp.317-320, pl.63.

'Emergence of Urban Centres in Early Historical Andhradesa', in B.M.Pande and B.D.Chattopadhyaya (eds.), Archaeology and History. Vol.11, Delhi, 1986.

Sarma, I.K., 'Ancient Canals', JIH, Vol.XL, pt.2, pp.307-309.

~ 'Vijayapuri', the Capital of Ikshvakus of Nagarjunakonda', IHQ. Vol.XXXIII, 1962, pp.267-282.

— C14 Dates,'NBP Ware and Early Historical Archaeology of Peninsular India', JIH, Vol.XXXXI, pt.1, pp.49-59.

— 'Historical Archaeology of Ancient Andhra in the Light of Recent Excavations of Amaravati, Nagarjunakonda and Pedavegi', in Amita Ray and Sameer Mukheerjee (eds.), Historical Archaeology of India. Delhi, 1990, p.110.

'Alampur Temples : Rare Evidence on Constructional Modes and Consecrational Rites' in A.V.N.Murthy and I.K.Sarma (eds.), Sri Rama Chandrika (Prof.O.Ramachandriaya Festschrift), Delhi, 1993, pp.352-368, fig.23 and 24.

Sarma, M.R.K., 'Temples of Telingana. Hyderabad, 1972.

Sarma, M.S. (ed.), Telugu Culture. Madras, 1960.

Sastry, K.A.N., A History of South India, Madras, 1947.

Sastry, A.M., India as Seen in the Brihatsamhita of Varāhamihira. Varanasi, 1969.

Sastry, B.N., Kanduru Chōdula Charitra Samskrti Sāsanalu. Hyderabad, 1984.

— Cheraku Vamsa Charitra Sāsanamulu. Hyderabad, 1989.

Sastry, P.V.P., The Kākatīyas of Warangal. Hyderabad, 1978.

'Political System in Early Coastal Andhra', in D.Handa (ed.), Ajayasri : Prof. A.M.Sastry Felicitation Volume. Delhi, 1989, pp.71-74.

Sastry, P.V.P., 'Popularity of the Kakatiya Rulers', inS.N.Rao (ed.), Cultural Heritage of the Kakatiyas. Warangal, 1993, p.15.

Sastry, T.V.G., 'A Bhumija Temple from Chaityagriha at Cejarla', Itihas. Vol.III, no.1, p.19.

Satyanarayana, K., A Study of the History and Culture of the Andhras. Vol.1, Delhi, 1975.

Senneviratne, S., 'Kalinga and Andhra: The Process of Secondary State Formation', IHR, Vol.VIII, nos.1-2, p.54.

Seneviratna, 'The Ritualisation of Space in Buddhist Architecture 1n Sri Lanka', in Kapila Vatsyayan (ed.), Concepts of Space Ancient and Modern. Delhi, 1991, p.365.

Service, E.R., Primitive Social Organisatio: An Evolutionary Perspective. New York, 1962.

Settar, Ashok, 'Aspects of Agricultural Expansion in Early Medieval Southern Karnataka', in K.Veerathappa (ed.), Studies in Karnataka in History and Culture. Vol.11, Mysore, 1987, p.15.

Settar, S., The Hoyasala Temples. 2 Volumes, Dharwar, 1992.

Sewell, R., Lists of Antiquarian Remains in the Presidency of Madras. Madras, 1882; Lists of Incriptions and Sketches of Dynasties of South India. Madras, 1884.

Shah, Priyabala, 'Aiduka', JOI, Vol.1, 1951-52, p.271.

Sharma, R.S., Indian Feudalism (c.300-1200 A.D.). Calcutta, 1975.

— Indian Feudalism. (c.300-1200 A.D.). Delhi, 1980, (Reprint).

'Origin of State in India', D.D.Kosambi Memorial Lectures. Delhi, 1987, p.2.

— Urban Decay in India (c.300-1200 A.D.). Delhi, 1987.

Sherratt, A., 'Water Soil and Seasonability in Early Cereal Cultivation', WA, Vol.XI, no.3, p.321.

Sherwani, H.K., History of the Qutubshahi Dynasty. Delhi, 1974.

Shrimali, K.M., 'Cash Nexus on Western Coast A.D.850-1250: A Study of Silaharas', in A.K.Jha (ed.), Coinage Trade and Economy. Nasik, 1991, pp.178-193.

Sircar, D.C., Studies in Geography of Ancient and Medieval India. Delhi, 1971.

Siva Nagi Reddy, E., The Mallesvaram Group of Temples', PAPHC. 14th Session, Warangal, 1992, p.90.

— 'Explorations at a Megalithic Site at Damaravai in Warangal District, A.P., Hyderabad, 1993 (Cyclostyled).

Siva Nagi Reddy, E., 'Statue Menhirs of Proto-historic Andhra', a Paper Presented at XVIII Session of A.P. History Congress. Tenali, 8-9, January, 1994 (typed), p.1.

'A Report on the Discovery of a few Rock-cut Cells around Gopalapatnam near Tuni, Visakhapatnam District, (Unpublished), Hyderabad, 1994.

— Saraswatigana: New Epigraphical Evidence of a Guild of Architects from Medieval Andhradesa' a Paper Presented at the 3rd National Seminar on Silpaic Tradition in Ancient India. held at the University of Mysore, Mysore, January, 28-31, 1994, conducted by the Academy of Art and Architecture, Mysore.

Siva Nagi Reddy, E., and Subrahmanyam, B., 'A Unique Panchakuta Temple of Kakatiya Period at Ranamujapuram' in S.N.Rao, (ed.).Cultural Heritage of the Kakatiyas. Warangal, 1993, pp.47-51.

— 'Materials and Techniques of Kakatiya Temples', a Paper Presented at a National Seminar on The Kakatiya Art & Architecture. held at Telugu University, Srisailam Campus, November 17-19, 1991.

'A Copper Antennae Sword from Proto Historic Andhra: A Study', PAPHC. 16th Session, Karimnagar, 1992, pp.20-22.

Sivarama Murthy, C, Amaravati Sculpture in Madras Government Museum. Madras, 1942.

— Early Eastern Chalukyan Sculpture. Madras, 1947.

Soma Reddy, R., Hindu and Religion Institutions of Andhradesa 1300-1600. Madras, 1984.

Sompura, P.O., 'The Vastu Vidya of Viswa Karma', in Pramod Chandra (ed.), The Studies in Temple Architecture, Varanasi, 1975, pp.47-56.

Soundara Rajan, K.V., Architecture of the Early Hindu Temple of Andhra Pradesh. Hyderabad, 1965.

'Stone Age Industries near Giddalur, District Kurnool', AI, no.8, p.64.

— Megalithic Architecture in South India. Missouri, 1975.

— Indian Temple Styles. Delhi, 1982.

— Early Kalinnga Art and Architecture. Delhi, 1984.

— 'Tamil Temple Architecture and Art', Marg. Vol.XXXIII, no.2, 1990, p.16.

Spate, O.H.K. and Learmonth, A.T.A., India and Pakistan A General and Regional Geography, Great Britain, (3rd edn.), 1967.

Spencer, H., The Principals of Sociology. Vol.1, New York, 1986.

Sreenivasachari, P., Ramappa and Other Temples at Palampet. Hyderabad, 1953.

Srinivasan, K.R., 'A Survey of South Indian Megalithics', AI, no.9, p.109.

— 'The Pallava Architecture of South India', AI, no.14, p.117.

— Temples of South India. Delhi, 1972.

Srinivasan, T.M., 'Water lifting Devices in Ancient India', IJHSC. Vol.V, no.2, p.381.

Irrigation and Water Supply in South India 200 B.C.-1600 A.D.. Madras, 1991.

Stein, B., 'Integration of the Agrarian System of South India', in R.E.Frykenberg, (ed.), Lang Control and Social Structure in Indian History. Delhi, 1969, pp.175-216.

Subba Rao, B., 'The Geographic Factors in Andhra History and Archaeology', BDCRI. 1948, pp.168-171.

— The Personality of India. Baroda, 1958.

Subrahmanyam, R., The Suryavanshi Gajapatis of Orissa. Waltair, 1957.

— Nagarjunakonda-I (1954-60). Delhi, 1975.

'Brahmanical Structures at Nagarjunakonda', Itihas. Vol.VIII, 1981, p.1-13.

'Musalimadugu and its Antiquities' in Sri Dineshchandrika Indology. Delhi, 1982, pp.176-180.

-- 'Secular Remains at Nagarjunakonda', JAHRS. Vol.XXXVIII, pt.4, pp.1-41.

Subrahmanyam, B., Proto-historic and Early Historical Cultures of the Mahaboobnagar Regionn. (Unpublished Ph.D. Thesis), University of Mysore, Mysore, 1986.

Sukla, D.N., Silpaśāstram. Varanasi, 1969.

Sundara, A., The Early Chamber Tombs of South India. Delhi, 1971.

Sundaram, K., Studies in Economic and Social Condition in Medieval Andhra. Machilipatnam, 1968.

Suryanarayana, K., 'Asannapura', PAPHC. 3rd Session, Vijayawada, 1978, p.70.

Tadgel, C., A History of Architecture in India. Delhi, 1990.

Tavis, I., Society and Technology. Harvard University Project no.6, 1970.

Tejaswini, Y., 'Social Groups and Economic Changes 7th-13th Century A.D.', in Aloka Parasher-Sen, (ed.), Social and Economic History of the Deccan - Some Interpretations. Delhi, 1993, p.158.

Thakur, V.K., Urbanisation in Ancient India. Delhi, 1981.

'Literary References to Fortifications in Ancient India', in A.V.N.Murthy, (ed.), Giridharasri. (Dr. G.S.Dikshit Felicitation Volume), Delhi, 1987, pp.15-20.

'Feudal Content of the Pala Art: A Framework for Enquiry', PIHC. 48th Session, Goa, 1987, p.104.

— 'Trade and Towns in Early Medieval Bengal, (c. A.D.600-1200)', JESHO. Vol.XX, pt.II, June, 1987, pp.196-220.

Thaper, B.K., 'Problems of the Neolithic Cultures in India: Retrospect', Puratattva. no.7, 1974, p.6.

Thaper, R., From Lineage to State. Bombay, 1984.

Thesiger, W., The Marsh Arabs. London, 1964.

Tod, James, 'Remarks on Certain Sculptures in the Cave Temples of Ellora', TRAS, Vol.11, pp.328-329.

Trigger, B.G., 'Monumental Architecture: A Thermodynamic Explanation of Symbolic Behavior', WA, Vol.22, no.2, p.121.

Tylor, E.B., Primitive Culture. New York, (3rd edn.), 1857.

Venkataramanayya, N., Vishnukundinulu (Telugu), Hyderabad, 1975.

Venkateswara Rao, T., Local Bodies *in* Medieval Andhra. Hyderabad, 1987.

Vibha Tripathi, 'Impact of Metal Technology on Economic Development; in Amita Ray and Sameer Mukheerjee (eds.), Historical Archaeology of India. Delhi, 1990, p.195.

Volwashen, A., Living Architecture - India. Calcutta, 1969.

Weber, M., The Religion of India. Glencoe, 1958.

William Erskine, 'Account of the Cave Temples of Elephanta', ILSB, Vol.1, 1819, pp.190-250.

Williams Raymond, Key Words : A Vocabulary of Culture and Society. (Rev. Edn.), 1983.

Wittofogel, K.A., A Oriental Despotism : A Comparitive Study of Total Power. New Haven, 1959, (Reprint).

Yazdani, G., 'Ramappa Temple', MASI, no.6, Delhi, 1954.

— The Early History of the Deccan. pts.1-4, London, 1960.

APPENDIX: ☞

LIST OF SITES SUB-REGIONWISE

APPENDIX

LIST OF SITES SUB-REGIONWISE

Sub-region A:

S1 ADAVISOMANAPALLI - III
Karimnagar District

S2 ALAMPUR - III
Mahboobnagar District

S3 AMRABAD - I, IV
Mahboobnagar District

S4 BANDARAMESVARAPALLI - IV
Nizaamabad District

S5 BHIMAVARAM - I
Mahboobnagar District

S6 BHONGIR - IV
Nalgonda District

S7 BIRAMPALLI - I
Mahboobnagar District

S8 BODHAN - II
Nizambad District

S9 BUDIDAPADU - I
Mahboobnagar District

S10 BUDIGEPALLI - I
Karimnagar District

S11 CHAGATUR - I
Mahboobnagar District

S12 CHINTAPPALI - I
Nalgonda District

S13 CHINNAMARUR - I
Mahboobnagar District

S14 CHOPPADANDI - IV
Karimnagar District

S15 DHULIKATTA - II
Karimnagar District

S16 DUDDEDA - IV
Medak District

S17 GAMBHIRAOPET - IV
Karimnagar District

S18 GANDHARIKOTA - III
Adilabad District

S19 GHANPUR - IV
Mahboobnagar District

S20 GODISALA - IV
Karimnagar District

S21 GOLLATHAGUDI - III
Mahboobnagar District

S22 GONDIMALLA - I
Mahboobnagar District

S23 GUMMADAM - III
Mahboobnagar District

S24 HASHMATHPET - I
Hyderabad District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S25 JANAGOAN - IV
Karimnagar District

S26 KADAMBAPUR - I, II
Karimanagar District

S27 KALUVA KOLANU - IV
Mahboobnagar District

S28 KANDI - II
Medak District

S29 KANDUR - IV
Mahboobnagar District

S30 KANUKOLLU - I
Krishna District

S31 KAPPARAOPET - II
Karimnagar District

S32 KETHIREDDIPALLI - I
Ranga Reddy District

S33 KEESARAGUTTA - III
Ranga Reddy District

S34 KOLANUPAKA - IV
Nalgonda District

S35 KUDALI SANGAMESVARAM - III
Mahboobnagar District

S36 MALLESVARAM - IV
Mahboobnagar District

S37 MAULALI - I
Hyderabad District

S38 MUNULAGUTTA - II
Karimnagar District

S39 NAGUNURU - IV
Karimnagar District

S40 NANDIKANDI - IV
Medak District

S41 PADRA - I
Mahboobnagar District

S42 PANCHALAINGALA - III
Kurnool District

S43 PANGAL - IV
Mahboobnagar District

S44 PAPANASI - III
Mahboobnagar District

S45 PASHIGOAM - II
Karimnagar District

S46 PEDDABANKUR - II
Karimnagar District

S47 PEDDAMARUR - I
Mahboobnagar District

S48 POLAKONDA - I, II
Warangal District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S49 PUDUR - IV
Mahboobnagar District

S50 PYDIGUTTA - I
Mahboobnagar District

S51 RAIGIRI - I
Nalgonda District

S52 RAJAGOPALAPET
Medak District

S53 RANGAPUR - III
Mahboobnagar District

S54 RANJALA - IV
Karimnagar District

S55 RAMAGUNDAM - IV
Karimnagar District

S56 SHANKARAMPET - IV
Medak District

S57 SOMASILA - II
Mahboobnagar District

S58 SUNDARAGIRI - I
Ranga Reddy District

S59 TADIKONDA - I
Mahboobnagar District

S60 TELGHIRI - I
Ranga Reddy District

S61 TELLAPUR - IV
Medak District

S62 TORRUR - IV
Warangal District

S63 TUMMALAGUDEM - III
Nalgonda District

S64 TUMUGUNTA - IV
Mahboobnagar District

S65 UNDRUKONDA - III
Mahboobnagar District

S66 UPPALAPADU - I
Mahboobnagar District

S67 UPPAIR - IV
Mahboobnagar District

S68 UPPUNUTHALA - IV
Mahboobnagar District

S69 URUKONDA - I
Mahboobnagar District

S70 VADLURU - II
Nizambad District

S71 VADLALA - IV
Nalgonda District

S72 VALIGONDA - I
Nalgonda District

S73 VARDHAMANAPURAM - IV
Mahboobnagar District

S74 VEMULAVADA - IV
Karimnagar District

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

Sub-region B:

S75 AHALYA - IV
Nalgonda District

S76 AINGARIPALEM - III
Guntur District

S77 AINOLE - IV
Warangal District

S78 ALLURU - II
Krishna District

S79 ANNASAGARAM - I
Nalgonda District

S80 ATMAKUR - IV
Warangal District

S81 BARRELAGUDEM - I
Khammam District

S82 BAYYAVARAM - IV
Khammam District

S83 BHAIRAVAKONDA - III
Nellor District

S84 BUDAVADA - I
Chittor District

S85 CHANDAVARAM - II
Prakasham District

S86 CHEBOLE - II
Kurnool District

S87 CHEJARLA - II, III
Guntur District

S88 CHINTALA CHERUVU - I
Anantapur District

S89 CUMBUM - I
Prakasham District

S90 DACHUR - I
Prakasham District

S91 DAMARAVAI - I
Warangal District

S92 DOMADA - I
Warangal District

S93 DONGATOGU - I
Khammam District

S94 DOSAPADU - I
Guntur District

S95 DURGI - IV
Guntur District

S96 GADIGANAMALA - I
Anantapur District

S97 GAJJALAKONDA - I
Prakasham District

S98 GANDLURU - I
Guntur District

contd...

Key:

S	**Number of site**
I	**Period I**
II	**Period II**
III	**Period III**
IV	**Period IV**

S99 GARIKAPADU - I
Guntur District

S100 GHANPUR - IV
Warangal District

S101 GOLLAPALLI
Krishna District

S102 GOLI - I, II
Guntur District

S103 GUMMADIDURRU - II
Krishna District

S104 JAGGAYYAPETA - II
Krishna District

S105 JAKARAM - IV
Warangal District

S106 KACHANAPALLI - I
Khammam District

S107 KAMEPALLI - I
Guntur District

S108 KANCHIKACHERLA - IV
Krishna District

S109 KAREMPUDI - I
Guntur District

S110 KARLAPAHAD - I
Khammam District

S111 KARUKONDA - II
Khammam District

S112 KATAKSHAPUR - IV
Warangal District

S113 KATAPUR - I
Warangal District

S114 KESAMUDRAM - IV
Warangal District

S115 KESANAPALLI - II
Guntur District

S116 KODAVATUR - IV
Warangal District

S117 KONDAPARTHI - IV
Warangal District

S118 KUSUMANCHI - IV
Khammam District

S119 LAKHNAVARAM - IV
Warangal District

S120 MACHERLA - IV
Guntur District

S121 MADHIRA
Guntur District

S122 Mallavolu - IV
Nalgonda District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S123 MANIKESVARAM - I
Krishna District

S124 MUKTHYALA - I
Krishna District

S125 MUSALIMADUGU - IV
Kurnool District

S126 NAGARJUNAKONDA - I, II
Guntur District

S127 NAGULAPADU - IV
Nalgonda District

S128 NALLAKUNTA - I

S129 NAMILE - IV
Nalgonda District

S130 NELAKONDAPALLI - II
Khammam District

S131 NIDIKONDA - IV
Warangal District

S132 PALAMPET - IV
Warangal District

S133 PALONCHA - I
Khammam District

S135 PANGAL - IV
Nalgonda District

S136 PARADA - IV
Nalgonda District

S137 PEDAPULA CHERUVU - IV
Cuddapah District

S138 PHANIGIRI - II
Nalgonda District

S139 PILLALAMARRI - IV
Nalgonda District

S140 PITAKAYAGULLA - II
Prakasham District

S141 PONDUGULA - III
Guntur District

S142 PRATHAKOTA - III
Kurnool District

S143 RAMAKRISHNAPURAM - IV
Warangal District

S144 RAMANUJAPURAM - IV
Warangal District

S145 RAVIROLA - I
Krishna District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S146 REGONDA - III
Warangal District

S147 RUPALA SANGAMESVARAM - II
Kurnool District

S148 SATYAVOLU - III
Prakasham District

S149 SIDDESWARAM - III, IV
Kurnool District

S150 SIVAPURAM - IV
Warangal District

S151 TATICHERLA - I

S152 TRIPURANTAKAM - III, IV
Prakasham District

S153 TURIMELA - III
Prakasham District

S154 UCHCHURU - I
Nellore District

S155 VADDAMANU — I, II
Guntur District

S156 VEGIMADUGU - I
Prakasham District

S157 VEERAPURAM - I, II
Kurnool District

S158 WARANGAL - I,II
Warangal District

S159 YARRAGONDAPALEM - I
Guntur District

S160 YELESWARAM - I, II, III, IV
Nalgonda District

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

Sub-region C:

S161 ACHUTAPURAM - IV
Srikakulam District

S162 AGIRIPALLI - I
Krishna District

S163 AMARAVATI - I, II, IV
Guntur District

S164 ASANAPURA - III
Visakhapatnam District

S165 BAVIKONDA - II
Visakhapatnam District

S166 BHATTIPROLU - II
Guntur District

S167 BHIMAVARAM - IV
West Godavari District

S168 CHALUKYA BHIMAVARAM - IV
East Godavari District

S169 CHEBROLU - IV
Guntur District

S170 DANTAPURA - II
Srikakulam District

S171 DHARANIKOTA - II
Guntur District

S172 DIVI - III, IV
Krishna District

S173 DRAKSHARAMA - IV
East Godavari District

S174 GANAPAVARAM - IV
Guntur District

S175 GANAPESVARAM - IV
Krishna District

S176 GHANTASALA - II, IV
Krishna District

S177 GOPALAPATNAM - II
Visakhapatnam District

S178 GUDIVADA - II
Krishna District

S179 GUNTUPALLI - II
West Godavari District

S180 GUNTUR - IV
Guntur District

S181 JONNAWADA - I
Nellore District

S182 KALINGANAGARA - II, IV
Srikakulam District

S183 KANCHIKACHERLA - IV
Krishna District

S184 KANDUKURU - III
Prakasham District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S185 KATTEMU - III
Nellore District

S186 KALANU (KOLLERU) - III, IV
Krishna District

S187 KOTAMITTA - II
Nellore District

S188 KUCHIDIBBA - I
Krishna District

S189 LAM
Guntur District

S190 MALKAPURAM - IV
Guntur District

S191 MALLEPADU - I
Guntur Distrrict

S192 MOGALRAJAPURAM - III
Krishna District

S193 MOTUPALLI - IV
Prakasham District

S194 MUKHALINGAM - III, IV
Prakasham District

S195 MUKKAMALA - IV
Guntur District

S196 NADENDLA - IV
Guntur District

S197 NAVABPET - IV
Guntur District

S198 PANCHADHARLA - IV
Visakhapatnam District

S199 PATTIPADU - IV
Guntur District

S200 PAVURALAKONDA - II
Visakhapatnam District

S201 PEDAGANJAM - II
Prakasham District

S202 PEDAVEGI - III, IV
West Godavari District

S203 PEDDASANAGALLU - I
Krishna Distrrict

S204 PUDURU - II
Nellore District

S205 RAMATHIRTHAM - II
East Godavari District

S206 RAMPA ERRAMPALEM - II
East Godavari District

S207 SALIHUNDAM - II
Srikakulam District

S208 SANGAMAYYAKONDA - IV
Srikakulam District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S209 **SANKARAM - II, III**
Visakhapatnam District

S210 **TENNERU - I**
Krishna District

S211 **THOTLAKONDA - II**
Visakhapatnam District

S212 **UNDAVELLI - III**
Guntur District

S213 **VALIVERU - IV**
Guntur District

S214 **VIJAYAWADA - III**
Krishna District

S215 **YADAVALLI - IV**
Guntur District

S216 **YANAMADALA - IV**
Guntur District

Key:

S		Number of site
I	:	Period I
II		Period II
III		Period III
IV		Period IV

Sub-region D:

S217 ADONI - IV
Kurnool District

S218 ALLURU - I
Kurnool District

S219 ATTIRALA - IV
Cuddapah District

S220 CHILAMAKUR - IV
Cuddapah District

S221 GANGAPERURU - IV
Cuddapah District

S222 GUDIMALLAM - II, III
Chittor District

S223 GUNTAKAL - I
Anantapur District

S224 GUTTI - III
Anantapur District

S225 HULIKAL - I
Anantapur District

S226 KALYANADURG - I
Anantapur District

S227 KANIPAKAM - III
Chittor District

S228 KANYATHIRTHAM - I
Cuddapah District

S229 KONDAPALLI - I
Anantapur District

S230 MAHANANDI - III
Kurnool District

S231 MALLAPURAM - IV
Kurnool District

S232 MEKADONI - II
Kurnool District

S233 MEKALA BALAYYAPALLE - I
Chittoor District

S234 NANDALUR - II
Cuddapah District

S235 PALAVOY - I
Anantapur District

S236 PANYAM - III
Kurnool District

S237 PUNGANURU - III
Chittor District

S238 PUSHPAGIRI - IV
Cuddapah District

S239 RAMAGIRI - III
Chittor District

S240 RAMAPURAM - I
Kurnool District

contd...

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV

S241 RAVIPADU
Krishna District

S242 RAYACHUR - IV
Cuddapah District

S243 SASANIKOTA - II
Anantapur District

S244 SATANIKOTA - I, II
Kurnool District

S245 TADIPATRRI - IV
Anantapur District

S246 TAVALAM - I
Chittor District

S247 VELUKURU
Chittor District

S248 YAGUVACHERLOPALLI - I
Kurnool District

S249 YOGIMALLAVARAM - IV
Chittor District

Key:

S	Number of site
I	Period I
II	Period II
III	Period III
IV	Period IV