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PREFACE

The International Seminar titled "Towards the Second Century of Archaeology in Sri Lanka" is organised by the Department of Archaeology in order to commemorate the event of the establishment of the Department of Archaeology of Sri Lanka in 1890. The papers of the present publications are the contributions by the invited delegates to the seminar from the seven SAARC countries and the international community of South Asian Archaeology. The themes of the seminar are as follows: a. Letters, Literature and Archaeology b. Man, Environment and Archaeology c. Science, Research and Archaeology d. Culture, Tourism and Archaeology. In this connection it may be mentioned that due to lack of time and the delay in the submission of papers, the organising committee was compelled to published unedited versions of papers in order to complete the publication opportunity to participate actively in the forthcoming deliberations. However, it has been decided to publish an edited version of the proceedings later. The diacritical marks which have been ommitted due to technical reasons will be included in the final print. Any incovenience caused to the authors and the readers in this regard is very much regretted. Finally, the organising committee takes this opportunity to thank all the delegates who made their contributions in time accepting our invitation. We also extend our thanks to all the members in the department and our friends and wellwishers who helped in various ways to get this publication in a successful manner.

Organising Committee.

ASPECTS OF THE ICONIC REPRESENTATION OF BUDDHA

By
M.C. Joshi

According to some references preserved in the Mahaparinippan Sutta, Buddha told Ananda not to bother to worship his mortal relics (sarira)[1] after his passing away but attempt to achieve the essence of Dhamma. The Sutta, however, records that the Blessed are known that his intensly devoted followers amongst knowledgeable Kshatriyas, Brahmanas and Grihapatis would (certainly) offer worsilip to his corporal remains after the Parinibbana what was predicted by Buddha came true as all the eight stupas built on his mortal remains by different groups became principal object of worship. In the third century B.C. Asoka as mentioned in the Divyavadana[2] exposed most of these old stupas to obtain the original mortal remains (dhatus) of Buddha redepositing them in numerous newly raised stupas, which are stated to be 84000 in number, in different parts of his kingdom to propagate Buddhism in a much wider area. Evidence also shows that Asoka also attempted to formalize the form of the stupa by decorating it with chhatra, harmika and perhaps vedica or railing. A question emerges as to why the system of worshipping the stupas with sacred dhatus became popular despite the fact that Buddha himself did not favour the idea ? What appears to be likely that following popular belief based on age old concepts of magical tradition that every bit of Buddha's mortal remains represented his physical and external presence through the stupa where it was deposited. This is also confirmed by the traditions of Buddhism as preserved in later texts like Saddharmapundarika, a Sanskrit text compiled not later than the third century A.D,

According to the text in connection with an enquiry by Mahapratibhavana Bodhisattva, following the appearance of a stupa the Lord (Bhagavan) tells him that in this stupa exists the actual body of one substance of a Tathagata.3 Gilgit manuscript also supports a similar idea referring to the presence of Buddha in a stupa.[4]

अहं च दृष्टो इहं शासनास्मि भगवांश्च यो यं स्थितस्तूपमध्ये ।
. . . . ।।

Asoka's attempt to provide chhatra on the top of the stupa also supports the idea that stupas with relics were possibly treated as the symbols of living Buddha. The vedia provided it a specific structural personality like the chaitya-vriksha which represented in each case a divine sprit.

Emperor Asoka also seems to have invented some new symbols to represent Buddha and event connected within like. From this standpoint the most impressive example is his pillar at Sarnath with its lion capital originally supporting a dharma chakra and thereby giving it the character of a chakradhvaja symbolizing the Buddha delivering his first sermon at Mrigadava. The four lion supporting the wheel served only as pedestal or throne in conformity with the ideal of chakravartin.

Perhaps Asoka himself was responsible for symbolizing the event by shaping memorial pillar into a Chakradhvaja, for it was also he who introduced many kinds of spectacles for the propagatiQn of dharma in terms of dramatic performances. These are enumerated in his fourth Rock Edict as 'vimana-dasana hasti-dasana agi-khandani- cha anani diyvani rupani dasayipta...... ' i.e. sights of celestial mansions or cars, celestial elephants, colwmns (skandha) of light and other divine forms. Many of these divine spectacles find expression in the post- Mauryan art tradition e.g, the sudharma devasabha (celestial hall) in Bharhut rail, divine elephant in depiction of Maya dream or elsewhere as a symbolic representation of Bodhisattva and flaming pillar in Amaravati sculpture. Asoka is also believed to have standardized the stupa design formally with the introduction of chhatra, harmika, rails, etc.

Due to socio-cultural and other reasons by about the beginning of Christian era and more vigourously in the subsequent centuries the growth of Buddhism underwent a process of change, philosophically and artistically. These changes were mainly responsible for the innovation and popularization of the Buddha image in human form and modification in the corresponding aspects of the faith.

The origin of Buddha image in human form itself is a much debated subject. There are scholars who feel that it originated in Gandhara while others suggest Mathura as the place of its origin. In this connection we propose to draw the attention of art historians to some data associated with this subject in Divyavadana an early Sanskrit text of the Sarvastivada school of Buddhism which vitally significant to understand the measures taken for popwlarization of Buddha's worship in human form. The material under reference is preserved in Pamsupradanavadana (Episode of the Gift of Dust) which itself is a part of Asokavadana.

What is important for us in this Avadana is the story of Upagupta who is stated to have converted Asoka to Buddhism. According to the text Upagupta was youngest child of a Gandhika (scent-dealer) named Gupta. He was ordained to Buddhism by a learned monk named Sthavira Sanakavasi and he attained arhatva (stage of an arhat) in a short period. He was so important as a monk that he has been styled as a Buddha without lakshanas (Alakshanaka Buddha). His birth at Mathura was predicted by no less a person than Buddha himself when the later visited Mathura.

He is also said to have subjugated Mara like the founder of Buddhism. The details of the actual episode are as under.

One day when upagupta was preaching the law amidst a great gathering in the city of Mathura, Mara, the god of Temptation, showered strings of pearls amongst the assembled people to divert their attention. As a result none could realize the Truth. Next day, too during his discourse there was again a rain of gold and real pearls. Upagupta's preaching remained effectless. On the third day when Upagupta began to expound the Dharma, Mara caused ceslestial damsels to appear there and to sing and dance with the diving instruments. Consequently the audience felt attracted towards the heavenly nymphs and their music. Mara was delighted at this sight and Placed a flower-garland around the head of Sthavira Upagupta. There upon the great monk thought of subjugating Mara and created a flower garland out of the skeletons of a snake a dog and a man. The garland was put around the head of Mara who found after Wearing it that instead of garland there were skeletons of snake, dog and man tied to his head, neck and ears. Mara tried to remove the bones from his body but did not succeed. He thereafter flew up into the sky and sought the help of the gods like Indra, Rudra, Vishnu (Upendra), Yama, Varuna and other divinities but they expressed their helplessness in the matter. Lastly for his relief he approched Brahma who adviced him to resort to Upagupta quickly to attain deliverance. Mara then realized the significance of Buddha as expressed in the following verse:

ब्रह्मणा श्रूयते यस्य शिष्याणामपि शासनं ।
तस्य बुद्धस्य सामर्थ्यं प्रमातुं को नु शक्नुयात् ॥२६॥
अहो मैत्रि मुने महाकरुणता तस्यापि मैत्रात्मनः सर्वोपद्रवविप्रमुक्तमनसः
मोहान्धेन हि तत्र तत्र समयः तैस्तैर्नयैः खेदित तेनाहं च तथापि नाम बलिना चामीकराद्रिद्युतिः ।
नैवाप्रियं श्रावितः ॥२७॥

i.e. How great must have been the Powers of Buddha,because even Brahma respected the command of his disciple, It was only the forgiveness of the Compassionate one that in spite of his Mara's repeated attacks on him ,due to ignorance the Benevolent Master even did not address him in harsh words ever.

Consequently with a feeling of deep repentance Mara Prostrated at the feet of Venerable Upagupta and requested for the removal of the skeletal fetters from his body. The great Monk agreed to do so on to Conditions that thereafter he would not disturb the Bhikshus and he would kindly show him the human form of Buddha, for he has seen only dharmakaya of the Lord of Three worlds and not his rupakaya.

धर्मकायो मया तस्य दृष्टः त्रैलोक्यनाथस्य ।
काञ्चनाद्रिनिभस्तस्य न दृष्टो रूपकायो मे ॥
तदनुग्रहं प्रति त्वमिह विदर्शय बुद्धविग्रहं ।
प्रियमधिकमतो हि नास्ति मे दशबलरूपकुतूहलार्थिनः

Mara agreed to obey the comnands of Upagupta but warned him that he should not show any respect to him in his form as Buddha, for that Would destroy him. The God of Temptation (Kama-dhatupati) then disappeared and reappeared shortly in the garb of Buddha with thirty two signs from a forest. It was most pleasing to the eyes and looked like a brilliantly produced coloured - portrait. The actual text is as under:

सहसा त्वामिह दृष्ट्वा बुद्धनेपथ्य धारिणम् ।
न प्रणामस्त्वया कार्यः सर्वज्ञगुण गौरवात् ॥ 40 ॥
बुद्धानुस्मृतिपेशलेन मनसा पूजां यदि त्वं मयि
स्वल्पामप्युपदर्शयिष्यसि विभो दग्धो भविष्याम्यहम् ।
का शक्तिर्मम वीतरागविहितां सोढुं प्रणामक्रियां
हस्तिन्यासमिवोद्वहन्ति न गजस्यैरण्डवृक्षाङ्कुराः ॥ 41 ॥
. . . .
मारश्च वनगहनमनुप्रविश्य बुद्धरूपं कृत्वा नट इव ...
तद्यथा हि : तथागत रूपस्योत्तमलक्षणाढ्य - मादर्शयन्नयनशान्तिकरं नराणाम्
सत्यम्परङ्गमिव चित्रपटं महार्हमुद्घाटयन् वनमसौ तदलंचकार ॥ 43 ॥
अथ व्यामप्रभामण्डलमण्डितमसेचनकं दर्शनं भगवतो रूपमभिनिर्माय दक्षिणे पार्श्वे
स्थविरशारद्वतीपुत्र वाम पार्श्वे स्थविरमहामौद्गल्यायन पृष्ठतश्चायुष्मन्तमानन्दं
बुद्धपात्रव्यग्रहस्तं स्थविरमहाकश्यपानिरुद्ध सुभूति प्रभृतीनां च महाश्रावकाणां
रूपाण्यभिनिर्माय अर्धत्रयोदशाभि भिक्षुशतैरर्धचन्द्रेणानुपरिवृतं
बुद्धवेषमादर्शयित्वा मारः स्थविरोपगुप्तस्यान्तिकमाजगाम ।

Seeing this pleasant spectacle Upagupta condemned the impermanent nature of things which destroys the rupa including even that of Buddha.The avadava beautifully describes the majestic form of Buddha as seen by Upagupta which was full of grasce and spotless beauty.

वक्त्रेणाभिभवत्ययं हि कमलं नीलोत्पलं चक्षुषा
कान्त्या पुष्पवनं घनं प्रियतया चन्द्रं समाप्तद्युतिम् ।
गाम्भीर्येण महोदधिं स्थिरतया मेरुं रविं तेजसा
गत्या सिंहमवेक्षितेन वृषभं वर्णेन चामीकरम् ॥ 45 ॥
संबुद्धालम्बनैः संज्ञां विस्मृत्य बुद्धसंज्ञामधिष्ठाय मूलनिकृत्त इव
द्रुम सर्वशरीरेण मारस्य पादयोर्निपतितः । . . . .
. . . . . . ? मार उवाच - ननु प्रतिज्ञातं भदन्तेन - नाहं भवन्तं
प्रणमिष्यामीति ।

Upagupta feeling the presence of the Lord forgot that it was an illusion and prostrated like a fallen truak of a tree in front of the figure of Buddha. When Mara reminded him of his promise the monk said that he was paying homage to Buddha and not to Mara, although he knew that blessed One was no more. He further told that When people worship earthen images they bow to the god represented by the icon and not to image itself, and his action was similar only to this kind of worship.

मण्मयेषु प्रतिकृतिष्वमराणां यथा जनः।
मृतसंज्ञामनादृत्य नमत्यमरसंज्ञया ॥ 49 ॥
तथाहं त्वामिहोद्वीक्ष्य लोकनाथवपुर्धरम।
मारसंज्ञामनादृत्य नतः सुगतसंज्ञया ॥ 50 ॥
अथ मारो बुद्धवेषमन्तर्धापयित्वा ~~स्थ~~ स्थविरोपगुप्तमभ्यर्च्य
प्रक्रान्तः। यावच्चतुर्थे दिवसे मारः स्वयमेव मथुरायां
घण्टावघोषितुमारब्धः - यो युष्माकं स्वर्गापवर्गसुखं
प्रार्थयते, स स्थविरोपगुप्तसकाशाद्धर्मं शृणोतु ......
. . . .

Mara then came in his actual form and invited people to listen Upagupta discourse.

It is necessary assess contents of the Avadana in the light of known facts of history. During the 3rd Century B .C. Upagupta might have been a historical personality who might have interpretted the Law of Buddha in one or the other way but the story of sabjugation of Mara by Upagupta appear to have been deleberated added to introduce justify the worship of Buddha's image in anthropomorphic form. This is evident from Upagupta's reference to the prevailing worship of images in terra-cotta of various deities. The need of such an action was mo st probably felt at Mathura by Sarvastivadins. Asagosha who seems to be leader of such a monument, gave it a mythological colour. MOst probably he was also the author of Asokavadana for it tallies to a great extent with the contents of Asvashaosha's Sutratankara even in the translated form. In the great Buddhist Council held under the patronage of Kanishka(I at Kundala-Vana Mahavihara, with which Asvagosha was also associated as Vice-President, perhaps approved the idea to introduce the worship of the image of Buddha in human form.

It is due to this reason that early images of the Buddha are available both in Mathura and Gandhara at the same time. The spread of this movement to important Buddhist Centres in Madyadesa is further attested to by records of monks inscribed around the third regnal year of Kanishka (I) at Sarnath, Kausambi and Sravasti which refer to the installation of Bodhisatva images resembling the earlier representations of Buddha.

What we intend to emphasize is that through the episodes like the one of Upagupta and Mara presented in the Divyavadanam the Buddhists of the Sarvastivada school attempted to project the importance of Buddha's Rupakaya although that may even be false or an illusion. In this episode, even the Mara, the enmy of Buddha in a way is utilized for a noble cause generating an intense devotion to the Blessed one, Thus the narration of such stories amongst the public by Dharma-Bhanakas (narrators of Dharma) and efforts made by monks like Bala in setting up the Buddha image under the name of Bodhisatva may have convinced to a large extent orthodox Buddhist of Ganga-Yamuna region to accept the figure of Buddha as an object of worship.

REFERENCES

1.Cf.Ananda: 'Kathamayam Bhante Tathagatssa sarire pattipajjamiti' Buddha 'Ayvavata tumhne Ananda hotha Tathagassa sarira-pujaya. Ingha tumhne Ananda sadatthl ghatapa............'Mahabarinibbana sutta

2. P.L. Vaidya (ed) Divyavadanm (mithila, 1900) p.240-241.

3. Nalinaksha dutta (revised), Saddharmpundarikasutram (with N. D. Mironov's readings from Central Asia Mgs.) (Calcutta, 1953), P.xiii

4. Ibid., P.xiv

5. M.C. JOSHI, Aspects of Mauryan and Early post-Mauryan Art in Journal of the Indian society of oriental Art (new Series), Vol. XVI & XVII (Calcotta 1989), P.16

6. P.L. Vaidya, op.Cit PP.216 ff. and also Sujitkumar Mukhopadhyaya (ed, annoted and partly translated) Asokavadana (New Delhi, 1963) pp. 1 ff.

7. D.C. Sircar, Select Inscriptions, second edition, (Calcutta 1965) pp.135-137 and PP.144-145

ARCHAEOLOGICAL EVIDCNCE OF BUDDHIST LINKS BETWEEN SRI LANKA AND ARAKAN

By
C. Raymond

Arakan (or Rakhine, in the Arakanese language) is the region occupying three hundred and sixty miles (c. 600 km) of the northeastern Bay of Bengal coast. Situated between India (the present-day Bangladesh) and Burma proper, Arakan has served historically as a vital conduit for the propagation of Indian culture, art, and religion throughout Southeast Asia. Because of this critical geographic position, Arakan's history has been intertwined with both the fortunes of the Hindu and the Muslim dynasties of eastern India and those of the Burmese kings of Pagan, Ava, Pegu and Amarapura.

The historic boundaries of Arakan have expanded or shrunk with the military prowess and administrative abilities of the various Arakanese kings: in time of greatness, the Kingdom of Arakan extended even to Chittagong (well into Bengal), and encompassed about twice the territory of the present Burmese state of Arakan.

According to the Arakanese chronicles, the region's earliest inhabitants were the *Raksha* or*bilu* (referring, possibly, to negrito aborigines of uncertain origin.) Subsequent waves of immigration included tribals such as the Mros and Saks, followed by Chins, Khamis, Daignets and Chaungthas, the descendants of whom remain to this day in the more isolated, hilly areas of Arakan.

The local chronicles make much of the coming to Arakan of Indo-Aryan peoples from the Gangetic Plain, and the founding of the cities of Dhanyadi and Vesali in the foothills above the Kaladan River Valley, some fifty miles upriver from the present city of Sittwe (Akyab).

If the Mahamuni legend as related in the ancient manuscript entitled *Sappadadamapakarana* is largely historically accurate, Buddhism has a particularly long history in Arakan: according to these tales, Chandasurya, king of Dhanyawadi (the first Arakanese capital) during Buddha's lifetime, was graced by a personal visit from Lord Buddha. In reality, however, King Chandasurya did not ascend the throne of Arakan until 146 A.D., some six hundred years after the death of Buddha.

But in *Sappadadamapakarana*, the The Buddha, with his retinue of five hundred *rahans* (Burmo-Rahkine for the Pali *arahat*), flew through the skies from India, to preach a great sermon on Kyautaw Hill (near Dhanyawadi). The Buddha's week-long visit was a great success: the King, his court and all his subjects were passionately converted to the new faith. Before departing, the king prevailed upon the Buddha to allow an exact likeness of himself to be made as a continual reminder of the truth and goodness of his teachings. The Buddha agreed, and with considerable help from the gods, the inhabitants of Dhanyadi cast a bronze image under the Buddha's personal supervision. After the sacred image was finished, it was installed with much pomp and ceremony on a small hill close to the city. This statue known as the Mahamuni Buddha became famous for its magical powers for ages afterwards.

With the passage of time, that site became a major religious centre for the Arakanese as well as for pilgrims from neighbouring Buddhist states who, understandably, were extremely envious of the Mahamuni image. There are records which state that various kings of the historic Burmese capitals —Sri Ksettra, Pagan and Pegu— had mounted periodic forays into Arakan with the expressed intention of carrying off the Mahamuni image, considered by the Arakanese being the palladium of their kingdom, for themselves.

Many of the Arakanese chronicles emphasize Gautama Buddha's visit to Arakan, dating the arrival of Buddhism at Dhanyawadi to the lifetime of the Great Master. In the "Vesali and Mahimsaka Chronicle" —one of more than forty ancient palm-leaf manuscripts still extant relating the traditional history of Arakan— the place-name "Mahimsakamandala" appears, corresponding to the area of greater Arakan. In both the Lankan *Mahavamsa* and the Burmese *Sassanavamsa* are found references to the Buddhist mission to Mahimsakamandala dispatched by Emperor Asoka and led by the Venerable Maharevata.

The later copper-plate inscriptions of the Vesali King Niti Candra (520-575 AD ??) recording "the perpetual deeds of merit and charity done by the king in solemn devotion towards the Buddha" constitute further evidence of a comparatively early Buddhist presence in Arakan (relative to Burma, if not to Lanka).

We also have other such indicators: the Sanskrit "Ananda Candra" inscription on the Vesali pillar now preserved at the Shitthaung temple of Mrauk-U, the last capital of Arakan (15th-18th centuries AD), and epigraphically dated to the early 8th century A.D., enumerates the list of all kings —Dhanyawadi, as well as Vesali— who were believed to have ruled over the area prior to King Ananda Candra of Vesali.

If we did an estimate based on this kingly genealogy, rather arbitrarily lending to each ruler an average tenure of twenty years, the reign of King Candradaya of Vesali —inscribed on the Shitthaung pillar as "the good", and "the benevolent"— can be placed somewhere near the end of the second or the beginning of the third century A.D.

The use of these particular two epithets suggests a royal Buddhist affiliation, in which case Buddhism would have certainly been prevalent in Arakan by the 2nd century A.D. However, Buddhism is strongly believed to have come to Arakan at a considerably earlier date:

According to our method of chronologically de-coding the Shitthaung pillar, it would seem that Dhanyawadi was the capital of Arakan until about 370 AD, followed by Vesali until at least A.D.597. In both cases, the archaeological remains of the two cities reveal an outer city wall and an inner moated city surrounding a palace site where royalty and officials resided. Commoners occupied and cultivated rice within the confines of the outer city.

Vesali, the larger of the two cities, covered an area of 2.7 square miles. Remains of stone steps formerly leading to a pier may be seen at low tide on the northwestern side of the city. Vesali was once a notable trading port: according to the the chronicles "as many as a thousand annually". Under the founding Candra Dynasty (A.D.788-957), Vesali was a prosperous Hindu-style Bengali kingdom.

Numerous Brahmanical silver coins have been found in around the Vesali city site. On some coins there is an undecipherable Nagari inscription. Stone statues from both the Hindu and Buddhist pantheon, dating as far back as the fifth century A.D., have been recovered in the vicinity of Dhanyawadi and Vesali. Although cruder than Indian work, Pala and Gupta influences are clearly evident. It would appear that Hinduism and Buddhism (possibly of the Mahayana lineage) existed side by side in ancient Arakan. Better evidence should arise from excavations being carried out and planned by Burma's Department of Archaeology at Dhanyadi and Vesali, although no significant finds have thus far been reported.

In the middle of B.C. 3rd century[1] during Devanampya Tissa's rule, the great Buddhist missionary Thera Mahinda arrived in Lanka: in short order, Buddhism gained the status of state religion there. The Mahavihara Buddhist centre was well-established at Anuradhapura by the close of the 3rd century B.C.[2] A century later, Vattagamini Abbaya (29-17 B.C.)[3] built the Abhayagiri Vihara, a second major centre of monastic Buddhist learning in Anuradhapura.

By the close of the first century B.C., there was a surfeit of important events in Anuradhapura: the city was ruled by five Hindu Tamil kings from 43 to 29 B.C., and the Buddhist King Vattagamini went into hiding. In 13 B.C., Mahaculika Mahatissa was succeeded by Vattagamini Abhaya's son, Coranaga. Coranga was hostile to Buddhism and destroyed eighteen viharas, where he had been denied shelter earlier when he was staging a rebellion against his cousin, Mahaculika Mahatissa (B.C.17-3).[4]

During this era of disturbances the country was ravaged by a famine, popularly known as the Brahmana Tissa famine or *Brahminityiasya*: according to the myths, starving people were compelled to committ such atrocities as killing —and then eating— those same Buddhist monks whom they had previously venerated. With or without cannibalism, thousands of Buddhist monks and lay-people doubtless perished. Viharas were deserted, even the Mahavihara was abandoned to the jungle and the Mahathupa lay in complete neglect. Many monks left the island for India. The country was physically and spiritually devastated.[5]

Elder Sinhalese monks perceived that the future of Buddhism was endangered, since the continuation of the oral tradition of conveying the *Tripitaka* from teacher to pupil appeared no longer possible in such a tragic and murderous period. Attempting to safely preserve the Teachings of Lord Buddha in a time of chaos, the far-sighted mahatheras —under the patronage of the local chief— assembled at Aluvihara at Matale (in the south of the island), and for the the first time in Lankan history, commited to writing the whole of the Tripitaka, along with with the full commentaries, *in order that the True Doctrine might endure.* [6]

In the A.D. first century, dissension began to show up in the Sangha, which had till then had been united under the influence of the Mahavihara. Later, the Dhammaruci sect (the Abhayagiri Vihara group) separated from Mahavihara and founded Jetavana vihara, which eventually became Mahayana-oriented.

According to the Arakanese Chronicles, Sri Lanka and Arakan religious exchanges began from the second century A.D.[7] During the reign of King Suriyasiri (A.D. 201-221),[8] twelve Arakanese monks led by Nanasiridhipati Mahatera were sent to Sri Lanka as missionaries, after a period of Hindu ascendance there.

According to the *Culavamsa*, Vijayabahu I (A.D. 1065-1120) sent envoys with valuable gifts to Anirudda, the king of Ramanyadesa (Pagan), seeking assistance against Cola invaders. (No indication of Anirudda's assistance, if any, has been found.)

K.L.Hazra says, "during this time, Theravada Buddhism was in a flourishing condition in Lower Burma. The conquest of Thaton in A.D. 1057 by Pagan marks as a landmark in Burmese history, and Pagan eventually evolved into a famous Buddhist centre in South-East Asia."[9]

According to the Arakanese Chronicles, the Kingdom of Arakan conducted religious exchanges with Sri Lanka during this same period, although Sri Lankan sources are silent on this matter. But Arakanese chronicles note the sending of religious envoys to Arakan by the King of Sri Lanka, during the reign of Datharaja (A.D. 1123-1139).[10] The delegation sent by Datharaja was comprised of twenty-seven monks, headed by the Venerable Atulavijaya Mahathera.[11]

The Polonnaruva stone inscription of the Velaikkaras (A.D. 1137-1157)[12] mentions a purification campaign conducted within three sects in Sri Lanka during the reign of Vijayabahu I, with the help of Sangha delegates from *Arumana*. (According to the Arakanese chronicles, *Arumana* can be one of the names for Arakan.)

Later, King Nga-ra-man (who in 1156, succeeded his father Min-zu-thein, who had established his capital at Parein) sent a delegation of 36 Buddhist monks, led by Ven.Uttara Dhamma, to Parakramabahu I (1153-1186).[13] But the period between Vijayabahu I and Parakramabahu I can be consideredas a dark chapter in Sri Lankan history. According to K.L.Hazra, "during this period neither Burmese sources such as the *Sassanavamsa* and "the Glass Palace Chronicle", nor Sinhalese sources like the*Culavamsa* mention any religious or political contact between Sri Lanka and Burma".[14]

The Golden Age of Mrauk-u, extending from the fifteenth to the beginning of the seventeenth century, was also a high point of cooperation betweeen Arakan and Sri Lanka. Considerable evidence indicates the close political, cultural and religious ties then existing between these two countries: King Ba Saw Phru (1459-1482) received the Tripitakas from Sri Lanka in A.D.1476[15] and in return, sent a religious delegation to Lanka led by the Ven. Siddharta. An ola leaf manuscript, the Kaladora Grant[16] found in Sri Lanka, refers to religious intercourse between Lanka and *Rakkhangapura*[17] (Arakan) during the sixteenth century A.D. Suchinformation is corroborated by the *Culavamsa*, the *Sulupujavaliya* and the *Narendra Caritavaloka Pradi Pikava*.

In the reign of Mon-raza-Gri, a Lankan envoy bearing gifts arrived at Mrauk-u, and in return, the Arakanese king sent twenty Buddhists monks under the leadership of the Ven. Candravilasa Mahathero to Sri Lanka. On arrival there in November 1563, they staged a reformation campaign of the Buddhist Sangha and conducted the Ordination *(Upasampada)* at Udaku-khepa sima.

In the reign of Vimaladhamma Surya I (A.D. 1592-1604) when Sri Lanka was in need of learned monks to restore the Buddhist Sangha, the king sent a mission to Rakhangapura, specifically inviting the Arakanese monk Nandicakka, one of the leading *theras*, and a figure so well-known that his fame even reached Lanka.

(This period was characterized by a serious set-back to Buddhism in Burma under Nanda Bayin, with the country then divided into a host of small states; Pegu, once a great centre of Theravada, was depopulated by famine, war and internal conflict.)

Shortly thereafter, King Min-khaung-raza (1621-1631)[18] ruled in Arakan. He appointed his son, Min-bar as Governor of Sandoway. Prince Min-bar selected the Ven. Tejosara, from Mrauk-u, to be sent on a religious mission to Lanka.

The Kings of Sri Lanka warmly received both the Nandicakka and Tejosara missions.

The *Culavamsa* and the *Sassanavamsa* each contain important evidential records of religious intercourse between Arakan and Sri Lanka during King Vimaladhamma Surya II's reign. Both chronicles refer to the arrival of the Sinhalese envoy in Rakhangapura[19] and the restoration of the Sri Lankan Buddhist Sangha by Arakanese monks.

After receiving another envoy sent by the Lankan King Vimaladhamma Surya II seeking religious assistance, the Arakanese king Maruppya (1606-97) selected the Ven. Indamanju, Abbot of Sattatthana monastery, as leader of a mission to Sri Lanka in 1696.[20]

Of the two, the Ven. Nandicakka was a leading Mahathera whose name must have been well-known to the Sri Lankans as a result of Sri Lanka's close connections to Arakan. His group was received with great honours and the *upasampada* ordination was conducted under the auspices of Ven. Nandicakka himself in the udakkhepasima (ordination hall) at Getambe near Peradanya in A.D. 1696.[21] Several members of the royal family and many other nobles received lay ordination at that time. Thus the Sri Lankan Buddhist Sangha was repeatedly restored by Arakanese monks.

Another ola leaf manuscript[22] recording religious intercourse between Arakan and Sri Lanka was discovered at Kadedora Vihara in Gannave Korale, Udahevahata, Sri Lanka, mentions Candivilasa and Nandicakka. The *Culavamsa,* however, does not speak of Candavilasa, but refers only to Nandicakka.[23] The *Sulu-paja-valiya* states the names of both Mahatheras.

Thus, in the 16th and 17th centuries, the relationship between Sri Lanka and Arakan had been critical to the re-establishment and restoration of Buddhism in Sri Lanka, specifically in the performance of religious ceremonies and higher ordinations.

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1 *Dipavamsa* vol.vii, p.18 and, p. 39-54.& *Mahavamsa* vol.v, p.195.

2 W. Rahula, *History of Buddhism in Ceylon*, 1966, p. 52.

3 *Mahavamsa* xxxiii, p. 18.

4 W.Rahula, op.cit. p.85

5 *Vibhanga Atthagatha*, p. 314-318.& *Annguttara Nikâya Atthakarathâ*, p.52.

6 *Mahavamsa* , xxxiii, p.100-101 & *Dipavamsa* ,xx,p.45.

7 *Rakhaing Magazine*, vol. iv, 1977, p.132.

8 *Rakhaing-prene Phritsaing Thamaing Hmâ*, vol. i, 1984, p. 120.

9 K.L.Hazra, *History of Theravada Buddhism in South-East Asia*; 1982, p. 82.

10 *akhaing-prene Phritsaing Thamaing Hmâ*, vol.i, 1984, p. 120.

11 *Rakhaing Magazine*, vol.iv, 1977, p. 132.

12 *Epigraphia Indica*, xviii, 1925, p.133.

13 Ashin Candamâlâlikâra, *Rakhaing Razawon Thee Kyan*, vol.i, 1931, p. 347.

14 K.L.Hazra,. op.cit. p.89.

15 Ashin Candamâlâlikâra, op. cit.,vol.ii,1931, p.31.

16 *Journal of the Ceylon Branch of the Royal Asiatic Society*, vol.ii, 1952.

17 Rakkhangapura means "Arakan"

18 *Rakhaing-prene Phritsaing Thamaing Hmâ*, vol. i, 1984, p.124.

19 *Culavamsa*, xciv, p. 15-16 & *Sassanavamsa*, p. 27.

20 *Rakhaing Magazine*, vol.iv, 1977, p.133.

21 *Culavamsa*, xciv, p.15.

22 *Journal of the Ceylon Branch of RAS*,vol.ii, 1952, p. 157.

23 *Culavamsa*, xciv, p.15.

ARCHEOLOGIE ARAKANAISE
panorama archéologique de l'ancien royaume d'Arakan en Birmanie, dès origines au XVIIIème siècle

par
C. Raymond

(Condensed version of the text accompanying a slideshow originally presented in Paris, 7 February 1990 at Institute Nationnal des Langues et Civilisations Orientales.)

L'objectif était de présenter une partie des recherches sur le royaume de l'Arakan situé le long du golfe du Bengale, entre l'actuel Bangladesh et Yangon (Rangoon) la capitale de Myanmar (Birmanie).

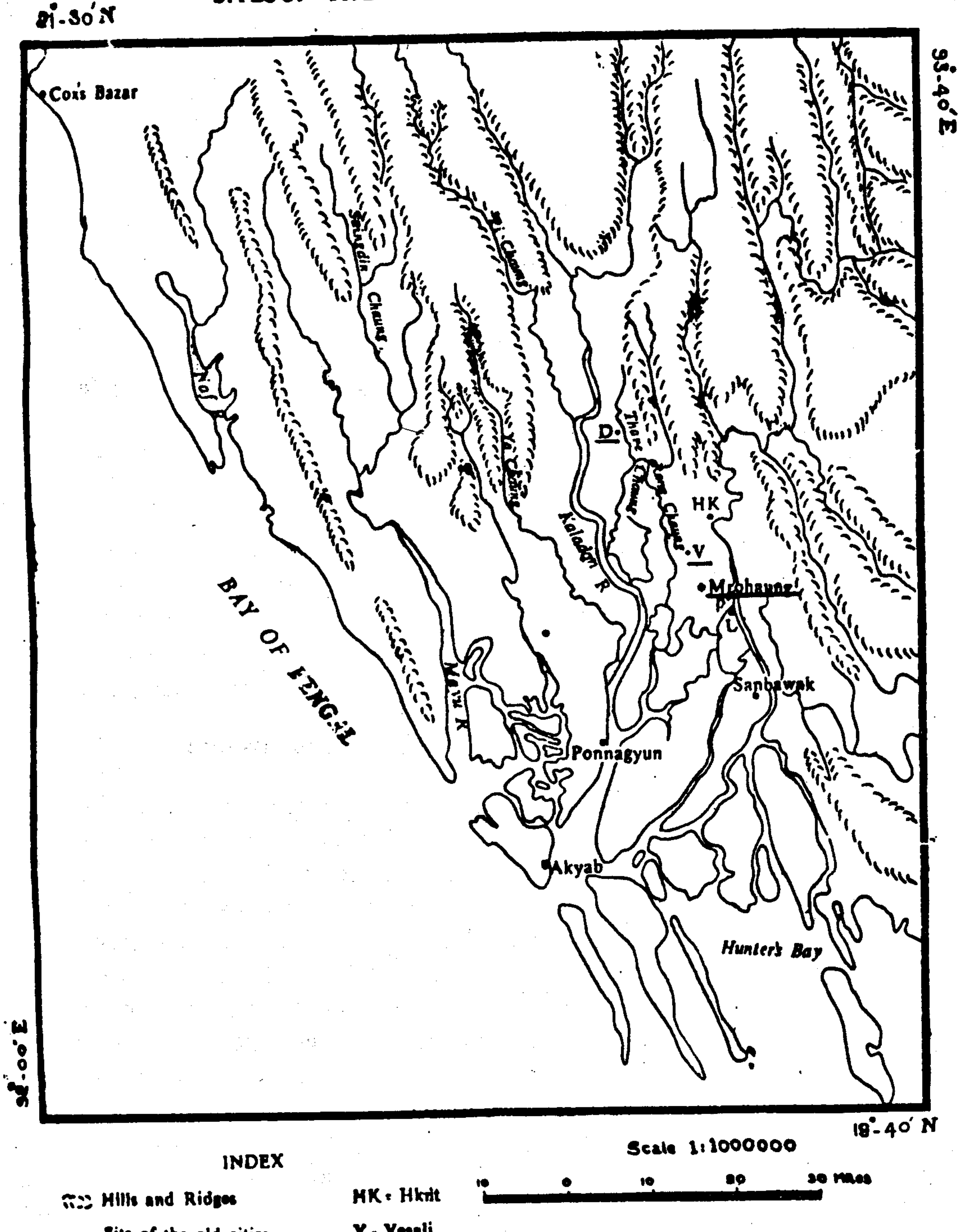
Selon la légende, son origine remonte au début de l'ère chrétienne et bien qu'il fut quelquefois tributaire de la Birmanie ou du Sultanat du Bengale, il su préserver son indépendance jusqu'au XVIIIème siècle date à laquelle il fut intégré à la Birmanie. Grâce à sa situation privilégiée entre l'Inde et l'Asie du Sud-Est, l'Arakan fut l'une des voies de pénétration de la culture indienne et du bouddhisme en Asie du Sud-Est.

Difficile d'accès — accès soumis, en outre, à des autorisations spéciales— cette région ne fit guère l'objet d'études du temps des Britanniques. Pourtant, de nombreux sites archéologiques jalonnent ce royaume qui dut déplacer sa capitale de nombreuses fois au cours de son histoire (cela dû en partie à sa topographie).

Une topographie qui en dit long sur son histoire.

L'Arakan, longue bande de terre s'étirant du Nord au Sud le long du Golfe du Bengale, est limité au Nord et à l'Est par une longue chaîne de montagnes- l'Arakan Yoma-, à l'Ouest par le Golfe du Bengale et l'estuaire de la Naf, et au Sud par une série de criques le séparant du district d'Aung et de l'île de Ramree. Trois grandes rivières la traversent: à l'Ouest la Mayu, au centre la Kaladan et à l'Est la Lemro. Toutes les trois dirigent leurs cours du Nord vers le Sud et chacune d'elle est séparée par des chaînes de montagnes alternant avec des plaines fertiles à perte de vue. Les trois rivières se rejoignent et forment un vaste delta composé de nombreuses criques. Ainsi se dessine deux zones: un pays montagneux au nord ayant abrité de tout temps de nombreuses tribus comme les Mro, les Saks, les Chins, les Khamis, les Daingnets et un pays de plus en plus ouvert. Quelques chaînes de montagnes s'intercalent entre les plaines fertiles s'étendant à perte de vue jalonnées de villages

SITESOF THE OLD CAPITALS OF ARAKAN



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Hills and Ridges

Site of the old cities

D - Dinnyawaddy

P : Parein

HK - Hkrit

V - Vesali

L - Launggret

et de nombreuses rizières coupées de sombres forêts. C'est dans ces plaines, le long des rivières, que ce sont implantées les capitales légendaires de l'ancien royaume de Dannyawadi.

Arthur P. Phayre, en 1841, fut un des premiers historiens de langue anglaise à s'intéresser à l'Arakan. Il s'appuya essentiellement sur les chroniques et les manuscrits arakanais conjointement à l'étude numismatique et épigraphique de documents arakanais pour nous livrer un certain nombre d'informations.

Mais c'est à Forchhammer que nous devons le premier rapport archéologique sur les anciennes capitales arakanaises qu'il inspecte en 1884. Ce n'est qu'en 1921, sous la direction de Charles Duroiselle, que les services archéologiques prennent en considération la restauration des monuments de l'Arakan, déjà fort endommagés lors de la visite de Forcchhammer. En 1927 commence la restauration des principaux édifices de la dernière capitale "Mrauk U" (oeuf de singe) de nos jours appelé Myo Aung (ancienne cité) et un musée y fut crée.

Delaissés à nouveau aprés l'indépendance de la Birmanie, la restauration et l'entretien du site sont actuellement poursuivis par le département archéologique de Rangoon, qui mène parallèllement , selon les années, des campagnes de fouilles, cela depuis 1979. Un nouveau musée a été aménagé depuis 1986.

Dépendant étroitement de son accés à la mer, l'histoire de l'Arakan se déroule le long de ces rivières. Pour des raisons de sécurité, les capitales vont s'établir de plus en plus à l'intérieur des terres, dans la zone montagneuse, en utilisant la configuration du terrain pour établir ses défenses afin de bénéficier de protection naturelle contre l'envahisseur envieux de la richesse de ces terres.

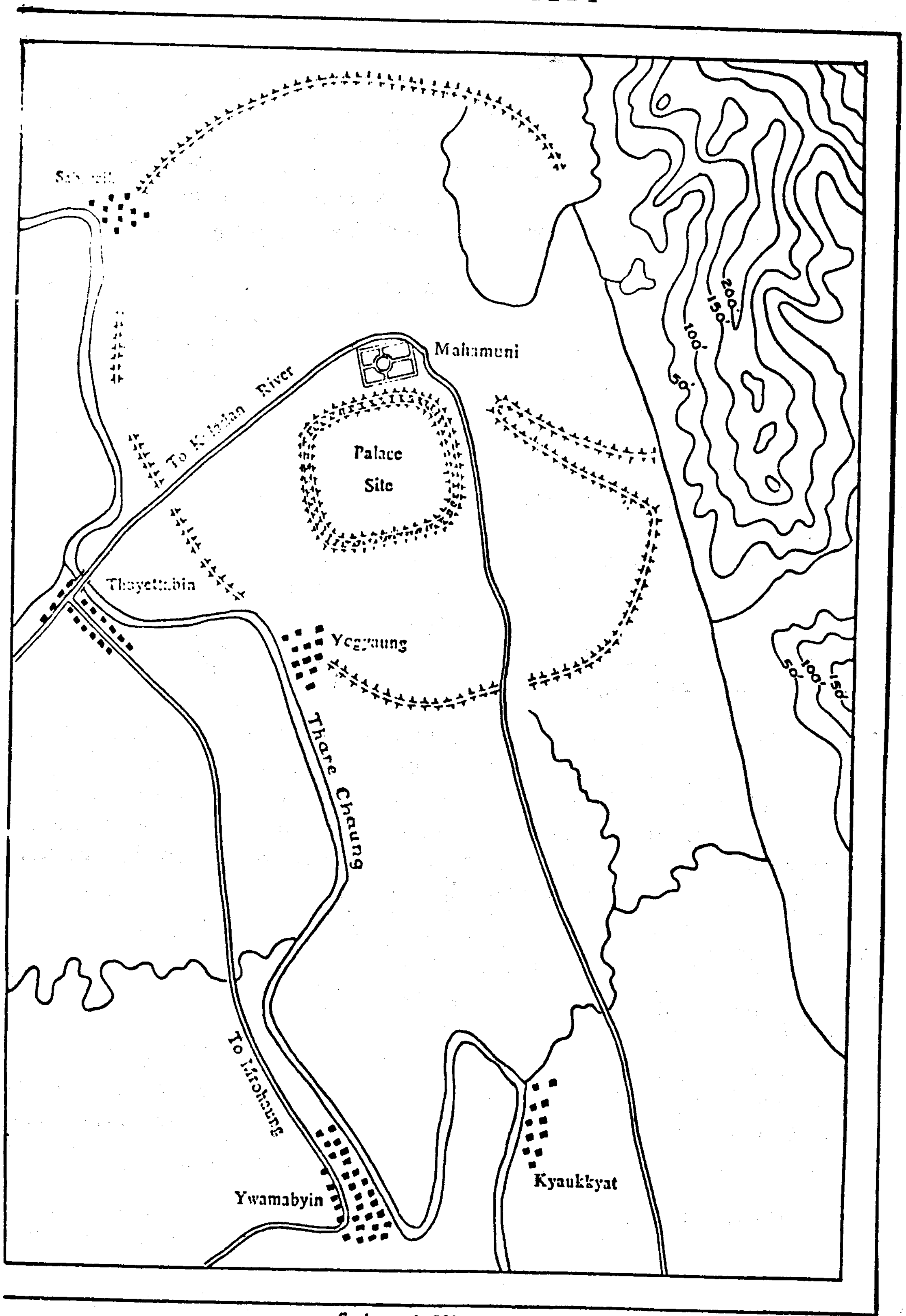
A. Les cités de la vallée de la Kaladan

Dannyawadi est aussi le nom qui désigne le royaume d'Arakan dans les chroniques. Selon elles, la cité aurait été la première capitale, ayant précédé Vésali. D'après Phayre et Harvey elle aurait existé de 146 à 788 après J.C.

Aujourd'hui il ne subsiste que les enceintes de l'ancienne cité, celle du palais et de la célèbre pagode Mahâmuni ayant abrité pendant des siècles l'imposante statue du Bouddha Mahâmuni, tant convoitée par les rois birmans et considérée par les Arakanais comme le palladium du royaume. En 1784 quand l'Arakan tomba sous le joug des Birmans le roi Bodawpaya mutila l'image sacrée afin de la transporter dans sa capitale, Amarapura.

De nos jours, elle se trouve à Mandalay dans la pagode de l'Arakan. Protégeant l'édifice, neuf statues en pierre toujours *in situ* furent

DINNYAWADI



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1000 500 0 1000 2000 3000 4000 5000 feet.

Contour Interval 50

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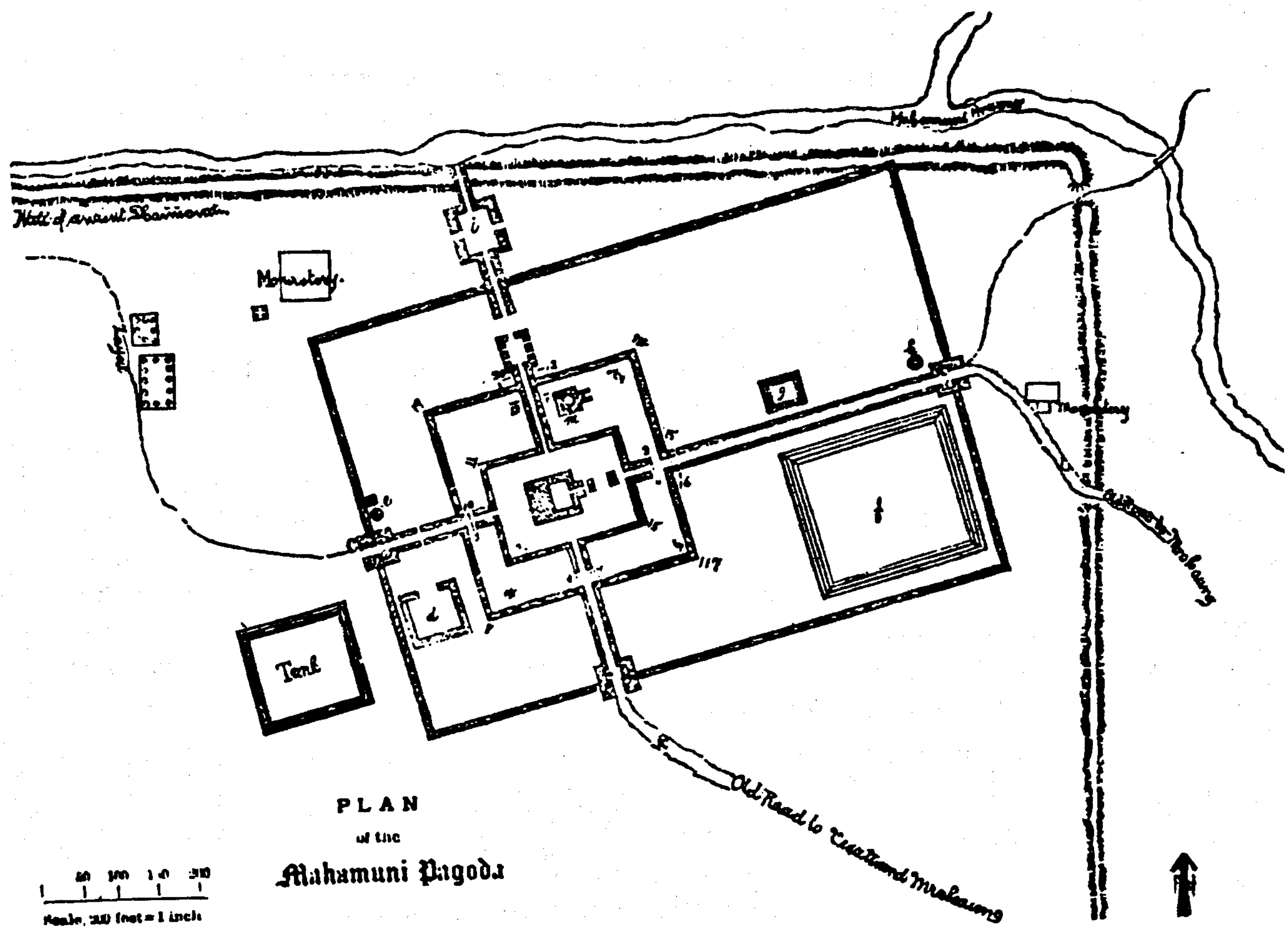
Village

Pagoda



Plan of the Mahamuni Shrine

retrouvées aux quatre points cardinaux. Selon Duroiselle, elles appartiendraient au style Gupta tardif et pourraient être datées entre le VIème et le VIIIème siècle. Mais aucun élément jusqu'à ce jour ne permet d'affirmer ou d'infirmer les dates proposées par les chroniques (la pagode Mahâmuni, a été détruite et reconstuite de nombreuses fois - la dernière reconstruction datant du début du XXème siècle- ne peut nous fournir aucune indication quant à l'époque de ces statues).

Vesali ancienne capitale de l' Arakan entre le VIIIème et le XIème siècle est aujourd'hui un petit village implanté sur les ruines de l'ancienne capitale. Elle était constituée d'une enceinte plus ou moins ovale entouré de fossés avec des murs en lignes droites au nord et à l'est et des murs incurvés au sud et à l'ouest. Elle possédait une cité *intra muros* comme à Dannyawadi. De nombreux réservoirs lui permettait de faire face à la saison sèche. Le département archéologique y dirigea cinq campagnes de fouilles entre 1979 et 1984 permettant de faire apparaître plusieurs structures attestant de la présence du bouddhisme et de l'hindouisme.

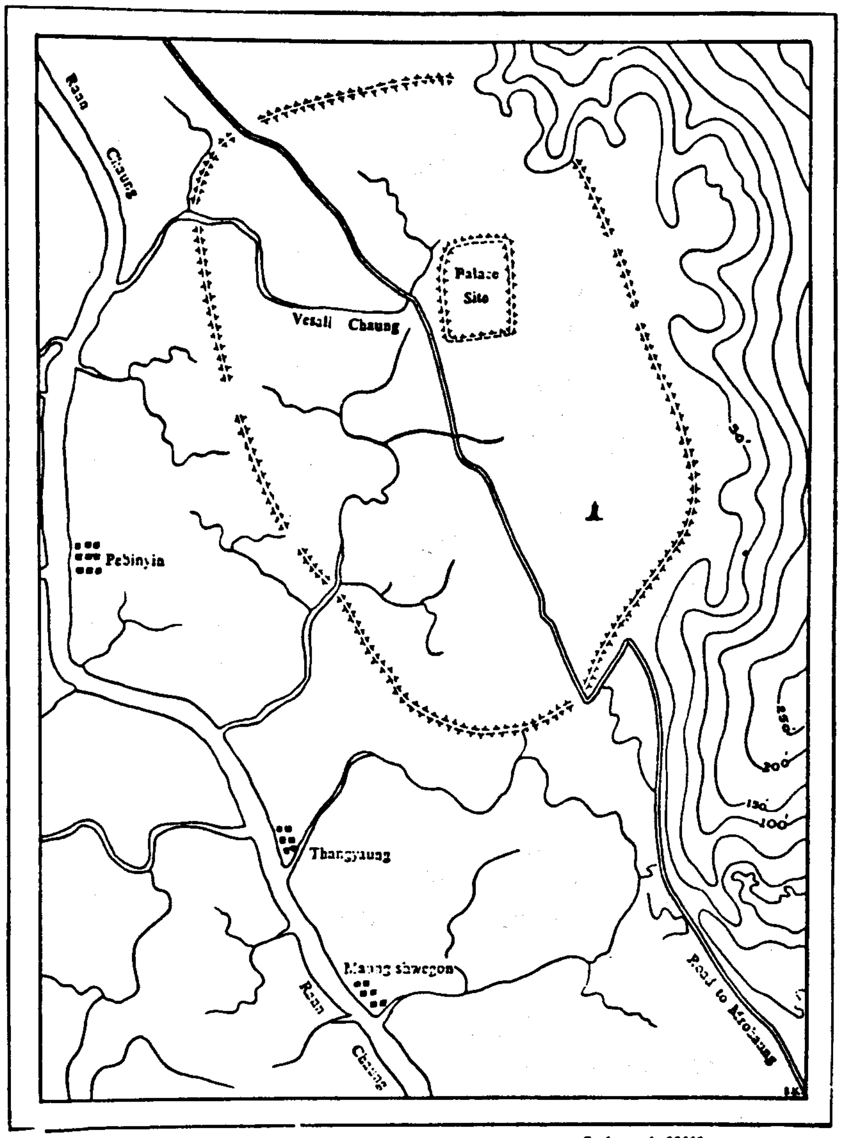
Le rapport définitif n'a pas encore été publié. Seul un article récapitulatif comprenant plusieurs planches des structures mises au jour, a été publié dans la revue "Arakan" en langue birmane. D'après les différentes inscriptions et le matériel exhumé U Nyunt Han, responsable de la campagne propose une nouvelle datation pour l'ensemble du site allant du IVème au XIème siècle. Ce qui d'après les résultats de la fouille paraît quelque peu surestimer l'ancienneté. Cette cité disparait au début du VIIIème siècle sous le roi Anandachandra. Celui-ci nous fit don d'une précieuse inscription en sancrit couvrant les quatre faces d'un pilier en pierre et portant la liste généalogique de ces prédécesseurs.

B. Les cités de la vallée de la Lemro

Du XIème au XVIème siècle une série de capitales éphémères va se succéder le long de la Lemro. Pour fuir l'envahisseur, les villes vont se fortifier et s'établir de plus en plus à l'intérieur des terres, en amont du fleuve.

Sambawak (Pyinsa) (20°23 de lat. N.,93°16 de long. E) fut dit-on, construit par un descendant du roi Chandra de Vesali en 1018 après J.C.. A cette époque l'Arakan doit s'incliner devant les raids successifs du jeune royaume de Pagan et devient son tributaire C'est le début des petites cités en Arakan.

Parrein (20°34 de lat. N., 93°14 de lon. E) fut fondée en 1118 par un usurpateur du nom de Letyaminnan. Il semblerait que celui-ci ait transféré sa capitale en raison d'une île qui se serait formée entre la Lemro et Sambawak. De la ville ancienne il ne reste plus rien.



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Scale 1: 20000

Village

Pagoda

Embankment

MAP City of Vesali

Hkrit (20°35 de lat. N.) élevé au XIIIème siècle, en amont de la Lemro pour des raisons de sécurité, à 17 km de Parrein est située entre la rivière Hkrit et la Lemro. De nos jours même le nom a disparu, seul subsistent les traces d'une enceinte carrée renforcée d'une double rangée de murs, entourés d'étroits fossés. Le site est actuellement recouvert de rizières.

Launggyet (20°82 de lat. et 93°14 de lon.E.) dernière des capitales éphémères occupe de nos jours une île sur la Lemro. A cette époque l'Arakan s'affranchit de la tutelle de Pagan et connait quelques années de paix et d'indépendance où elle étend son contrôle jusqu'à Chittagong. En 1404 elle est à nouveau l'enjeu de convoitise entre les birmans de Birmanie Centrale et les môns de Basse Birmanie. Le royaume d'Ava envahit son territoire et réaffirme sa suzeraineté. Le roi Minsawmun se réfugie au Bengal. Ce n'est qu'en 1630 que, soutenu par le sultan musulman Nazid-ud-din, il reconquiert son royaume et fonde une nouvelle capitale Mrauk U.

C. Entre la Lemro et la Kaladan

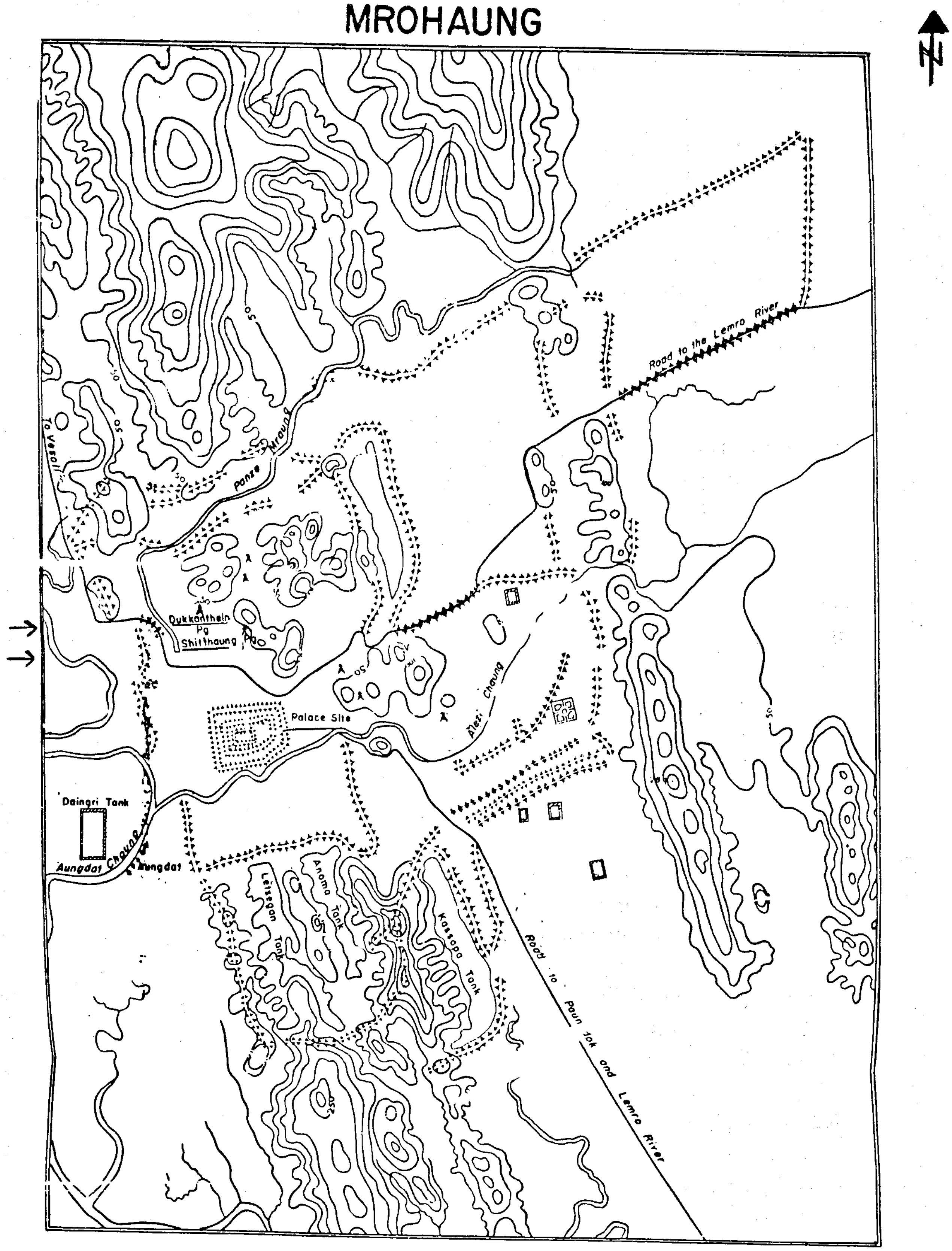
Mrauk U dit aussi Myohaung (20°25 de lat. N., 93°11 de long. E) C'est l'unique cité où subsiste, encore de nos jours, les défenses de la cité . Elle fut construite par Min Saw Mun en1430 avec l'aide des portugais. Elle commande l'accès, à la fois à la Lemro et à la Kakadan, par voie de terre et par voie d' eau. La ville s'adosse à une série de chaînes de collines parallèles de l'Ouest au Nord. C'est la plus grande cité de l'ancien royaume de l'Arakan. Ses défenses furent construites et renforcés de nombreuses fois pour se protéger des attaques birmanes et des menaces à l'Ouest. A l'image des anciennes capitales, elle possèdait une ville *intra muros* où se trouvait l'emplacement du palais dont seul subsiste une large plateforme de 2000 mètres de coté, surélevé par trois terrasses .

Au XVème et XVIème siècle le royaume est en plein essor comme l'atteste les nombreux monuments de la capitale édifier à cette époque. Le bouddhisme est en pleine expansion et l'on construit de nombreux temples et pagodes en pierre . Les plus célèbres sont le Shittaung, le Htukkanthein, l'Andawthein, le Ratanabon qui sont encore là pour nous parler des fastes de l'ancienne capitale décrit par les voyageurs étrangers se rendant en Extrême-Orient.

Au XVIIème siècle en proie à des luttes intestines le royaume va décliner rapidement et en 1784 le roi des birmans, Bodawpaya, l'annexera définitivement à la Birmanie.

MAP

MROHAUNG



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Village
Tank
Pagoda
Embankment

Scale 1: 20000

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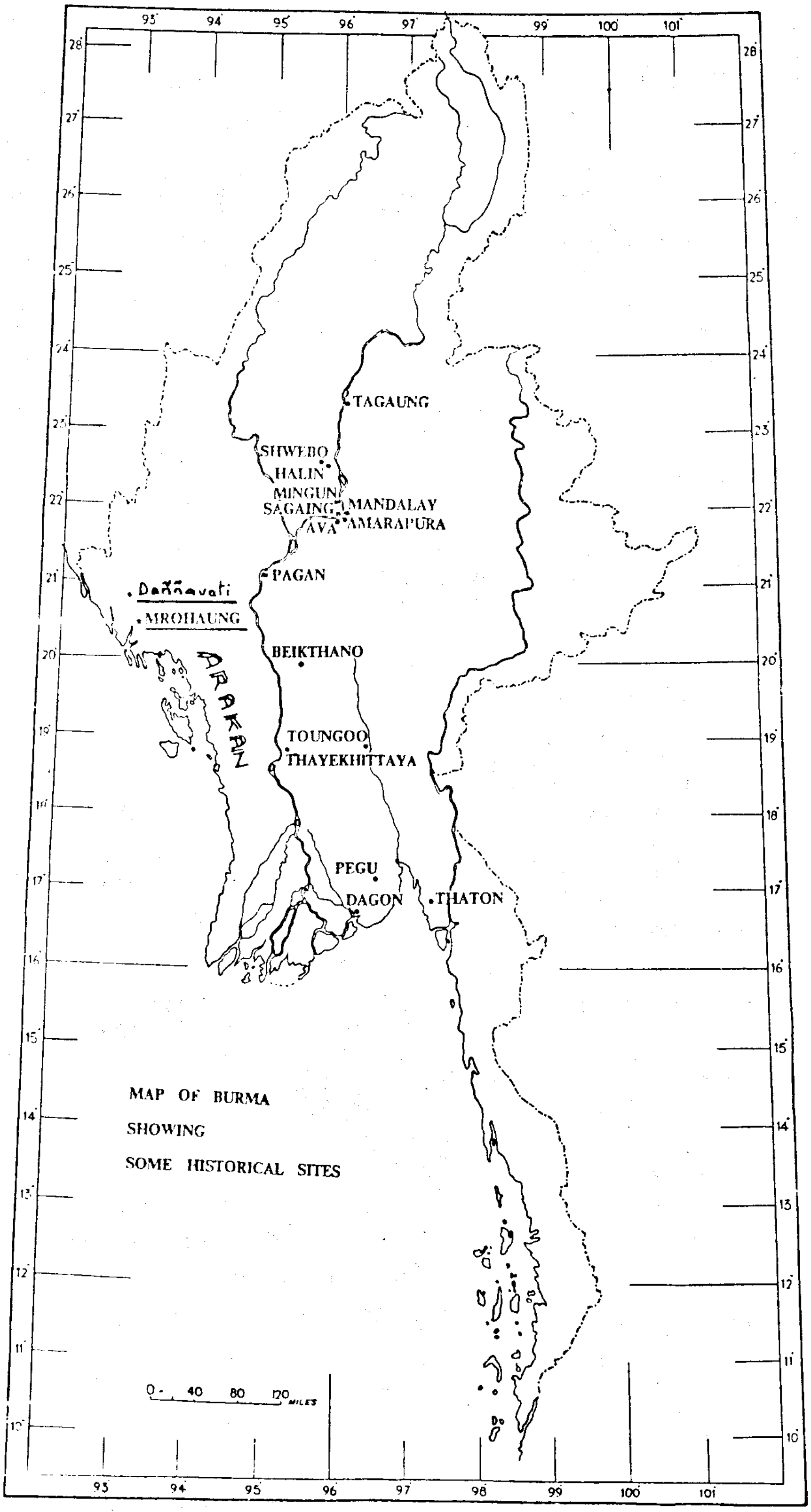

MAP OF BURMA
SHOWING
SOME HISTORICAL SITES
TAGAUNG
SHWEBO
HALIN
MINGUN
SAGAING
MANDALAY
AVA
AMARAPURA
PAGAN
Daññavati
MROHAUNG
ARAKAN
BEIKTHANO
TOUNGOO
THAYEKHITTAYA
PEGU
DAGON
THATON
0 40 80 120 MILES

CONSERVATION AT CROSS ROADS IN SOUTH ASIA

By

M. S. Nagaraja Rao

With a glorious past, South Asian region has inherited a rich cultural heritage in the form of monuments sculptures, paintings and various other Art forms belonging to different periods through out the length and breadth of the region. While we aught to be grateful to the erst-while colonial rulers who rediscovered many of our ancient heritage, it is also a fact that more than two centuries of servility has resulted in the loss of respect of our own cultural heritage. In each country, there are probably National and Regional Organizations who are charged with the responsibility of the preservation of the ancient monuments. However, the policy for preservation of our heritage is still dictated by the manuals of the colonial era. With the resurgence of nationalism, the almost extinct values for our own heritage have been rekindled which has now started glowing. Peoples of the Nations of the South Asian region have become alert and want the heritage to be preserved for posterity. It is therefore, timc that the South Asian Region reviews the existing conservation policy to the cultural heritage.

Taking the example of India, it is proposed to review the existing protection and preservation policy with a view to enunciate a policy that fits into our region.

There are National and State level organisations in India who are charged with the responsibility of the preservation of our monuments. While more than five thousand monuments and archeological sites are declared as of National importance, there is an equal number of monuments and sites declared as of State importance. It is also a fact that there are literally thousands of ancient monuments which deserve to be protected and preserved for posterity. However it is only a few National and International famous monuments which always receive attention.

If we examine the status of the organisations which are responsible for the preservation of monuments, the situation is very disappointing. There is dearth of trained personnel as the expertise in various branches of conservation is gradually dwindling. If any good work is being done it is only because of a few decoted involved Conservationists of old tradition still surviving. We seem to be basking in past glory of an experience of more than a century and a quarter.

When we look at the regional level organisations responsible for preservation of monuments the picture is not quite encouraging. Many states do not have trained Archaeologists to lead the departments of Archaeology. Many others do not have a Conservation Wing or necessary Engineering staff with the required skills. Even States with vast geographical territory have declared monuments as protected which can be counted on finger tips.

It is only in the recent past that certain voluntary agencies like INTACH and Heritage Societies which have come into being and are taking interest in the Preservation of Cultural Heritage. Unfortunately these agencies do not have the necessary infrastructure nor sufficient funds. While their attempts have created awareness among the people regarding the preservation of our Heritage, they are being critisised, perhaps not with out reason, that their approach is elitist.

Conservation and Preservation of our monuments by the Central and the State level Organisations have so far suffered primarily because of the lack of sufficient financial resources. The Archaeological Survey of India, however is better off in the past few years. What has really affected this task even with meagre resources, is the dwindling expertise and lack of attempts to create a cadre of trained personnel. No doubt, other causes include a lack of respect and ignorance of the public at large for historica or other reasons leading to the misuse of our monumental heritage. Developmental projects and Industrialisation which have caused pressure on land use and the growth and movement of population causing encroachment are the other reasons for the improper care of monuments.

Having set out the present situation about the agencies and the problems faced by them in the preservation of monuments, we may examine the existing policy of conservation. If we ask ourselves whether we have a state policy for conservation, I am afraid one cannot honestly say that we have a definite policy. What we have today is, in my view, an outmoded system, a colonial legacy in the preservation of our heritage. The protection policy of the Archeological Survey of Inaia is still not a comprehensive one. A monument here and a monument there is declared as of national importance. The idea of "area Conservation" is yet to be evolved and implemented. For example, the Golkonda Fort in Andhra Pradesh is not entirely

declared as a monument of national importance. Only 56 structures in the city of Vijayanagara (Hampi), have been declared as protected monuments. In some places, only an inscription is declared as protected while the ancient structure in which it is located is not protected. Only the paintings in Kota-Bundi is declared as protected and not the entire complex of monuments in which the paintings are located. The boundaries of the protected monuments are not clearly defined. Consequently we are unable to tackle the probelsm of encroachment. There are classic examples of this nature in the historica city of Lucknow.
States are also protecting monuments. But it serves no purpose just to inscribe monuments on their lists, without the resources and the required skilled staff to look after them.

In this context, it is disheartening that there is also a trend to deprotect monuments of Natural importance, which the State level Departments will have to take charge. Many important monuments which have been declared as monuments of national importance decades ago have received little or no attention, since the date of protection for reasons already stated.

It is therefore now thw opportune time to review the pational protection policy and consider whether the regional organisations will take charge of atleast some of the most famous monuments so that teh regional pride is inspired. Perhaps this will encourage the regional administration also to provide more financial resources for the preservation of monuments. This is also an occasion when one should reflect on the conservation methods that is being adopted in our country.

Even after four decades of independance we are still following the Conservation Manual by Sir John Marshell produced in 1923. According to this Manual, we have to conserve and preserve a structure in the condition in which it exists. We are not expexted to restore the structures. However, when we look at the conservation methods adopted in Britain, we find that restoration of structures is permissible. We know that the House of Parliament, West Minister Abbey, have been restored by providing missing or decayed architectural members. One wonders as to why there was dual policy. If we follow the dual principle that we should not restore but only maintain whatever is left of our monuments, I am afraid that one day Taj Mahal will become bald. We are now replacing the marble veneers which get out of their positions because of the expansion of the iron dowels.

Therefore, it is time now that we wake up and workout a policy which is commensurate with the changing of needs of our various regions. Perhaps there should be a Asian debate within a time frame in which we should decide the issues such as how much should we conserve, how much reconstruction could be allowed and what are the conservation methods and policies that were adopted by our ancients.

Historically, we have clear evidence that many of the ancient kings have conserved many monuments. In fact many of the inscriptions which are donative in character register many grants for "Khandasphytitha Jeernorddhara", which means for repairing breakages, for restoration and conservation. I would like to specifically cite two examples. There is a temple near Bangalore in Karnataka State dedicated to Hulleswara at Doddahullur. The Tamil inscription on the moulding of the basement ascribable to late 11th century or early 12th century, records that when the temple was in an extremely dilapidated condition, the whole structure was dismantled and reconstructed from Upana to Stupi i.e. from basement to finial. Within the complex of the Mysore Palace, a temple dedicated to Vishnu was provuded with a Mahadvara surmounted by a Gopuram by King Raja Wadiyar in the first quarter of the 17th century. An inscription of mid 18th century, records that Krishnaraka Wadiyar III having found the Gopuram in a dilapidated condition, got the entire structure reconstructed. Epigraphical references could be cited in large numbers.

We have Agama sastras recording specific prescriptions with regard to the conservation of monuments by natural calamities or man made calamities or because of age. They definitely provide for the restoration and even reconstruction. Examples can be cited from Vaikhanasa and Shairagamas, particularly Marichi Ssmhita.

If we study several of the monuments in our country, there is clear evidence of structures being not only conserved reconstructed byt added to in different times and by different kings. Artisans, craftsmen architectsw received liberal donations for their contribution in this sphere. At some point of history, it appears that this tradition has been stopped and we have inherited a manually prescribing that we should maintain the monuments in the condition in which they were protected. If that be so, what will be the contribution of our generation in the 20th century to our artistic creations? Ours is a continuing, living tradition. Should we stop this tradition?

If we just look around and see what is happening in other parts of the world, we find that reconstruction is being practiced without any hesitation. Let us take the example of Mexico. The pyramids of Tectihucan have been totally reconstructed. In this Island country of Sri Lanka, restoration and even reconstruction is being done because of religious considerations. Thus for example, the ancient Stupas of Anuradhapura are not only reconstructed byt also totally plastered.

Keeping all these in mind, we should not attempt to evolve not only a national policy for India, but a regional policy for South Asian Region since we share common cultural heritage and traditions. while evolving a policy, we should keep the following in view:

(i) Our Acts and Rules should be amended at the earliest.

(ii) We should consider evolving a Conservation Manual, relevant to our country and region, based on traditional texts and epigraphical references. No doubt good aspects from western methods could be suitably incorporated in our manual.

(iii) We should protect and conserve not just isolated buildings, but consider conservation of "historical areas".

(iv) The emphasis should be total conservation i.e. structural conservation, chemical preservation and protection of the environment around the monuments.

(v) We should evolve a consensus on how much of reconstruction should be allowed.

(vi) We should also consider reuses of certain monuments particularly secular structures. Perhaps here there is no harm in taking examples from Europe, where castles are converted into Museums and put to reuse and thus well maintained.

(vii) Finally, we should take the people into confidence and involve them in the preservation of our heritage. The common criticism we have against the Departments of Archaeology is that the people are told what they should not dom but not what they should do in respect of any monument.

We should seriously consider now to evolve a policy to restore, to reconstruct and to reuse the monuments.

CRUCIBLE STEEL IN SRI LANKA AND INDIA: NEW EVIDENCE.

By
G. Juleff

In 1908 Ananda Coomaraswamy described in his book Mediaelvel Sinhalese Art how he had watched two old men at Alutnuvara near Balangoda making small ingots of steel in long, slender enclosed crucibles. Although what Coomaraswamy observed was only a demonstration of a process that was already obsolete, he was well aware of the gathering scientific interest in similiar steel making porcesses in India and consequently wrote his report with the thoroghness he knew the subject deserved. However, he did not give the exact location of the place where he had seen the steel being nade and the samples he collected cannot now be traced.

This paper, after highlighting some aspects of the crucible steel technology, describes the recent Re-discovery of Coomaraswamy's site and compares its material remains with that of crucible steel sites in India. It also re-assesses aspects of Coomaraswamy's account in the light of new ethnographic and field data. The observations and comparisons made here are based on a visual examination of the material only and do not include any of the results emerging from the present programme of scientific analysis.

Iron and Crucible Steel

Crucible steel, more popularly referred to as "wootz", occupies an elevated and unique position in the full spectrum of iron metallurgy, both ancient and modern. Pure iron in itself is a soft metal with a very limited range of possibilities, e.g. it can not be significantly hardened or strengthened by heat treatments. However, combined with small amounts of carbon (0.2-2.0%) to form the alloy steel, its strength, hardness and working porperties increase exponentially. Before the advent of modern high temperature furnaces, the process by which steel was manufactured relied upon the very slow rate of molecular diffusion of carbon into iron in the solid. A piece of wrought iron was buried in charcoal and heated in a hearth for many hours or even days. Fro example, it would take nine hours at a temperature of 910oC for carbon to penetrate into iron to a depth of 4mm (Maddin, 1984). This method, known as carburization, produced a thin surface layer of steel, and by repeated re-forging and re-carburizing it was possible to produce a piece of low carbon steel with a reasonable degree of homogeneity. that iron workers persevered with this technique for centuries, despite its awkwardness, bears testimony to the economic and technological value of the end produc.

On the other hand, makers of crucible steel were able to procuce, in a single operation, a small ingot of fully honogeneous, high carbon steel of exceptional hardness. The precise nature of the processes taking place inside the crucible has been the subject of much debate among metallurgists, and one of the more convincing recent explanations is given by Yater (1982-4). In brief, what appears to happen is that a crucible is charged with wrought iron, or possibly ore, and fry wood and/or leaves, and is sealed with caly. A number of crucibles are then heated together in a simple charcoal furnace to the maximum temperature achievable, which is approximately 1,300oC. At this temperature the iron absorbs carbon from the organic material in the solid state until if vecomes sufficiently saturated that its melting point is depressed from 1,537oC to 1,300oC, or to that of the furnace. The steel then nelted and convection currents stirred the mixture until it was fully homogeneous. The crucible was then allowed to cool in air before being broken open to retrieve the highly crystalline steel ingot. In some cases the carbon content of the ingot at that stage was too high and the naterial was in fact a white cast iron (Lowe, 1990). Subsequent high temperature annealings and rapid air coolings were used to de-carburize the ingot until it reached a hyper-eutectoid composition with 0.83-2% carbon. This brief description of the process is amalganated from a number of accounts, which will be quoted seperately later in this paper, but draws heavily on the work of yater (1982-4), who has combined a practical knowledge of iron working with the documentary evidence.

The greatest claim to fame that crucible steel can make to date is that it is the raw material of the famous Damascus swords with their beautifully patterned surfaces, and legendary quality of strength and cutting edte. Many metallurgists claim that the damascene patterning on the swords derives from the crystalline nature of the original ingots (Wilkinson, 1837: Belaiew, 1918; Zschokke, 1924; Piaskowski, 1968), and it is through studying the patterns that interst in curcible steel was first aroused. However, as Bronson (1986) argues, it is unlikely that swordsmithing was the only application for crucible steel. There is documentary evidence that the crucible steel made in the Mysore area was used for making stone-cutters chisels and fine wires for musical instruments (Buchanan, 1807) and, as new field date is processed and objects are analysed, other uses and variants will no doubt come to light.

Crucible Steel in India

Present knowledge of crucible steel relies very heavily upon documentary evidene. Probably the most useful recent review of the estant literature is that by Bronson (1986). Bronson begins by enumerating the few references in classical literature which point to iron and steel being made and exported from India including the note on the iron of the exported from India including the note on the iron of the Seres in the 39the book of Pliny's Historia Naturalis. The location and origin of seres has been much debated and is often associated with the silk export along the overland route from China. however, if one is prepared to consider the explanation put forward by Schoff (1915), not included in Bronson's review, that Seres is derived from the Sinhalese word Seri denoting the Tamil kingdom of Chera, we may have the first clue connecting Sri Lanka and iron production.
Bronson (1986 then discusses the many references in Arab literature to Indian iron and steel. By the sixth and early seventh century there are several references to hinduwani or hunduwani. The present author has not investigated the etymology of the word wani, but it is instantly recognisable as the nodern Sinhala term for steel, and perhaps furnishes a second clue. It is notable that, while many of these early references talk of steel, it is not until the twelfth century, and the writings of Al-Biruni (al-Hassan and Hill, 1986), that crucibles are first mentioned.

From the sixteenth century onwards there is an ever increasing number of references and, by the nineteenth century, crucible steel had become the pet topic of scientists, metallurgists and travellers. Detailed accounts on the subject fall into three main categories: scientific experimentation on original samples in an attempt to explain the damascene phemonenon, replication experiments for industrial purposes and first hand accounts of the process in India and Ceylon. From an archaeological point of view, it is the latter which is most interesting. Bronson (1986) attempted to bring some semblance of order into the widely varying accounts by dissecting the process elements described in eighteen of the, apparently, most accurate eyewitness accounts.

What emerged from this analysis was a disquieting tendency towards plagiarism, even in the most convincing accounts, which, in the absence of a more substantial body of field data is often difficult to detect. However, the data does distil into four main geographical centres of procuction, each with improtant variations in process.

Hyderabad

Progressing from north to south, the first centre is in the Nizamabad District of Andhra Pradesh on the Central Deccan Plateau. This area has been the subject of extensive and intersive survey by Thelma Lowe, of the Univeristy of California, Berkeley and the author has been extremely fortunate in visiting the some of the ore deposits, smelting sites and crucible steel production sites with the researcher while the survey was in progress. The most important account from this area is that by Voysey (1832) who watched steel being made in crucibles on several occasions in a village called Konasamudram. Voysey was the only European to observe steel making on more than one occasion in this area, or anywhere in India, and his report has an encouraging ring of truth and accuracy. Lowe (1990) has made a detailed study of the large heap of industrial debris remaining at the sie, paying perticular sttemtion to the nature and fabric of the cruccibles temselves. It should be noted that one of the critical factors effecting the success of the process was the quality of the refractory material of the crucible itself which had to withstand long periods at high temperatures and also provide sufficient insulation during the all important cooling period after firing. Lowe has shown that the curcible fabric is composed of charred rice hulls mixed with clay which, on firing, becomes a high-performance fibre-reinforced ceramic refractory (Lowe, et al. 1990, in press).

The crucibles of this area are squat and cup-like with large lumpy coarse-textured clay lids completely sealing the crucible mouths (Fig.1). They vary in diameter from 2.5 cm to 12 cm and the resultant ingot would ba a round bun shape, as described by many writers. The external surfaces of crucibles and lids are covered with a thick green to black ash glaze. The internal surfaces of what Lowe describes as the ingot speace are covered with a ting layer of slag/glaze that is a dull greenish colour. The top of the of what would have been the ingot is marked by a "fin", protruding from the crucible wall, of the same greenish slag. Lowe explains that the molten metal rested in a bath of alsg which protected the vessel wall from attack during firing. According to Voysey's description, the crucibles were not charged with wrought iron and wood or leaves, but with two different kinds of iron and a piece of slag (Voysey, 1832).

From the author's brief visit to Konasamudram it was obvious, from the amount of debris, that the site operated on truly industrial proportions. The majority of the debris comprised broken used crucibles, but there was also a substantial amount of greenigh glassy slag. Lowe's final detailed report on this and other sites like it in the area ambiguities surrounding crucible steel.

Mysore

Further south, in Karnataka, the next centre is in the Mysore district. The earliest eye-witness accounts, by Buchanan (1807), Heyne (in Bronson. 1986), and C.V.B. (1820) relate to this area and it is intersting to note Bronson's comment on the effect these accounts have had on later descriptions, and the problem of assaying accuracy from documentary evidence only.

" It is in a way unfortunate that the initial field publications on wootz (a term neither Buchanan nor Heyne uses) should have been such paragons of their kind. Almost all later field observers show, often without bothering to add footnotes, that they are thoroughly familiar with Buchanan's and Heyne's descriptions".

However, ironing out the minor inconsistencies in the various accounts, the basic features of the Mysore process seem to be conical or "plantain-flower" (C.V.B., 1820) shaped crucibles with sealed lids. The crucibles were charged with wrought iron with wood (Buchanan, 1807), and/or leaves (Heyne, in Bronson), and /or rice husk (C.V.B., 1820). At least 20 crucibles were placed in the furnace which was fired for upto 10 hours. The resulting ingot assumed the conical shape of the inside of the crucible. At present, the best known site in this area is Gattihoshalli, near Chitradurg. The material from this site has been studied principally by Mr. K.N.P. Rao of the Indian Institute of World culture, Bangalore, in conjunction with other scientists (Rao, Mukherjee and Lahiri, 1970).

The author had the opportunity, through the good offices of Mr. K.N.P. Rao and Mr. R.H.Sawkar, Deputy Managing Director of Chitradurg Copper Co Lid., to visit the site at Gattihoshalli. As with Konasamudram, the extent of the debris is on an industrial scale and, again, it' comprises primarily of broken crucibles and fragments of dark green and blue glassy slag. Tylecote describes this material as resembling blast-furnace slag (Tylecote, 1984). There are many similarities between these and the konasamudram crucibles. The crucible fabric is a coarse black compostion of charred rice husks with clay. There is a "fin" of slag indicating the top of the ingot and a thin surface layer of slag on the internal wall of the crucible where the ingot would have been. The external surface is covered with a thick layer of glassy slag which tends to run down the over the walls of the crucible forming a two layer structure: an inner crucible with a coarse, protective outer layer which contributes to the glassy slag formation. Many of the covers have small indentations. very like thumb impressions, in the centre of their external surfaces.

A range of samples, including an unfired and a fired crucible, a typical crucible charge and two ingots, from a Mysore site is now in the collection of the Institute of Archaeology in London, and are illustrated in Plates 1-5.

Tamil Nadu

The third steel manufacturing centre in India was in Tamil Nadu, in the Salem district. The documentary evidence for this centre is scanty and of, as Bronson puts it, "Somewhat doubtful status". From what can be gleaned, it seems the process was similar to that of Mysore and involves charging the crucible, of either pear or flower-pot shape (Bronson, 1986), with worught iron and, either wood, or leaves.

While the Department of Ancient Industries at the Tamil University, Thanjavur intends to undertake a study of crucible steel in Tamil Nadu, it appears what no sites have been located and examples of crucibles have not been found.

The fourth steel making centre in Sri Lanka will be dealt with in more depth in the follwing section. Bronson points our that only the ingots from the Hyderabad area are described as being crystalline and, consequently, were used in the manufacture of damascene blades. He thus sub-divides the four areas into two process types: the South Indian process, including Mysore, Tamil Nadu and Sri Lanka, which involves a crucible charge of wrought iron and dried wood and/or leaves, and the Hyderabad process, in which the crucible is charged with two types of iron. It should be stated that the descriptions giben above are extremely limited and draw primarily on the visual impressions gathered by the author during a field visit to India. They do not take into account the wealth of additional information concerning ores, smelting processes, furnace types, etc. Which is contained in the documentary sources.

Crucible Steel in Sri Lanka

As far as Sri Lanka is concerned the first refernces to steel occur in Arab literature. The mid-ninth century writer, al-Kindi, in his book on the Qualities of Swords (Hammer-Purgstall, 1854; Wulff, 1966) pays great attemtion to the superior steel from Serendib. He mentions four important sword-making centres that favoured Serendib steel: Yeman, Fars, Khorasan and Mansura (Bronson, 1986). Again, there is no hard evidence to connect this famed steel with a crucible process. Interstingly, the date of this reference (about 873 A.D. (Wulff, 1966)) coincides with the radiocarbon daes for the west-facing metallurgical sites discovered by the Samanalawewa Archaeological Survey (Juleff, 1990 (this Volume)). As yet, little can be fathomed, from the surface material alone, as to the exact metallurgical processes taking place but, as suggested, these sites appear to be contemporary with sound evidence for a more pedestraian bloomery iron smelting process servicing local needs and may, therefore, be producing a very different, specialized end product (ibid.).

Later writers allude to steel making in Sri Lanka but few say anything about the techniques used in its production. Knox's (1681) only comment on the subject reads, "Steel they can make of their Iron". Davy (1821), despite his thorough account of bloomery iron smelting, has little to say on the subject.

"Wether the Singalese know how to make steel, I have not ascertained in a satisfactory manner: I rather think they do; they are in the constant practice of case-hardening [carburizing]-"

Tennent (1859) quotes from a report made by Dr.Gygax (Colonial Geologist 1847-48) in 1854 on the minerals of Sri Lanka, which says, "the wrought iron from it [the iron ore] requires no puddling, and converted into steel, it cuts like a diamond." there are, no doubt, other similar references but they do not help a great deal in the unraveling questions such as how, where and when crucible steel was made in Sri Lanka.

The first useful account known to the author is that by Ondaatje in his contribution to the Ceylon Almanack of 1854 (Ondaatje, 1854). In this he describes the "Kandyan Mode of Manufacturing Steel", and claims that, by that time, it constituted "a little inland trade --- now made only in Saffragam and Kandepalle in the District of Badulla", but that it had been a flourishing industry under native rule. He describes the technique as follows.

"It consist in introducing a small bar of good iron into a clay mould of a tubular form which they call "covery" with pieces of dried wood of the Cassia aurivulata (Ranawara of the Singhalese). The open end of the tube is afterwards closed with clay, and it is placed in a charcoal fire for two hours, by which process carbon is supplied to the iron, which is converted to steel. The proportions for making steel of the best qualities are as follows; 7 parts iron to 3 parts of dried wood. They also use the wood of the Toddelia aculeata, the "Kudu Meris" of the Singhalese in which case the proportions are 3 of iron to 1 of wood. This wood, however, produces an inferior steel, but by increasing the iron to 5 parts a better kind may be obtained. this kind of steel is not generally manufactured, as it is brittle and unmalleable."

He then quotes from a lecture given by Prof. royle to the Society of Arts at the Great Exhibition of 1851, and from Heath (1839). He continues by describing how two blacksmiths from the Ouvah District annually supplied the Kings' stores with 24 small bars of steel, which are called "WAna karal" (steel seed pod). He claims that steel had been manufactured at, "Deheigolla and Iwalla in Wellasse; Irewandumpalla in Kandepalle.", and that it was then still made at, "Horaguna Hanahappawaela Kammala and Kosgama Kammala, belinging to Kandepalle, also at Mahawalgaha in Saffragam district."

The next, and most famous, account of crucible steel in Sri Lanka is that by Ananda Coomaraswamy in his book, Mediaeval Sinhalese Art (1908). Coomaraswamy first described seeing iron being smelted and steel being made, both in the Balangoda district, in the Annual Administration Reports of the

Mineralogical Survey, of which he was then Chief Mineralogist, for 1903 and 1904. The same account appears in a paper in the Ceylon Geographer (1961). While the account of the smelting process is extremely important, from the point of view of this paper, only the steel making passage will be assessed here.

Coomaraswamy saw the steel being made, "at Alutnuvara" by two old men. The central part of his description is quoted below.

"The steel makers are smiths (navadanno), thus much higher caste than the yamannu [smelters] from whom they buy the iron required. --- The furnace --- is smaller, and at the ground level, instead of being raised three feet above the ground; it is a semi-circular hearth filled with charcoal, into which air is conducted from the bellows, which are identical with those of the iron furnace. The steel is made in clay crucibles, each about eight inches long, two inches in diameter, and a quarter of an inch in thickness. Into the crucible is put a piece of iron, with some chips of Ranavara (Cassia auriculata); in the proportion of 12 1/2 oz. iron to 5 oz. wood, in the case examined. The crucible is covered with a lid, having small holes pierced for the escape of gas; six crucibles thus prepared are embedded in the charcoal, and a fire started. Very soon the gases burn off, and while this goes on the blowing is stopped. Then the blast is kept up continuously, while the tubes are turned about and more charcoal added, the great object being to keep up a constant and even distribution of heat. When the steel is likely to be ready, a hole is opened in the front part of the hearth, so that the blast goes right through the furnace, and the tubes are lifted up one by one in long iron tongs and shaken to see if the steel is quite liquid. Any which are not are quite ready are returned to the furnace for a time. The others are laid down to cool and subsequently broken open and the bar of steel removed."

A sample of the steel was analysed at the Imperial Institute and found to contain 1.97% carbon, and only very faint traces of sulphur and phosphorus. In the text and the footnotes of the passage, Coomarswamy makes reference to Ondaatke, and to other writers on Indian steel, notably Yule and Sambhasiva Iyer (in Bronson, 1986). From this we can construe that Coomaraswamy was well aware of the interest and importance of crucible steel. Bronson (ibid.) says of this account, "As Coomaraswamy's work is among the best documented and most credible of all descriptions of wootz making, we must accept his word." The photographs that

Coomaraswamy took of both the smelting and steel making processes provide the most convincing corroboration.

While Coomaraswamy himself does not mention where he deposited the samples collected on this occasion, Hadfield (1912) says in his paper on iron in Sri Lanka that samples of both the crucibles and the steel prepared for Coomaraswamy were. then in the Colombo Museum. P.G.Cooray (1967), in his book on the geology of Ceylon says, "some recently found clay tubes or moulds (kova) still with their casts (wane karal), are on view in the Museum of the Geological Survey Department. Sadly, neither sets of samples can now be located, at least, not by the present author, and there are presently no accessible examples of steel ingots in Sri Lanka.

Crucible Steel and The Samanalawewa Archaeological Survey

One of the primary aims of the Samanalawewa Archaeological Survey (Juleff, 1990 (this volume) was to relocate Coomaraswamy's steel making site, and also to sezrch for other, similar sites in the locality. Despite the wealth of archaeo-metallurgical data that began to emerge from the first day of the Survey, including the discovery of the previously unrecorded series of west-facing iron-working sites, finding the steel site was not as straightforward as anticipate.

Much of the survey work involved collecting etnographic data on traditional iron-working, through interviews with local people. It was during a visit to the Blacksmith village at Hatanpola, close to the Alutnuwara Devale (temple), that one of the smiths, H.A. Elias, recognised our description of a crucible and, with his guidance, the site was located in the village of Mawalgaha, about one and a half miles from Alutnuwara. H.A.Elias knew of the site only because he occasionally re-used the broken crucibles to melt brass for decorative work on knives he forged.

The site is situated in a village garden immediately overlooking paddy fields in the centre of the small village of Mawalgaha. The metric co-ordinates for the site are 163-000 N and 193-900 E, and the site distribution ma[s (Juleff, 1990 (this volume)). The garden is considerably overgrown and the crucible debris is only visible in the exposed banks of the garden above th paddy fields. The crucibles are visible in the bank over a distance of 16m and the overall height of the bank is 1.5m. The site is far smaller than any observed in India.

A surface layer of 30 cm, visible also in the exposed bank section, is composed almost entirely of large, complete, plano-convex or convex-convex slag cakes. The surface texture of these slag cakes, which often weigh upto 2kg, is consistently "knobbly" and, in appearance, they do not quite match other "furnace bottom" slag cakes found elsewhere in the survey area at bloomery iron smelting sites. When sectioned, these cakes are shown to contain large inclusions of metallic iron. They appear to be "furnace bottoms" from a smelting operation, although, they may be smithing hearth bottoms. Assessing from a visual examination only, the former explanation seems more probable. There are very few broken crucibles in this topmost layer of the site.

Beneath the layer of "furnace bottoms" there is a thick deposit of broken crucible fragments, densely packed in a soil and charcoal matrix. The shape of the crucibles, illustrated in Figs. 2 and 3, conform's to Coomaraswamy's description. The fragments vary in size and completeness from small base or wall fragments to almost entire crucibles missing only their lids. Lids, which also conform to Coomaraswamy's description (Fig. 2), having several small pierced holes in them, are represented in the debris. Although the external surfaces of the crucibles are coveredwith glassy slag, no separate fragments of slag were found in the deposit.

At about a distance of 30m from the site described above, and on a slightly higher elevation, another surface scatter of crucible fragments was discovered. This site, which may be interpreted as another working centre of the same site, is, again, situated in a village garden. The artifact assemblage of th4 scatter includes broken fragments of crucibles, but, in this case, the fragments are far smaller; crucible lids with holes; two tuyere ends, in both of which the tuyere is oval in shape and 3.5 cm in maximum diameter; and many small lumps and fragments of green and blue glassy slag similar to that observed on the Indian sites.

Looking more closely at the features of the crucibles similarities with the Indian material become apparent. The crucible shape is reminiscent of those from Gattihoshalli, although longer and more slender. While the crucible walls are thinner than any of the Indian examples, the fabric is of the same composition, charred rice husk and clay, and is the same uniform blak colour. As with all the Indian crucibles, the external walls are covered with a layer of the green, blue or black glassy slag which appears to run downware and collect in thick viscous lumps around the base. The crucible lids are far less substantial than those from either Konasamudram or Gattihoshalli, and differ importantly in that they wer intentionally pierced. Just as with the Indian material, internally, the ingot space is lined with a thin layer of glassy slag which appears to run downwards and collect in thick viscous lumps around the base. The crucible lids are far less substantial than those from either Konasamudram or Gattihboshalli, and differ importantly in that they were intentionally pierced. Just as with the Indian material, internally, the ingot space is lined with a thin layer of glassy slag and the top of the ingot is marked by a latdral slag "fin". However, there is a second "fin" in all the crucibles examined from Mawalgaha. This second "fin" runs at right angles to the first, longitudinally down the crucible, and marks the top of the ingot when the crucible was lain on its side to cool (see Fig. 3). This piece of evidence corronorates Coomaraswamy's account with pleasing simplicity. The ingot would, therefore, have taken on a long thin shape, very like the wani karal (steel seed pod) of its customary name, which would have been far easier to forge into blades or cutting edges for tools than the hemispherical form that would have resulted if the crucible remained upright during cooling.

In addition to collecting an examining a range of samples from the sites, interviews were held with the inhabitants of Mawlgaha and Hatanpola, to record any information pertaining to steel making that might remain in local oral tradition. Initially, it seemed that almost nothing was remembered about the site, but gradually information began to emerge that was born out by several different sources. It is possible that the initial relutance was due to the caste connotations of being associated with iron working of any kind.

The fact that this was the site that Coomarswamy described was confirmed when one of the villagers mentioned that there were said to be photographs of his, now deceased, relations in the National Museum. Some of the villagers in Mawalgaha carry the initials W.A. in their surnames denoting Wani achariya, achariya meaning craftman. All the smiths at Hatanpola have the surname initials H.A., meaning Hatanpola Achariya.

All of the blacksmiths consulted were in agreement that Ranawara, Cassia auriculata, was not used in the crucible charge, but that Mi, Madhuca longifolia, was. While it is true that Mi is not generally a rare tree in Sri Lanka, it is interesting that within 30m of the first crucible steel site there grows a large Mi tree which was immediately pointed out by the villagers as being associated with the site. Ranawara does not grow wild anywhere in the area and the area and the blacksmiths have never used it for fuel or charcoal. The question fo choices of wood for charcoal was thoroughly investigated as part of the research into the bloomery smelting processes and it is clear that there is a definite prefered range of species, native to the area, that was used consistently. Perhaps, in this point we find the first flaw in Coomaraswamy's account. The fact that all the writers on Indian steel-making talk of Cassia auriculata, which is common and abundant there, and that Ondaatje also mentions it, may have led Coomaraswamy to make an unsubstantiated assumption.

One of the older blacksmiths at Hatanpola claimed he could remember the steel-making workshop in operation. His account was slightly confusing and included the insistence that the steel was refined in a series of seven crucibles. The molten steel being poured from one crucible to the next. How this could be achieved while the crucible was soft, and the metal remained molten, is difficult to visualize. Although he did qualify the statement by saying that the metal cooled and solidified immediately after pouring and had to be heated again to melt it. Why, if this is the case, are there not many mor crucibles left on the site when, according to this account it would take 70 crucibles to produce 10 ingots? The blacksmith explained that the crucibles were reused several times over. Although this account sounds implausible, it is not the first time it has been heard. The author came across a similar story, told by an old man in the traditional iron-working village of Navangama in the Kotmale district in the central hills. There are also oblige references in the literature to pouring iron from crucibles into moulds.

"Iron-ore is found interlared in earth and clay, and that sometimes to a considerable depth under ground. It is melted in crucibles over a fire, which is blwon with two bellows. The scoria is seperated from it with tongs made expressly for the purpose, and the melted mass is poured into a mould made of clay, after which it is purified father, and forged for smaller uses." (from Thunberg's Travels in Europe, Africa and Asia, 1770-79, Second Journey to Mature).

In most other aspects the blacksmith's explanation of the process and the site concurred with other spoken accounts including the question of Ranawara versus Mi. In addition, he was insistent that the Wani achariya smelted their own iron at the site. They did not buy it from the smelters as Coomaraswamy reports. In the details of the smelting process used and the ore exploted the blacksmith was unclear but he was reasonably sure that they used a specialized technique to produce the raw iron they needed. This would xplain the large numbers of "furnace bottoms" on the the site, and why they do not appear to be the same as other bloomery smelting "furnace bottoms". Research into the bloomery smelting tradition has shown that there was little or no intertrading, of products or technology, between smelters and smiths, and that the exchange system was controlled by the temple, or devale, and the landlord through the service rent, or rakakariya system (Juless, 1990). Has Coomaraswamy made another ill considered statement?

That this site is not only the location of Coomaraswamy's steel making demonstration but also the site referred to by Ondaatke is indispitable. This fact introduced the exicting prospect that the other locations mentioned by Ondaatje would yield further evidence. Three places were explored: Irewandympalla, at Koslanda, Horaguna Hanahappawaela at Horagune and the Kosgama Kammala at Kosgama, barely five miles from Mawalgaha. All three were thoroughly investigated and, with the advantave of having examples fo investigated and, with the advantage of having examples fo curcibles, locating sites should have presented little problems. However, while there is evidence of blacksmithing at all three, and smelting at Kosgama, it can be stated with confidence that crucible steel was not produced at any of the sites. There were no crucible remains and local villagers had never seen crucibles resembling in any way the examples from Mawalgaha. It is interesting to speculate that, in this excercise.. we may have been following, in reverse order, the footsteps of Coomaraswamy in the search for crucible steel. As Chief Mineralogist to the Mineralogical Survey, Coomaraswamy would no doubt have explored the entire region from Ratnapura to Koslanda and, all the while, he must have had in the back of his mind the names of the places mentioned by Ondaatje.

Finally, as part of the overall strategy of the survey, a charcoal sample was taken from the Mawalgaha site. The dating of the sample was carried out by Beta Analytic of Florida, USA and the calibrated results, which are quoted elsewher in this volume (Deraniyagala, 1990; Juleff, 1990), give a date of 1663 AD and a date range from 1643 AD to 1680 AD, although Deraniyagala (1990) has calculated the range, according to Stuvier and Pearson (1986), to extend up to the 20th century.

In conclusion, it would be fatuous to attempt to interpret further at this stage the data set out here. Until the material rermains of the site are analysed thoroughly and ingots of Sri Lankan steel have been found and analysed, we will still ot be in command of the full picture. However, with the preliminary findings of the Samanalawewa Survey, the subject has mushroomed away from its customary reliance on Coomaraswamy's description alone. While the major part of Coomaraswamy's writings has been born out by the field evidence it is now possible to make a more critical assessment of specific points in his account.

Acknowledgements

I am indebted to Thelma Lowe for taking th etime to show mw some of the prize discoveries of her work. I am also grateful to K.N.P.Rao of Bangalore for hte same reasons. Their willingness to share the results of their work has lent greater perspective to the Sri lankan material. I would also like to thank the blacksmiths of Hatanpola, without whose contribution the subject would be far less entertaining, and all my colleagues from the Archaeology Department who have collaborated in then Samanalawewa Survey.

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Figures

Fig. 1 Cross section of a Deccani crucible (courtesy of Tehlma Lowe).

Fig. 2 A Mawalgaha crucible and lid.

Fig. 3 Section through a Mawalgaha crucible showing lateral and longitudinal "fins".

Plates

Plate 1. Fired and unfired crucibles from Mysore area (courtesy of Institure of Archaeology, London).

Plate 2. Tupical crucible charge for a Mysore crucible including a bar and a fragment of wrought iron, two crumpled leaves and six pieces of dried wood (courtesy of Institute of Arcaheology, London).

Plate 3. Two steel ingots from Mysore (courtesy of Institute of Archaeology, London).

Plate 4. Metallographic structure of Mysore steel ingot at low magnification.

Plate 5. Metallographic structure of Mysore steel ingot at high magnification.

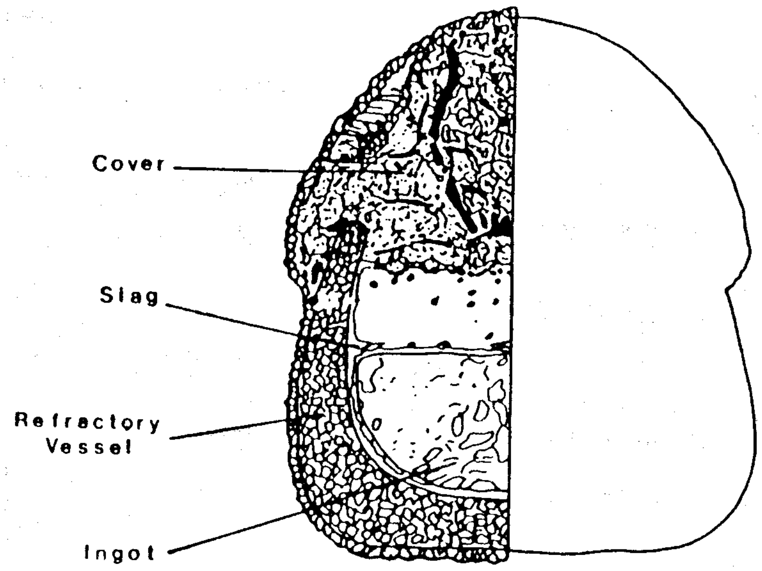


Fig.1

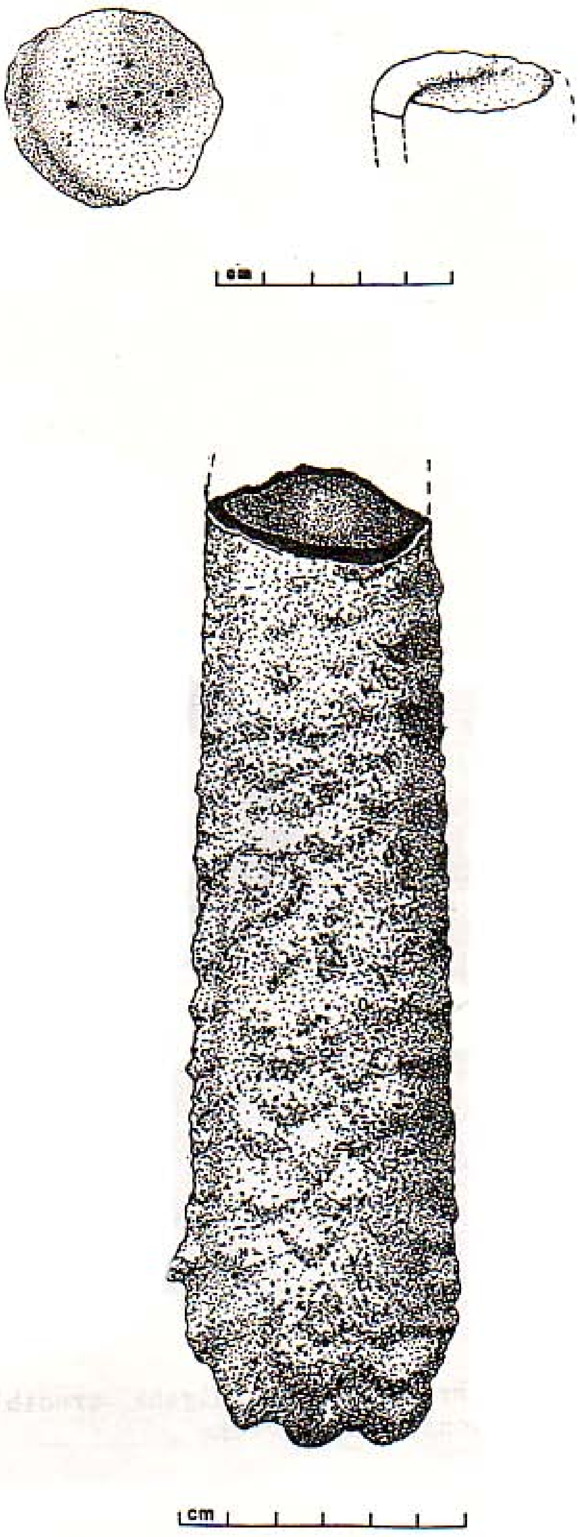


Fig. 2 A Mawalgaha crucible and lid.

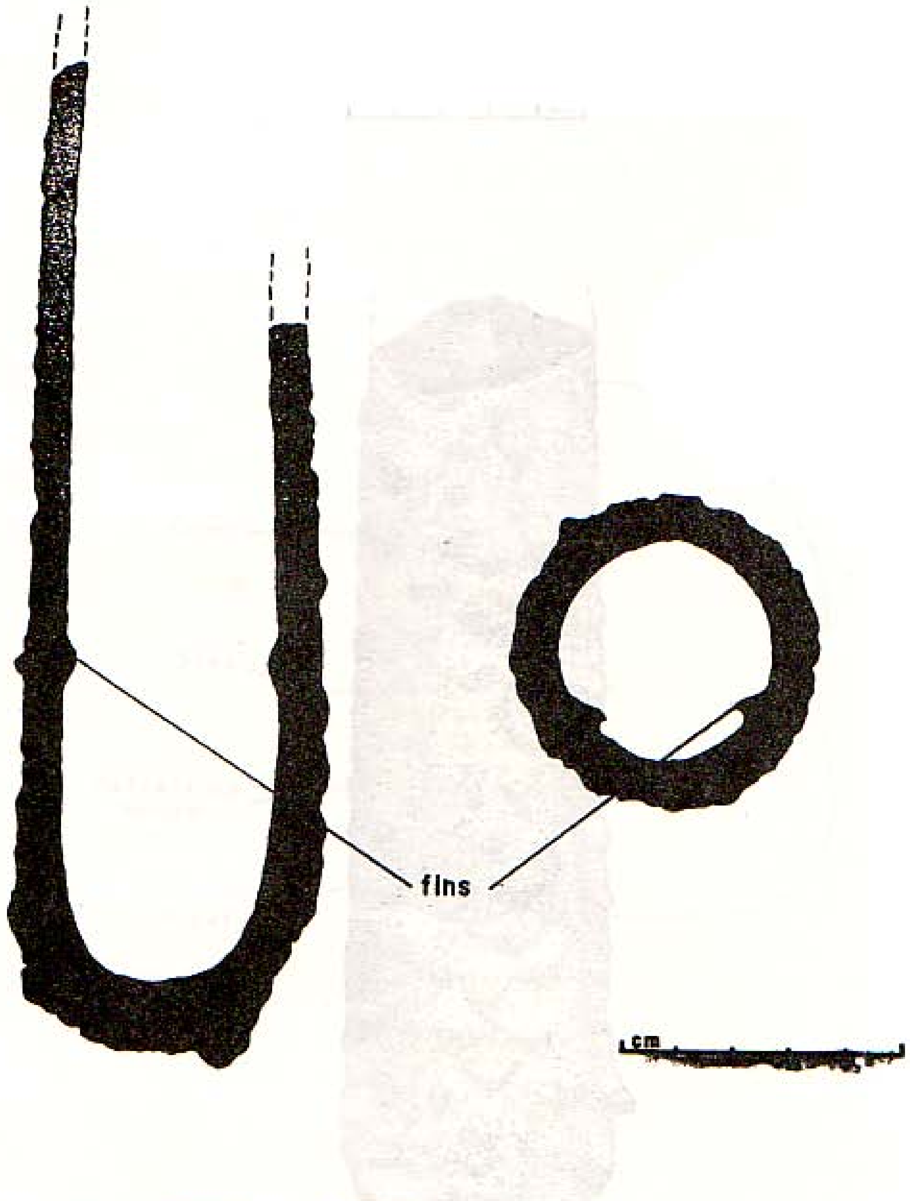
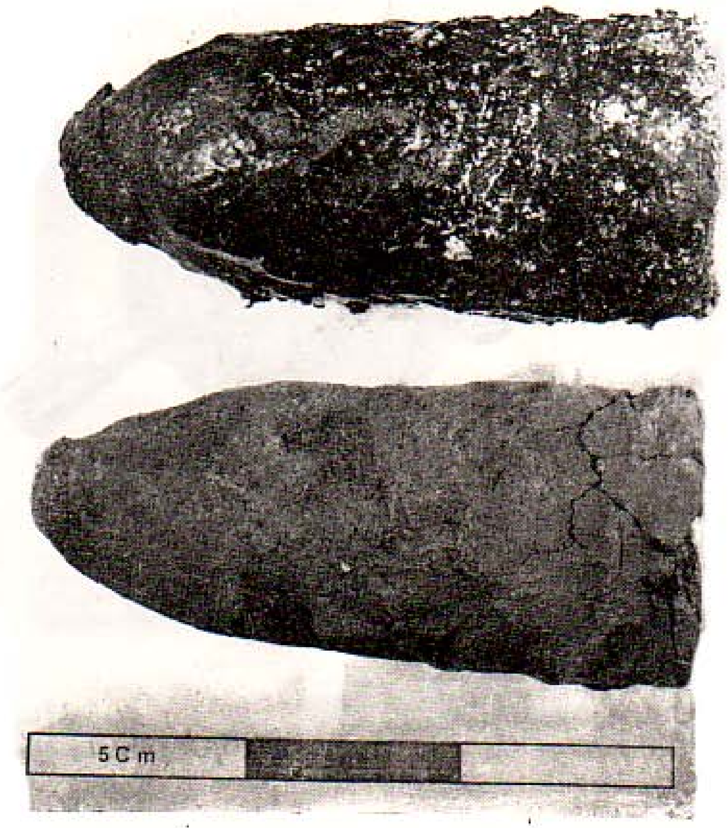


Fig. 3 Section through a Mawalgaha crucible showing lateral and longitudinal "fins".



Pl. 1

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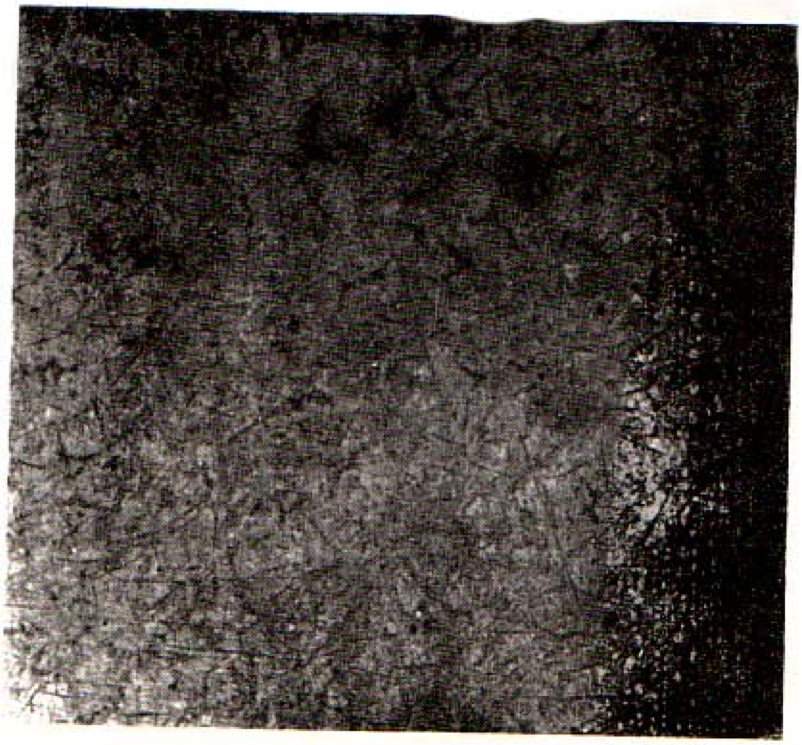
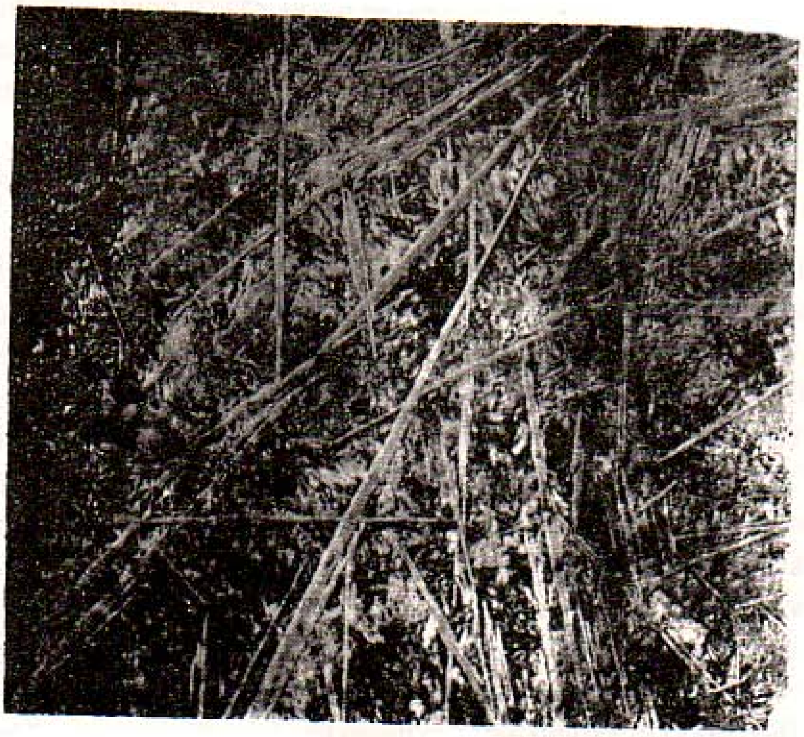
Pl. 3



Pl. 4



Pl. 5

THE IDENTIFICATION OF MINERAL PRESERVED ORGANIC MATERIALS AND THEIR OCCURANCE IN THE INDIAN SUB CONTINANT.

By

Annie Howell

Abstract

A large number of artefacts excavated from archaeological sites in Europe over the last ten years have been found to have traces of organic materials preserved within their corrosion layers. These organic materials which have been preserved as a result of their proximity to corroding metal artefacts are referred to as being mineral preserved. Using both optical and scanning electron microscopy it has been possible to identify these traces, often to species level. Recently mineral preserved organic materials have been identified on artefacts excavated at Sannathi in southern India.

Introduction

The laws of thermodynamics state that all order must decline into chaos. It follows therefore, that all matter whether inorganic or organic must be subject to decay. As the composition of all organic materials is based on carbon they are an integral part of the natural process of decay and their carbon is recycled into the environment as deterioration takes place. The decay of organic materials may be divided into two parts - physical and chemical. In the physical process of deterioration the object is subjected to physical abrasion by agents such as small animals and runing water, whilst chemical deterioration involves changes in the chemical composition of the object brought about by factors such as water, air or bacteria. The survival of organic materials therefore, depends not only on the nature of the material but on that of the burial environment. The absence of some or all of the agents of decay during burial will result in some degree of preservation although this is often difficult to predict owing to the complex, nature of the burial environment. Perhaps the two most important factors in the decay of organic material are water and oxygen. Water as the universal catalyst not only inflicts physical and chemical damage, but activates other agents of decay, whilst exygen controls mocro organism activity. As a result organic materials survive best where water is inactivated or absent as in the frozen Scythian tombs in Siberia (7th to 3rd century BC) or the shallow, dessicated pre dynastic burials of Eygpt; or where oxygen is excluded and the burial environment becomes anaerobic as in the waterlogged deposits at York.

In 1962 Biek noted for the first time the presence of organic traces on corroded metal artefacts. These organic remains were not merely the usual organic debeis which is associated with the burial environment e.g. seeds, insects and organic residues, but the remnants of organic objects which had been closely associated with the artefact during it's period of manufacture and usage or had been the organic componant of a composite object. In recent years a large number of artefacts have been recovered which show traces of wood, leather and other skin products, bone, horn ivory and textile which have been preserved by their proximity to corroding metal artefacts.

The Mechanisms of Mineral Preservatin

Mineral preservation of organic materials will only take place if the organic object is adjacent ot or in direct contact with rapidly corroding iron, copper alloy or lead artefacts. Corroding iron, copper and lead produce salts which protect the organic consitutant from micro organism activity. The ideal environment for such preservation to take place is one which is aggressive to metals causing the rapid formation of iron oxides or basic copper and lead Carbonates. For such reactions to occur the pH and redox potential of the system must be sufficient to enable active corrosion to take place until passivation occurs.

Metal corrosion products appear to preserve organic materials in three ways:

1. Coating

This is perhaps the most common form of mineral preservation where the original organic material is coated with metal salts which inhibit the activity of micro organisms. This type of preservation usually occurs in the presence of copper or lead salts which have bacteriostatic properties and seal off the organic material preventing hydrolysis from ccuring. The morphological structure is usually well preserved although rapid post excavation corrosion may lead to the formaiton of large crystals which disrupt and deform making identification difficult. Wood, textile and animal fibres tend to be preserved in this manner.

2. Impregnation.

Here metal salts coat and impregnate mainly porous organic materials The absence of toxic agents allows decay of the organic componant to take place, although the presence of metallic salts does tend to delay the process. The resulting product is one which is completely mineralised and tends to be fragile and powdery. Bone, antler, ivory, horn and leather tend to be preserved in this way.

3. Replacement.

This type of preservation is usually observed in iron corrosion layers but can also take place to a lesser extent in the presence of copper corrosion products. The organic materials becomes consolidated with corrosion products, following which it decays leaving a negative impression of it's surface detail and structure in the corrosion layers. Wood, textiles and pelts preserved in this way usually exhibit fine surface detail, and where individual fibres have been encapsulated a mould of the surface detail usually remains.

The actual process of mineral preservation is still not fully understood although much research work has been carried out in recent years. All organic materials are associated with water which can be held within the capillaries by physical forces, adsorbed onto the molectules and held in position by hydrogen bonding or it can be a constituant of the molecule itself. It seems possible that as the adjacent metal work decays the $Cu2+$ and the $Fe3+$ ions which are produced replace some of the water and bond onto the hydroxyl groups forming solid compounds along the length of the individual fibres. This delays the process of decay for a sufficient length of time to enable a record of the structural and surface details to be recorded in the corrosion layers.

Physical Appearance.

To the naked eye organic materials preserved by metallic corrosion products appear as thin, flat traces which differ in appearance and texture from the surrounding corrosion layers. Preservation by iron salts produces orange/brown traces which tend to be friable with a powdery texture. In the case of preservation by copper corrosion products the traces are usually darkgreen/black in colour and tend to be hard and brittle. Orange deposits may also occur on copper alloy objects if preservatin has taken place in the copper oxide layer. Where preservation by lead salts has occured the organic material appears as a friable cream/pale brown deposit similar to the surrounding lead carbonate corrosion cust.

Identification Techniques.

Low powered incident light microscopy is essential for al initial examination and cleaning carried out on archaeological artefacts and is therefore, usually used for the initial identification of mineral preserved materials. Low magnifications (x6 - x25) will reveal the "organic" nature of samples, as without magnification they may appear to be very similar to the surrounding corrosion products. Higher magnifications (x12 - x30) will reveal some surface features and will in most cases enable an identification of the type of organic materials present to be made.

The scanning electron microscope (S.E.M) is employed to study both the surface detail and the internal structure of samples. It has a depth of field 300 times that of the light microscope, greater resolution and can provide magnifications in excess of x3000. Such high magnifications allow the identification of many morphological and diagnostic feature which may be visible on the surface or in corss section.

Identification of Mineral Preserved Samples.

1. Wood

The anatomical features of wood tend to be well preserved by metal corrosion products which often enables accurate identifications to be made. The diagnostic features present need to be examined in samples taken from three planes-tranverse, radial longitudinal and tangential longitudinal. In cross section (transverse sectin or T.S.) the arrangement of the pores and resin canals, the distribution of axial parenchyma and any unusual features of the rays may be visible. The radial longitudinal section (R.L.S.) may show perforation plates in the vessels, spiral thickening in the vessels or tracheids, pitting in tracheids, cross field pits, the longitudinal details or ray cells or whether the wood is ring or diffuse porous. From the tangential longitudinal section (T.L.S.) the cross section of ray cells and their arrangement, the perforation plates, the axial resin canals and axial parenchyma may be visible. By noting the presence of some or all of these diagnostic features it is possible to use an established microscopic key to identify the species of the wood. However, owing to the friable nature of replaced wood it is often difficult to obtain a cross section for study and so identification has to be based on information gained from the longitudinal sections along. For hardwoods the transverse and tangential longitudinal sections are most indicative, whereas for coniferous woods the transverse and radial longitudinal sections give most information.

2. Animal Tissues.

As previously mentioned various types of animal tissue such as leather, fleeces, pelts, hairs, bone, antler, ivory and horn may be preserved by contact with corroding metalwork. However, unlike wood they do not have the enormous number of diagnostic features which allows the species to be identified. Therefore, in most cases it is only possible to determine the types of material used.

a. Bone, Antler, Ivory and Horn.

Bone and antler are both composed of colagen and hydroxyapetite and have very similar structures making it very difficult to distinguish between them in samll samples. Bone can sometimes be identified by the presence of Haversian canals which may be visible in both longitudinal and corss section.

The term ivory is usually ascribed to elephant tusks although it is often used when referring to other large mammalian teeth such as walrus or hippopotamus. It is composed of dentine and has a laminated structure caused by growth rings but no canal system. During burial the dentine is rapidly attacked and decays to powder before mineral preservation can occur. Using the s.E.M. the presence of dentinal tubules can be seen at high magnifications which will identify the material as ivory but not the species.

Horn is composed of Keratin which breaks up into fine rippled layers during burial. When preserved by metal corrosion products the layeered structure is maintained and is visible as rows of parralel ridges. At low magnifications this structure resembles that of wood but using the higher magnifications of the S.E.M they can be distinguished by the lack of morphological features.

b. Leather and Skin Products.

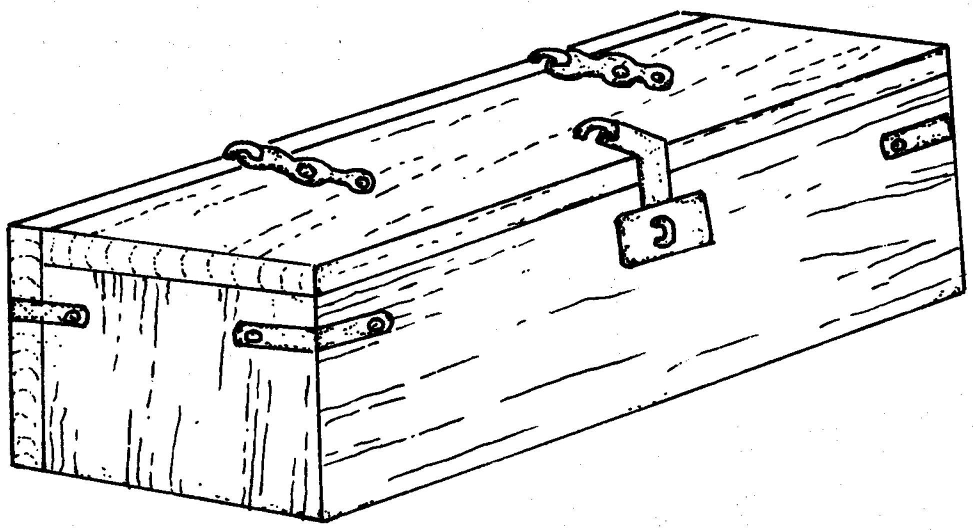
Leather and its associated skin products such as fleece and pelts are also difficult to identify to species level. Identification of skin types is based on the grain layer present in the upper section of the corium. The compact interweaving of fine collagen fibres forms a smooth surface interupted by empty hair follicles which give rise to the distunguishing grain patterns. If the grain pattern is well preserved the skin type can be identified quite accurately using simple keys or a reference collection. However, if much of the grain pattern has been removed, by viewing the sample in cross section it may be possible to distinguish the sample from other animal tissues by the presence of collagen fibres in the corium. The hairs of pelts and fleeces tend to be well preserved by metal corrosion products and greatly aid identification as large concentrations of hairs are often clearly visible on the surface. The hairs can be identified from the clear moulds which they make in the corrosion layers prior to their decay. These moulds are usually seen as negative imprints, but the species type may be dtermined from the distinctive bract patterns with the aid of a reference collection.

3. Textiles and Fibres.

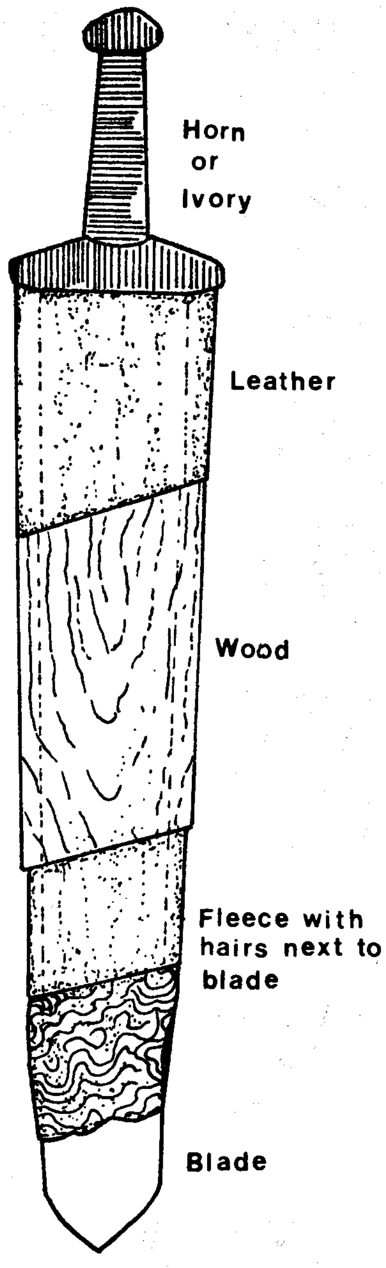
Metal corrosion products tend to encapsulate individual fibres without distorating or disturbing the weave or stitching. This enables the surface detail to be studied microscopically with very little disruption to the sample. Where fibres have been coated by copper corrosion products it is possible to extract them using sequestering agents such as E.D.T.A. and to carry out standard examinations using transmitted light microscopy. Textiles and fibres preserved in heavy corrosion layers can be identified with the aid of the S.E.M.

Uses and implications.

Through careful study of mineral preserved organic traces on metal work it is possible to produce reconstruction diagrams of the original artefact. In order to do this it is essential to carefully plan the pieces during excavation, and wherever



Reconstruction of a large wooden box based on wood preserved by the corroded iron fittings.



Sword with cut away scabbard.

possible to leave the mineral presserved material in situ.

Wooden caskets have been successfully reconstructed from the traces found on metal fittings such as hinges, locks, and bindings. In the example cited below it was possible to reconstruct the box in detail. Both mitred and butt joints held together by wooden tenons and dowels had been used in the construction. In addition to recording the carpentry techniques used it was also possible to determine how the timbers used had been reduced to planks.

Much work has been carried out on swords of the Anglo Saxon period as they tend to exhibit a wide range of mineral preserved materials. In the example shown below three seperate traces of horn were identified on the hilt with their grain patterns runing in different directions. These were interpreted as corresponding to the pommel, grip and guard sections of the hilt. Traces of leather, wood and fleece were identified on the blade. From the relatinship of these traces to each other it was possible to reconstruct the scabbard in which the sword was housed. The outermost layer was identified as leather on the basis of a well preserved grain pattern. Further examination showed this to be either sheep or goat skin (the grain patterns for sheep and goat are indistinguishable). Below this thin layers of wood had been inserted to keep the scabbard rigid and give it shape. The traces which appeared to be closest to the blade were identified from the extensive hair bract patterns as being those of sheep. It would seem that a fleece lining protected the blade as the lanolin present in the fleece would act as a natural lubricant keeping it well oiled and helping to prevent rusting.

Occurance in India

During recent excavations at Sannathi in Gulbarga district, Karnataka a number of metal artefacts were excavated which exhibited traces of mineral preserved organic materials. A total of five copper alloy and two iron artefacts showed evidence for organic materials which had been preserved by metal corrosion products. Four of the copper alloy artefacts appeared to be very similar consisting of curved lengths of copper alloy sheet with a convex outer surface decorated with a series of horizontal bands. At various points along the length of the object small copper pins had been hammered through the surface. Around the copper pins on orange/brown deposit was noted. Closer examination showed this to be traces of mineral preserved wood. From the contextual evidence it seemed probable that all the copper alloy fragments were in fact part of the same artefact. An attempt to reconstruct the artefact proved to be difficult as the fragments had not been planned in situ and the mineral preserved wood was very nfriable making it difficult to dertermine the direction of the grain. However it would seem possible that the artefact was either an edging for a wooden casket or part of a frame for a religious or votive object. The fifth copper alloy object, fragments of a flat sheet with perforated edges also appears to be connected with object in some way. This could possibly have been part of a plate attached to the box or part of the backing for the frame. On cleaning the artefact it became evident that the alloy was in fact composed of copper and gold,indicating that it was an object of value and importance when in use. The pins however, appeared to have a higher copper content than the remainder of the artefact which would explain the concentration of mineral preserved material at these points, as the copper would have corroded at a faster rate that the gold componant. The two iron objects, a spear head and a piece of folded sheet were also shown to be supporting traces of mineral preserved wood. In the case of the spear head the wood was found at the base of the point where the artefact would have been attached to a wooden shaft. The purpose of the iron sheet is not known, but it is possible that it was part of a fitting for a box or some other wooden object. In all cases the mineral preserved material was in a very poor state of preservation and had become extemely powdery and friable. Preliminary examination of the traces showed them to be wood, but it was not possible to identify the species as samples could not be obtained for the scanning electron microscope owing to the delicate nature of the material. It is perhaps not too surprising to find mineral preserved organic materials in this context. The burial environment is composed of black cotton soil which is well aerated and retains waterwell at the time of the monsoon, but dries out quite rapidly once the rains cease. This would lead to rapid corrosion of the metalwork in which time the organic componant would be preserved, followed by subsequent periods of stabilisation where the artefact would be able to achieve equilibrium with the burial environment.

Conclusion.

Research has shown that under certain burial conditions organic materials can be preserved by corroding metalwork, and that these mineral preserved structures can be identified using reference collections or established keys. With the aid of the scanning electron microscope more accurate identifications of species type can be made and many of the technologicla details stueied. Such studies not only provide valuabel information on the development of various technologies and the types of perishable raw materials which were in use during the early historical period, but often help to verify or dispute the few literary references which exist.

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Pre-Harappan and Harappan Settlements in North Gujarat

By

K. T. M. Hegde

Through systematic exploration of Kutch District, J.P. Joshi brought to light seventeen Harappan sites which included the large mound at Dholvira which is now being excavated by the Archaeological survey of India under the direction of R.S. bisht and Surkotada which was excavated in 1971 and 72 by Joshi (Joshi, 1972). The pattern of districution of Harappan sites in Kutch clearly indicated to Joshi that the Harappan immigrants came to Kutch over land routes.

This was a significant observantion. At the M.S. University of Baroda, we thought that at least some of the immigrant groups from the Indus Valley may have settled in north Gujarat. There was also another question which appeared to be pertinent to us. There are innumerable Mesolithic sites in Gujarat. North Gujarat is specially rich in them. But none of these sites has shown the necessary evidence to indicate that they were transforming from food gathering stage to food producing stage. It was therefore interesting to know if the settled way of life began in Gujarat only after the mature Harappan communicites migrated into Gujarat or was there any evidence to indicate that the Pre-Harappan peasant communities also migrated to north Gujarat and they indicated the settled way of life in the state.

We, therefore, carried out a detailed village to village survey in the estruary of the Rupen river, in an area bound by 23 15' - 23 45' N and 71 30' - 72 E. The exploration brought to light 34 mature and late Harappan settlements.

The Rupen estuary is built up of alluvial silt, sand and clay, brought down by the Rupen and its tributories flowing from the western slopes of the Ratanga Hills. In response to an arid climate during the late Plistocene period, the estuary developed a series of sand dues. During the early part of the Holocene these dunes were stabilized under a soil formation and vagetation cover. The dunes are relict now. Roads crossing the estuary cut throught two dunes in each kilometer (Allcin, Goudie and Hedge, 1978).

When the dune tops weathered not only a fertile soil developed on them but also numerous fresh water lakes between inter-dunal depressions were also formed. The sand and silt particles on the dunes include particles of feldspars. Feldspars when subjected to weathering produce clay and respective alkali or alkali earth carbonates. Clay particles being tiny, flaky and light flow down from the duen tops along with the monsoon run off and form an impervious layer over the inter-dunal depressions, converting them into lakes. Many of these lakes are large and perennial. They supply the potable water to the present day villagers in that area.

The sub-soil water in the Rupen estuary is brackish. The soil on the dunes, if it is not too close to the Rann, is not unfertile. And inter-dunal depressions forming the sources of perennial supply of potable water, the Rupen estuary formed an attractive land for agriculturists. The area received twice the present rain fall during the third mellinnium B.C. (Ramaswamy, 1968). At present the mean annuar rainfall in this area ranges from 45 to 50 cm. In the third mellinnium B.C. the rain fall probably ranged between 90 and 100 cm. It was indeed an attractive land. It is therefore no wounder that we found as many as 34 Harappan sites within this small area.

Unfortunately, many of the Harappan sites found by us were deeply ploughed using tractors. Upper layers of these sites were heavily disturbed. One of these sites, located in Nagwad village, close to the eastern edge of the Little Rann of Kutch was found to be least disturbed by modern agricultire. Because of its proximity to the Rann, the soil on this dune was subject to salt efflorescence. It was not fertile. We contoured this duen and put it under 10 metre squre grid and estimated the phosphate content of the soil smaples obtained from 25 and 35 cm depth from each square to demarcate the ancient Harappan village within the dune.

Excavation within the phosphate rich area brought to light successive mud brick and rubble structures of the mature Harappan period in the upper five layers. Below these structures, deep within the vergin soil were found extended and pot burials of the Pre-Harappan peasant community. Grave goods in these pre-harappan burials includeds a variety of typical pre-harappan pottery whose forms fabric, slip and decoration closely re resumbled the pre-harappan pottery recovered in the excavation at Amri and Kot-digi, Nagwada is the first site in Gujarat to reveal the evidence of pre-harappan peasant settlement. There must be may more of these sites.

Our excavation so far on the Nagwada mound has been limited. We are yet to unearth a clear habitation deposit of the pre-Harappan peasant community in it. It is very likely, that the pre-Harappan habiration deposit was disturbed by the structural activities of the mature Harappan community who came to live on the mound later. We have found numerous sherds and almost complete pots of the pre-Harappan period in the lower most layer of the mature Harappan period. It is therefore clear that the pre-Harappan peasants did live at Nagwada and also buried their dead there.

Up above the pre-harappan graves at Nagwada was found a metre thick habitation depost of the mature phase of Harappa culture. This deposit consisted of four well-built structural strate. The structures were built of rubble and mud bricks. Mud Bricks were very well moulded and measured 32 cm long 16 cm broad and 8 cm thick. Mud brick walls measured 50 cm thick. Clay was used as mortar. Arrangement of bricks on the walls showed alternating layers of headers and stretchers. Rubble walls measure 50 cm thick. Rubble was also very carefully arranged using clay mortar.

From the floors of these structures we have recovered valuabel Harappan relics. They enable us to reconstruct the activities, way of life and economic wall-being of the Harappan village community. So far, we have only one radiocarbon date obtained on charcoal recovered from the second layer, from the floor of one of the structures. The date is 2140 = 80 B.C. Four more charcoal samples await radiocarbon assay.

Floors of the structures yielded a large quantity of Harappan pottery. These includee beautfully painted, gracefully shaped and well backed Red Ware, Grey Ware and Buff Ware. Among the shapes were typical Harappan dishes-on-stand with the incised radiating concentric circle designs on the dishes, perforated jars, storage jars, bowls and dishes. Along with these pottery there were also non-Harappan pottery produced in a gritty red ware. Many of the Harappan shapes were also produced in a gritty red ware. Many of the Harappan shapes were also produced in this fabric. There were also Black and Red Ware bowls with and without stud handles.

Amongthe other antiquities are a variety of ornamental beads made of steatite, lapis lazuli, agate and amazonite. Among these agate and amazonite beads were manufactured at Nagwada. We recovered in the excavation numerous chipped and unpolished stone pieces in other words, unfinished beads in different stages of manufacture, grooved stones that were used in polishing the beads and drill bits that were used in perforating the beads. Completed agate and amazonite beads recovered at Nagwada are cylindrical, well polished and beautiful to behold. Agate and amazonite nodule are found near Nagwada on the bets, in the Little Rann of Kutch.

Excavation at Nagwada has also yielded evidence of manufacture of shell bangles at the site. Sea shells like Turbinella Phrum was locally available during the third millennium B.C. During that time Flandrian Sea level around Kutch, nothe Gujarat and Saurashtra was five metres higher than what it is to-day. During that time the great and the Little Rann formed an inlet of the Arbian Sea and the Little Rann was connected to the Gulf of Kutch which to-day is rich in Turbinella Pyram shells. It is very likely that the Little Rann was equally rich in these shells. They were exploited at Nagwada for producing shell bangles. The excavation at Nagwada has yield a large number of fragments cut shell circlets, some of them yet to be polished and some fully polished with the Harappan chevron mark over them. The beads and bangles were manufactured at Nagwada for sale at different Harappan sites.

We subjected the earth recovered from the floors of the structures to floatation. This released the ancient floral fragments from clay and sand and they floated up. These floral fragments were collected, dried and sent to Birbal Sahani Institute of Palaeobotany at Lucknow for examination. The Institute has reported the occurrence of wheat, barley and bajri fragments. In the excavation we have recovered more than thirty spindle words. These were used for producing cotton thread which was probably weaved at the site.

The zoologist in the department has reported the occurrence of very high percentage of sheep bones among the bones among the borus recovered in the excavation from the mature Harappan levels. It is also very likely that woolen cloth was also weaved at Nagwada.

Agriculture, cotton weaving, production of woolen cloth, manufacture of agate and amazonite ornamental beads and shell bangles show the continuous year round activities of the Harappan community at Nagwada. These activities produced much wealth for the people. This wealth is reflected in well-built rubble and mud brick houses and in the variety of antiquities recovered from these structures. Among them are a vareity of copper ornaments and tools. Among the tools were three large sized are heads each of them weighing more than 1800 grams. With the handle they will have weighed much more than 2000 grams. Wielding such heavy axes needed very strong bicps. These aces reflect the physical well being of the Harappan community at Nagwada and nutritious food they are to maintain their health. A large number of variety of gold ornaments recovered from these structures further support the economic well being of these community which is also reflected in the import of lapis lazuli beads and ivory coloured long flint blades found in large numbers from each of these structures. These blades were brought to Nagwada from the Rhori Hills in Sindh. Among the other antiquities are three agate weights. The smallest of these weights 0.064 gm. The next one in size, being twice that of the first, 1.925 gm. The largest of them should have weighed 64 times that of the first, but weighs slightly less, 54.43 gm. At Harappa and Mohenjo Daro also this weight around 54.50 gm. These weights clearly support the long distance trade that formed a part of the activities at Nagwada. This is further supported by the discovery of a Hazrappan sealing on a block of clay with a line of Harappan inscription at the top and the impression of a bull below the inscription. Occurence of this sealing at Nagwada clearly demonstrated that at least some of the people at Nagwada were literate.

The site also yielded a terracotta image of a mother goddess and a beautiful spincal shell object decorated with six sets of concentric circles. Strucrtures and antiaquities recovered at Nagwada clearly indicate that it was a hard working prosperous village. These villages sustained the rich life that prevailed in Harappan towns and cities.

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PROJECT: DAMBEGODA, SRI LANKA RECONSTRUCTION OF THE BODHISATTVA IMAGE

By

Martin Wiese

In April 1987 I was commissioned by Prof.Reiderer of the Rattigen - Institute (State Museums of Prussion Culture, West Berlin) to undertake core drilling of a large statute of coarse crystalline limestone in Sri Lanka. What in actual fact had been planned as a single and short operation turned out to be a much larger and adventurous restoration project which could be brought to a completion only three years later, May 1990.

Dambegoda - description of the site

Dambegoda lies about 250 kilometres east of Colombo, namely in the south easte5rn part of Sri Lanka. A few kilometres to the north starts the central hill country which rises to a height of 2,500 metres. To the south stretches the broad plain of the Yala National Park. Although the area around Dambegoda is covered by jungle it is relatively thickly populated while the nearest settlement which can be described as a village is about 5 kilometres away.

The Bodhisattva statue in Dambegoda has to bd considered as belonging together with the temple complex and the 16 metre high (also fallen down) Buddha statue at Maligavila, one kilometre away, and likewise fully sculptured and hewn out of a single block. While this part of the complex is supposed to have belonged to the 8th century A. d., the Dambegoda statue is supposed to belong to the 9th or the 10th century.1 IN the thick jungle nearby a historical quarry was recently discovered where marks clearly indicate that a further colossal block had been wedged out from the rock here. The Bodhisattva stateu is made out of coarse srystalline limestone and its surface is smoothly polished although a few places show traces of lime which makes one infer that it was most probably painted over with mortar plaster. The statue is 9.85 metres in height from the bottom at the feet to the top of the head and has an average span of 2.6 metres (maximum width is 2.8 metres at the elbow) and stands on a lotus flower, 64 centimetres high and 3.8 metres in diameter, turned out of the same material.

The figure is placed facing the north on the summit opf a hill which slopes equally steeply to the east and the west. The back side which is to the south is defined by a slightly rising hillock. To the north the summit of the temple is terraced so as to form three levels which are connected with each other by means of four flights of steps. On the ground level as well as oin the first terrace of this complex smaller temple buildings or statue-hourse are to be found on the eastern and western sides. The exact function of these buildings, however, will become clear only with the completion of the excavations which are presently being carried out. The uppermost flight of stairs which is subdivided by a small landing opens into the entrance section of the square shaped main structurte which is enclosed by a profiled and 1.8 metre thick brick wall on which one of the feiezes running round it has been provided with plastic decorated clay tiles. The wall today, is seen as a stump reaching up to a maximum height of 1.25 metres and its original height remains still undecided. In the intrior of the basement, symmetrically arranged floor level foundation stones in the centre of which quadrangylar holes of about 15 centimetres in depth have been dug make it possible to recognize that wooden pillars stood here supporting a framework annd that this framework held the roof which covered the statue. At the lower level of the upper two-piece staircase, excavations have revealed a basement ledge cut into the natural rock which at least borders the three sloping sides of the hill. This is a further indication of th extensiveness of the complex (See Picture 2).

This statue which had fallen face downwards was re-discovered in 1893 in the thick jungle. As it fell it broke into larger asegments and around 1948 the statue was visited by treasure hunters who bored some blocks from behind and blew uwith dynastic as they thought it might contain deposited treasures like gold and jewellery. In the explosions the feet and the rear side of the statue around the hips were totally destroyed and the corresponding front section broke into smaller pieces. Fortunately, from the head only the back part was blown away so that teh face which is one of the most beautiful and finest pieces of sculpture in Sri Lanka's history remained intact.

Due to the fact that the statue fell face downwards its front side remained well preserved in its polished condition until to day owing to the preservative action of the soil The plaster must hav come off the stone already at an earl;ier point of time. The slightly twisted fall to the left side explains the excellent condition of that side as against the right side where damage due to the elements are perievable owing to the disintegration of the crystal-building in the stone. Several pieces were no longer to be found.

The Planning of the reconstruction

In the seven it was decided by the Department of Archaeology of Sri Lanka to re-erect this statue owing to, among other reason, the excellent condition of its head. In 1976 it was agreed with Prof. Riederer to carry out this project as a joint-venture, with the federal Republic of Germany providing material and technical assistnace. In 1981 my German colleague, F. Roedl, began with the photography and the arrangement of all the fragments belonging to the statue. In all 103 peices, with weights varying from 500 grammel to 3 tour were counted. The total weight of the state is estimated at around 40 tons.

Taking into account the damages mentioned, a rough sketch was prepared by the two partres, in order to ensure the staties of the statue which was to be re-erected. The basic idea was to srill thorugh the statue ina certain horizontal alignemnt with a core drill in order to insert high grade steel rods - two vertically from the foundation through the legs up to the hips and from this height two more at an angle of 30 from the vertical perpendicular outwords reaching up to the shoulders. This static construction was somewhat sinplified by me when I took over the work for the first time in april 1987. Furthermore in collaboration with the Department of Archaoelogy I submitted a studied and comprehensive sheme of restoration.

The scheme of restoration in outline.

Construction of a massive foundation, planking of the base region and filling-up with concrete.

Placing together the individual blocks of stone and fragments to make nine figger 'units' with maximum possible horizontal jointing. Completion with high gradc steel anchor and eposide.

Insertion of reinforced, massive, high grade steel rods through the statue into the vertically running borings made by the core drill.

Pouring of the borings and the joints between te 'Units' with spoxide.

Adding of other smaller fragments and 'Units' lying outside of the reinforced section (right and left arm) in the described manner.

Filling of the hollow spaces and the construction of the missing parts in concrete reinforced with high grade steel and resembling natural stone.

Mortar-mixture ratio : stone chips - sifted sand - white cement = 1:1:1

Stonemason - like preparation and re-touching of the artificial stone.

The execution of the work in detail April 1987

At the time of my arrival in April 1987 one had collected all the rtraceable parts of the statue on a sand bed inside the floor space of the original statue house and placed theme together in a lying position with the faceupwards (see picture 8). The missingparts were then modelled in concrete. Asd thee did not exist any drawings or records of this Bodhisattva figure iit was possible to get an effective overall impression of the same only at this time.Of the complete front section a photogrammetry was made by the colleagues of the Department of Archaeology and this later served as the only relevant model in ther work of reconstruction (see picture 1).

As a further step a glass fibre form was also made which was later fixed to the scaffolding and which was to serve its purpose as the model representing the size during the work of erection.

Incidentally it must be mentioned that the Bodhisattva head was moulded separately twice on previous occasions and these models are used for exhibition purposes.

The feet which were turned out of bricks and concrete and were artificially added were now removed in order to drill two holes with a diameter of 85 mm proceeding centrally and in horizontal alignment from the lowermost, preserved original part up to the hips. This was carried out with a special core drilling machine of the fine type. The diamond mounted drill tube had a length of 3.0 metres so that it was long enough to drill into the next nearest piece. These drill holes served then-i.e. after the removal of the blocks drilled through - as a guidance for further drill work (see Picture 6). The simplification of the static construction lies only in that I did away with the two originally planned oblique drillings and instead caused a single centrally located drilling to be carried out from the area of the abdomen up to a distance of one metre into the head. These three passages provided an adequate overlapping in the cubic region of the belly where only smaller fragments in the front section had been found. The backside and a massive piece from the corresponding inner volume was entirely missing. This region had to absorb later a weight of around 20 tons, among them being a part of the shoulder weighing three tons and the head estimated to weigh about two tons.

Already available at this time was likewise the base foundation with the dimension of 4.1 m.x 4.10 m. x 5.50 m. on which the lotus flower was to be mounted later on. Two centrally placed shafts with a large diameter and up to a depth of 2.5 metres had been kept free in the foundation in which two of the high grade steel rods were to be planted later.

July 1987

The next step in the process of reconstruction which I had to take in hand during my second period of stay at Dambegoda was the arrangement of the individual fragments to larger 'units', altogether nine in number (see picture 11). Since the sides of many of the blocks were worn out and wasted due to exposure to the elements a clear alignment was not possible in mounting smaller pieces. But this on the other hand made this method of reconstruction easier because I put together the units in such a way that a perfect vertical mounting was made possible. Moreover,in working with epoxide gum it was a great facility that all the pieces could be brought into a horizontal position with their planes of fracture. The magnitude of these units was restricted by the technical resources available to us and indeed by the pulley blocks between three and ten tons of tractive power. Of course, the massive and thick construction of the scaffolding was also a determining factor. In putting the pieces together stainless steel anchor with a diameter ranging from 12mm to 25 mm were used, the number depending on the size and the stress of the planes of fracture. Since we drilled into the stone starting from the fracture planes, precise preparations which guaranteed the identical alignment of the drill holes, one upon the other, were indispensable(see picture 7). As this did not succeed in all the cases at the first try and as we had only the pully blocks earlier mentioned to move the blocks of stone, the mounting took more the blocks of stone, the mounting took more time than originally expected. Auchor and fracture surfaces were thereafter carefully cleaned and plastered up with an excellent Indian expocide product under the trade mark EPIFIX. In cases where fracture surfaces lying one upon the other had got wasted to such an extent due to exposure that there was very little contact area between the pieces concerned, we first placed ancho in epoxide and then closed the outer area of the joint with mortar up to the highest lying point in which the following day epoxide and then closed the outer area of the joint with mortar up to the highest lying point in which the following day epoxide was poured in.

The construction of the scaffolding was also started during the same time. As done earlier in the case of erecting a smaller scaffolding over the sand bed, now also a massive timber construction of tree trunks up to 15 metres in height was erected (see pictures 8 and 9). For this purpose suitable tree trunks of ebony, tamouring, and satin found within an area of two kilometres were cut down and transported to the construction site where they were erected with the assistance of pully-blocks.

Owing to political disturbances in this area, and still more owing to the fact that the German partner had exhusted the budget allocation for the project and also due to the Department of Archaeology giving priority to other projects in the country, the work came to a standstill during the larger part of 1988. Therefore the actual erection of the statue began only in June 1989 with my third period of stay.

June - August 1989

Thus actual work of erection began only in June 1989 with my third period of stay. Already in 1987 we had cast centrally on the foundation a concrete core (diameter 1.7 m) upto the top lotus flower which was to be finally mounted. The two earlier mentioned foundation shafts were extended through this pedestal. Unit I was now brought into its position over the pedestal and held suspended with pulley blocks after a stainless steel plaitwork had been already mounted in the missing part of the feet between the top of the concrete pedestal and the bottom of Unit I. Two 6 metre long stainless steel rods with a diameter of 80 mm were now driven in from the top to the bottom of theshaft and then centred and fixed in the clearance of the shafts. A form for the feet was made and then filled up with concrete together with the foundation shafts. In pouring concrete it was unavoidable that a puring concrete it was unavoidable that a pouring in of smaller original pices was also carried out. In order to carve these and also to make it easy to lay them open later such areas were coated with wax. The stainless steel rods in the area of the original stone was poured with epoxide and this owing to its density guaranteed a better clamping together of th stone blocks to the rods and consequently produced a proportional shifting of weight to the foundation.

Unit II which was made by putting together two main blocks (see Pictures 7 and 8) was then brought in position, the joints around wer filled up with plaster and it was filled up from above through the drill holes with epoxide. Unit III can really be called not a uniot but a section. The many available fragments which represent only smaller pieces of the original front side wer mounted piece by piece, in place (see Pictures 12-15).

A somewhat larger piece at this level which represents the loop of the gridle undr the right elbow could not be joined to any unit during earlier attempts as common planes of fracture were totally absent with an average joint of about 5 centimetres, this piece was clamped to the fixed position of the already erected figure or namely to the right iron rod by keeping suspended by means of several fully-blocks (see Picture 16).

Since both stainless steel rods wre too short for an optimal ovrlapping in this critical area they had to be lenghened by 60 to 80 cm in each case by welding. In this work and also in minor tasks later on, the English Pelwatte Sugar Corporation was very helpful to us.

Unit IV (see Picture 17) which represents the hip area with the left loop was now brought into position as the last unit on the two foundation rods. In the region of the back, a rod of 65mm diameter was inserted between the top of Unit II and the bottom of Unit IV and mortired in each case, the open back section was thus provided with a stainless steel plait-work. The central rod resting on Unit II was now inserted from above and aligned; the back side was planked and filled up with about 2 M3 concrete and addition of unidentifiable fragments.

Unit V (belly area) and Unit VI (shoulders, chest)(see Picture 18) were likewise moved on to the central rod and poured with epoxide. Unit VII, the head was bored to the central bore hole obliquely from the damaged part of the back of the head, for the purpose of pouring. The top of the head which originally too had been separately sculptured and staggered with stone tenors was assembled out of two parts and mounted. The left stiffening of the robe could then be completely transposed with several pieces and it served later as the model for the opposite side which was to be completed in artificial stone. (see Pictures 22/23).

February - May 1990

Units VIII and IX, the two arms, were then assembled in the usual manner so that they could be mounted later during my fourth period of stay (see picture 21). In each case four anchor 400 mm long and having a diameter of 25 mm were used.

In the case of the left arm whose fracture runs almost horizontal I caused a winding to be cut in the anchor in order to still intensify the clamping of epoxide to the anchor. In the vertical pasting up of the stainless steel in to the shoulder I used a chemical anchoring plaster (not flowing, fast hardening) which I pressed in with a spray gum. The space of the earlier original connection between the elbow and the girdle loop was bridged by a vertical anchor (diameter 25 mm) and arrested. After a steel reinforcement was done the space was planked and filled up with concrete.

For static reasons, hollow spaces have been filled up with concrete. All further forming was now done for optic reasons or in order to fill up smaller hollow spaces. The plankings were made with an average projection between 2 and 5 centimetres over the original surface. These surfaces were then worn down to the original surfaces or to the original ornaments in stone-masonlike workmanship with tools which I had brought from Germany. (see pictures 22-25). The work on the surface was carried out with the notched chisel so as to preserve a clear difference from the original surface as regards the structure.

As the last item of the stonemasonlike workmanship, the feet were worked out from the concrete blocks at the bottom which had been cast earlier. The only deliberately unchanged area which will also continue to remain as document of the damages done in 1948 is the back of the head where a bore hole is recognizable in which dynamite had been placed on that occasion. At the end a total cleaning operation was carried out.

Statistics

The Statue (assembled with 69 original pieces):
1 bored out natural stone core : 11.7 m (diameter 85 mm)
2 Epifix (Epoxide): 320 kg
3 Upat (chemical mortar): 1.8 kg
4 Stainless steel

diameter 0.80 m	=	13.80 m
diameter 0.65 m	=	5.80 m
diameter 0.24 m	=	7.20 m
diameter 0.14 m	=	18.10 m
diameter 0.12 m	=	46.00 m
diameter 0.10 m	=	15.00 m
diameter 0.06 m	=	18,00 m
diameter 0.03 m	=	20,00 m
diameter 0.02 m	=	25,00 m

5. White cement : 1358 kg
6 Natural stone chips: 3.25 m3 (0 12 mm)
7 Sand: 2.4 m^3

Mechanical lifting appliances and accessories
1 Pully blocks : 1x3 tons
5x5 tons
5x10 tons

2 Hydraulic jacks : 2 st a 10 tons
3 Lifting rope:510 m
4 Chains:4 nos, length between 8 and 23 m
5 linen sacks : 140 nos (for the protection of stone surfaces)

Electrical Machines
1 Drill hammers with bits of 0.8 to 3.0 cm 0
2 lore drilling machine
3 Angle drive grinder Dia.178 mm

Scaffolding

1 Tree trunks 15 and 18 m long : 14 Nos
2 Further trunks with different 0 and length: 800 m (estimated)
3 Binding rope (with different 0) = 545 kg
4 Nails 12.5 cm long : 13.45 kg.
2.5 cm long : 1.70 Kg

Further work

The further progress of the work will be in regard to the construction of the lotus flower of which only about 40 per cent of the original pieces could be secured. The missing portion will be cast in concerete in the manner mentioned earlier and worked over in a stonemason-like manner. Finally a roof will be constructed over the statue. How it will be done is still not clear, but most likely it will be a wooden pillar construction with a shingle roof. The terraces and the temple wall made of bricks will be further excavated and preserved.

The comprehensive planning of the Department of Ai :aeology ties up this edifice into an extensive Archaeological park which provides for the protection and conservation of the temple premises at Maligawila as well as the recreation of the likewise fallen Buddha statue and the preservation of the image house around it.

Epilogue

Some may now turn back and ask why this project has taken such a long time for completion. I would kindly suggest to them to take into consideration the location of this site, its infrastructure and the political situation prevailing in this area from July 1987 to December 1989.

Giving some details regarding the progress of work during this priod would certainly provide a better picture. The scaffolding with tree trunks up to 18 metres in height was constructed by the workers without any technical aids from the point of filling the trunks and trnsporting them up to a distance of two kilometres to the site and to its final erection at the site. There were many problems with the undependable generators which had to be hired from the vicinity. The transporting of a bucket of water from the nearest well took about 45 minutes. Last but not least, as already mentioned, the exclusive movement of the stone blocks with pulley-blocks was also not an easy task. For placing orders for material through the department in Colombo only the telephone at the post office lying 20 kilometres away was available and it must be said that its reliability was very much limited.

Bus transport between Maligavila and the nearest town was available only twice a day and on some days not available at all. Owing to the extemely critical political situation in 1989 even this form of transport was brought to a stanstill by wild strikes which went of control - and of course this affected not only our region. Curfews lasting several days at a time brought work to a stillstand and even worse were the unexpected curfews and work prohibitions declared during the night by the underground militant opposition, which further aggravated the situation. Even on normal working days the workers had to start very early on their homeward journey lasting several hours due to the fear of attacks in order to reach their houses before the darkness fell around 6.00 p.m.

Owing to partly permanent night curfews, contact with Colombo by road was also severaly restricted. Maligavila is about six hours away from Colombo by motor car.

Now-in the month of May 1990-the situation can be said to have cased very much. The peaceful period appears very appropriate to hand over the Bodhisattva statue now after its completion to serve its purpose as a place of worship and a spiritual meeting-point for all devout Buddhists and naturally for all those who have an eye for beauty.

(This may be copied from the original paper in the German language as they are named in English.}

DETERMINATION OF FIRING TECHNIQUES OF ANCIENT POTTERY. BY MOSSBAUER SPECTROSCOPY

By

Nanda Wickramasinghe.

Pottery objects are of great archaeological importance since they are items which were used widely in several functions of everyday life in the ancient world, varying from eating and drinking to burial rites. Due to it many uses, pottery was the object of extensive trade in ancient times. The provenance, manufacturing techniques and trade provide information about artistic and technological skill of various cultures and their influences.

The foregoing considerations explain why the study of the ancient ceremic technology has always been the subject of amateur and professional scientific investigations. A variety of techniques have been used for these studies such as differential Thermal analysis (DTA)', X-ray powder diffraction (XRD)2 optical microscopy3, Scanning electron microscopy (SEM)4 and Mossbauer spectroscopy5 which is the subject of this paper.

Mossbauer Spectra of ancient pottery were first reported by Cousin and Dharmawardera6 It provides information formation on the Oxidation state of iron and the symmetry of its immediate environment. The two main parameters which may be derived from such spectra are the isomer shift (S), which is a measure of the S-electron density at the nucleus, and the quadrupole splithing, which is a reflexion of the electric field gradient at the nucleus. These two parameters provide information about the local symmetry around the iron atom and its oxidation State.

Firing in an oxidizing or reducing atmosphere can be distinguished from the amount of Ferrous iron present in the Mossbauer spectra. Firing temperature can be extracted from the electric quadrupole splitling or the fraction of the iron that is in a magnetically orderd state, either by comparison with spctra of a caly test-fired in the laboratory or by a progressive refring procedure. The latter seems to be more promising since authentic clay is normally unavailable.

Dsecription of the Studied Samples.

The experiments were performed on two multi coloured pottery fragments form a excavation of a urn burial site dated 2000 B.C. at west Theben in Egypt. One of these (fragment A) was a part of a vessel which had been used for contents of urn burials. The other Sherd (fragment B) was a part of a seal fixed to the tomb giving details of the deceased.

Fragment A is red on one side and grey on the other with a brown intermediate layer. The curvature of this fragment suggests that the red surface has been the outer and the grey one has been the inner face of a vessel. Fragment B with a cylindrical form (length 8cm Radius 2.5mm) has a dark grey core, red surface layer and brown intermediate layer. (Plate 1)

Expriments.

Samples of the each layer were prepared by scraping with a tungsten carbide tool, and their mossbauer spectra were taken at room temperature (293 K) with a 57Co in Rh Source. To determine the firing temperature about 300mg of pulverized sample of the red layer of fragment B mounted on a platinum boat was heated in an electric furnace for six hours at 700oc, 800oc and 900oc. After each refiring a mossbauer spectrum was taken at room temperature. All the spectra were least squares fitted with a superposition of Lorentzian lines.

Results and Discussion.

The mossbauer spectra of fragment A are shown in Fig ! and relevant parameters are given in Table 1.The spectrum of red layer characterised by two iron forms: the octahedral Fe(III) (S = 0.37mm/s , E = 0.65-1.17 mm/s) and & Fe_2o_3. (S = 0.37 mm/s, Bint = 49.7 T) It does not contain Fe(II) at all. In addition to Fe(III) and Fe_2O_3 brown layer contains octahedral Fe(II) (S = 0.92 mm/s, E = 2.46 mm/s). The brown layer contains much larger fraction of magnetic iron. The iner grey layer shows larger fraction of Fe(II) and it contains small amont of Fe(III) and Fe_2O_3.

.The mossbauer spectra of fragment B are given in Fig.2 and mossbauer parameters are given in Table 2 Mossbauer parameters of the dark grey core reveals the presence of a large amount of ferrous ion (67%), while the red surface layer contains only a small amount.(5%). The intermediate brown layer contains a fraction of magnetic iron (60%) larger than either the red surface or the dark grey core.

The distribution of layers and the fraction of different iron species in each layer are similar in both fragments. Therefore the firing technique should be similar in both. Fe(II) fraction in each layer suggests that the firing was initiatly done in a reducing atmosphere. Then towards the end of the firing porcess more air was admitted into the kiln, such that the final firing was done in an oxidizing environment.

Slow oxidation of ferrous iron at a low temperature favours the formation of magnetic iron particles7 where as the rapid oxidation preferentially yields a paramagnetic or superparamagnetic oxidation products. The brown intermediate layer is the region where the Oxidations came to a halt because the oxygen did not penetrate any further before the sherd had Cooled. The reason for collection of a large quarntity of Magbetion iron in the brown layer was slow oxidization as against fast oxidation occured in red surface layer. The Inner core contains very little magfetic products due to in availability of oxygen to penetrate.

The determination of ancient firing temperatures may be based on the assumption that clay fired at Certain temperature can not be altered by subsequent refiring unless the inifial temperature is exceeded. This determination, of course, is approcimate since the original firing time and atmosphere are not known to be imitated. The fact that the various parameters of the fired clay do not alter with refiring up to the original temperature has been shown with the SEM8 and DTA1. It is therefore plausible that Mossbauer Parameters will show similar behaviour and this has been demonstrated in a number of applications. 9,10.

The Mossbauer spectra of refired samples are shown in Fig 3 and relavant parameters are given in Table 3. The relative intersity of the magnetic contribution at 700^{0}c refired sample in the same as what obtained from the original sample. this suggestes that the oxidation of the surface iron in the pottery may have taken place above 700oC. The relative intensities of the non magnetic ferric contribution A12, defined as the ratio of the area A1 of the paramagretic Ferric in phase 1 to that in phase 2

A12 = A1 (paramag-Fe3+ in Phase1)/A2 (paramag-Fe3+ in Phase2) are plotted in Fig.4 as a function of refiring temperature TR. The relativ intensity of the nonmagnetic ferric contribution of the original sample corresponds to a temperature of 770^{o}c in the diagram. This shows that this pottery was fired at the temperature on or around 770^{o}C.

Conclussion.

The result obtain in this paper suggest that the kiln which fired these pottery samples was initially in a reducing environment and then towares the end of the firing process more air was admitted into the kitn, such that the final firing was done in an oxidizing atmosphere.

The experiment conducted to determin the original firing temperature by refiring the samples suggested that original firing temperature was 7700c. However as the period of initial firing is not known, therefore it is not possible to measure exactly the original firing temperature.

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Plate 1 Photographs of Samples.

Acknowledgement

My thanks are due Prof. J. Riederer, Director Rathgan Research Laboratory, W.Berlin and Prof. E. Riedel, Department of Inorganic and Analytical Chemistry Technical University W. Berlin for their valuble Suggestions.

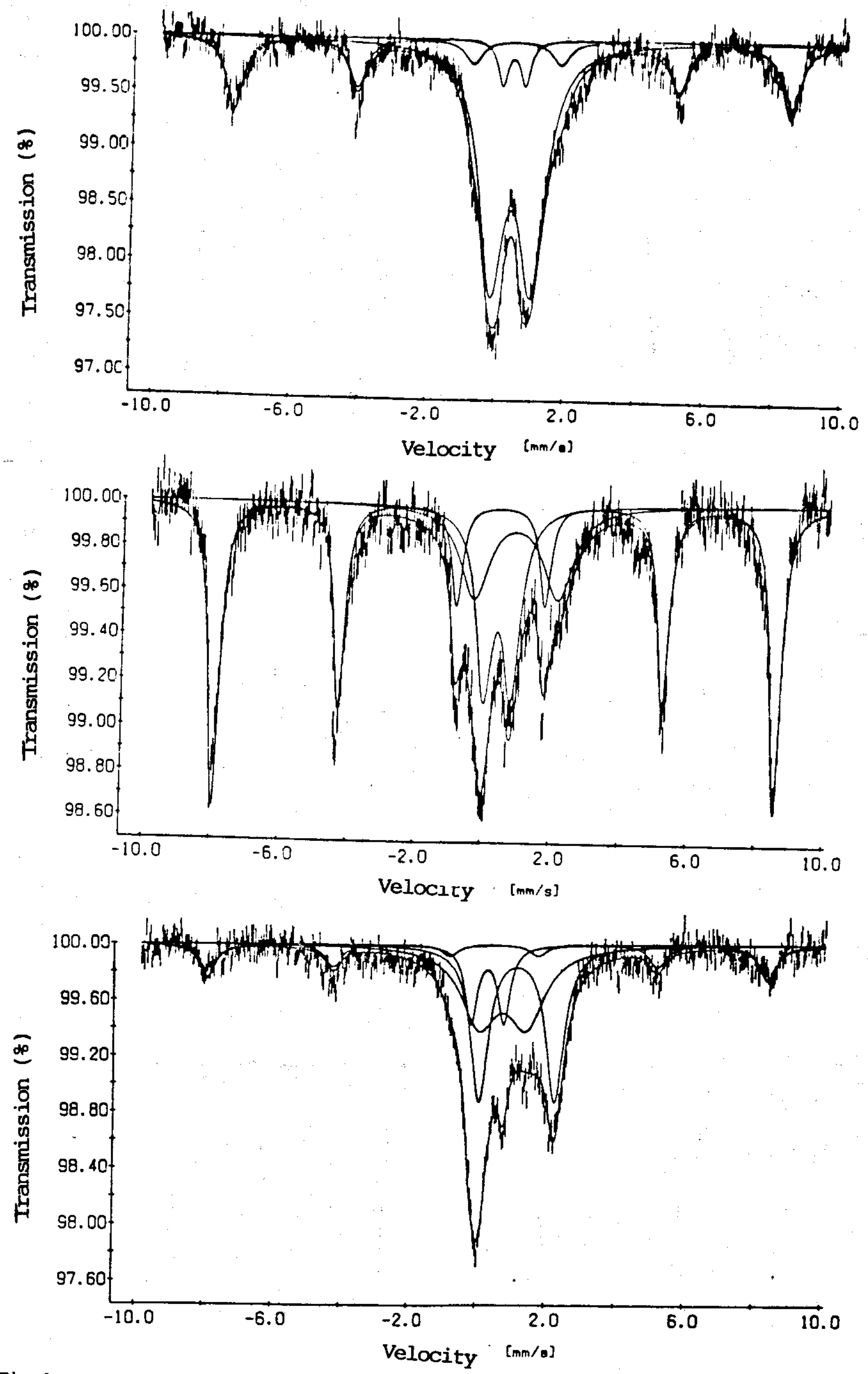


Fig.1 Mossbauer spectra of fragment A.

a. red layer

b. brown layer

c. grey layer

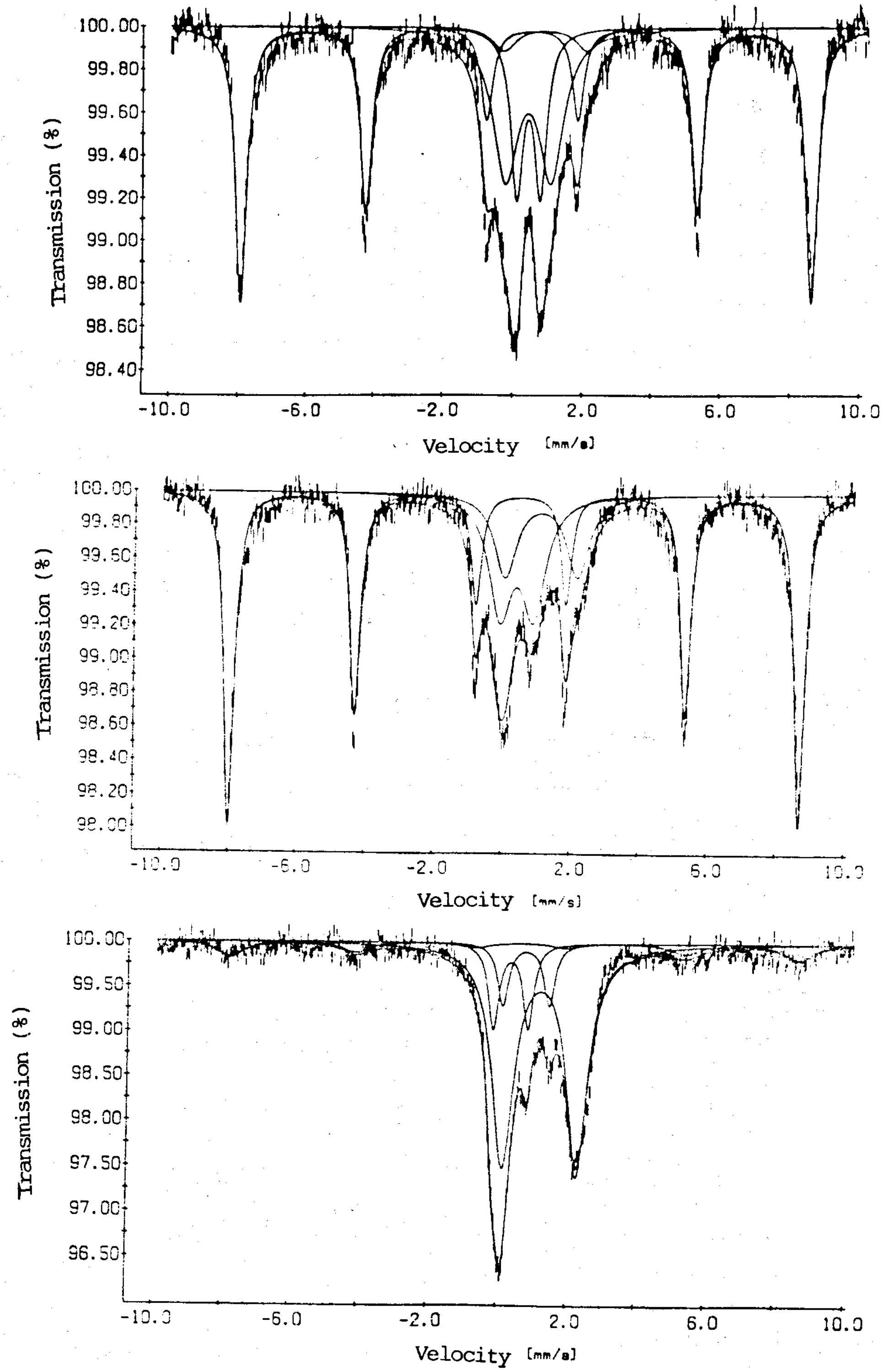


Fig.2 Mossbauer spectra of fragment B

a. red layer

b. brown layer

c. grey layer

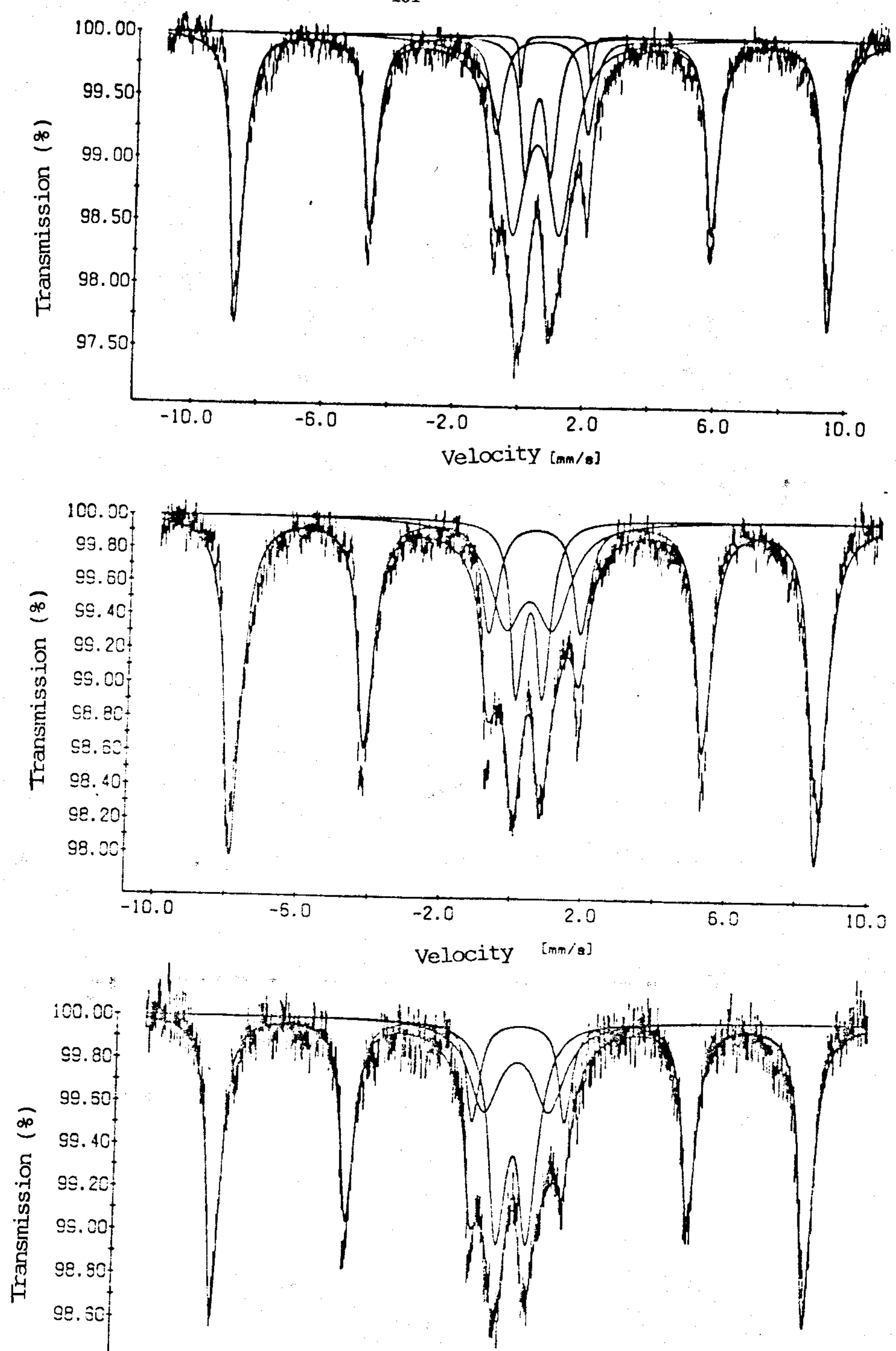


Fig.3 Spectra of the refired samples.

a. 700°C

b. 800°C

c. 900°C

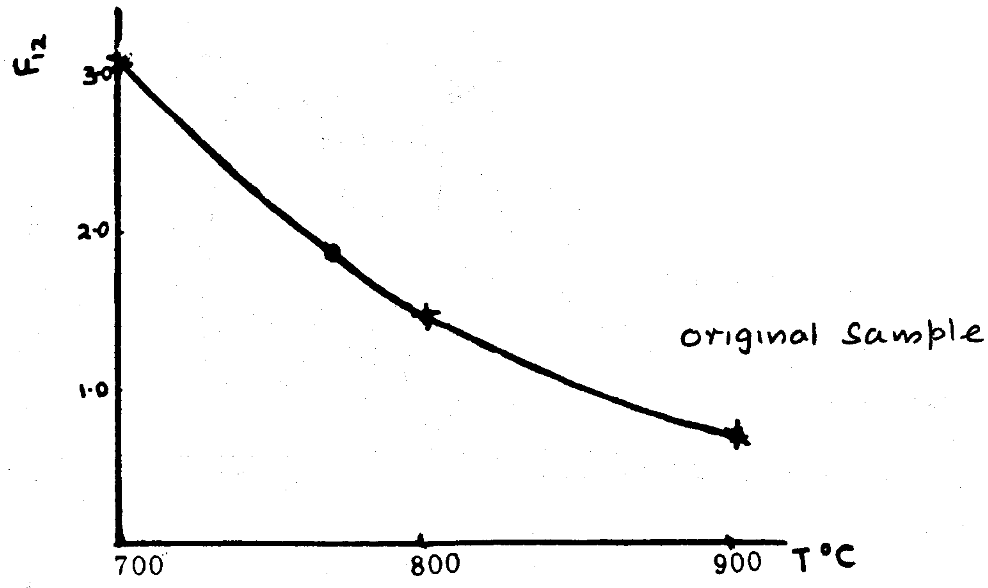
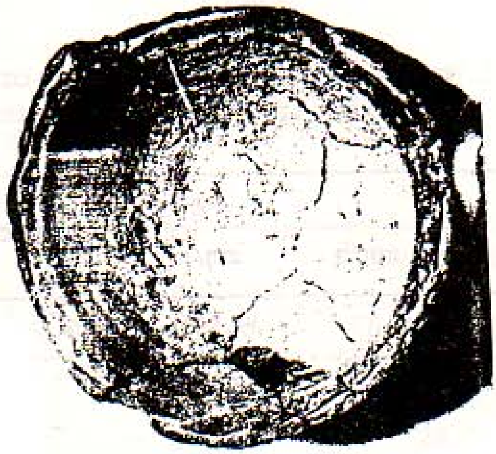
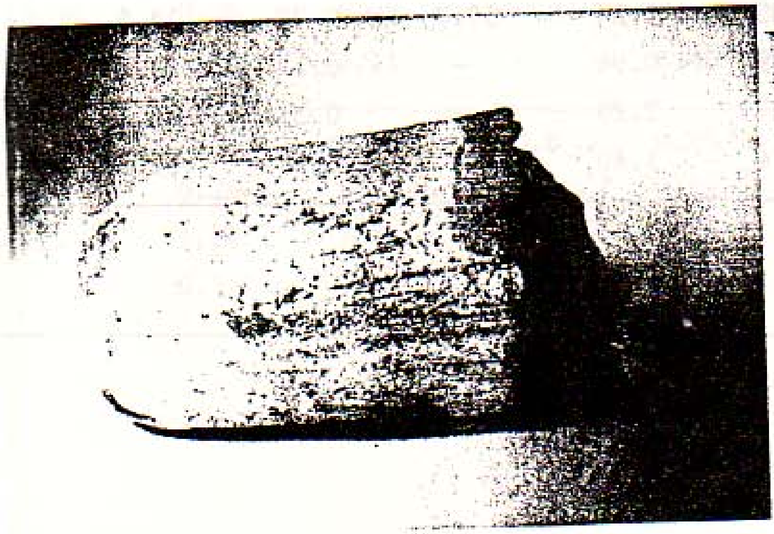


FIG. 4. Variation of non magnetic feric Contribution with the Temperature.



Fragment A.



Fragment B

Plate 1. Photograph of the studied samples.

Table 1 Mossbauer parametrs of the original sample A.

	mm/s	E mm/s	B_{int} T	mm/s	A_{rel} %
Red layer	0.37	0.17	49.7	0.30	28.9
	0.37	1.17	-	0.45	66.0
	0.37	0.65	-	0.17	5.1
Brown layer	0.38	0.17	51.1	0.20	53.8
	0.41	0.81	-	0.30	24.4
	0.92	2.46	-	0.52	21.8
Grey layer	0.35	0.24	50.7	0.28	14.5
	0.29	0.96	-	0.22	12.6
	1.17	2.20	-	0.31	36.7
	0.74	1.40	-	0.65	36.2

Table 2 Mossbauer parameters of the original Sample B.

	S mm/s	E mm/s	B_{int} T	 mm/s	A rel %
Red	0.37	0.21	51.0	0.20	51.4
layer	0.36	1.30	-	0.43	28.3
0.36	0.36	0.67	-	0.21	15.8
	0.85	2.39	-	0.41	4.5
Brown	0.37	0.19	51.4	0.18	60.2
layer	0.35	0.98	-	0.41	23.3
	1.05	2.11	-	0.40	16.5
Grey	0.45	0.23	50.6	0.45	11.0
	0.28	1.00	-	0.18	12.4
	1.14	2.14	-	0.38	66.9
	0.71	1.33	-	0.19	9.7

Table 3: Mossbauer parametrs of the refired Sample.

T °C	mm/s	E mm/s	B_{int} T	mm/s	A_{rel} %
700	0.39	0.22	52.1	0.23	53.1
	0.38	1.44	-	0.46	34.3
	0.39	0.78	-	0.22	11.4
	0.89	2.16	-	0.06	1.2
800	0.37	0.21	50.6	0.27	65.8
	0.33	1.32	-	0.57	20.1
	0.36	0.74	-	0.23	14.1
900	0.38	0.19	50.8	0.21	55.3
	0.41	1.80	-	0.52	18.8
	0.36	0.85	-	0.30	25.9

ARCHAEOLOGICAL RESEARCHES IN VIJAYANAGARA (HAMPI)

By

M. S. NAGARAJA RAO

INTRODUCTION

The foundation of city and the kingdom of vijayanagara in the year 1336 A.D. was an epoch making event causing the renaissance of Indian Culture. The foundation of this City caused the cohesion of all the crumbling states of the Southern India into a single empire and became the saviour of Indian Culture in general and South India in particular.

The City of Victory, Vijayanagara, was located in the picture surrounding, amidst striking and beautiful scenery, depicting nature at its wildest and best. The wide torrential and almost unfordable Tungabhadra on the north and the impassable craggy granite hills with bare and denuded boulders and tors onthe perifery of the City provided strong natural defences which the rulers used to have to utmost advantage. It is perhaps the most extensive City of the medieval period, of which architectural evidence has been preserved in tact. The contemporary literary works in Kannda, Sanskrit and Telugu as well descriptions given by contemporary foreign visitors help us in unearthing and identifying the archaeological remains of the City.

The imperial Capital at its heyday has been visited by the Moorish Traveller Abdur Razzak, the Russian Nikitin, the Portuguese travellers, Duarte Barbosa, domingo Paes and Fernao Nuniz and the Italian Nicolo Conti, who have left graphic description of the grandeur of the imperial city which they saw. To quote only Abdur Razzak "The City of Bidjanagara is such that the pupil of the eye has never seen a place like it, and the ear of intelligence has never been informed that there existed anything to equal it in the world"

It was therfore, creditable that during 1976 the farsightedness of the then Union Minister of Education Prof. Nurul Hasan, a noted Historian - Archaeologist, the Project of exposing the reminas of the three great medieval cities viz. Fathepur Sikri in Uttar Pradesh, Champaner in Gujarat and Hampi (Vijayanagara) in

Karnataka, was initiated. The National Project of Hampi is being carried out jointly by the Archaeological Survey of India and the State Directorate of Archaeolgy and Museums in Karnataka, for nearly a decade and a half.

RESEARCHES

The Research Project at Hampi consists of primarily three areas viz., Documentation of cultural remians and archaeological excavations, conservation and publications.

DOCUMENTATION OF CULTURAL REMAINS AND ARCHAEOLOGICAL EXCAVATION:

The Directorate of Archaeology & Museums in collaboration with Dr. George Michell and Dr. John Fritz (with the approval of Government of India) have been documenting the cultural remains of the City, primarily in the Urban core. Dr. George Michell prepared an architectural inventory of the Urban Core which has been published by the Directory of the Urban Core which has been published by the Directorate of Archaeology & Museums. The Directorate with its technical staff has been documenting inscriptions not so far noticed, besides carrying out excavations. While the State Directorate of Archaeology & Museums has been concentrating in unearthing palatial structures in the area known as Noblemen's quarters area, the Archaeological Survey of India has been excavating and conserving various structures in the Royal Centre in the heart of the City.

CONSERVATION

Besides carrying out excavations, simultaneously action has been taken to conserve restore not only the excavated remains but also the Bazaar Mantapas in the famous Virupaksha Bazaar.

PUBLICATIONS.

The State Directorate of Archaeology & Museums has initiated series of publications based not only on excavations but also research carried out by the Department and other scholars associated with it. The following publications have been brought out by the Directorate.

1. VIJAYANAGARA - Progress of Research 1979 - 83
2. VIJAYANAGARA - PROGRESS OF RESEARCH 1983 - 84
3. VIJAYANAGARA - Progress of Research 1984 - 87
4. VIJAYANAGARA -Through the eyes of Col. John Alexander Greenlaw (1956) and John Gollings (1983)
5. VIJAYANAGARA - Architectural Inventory of the Urban Core - Volumes I & II.

PROGRESS OF RESEARCH

We may now turn to the progress achived so far at Vijayanagara.

I. Excavations:

(a) Virupaksha Bazaar

The virupaksha Bazaar which extends in an area of 740 Mts. east-west was excavated from the eastern end. It was noticed that the original road had accumulated debris of more than a metre and a half. So far 125 metres length from east has been excavated exposing the original paved road as well as the Bazaar Mantapas on the northern and southern sides. Simultaneously the Bazzar mantapas have also been conserved to their original shape.

(b) Noblemen's Quarters area

In the heart of the Urban core is an enclosed area measuring about 122 acres by exotic granite formations. So far we have excavated 14 Palatial structures. The largest among them located in the southern end of the area appears to have been the residence of a very important noblemen. For, the main seven rooms constructed on a platform had double enclosure walls of cyclopean masonry entered through 13 flighted steps from the northern side.

The cultural remains unearthed from the debris of the structure include Chinese celedon ware primarily representing bowls of various sizes and decorated with typical Chinese figures indicating that the inhabitants of this Palace had received important Chinese visitors.

(c) Palatial structure - 2

To the south-west of the main structure described above was another royal structure constructed on a high platform also having an enclosure wall. Around the main building was a cloister consisting of anumber of rooms. The building was perhaps used as an Office of a high dignitary used for hearing public grivences, as in front of the ain structure are two open halls.

(d) Rangashala in the Mint area

To the south of the Noblemen's Palace area is an area consisting of double enclosures. One of the largest structure excavated by the Archaeological Survey of India has been identified as the Rangashala or dancing hall described by Domingo Paes. From the flight of steps found on the upper platform of the ain structure indicate that this was probably a double storeyed building.

(e) Sacred Tank

One of the major discoveries in the Royal Centre is the stepped tank unearthed by the Archaeological Survey of India during 1985-86. This is located to the south-west of the sacred platform known as Mahanavamidibba. The importance of this stepped tank lies in the fact that it appears to be a prefabricated structure. For, the stone used int e construction of this tank is the choloritic schist available only 70 metres away to the west of Vijayanagara. Each architectural member of the stone has a letter, a number and another letter indicating the direction, the layer and the exact positionns where that member is to be set up. Since this Tank is located in the royal centre very near the ceremonial platform, it appears that this Tank was used for ceremonial celebrations by the King during the Dasara festivities or the festivities of ten nights.

II. Conservation

While conservation has been a continuous process at Vijayanagara, both the Archaeologicla Survey of India and the Directorate of Archaeology & Museums have been conserving the excavated remains simultaneously with the excavations.

One of the important work of conservation which may be cited here is that of the Dharmashala located in the Moorish quarters of the City. This simple pillaredhall facing east is on the main royal road starting from Ramachandra temple to the ford at Tungabhadra. It has five line inscription which states that an Officer named Ahmed Khan constructed this Dharmashala and a well int he mid 15th Century with the intention that his Royal Master Devaraya II, may attain merit.

IMPORTANT DISCOVERIES

While the City of Vijayanagara has proved to be a haven for explorers, we may refer here to some of the important epigraphs which prove that the Royal Centre had several Watch Towers from where the Royal centre was watched. Although there are no structures indicating watch towers the top of the boulders were themselves used as a spot for the watchmen. Thus so far, we have located 27 inscriptions which give the names of the Watch Towers. For exampel, there is Hampiya Kottala, Hanumana Kottla meaning the bastion of Hampi, the bastion of Hanuman (the monkey God), Madana Kottala meaning the Bastion of Madana.

One of the significant discoveries to mention here is that of a series of 70 paper wax negative of the monuments of Hampi photographed by Col. John Alexander Greenlaw during 1856. These were discovered by Dr. George Michell in a private collection in Wales; Thanks to his courtesy we have been able to find out the condition of these monuments of Hampi 130 years age. Again with the courtesy of Dr. George Michell, we have beeen able to get the same monuments photographed by John Gollings from Austrlia, during 1983. We were able to pulbish the matching pictures of Col Greenlaw and John Gollings. The clarity of the pictures taken in the last century when photography itself was in its infancy is remarkable.

Thus Hampi, which has now been included as a World Heritage Site has been a source of inspiration for scholars and laymen equally.

CAPTION FOR ILLUSTRATIONS.

1. Virupaksh Bazer-View from East
2. --do-- -during excavation
3. Mantapa at the Eastern End of the Bazar - before excavation
4. --do-- -after excavation
5. Southern side - Mantapa - after excavation and before conservation
6. --do-- -after conservation
7. Nobleman's Palace No.1 - Mound in the Royal Enclosure Area
8. --do-- -after conservation
9. --do-- -Mound View from South-east
10. --do-- -after excavations
11. --do-- -Chinese porcelain -over view
12. --do-- -inner view
13. Nobleman's structure -before excavations - No.2
14. --do-- -after excavations & conservation
15. 'Rangashala' in the residential area formerly called 'The Mint'
16. Amhadkhan's Dharmashala -before conservation
17. --do-- -after conservation
18. Nagareshvara Temple -before conservation - view from North-east
19. --do-- -after conservation
20. --do-- -before conservation, view from South
21. --do-- -after conservation
22. Massive main entrance gate to The City of Vijayanagar -called "Sringarada Hebbagilu" -before conservation
23. --do-- -after conservation
24. --do-- -Temple inside the gateway -before conservation
25. --do-- -Temple - after conservation

Fig. 1

Fig. 4

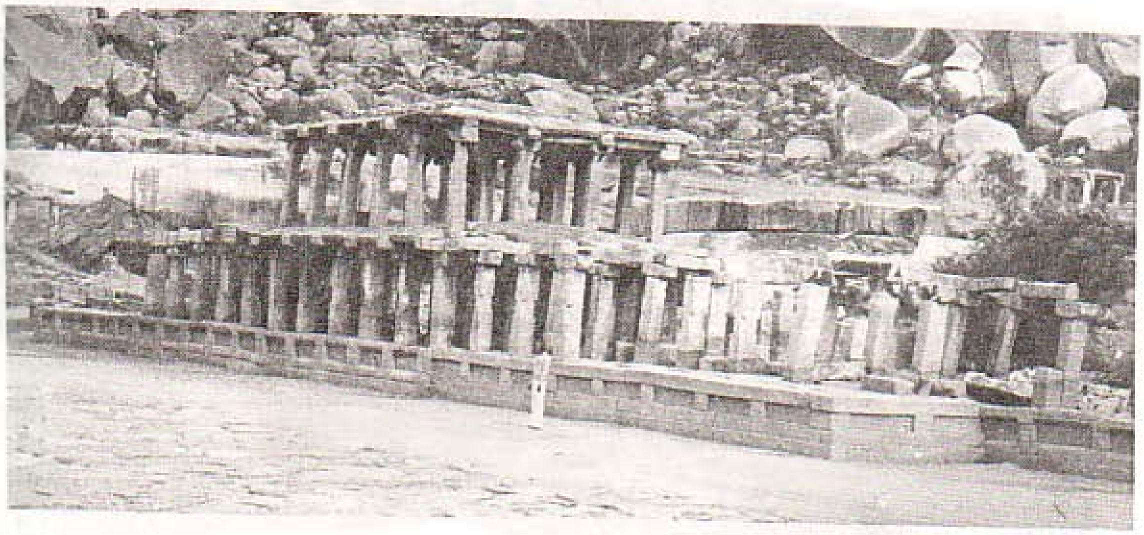


Fig. 5

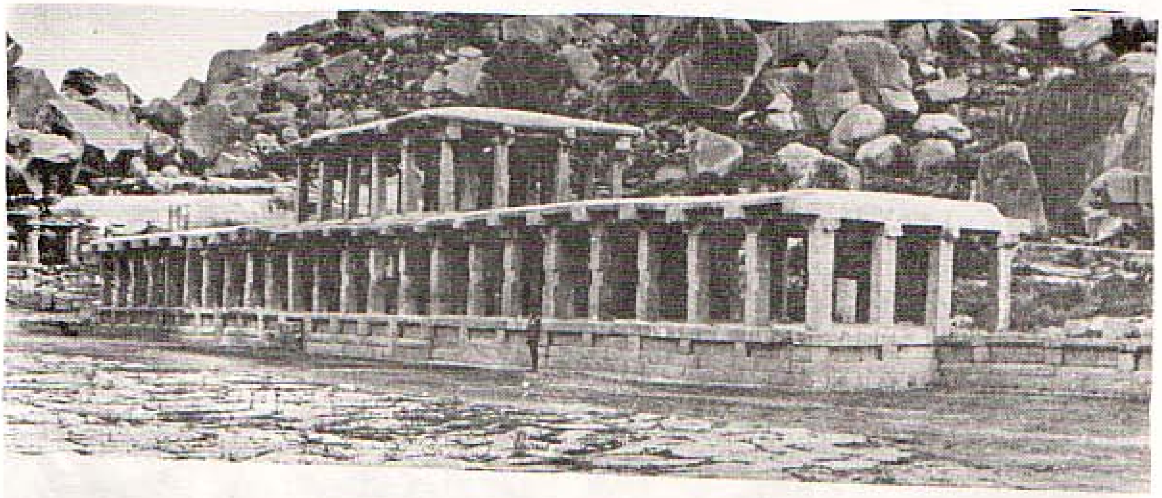


Fig. 6

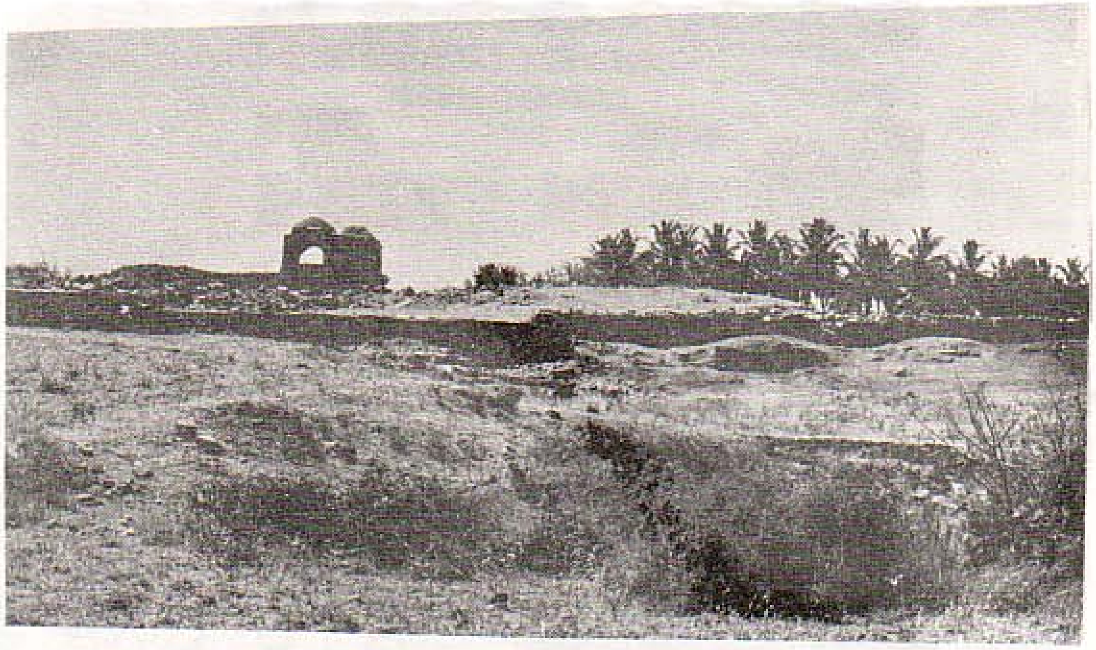


Fig. 7

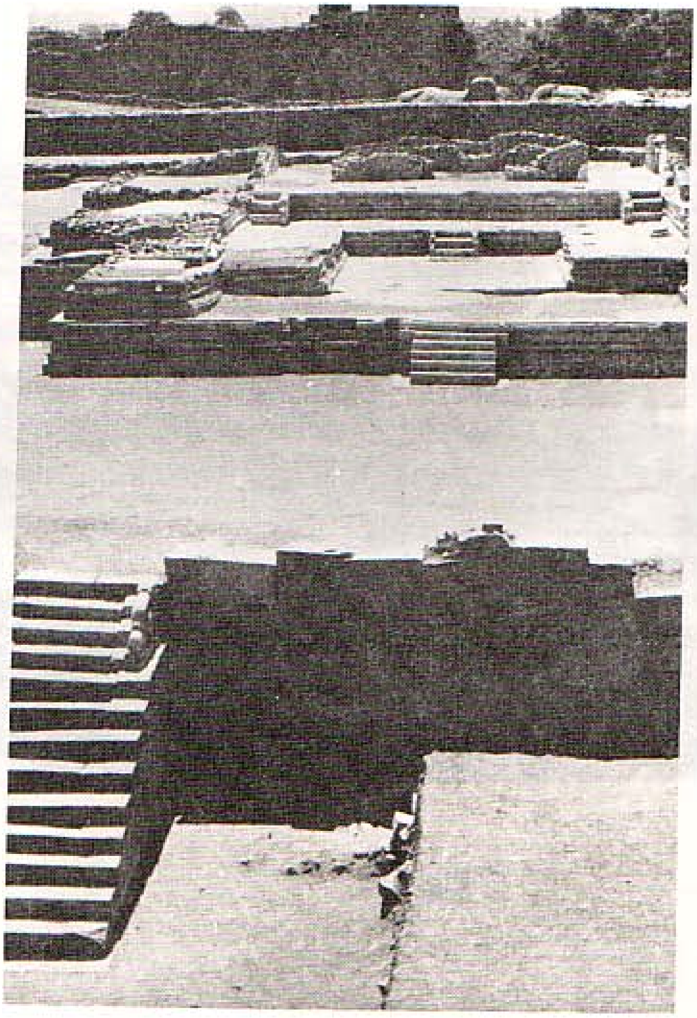


Fig. 8

Fig. 9

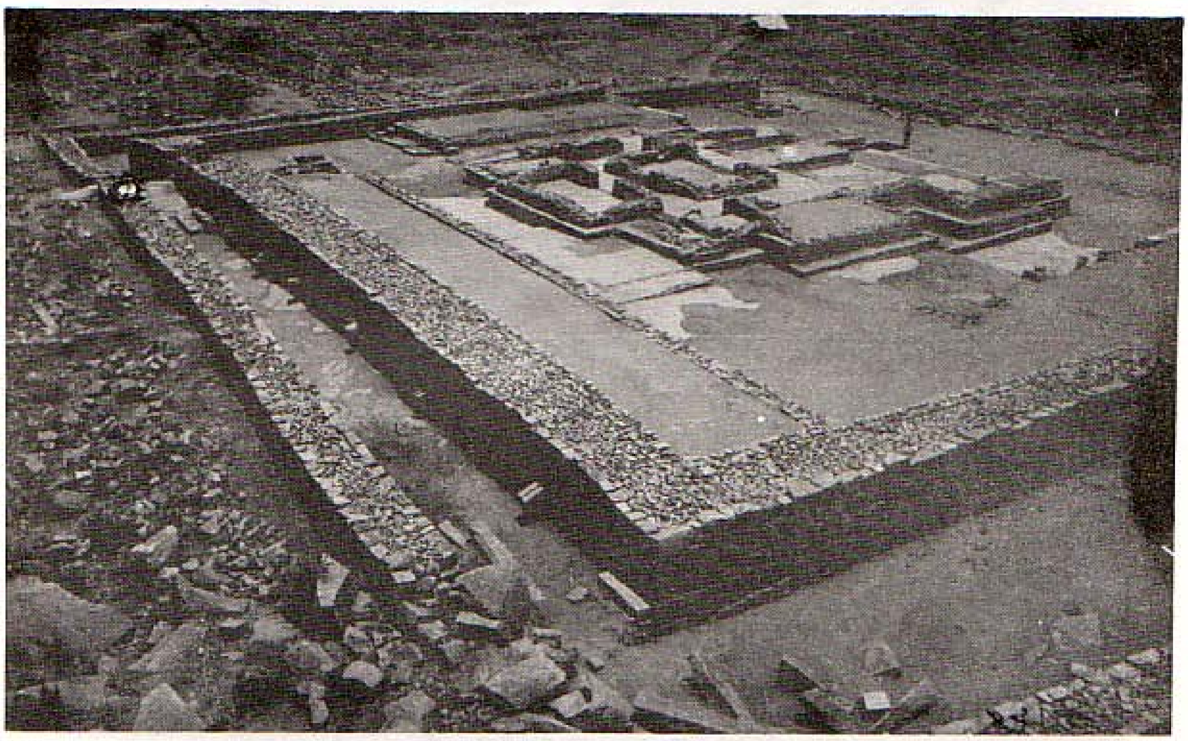


Fig. 10

Fig. 11

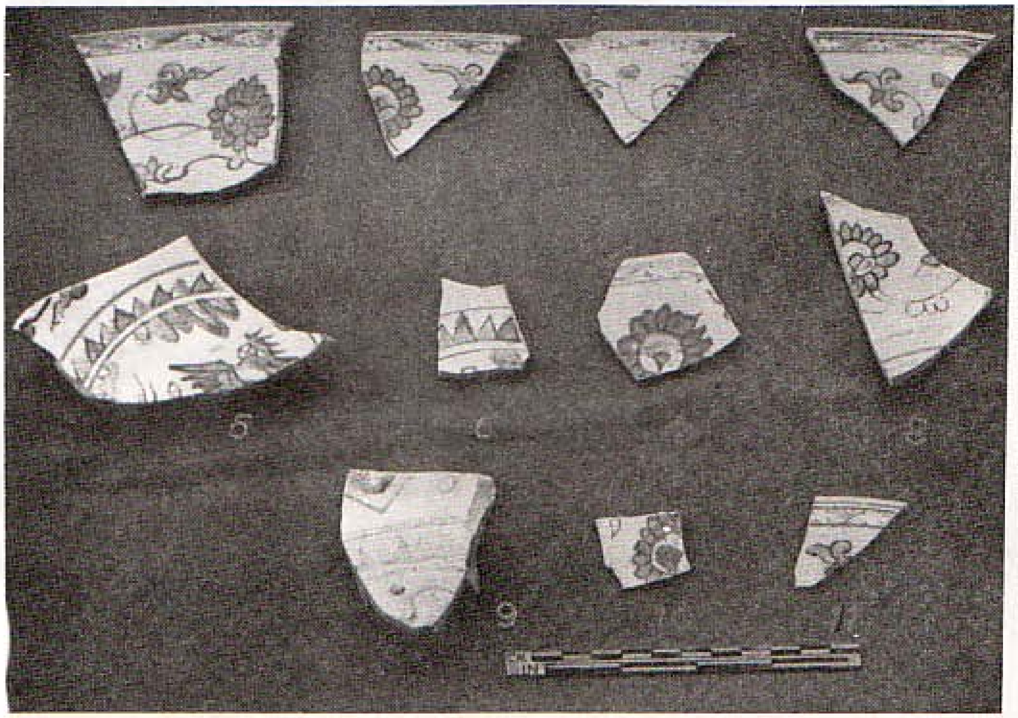


Fig. 12

Fig. 13

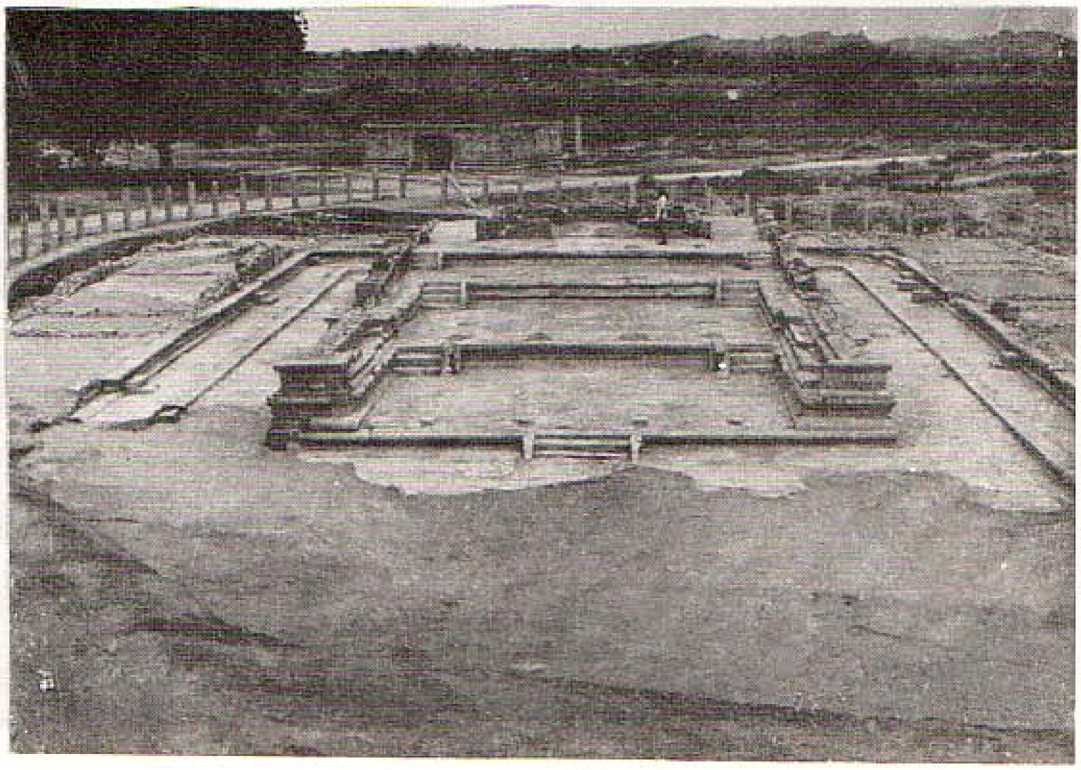


Fig. 14

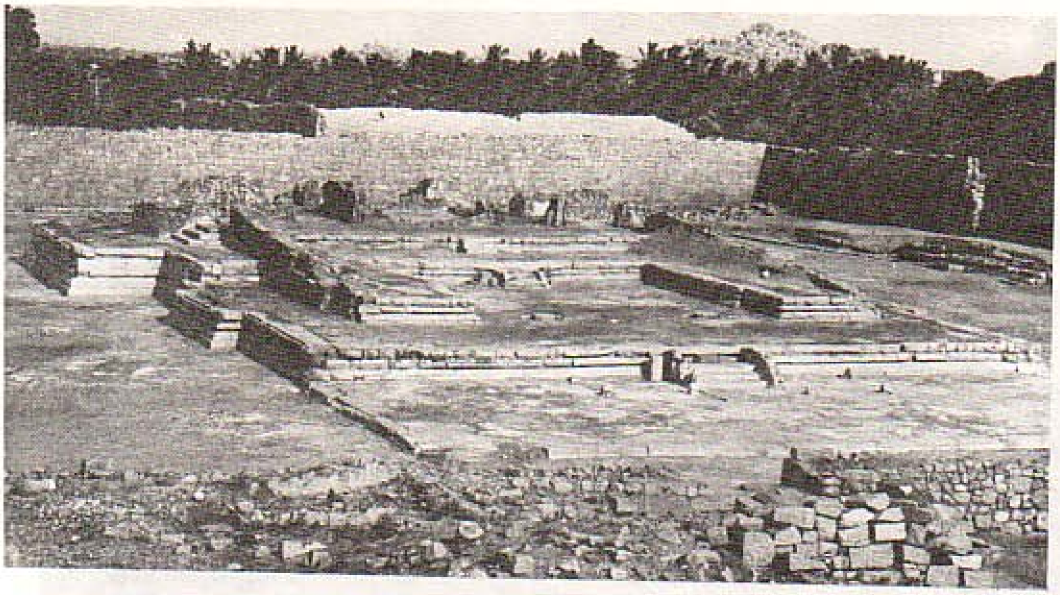


Fig. 15

Fig. 16

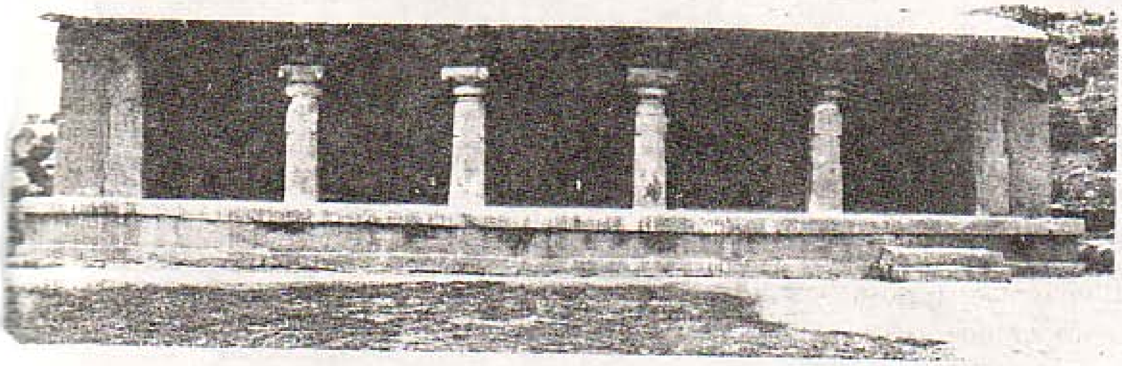


Fig. 17

Fig. 18

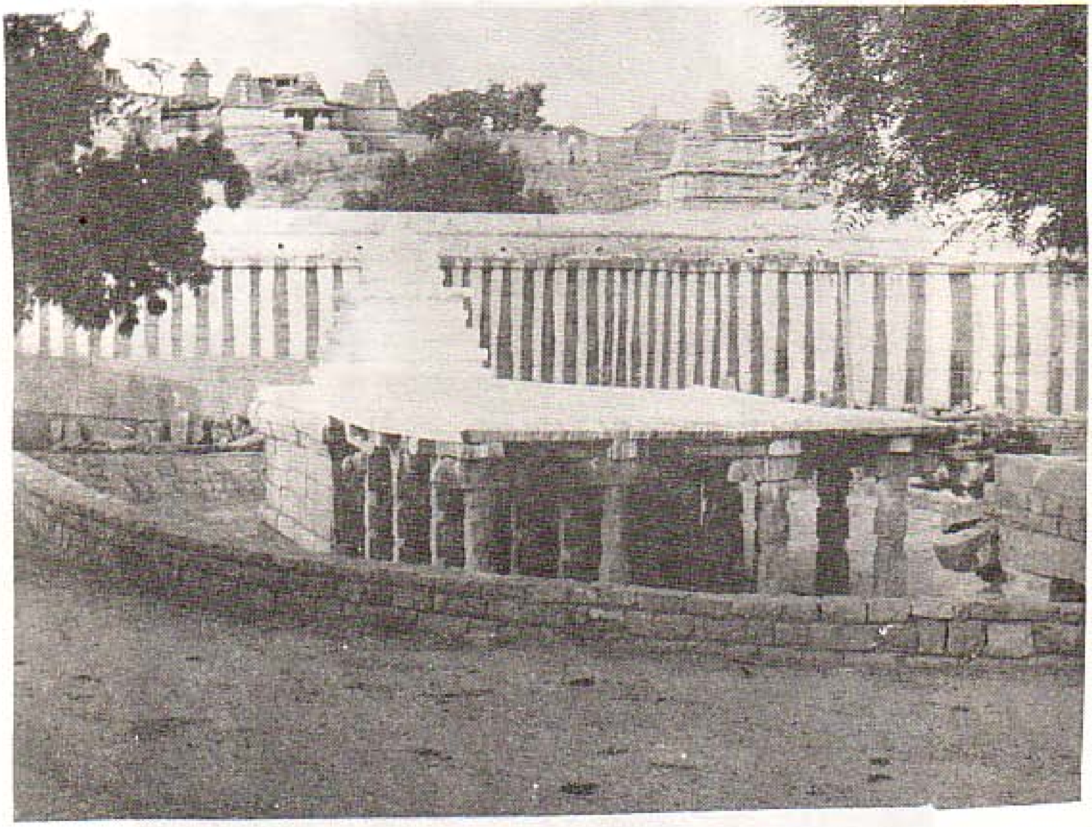


Fig. 19

Fig. 20

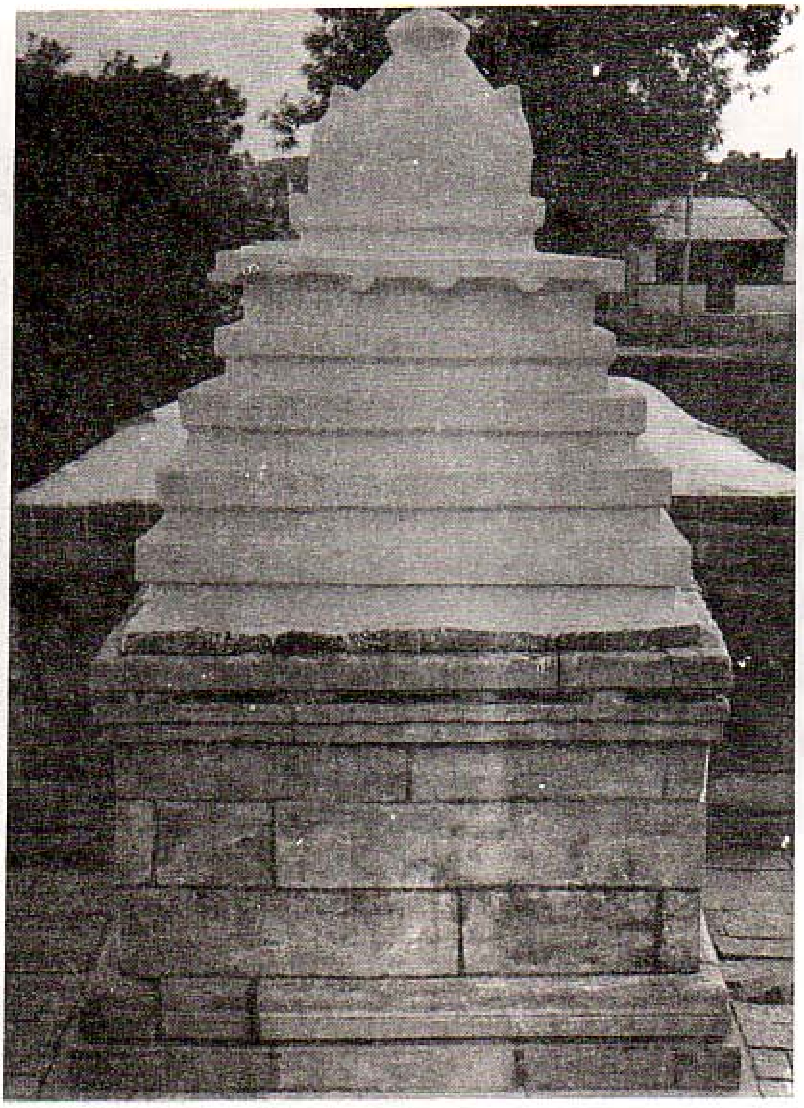


Fig. 21

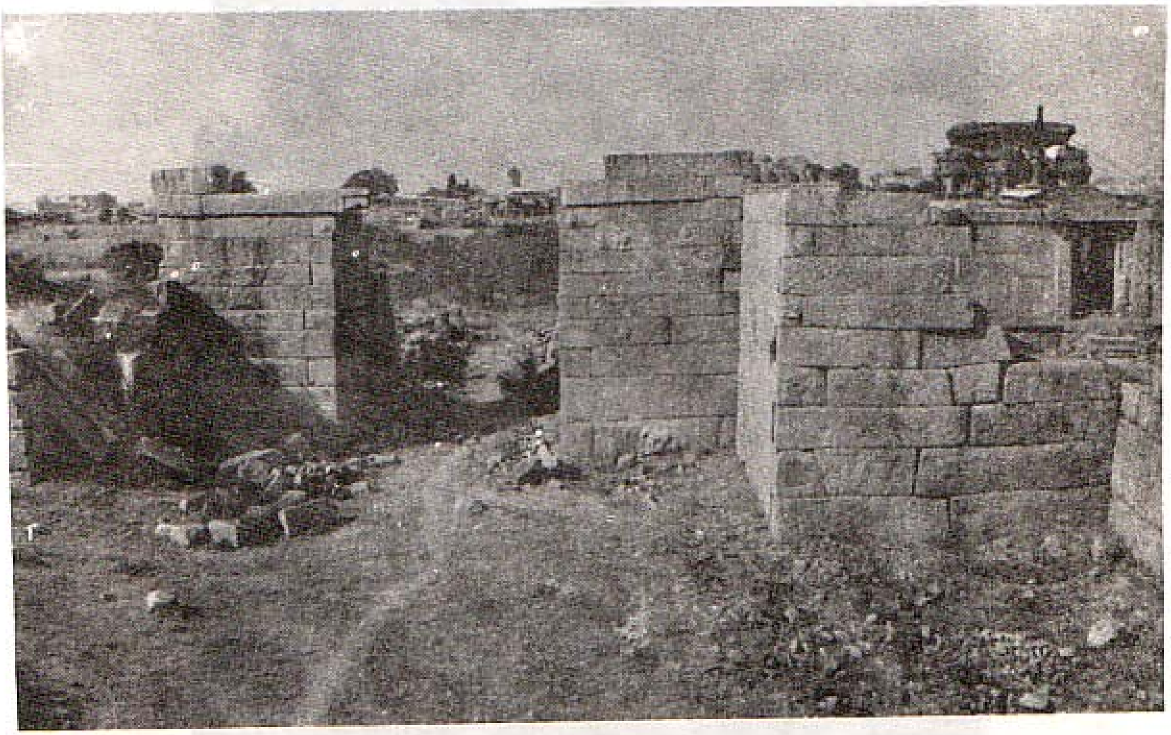


Fig. 22

Fig. 23

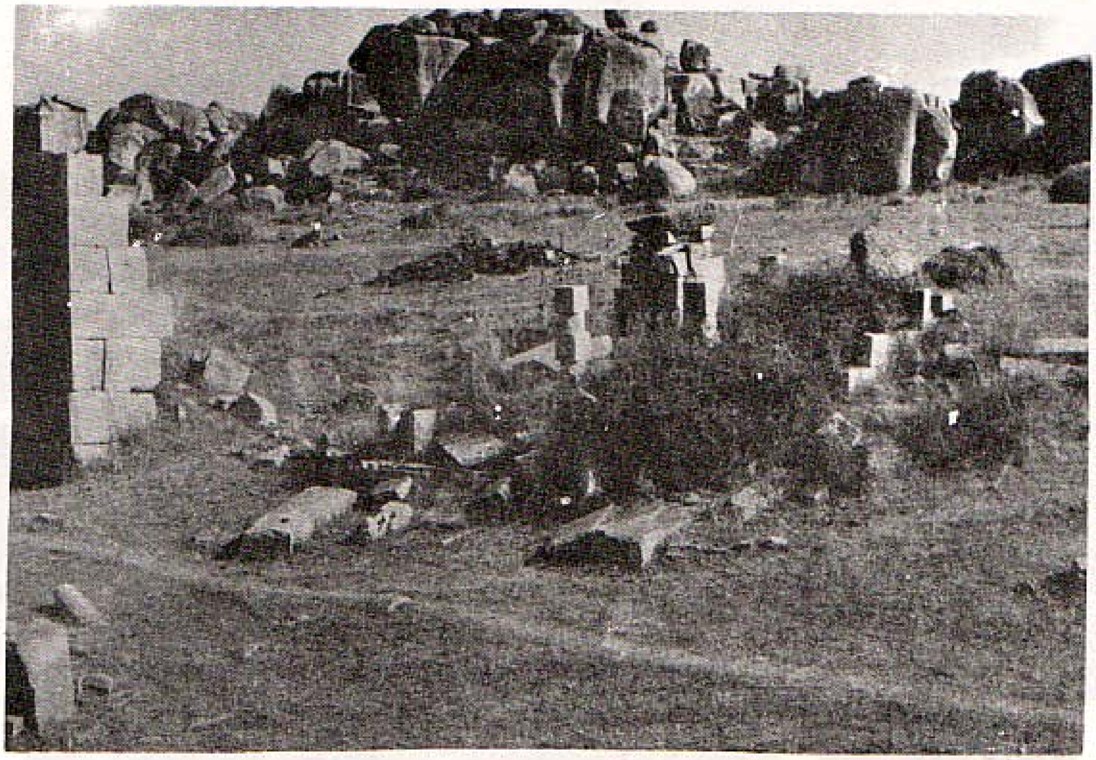


Fig. 24

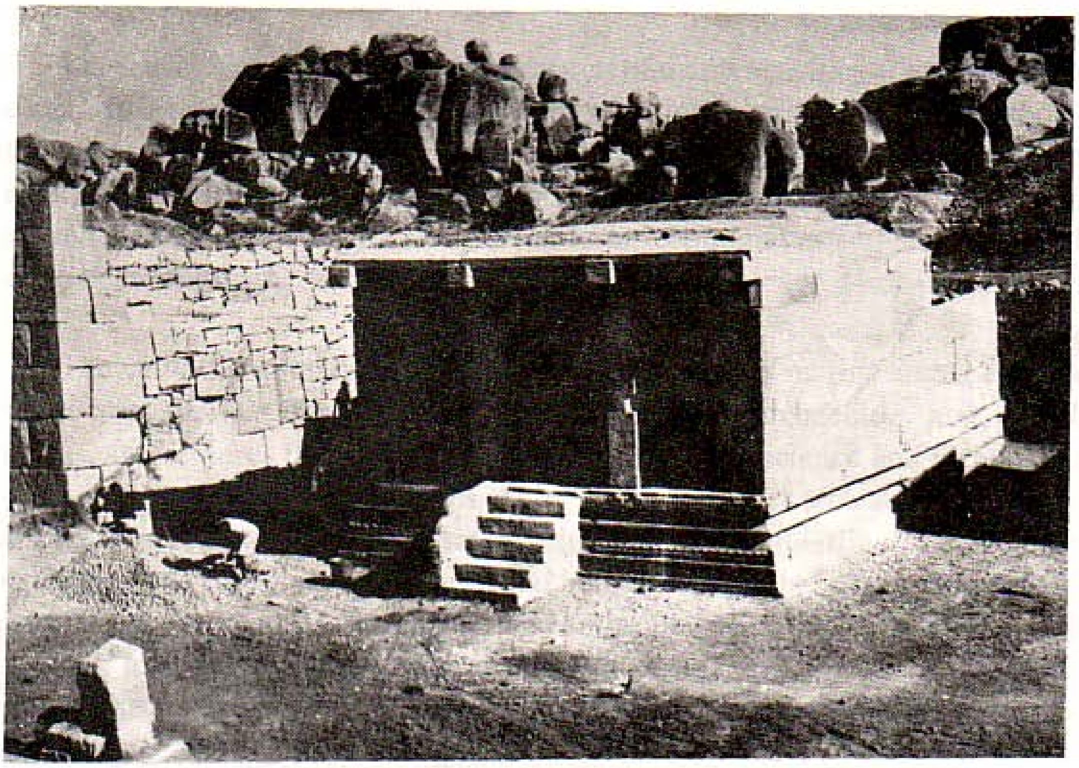


Fig. 25

THE EMERGENCE OF MARINE ARCHAEOLOGY IN SOUTH ASIA AND PROSPECTS FOR REGIONAL COOPERATION

By

E. V. Gangadharam

INTRODUCTION

Marine archaeology deals with all aspects of man's activities at or relating to the sea. It involves the study of submerged man-made structures such as shore settlements, ports and temples; the location, excavation and retrieval of shipwrecks; the documentation of maritime history and maritime trade of countries and regions; and even the socio-ethnological study of sea-faring communities and their activities such as boat-building.

The multi-disciplinary and inter-disciplinary nature of marine archaeology is evident from the fact that it includes aspects of history archaeology and social sciences, and requires the support of various branches of science and technology such as earth sciences, ocean sciences, diving and underwater technology and even the science of remote sensing and satellite imagery. This underlines the need for cooperation and coordination amongst and between researchers in the humanities (historians, archaeologists, sociologists and anthropologists) on the one hand, and scientists and technologists (geochemists, coastal and marine geologists, geophysicists, ocean engineers, divers and specialists in underwater photography and photogrammetry) on the other.

The purpose of this paper is to briefly review the birth and development of marine archaeology in India and to indicate the potential for cooperation in marine archaeology research in South Asia with special reference to India and Sri Lanka. Finally, areas of marine archaeology research with potential for collaboration between South Asia and other countries are suggested for consideration.

BIRTH AND DEVELOPMENT OF MARINE ARCHAEOLOGY IN INDIA

Marine archaeological research in India can be said to have begun in the '70s with the excavations by Dr. S.R. Rao at Lothal, about 100 km south of Ahmedabad and secured nation-wide exposure with the excavations at Dwarka in the '80s both in Gujarat. The establishment in 1981 of a Marine Archaeology Unit with Dr. Rao as Emeritus Scientist- in- charge at the National Institute of Oceanography, Goa was the first major step taken in India to promote marine archaeological research. The state of Tamilnadu has taken early initiative in starting marine archaeological research at university level when it established a Centre for Under-water Archaeology at Thanjavur in 1983. In 1987 Andhra University established the similar research Centre1 for Marine Archaeology studies at Waltair (Visakhapatnam, Andhra Pradesh) and work commenced in January 1989. The first Indian conference on the Marine Archaeology of th Indian Ocean Countries was held in October 1987 in Jamnaga Gujarat. A Society for Marine Archaeology was founded in 1988, and a marine archaeology training programme was instituted at N.I.O. Goa in 1989. The organisation of the Second Indian Conference on the Marine Archaeology of the Indian Ocean Countries at Bangalore and the publication of the first issue of Journal of Marine Archaeology in January 1990, are also landmarks in the rapid development of marine archaeology in India.

PIONEERING WORK DONE IN GUJARAT

Interesting work has already demonstrated the importance of marine archaeological research in highlighting India's maritime and historical heritage. The excavations at Lothal, Gujarat in the '70s have brought to light the technical capabilities of the Harappan civilization to conceive, build and utilise a large tidal dockyard. This dockyard was 210 m long, 35 m wide and 4 m deep, and was capable of handling upto thirty ships at a time. This was dated to about 2300 B.C. based on archaeological and carbon-14 methods (Rao 1979 and Rao 1985). Detailed near-shore exploration and underwater excavation at Dwarka, Gujarat have revealed fortifications and other structures such as rock-cut slipways, jetties and the remains of a temple, just off Samudranarayan Temple and the island of Beyt Dwarka on the western coast of Gujarat at the mouth of the Gulf of Kuchch (Rao 1987a). Archaeological and scientific dating show these to be of the Mahabharata period.

RESEARCH IN TAMILNADU

In Tamilnadu, the first application of marine geophisical methods helped to localise possible submerged structues and shipwrecks at the famed Poompuhar (also known as Kaveri Poompattinam) about 250 km south of Madras. Preliminary investigations have already been commenced off Tarangambadi (Tranquebar) by the N.I.O. group in the off-shore area just opposite to the old Danish fort and settlement. The anomalies revealed by initial marine geophysical surveys are suggestive of possible submerged structures and shipwrecks. The Centre for Under-water Archaeology of the Tamil University, Tanjavur has already undertaken collaborative interdisciplinary studies in marine archaeology such as the history of traditional navigation, tri-lingual nautical terminology, boat building ethnology and the impact of sea level variation on coastal environment (Rajamanickam and Subbarayalu, Eds. 1988) and Abstract Volume 1989).

MARINE ARCHAEOLOGY RESEARCH IN ANDHRA PRADESH

The Centre for Marine Archaeological Studies established by the Andhra University in 1987 took shape in 1988 with the grant of Rs.100,000 from the Unversity Grants Commission funds and started functioning from January 1989. Presently, it has a Coordinator, an Advisory Committee and a Visiting Professor. A Workshop on the Potential for Marine Archaeological Research in Andhra Pradesh was organized by the Centrein 1989. The key-note address and a popular lecture were delivered by Dr. S.R. Rao and 10 invited speakers addressed about 40 participants drawn from several university departments and other institutions representing various disciplines. Amongst the research activities commenced from January 1989 are a project to locate a legendary submerged temple for Vaisakheswara off Visakhapatnam; collection of archival and bibliographic information; compiling a marine archaeological data base on shipping, ships and shiwrecks; and investigation of the sites of ancient major and minor port towns such as Kalingapatnam and Motupalli. (Gangadharam 1989a, 1989b and 1990). Archival studies will be undertaken soon to secure further details of about 17 shipwrecks reported along the coast of Andhra Pradesh through the pioneering Archival Data-base compilation of Dr. S.R.Rao.

THE SUBMERGED (VAISAKHESWARA) TEMPLE PROJECT

This first and major project of the Centre for Marine Archaeological studies at Andhra University is to verify the strong local tradition and historical indications of the existence of a temple (now not seen several centuries ago on the sea-ward edge of Visakhapatnam. It was conceived and initiated2 and continued at the Centre after it commenced work in January 1989.

Oral tradition, local documents and inscriptions were recorded, compiled and interpreted respectively. Reconnaissance diving in target area by Navy divers was organised & supervised. An existing shore temple near target site is being thoroughly investigated (compilation of archival, bibliographic and official records; accurate surveying/mapping of temple; detailed study and photography of icons) to verify its reported relationship with the legendary submerged temple.

Recent progress (June 1990) includes the Analysis of digital data from remote sensing imagery of the French satellite SPOT shows a persistent anomaly in the target. Immediate plans diver-search and underwater photography at anomaly site and land excavations near existing shore temple. If the existence of the submerged temple is confirmed, the ruins located will be carefully photographed, mapped and recovered. After suitable conservation and restoration, attempts will be made to rebuild the temple as closely as possible to original estimated configuration.

If the project is successful, this will be the only submerged temple to be retrieved in India, and will be a marine archaeological achievement.

MARINE ARCHAEOLOGY IN WEST BENGAL

The region surrounding the ancient maritime trade centre of Tamralipti (present Tamluk, about 50 km southwest of Calcutta) has been studied by archaeologists. The excavations dated to the early centuries of the Christian era, yielded numerous pots, plaques and seals (Mukherjee, 1989). Two of the seals were recently described (Sarma, 1990) as depicting sailing vessels - one shows a bowl shaped vessel decorated at both ends with makara-mukhas (crocodile heads), and the other shows a three-masted sea-going similar to the ones depicted on the Andhra Satavahana period coins of Gautamiputra Yajna Sri Satakarni (Sarma, 1980). This and other ancient coastal trade centres of West Bangal have great marine archaeological potential. Coming to the modern times, the Saudheads and the Sunderbaus of West Bengal are the vast but shallow estuaries south of Calcutta which hold numerous wrecks of ships of the elsewhere British East India Company of the 17th to 19th centuries, awaiting location and excavation.

MARINE ARCHAEOLOGY OF ORISSA

The coastal region from Balasore in Orissa to Kalingapatnam in Andhra Pradesh belonged to the Kalinga kingdom during early centuries of the Christian era and is known for its Buddhist culture and maritime trade. Ancient port sites include Konagar (Konark), Balasose and Palur of Orissa and Kalingapatnam of Andhra. On-land archaeological studies at these sites yielded extensive evidence of florishing maritime trade and religious links with southern Indian states and Sri Lanka one the hand and with the southeast asian nations such as Burma, Thailand, Malaysia and Indonesia on the either.

The Chilka lake, a huge coastal lake southwest of Puri was mentioned in 10th century AD Brahmanda Purana as having a large port harbouring sea-going vessels trading between India and southeast asia (TRIPATI, 1990). The Orissan Institute of Maritime and South-east Asian Studies, Bhubaneswar, excavated at Manik[atna near Chilka lake which yielded Chinese celadon and porcelain, Roman rouletted ware and Ceylonese coins. Systematic marine archaeological investigations of near-shore regions of these sites will undoubtedly throw a flood of new light on the maritime history of India and southeast Asia. Remains of a 16th century AD wooden ship probably of Danish origin, built in the Viking tradition, was discovered in Orissa in May 1990 by the Orissan Institute and the State Archaeology Department. The boat timbers were found embedded in the bed of the Burhabalang river near Balasore, at a depth of about 2 metres, and appear to be in a very good state of preservation.

SOUTH ASIAN MARINE ARCHAEOLOGY

Sri Lanka being the northernmost landmass in the central part of the Indian ocean, served during historic times as the cross-roads of maritime trade routes to the west and the east. Archaeological studies in Bengal (Tamralipti), Orissa (Manikpatna) and Andhra (Vengipura) reveal not only maritime trade with Sri Lanka but also Buddhist religious links. For example, Nagarjunakonda of Andhra was a centre of Mahayana Buddhism during 3rd - 4th centuries A.D. which has great similarities to the Buddhism of that time in Sri Lanka. A carnelian intaglio (a locket containing an oval-shaped tansparent stone) depicting a youthful city goddess found in Vengipura (present Peddavegi of Andhra) dated to 4th century AD (Sarma, 1988) is reported to be similar to a carnelian intaglio from the excavations at Jetavana monastery (3rd century A.D.) in Anuradhapura Sri Lanka (Rohan Gunaratne quoted by Sarma, 1990).

Mahadeva, a Buddhist monk from Andhra is said to have travelled to Sri Lanka for the consecration ceremony of a great stupa sometime in the 1st century B.C. personal communication).

These selected examples are only indicative of active maritime links between the east coast of India and Sri Lanka. There is extensive information available on such trade and religious links through maritime activities not only within the countries of South Asia, but also between South Asia and southeast asia as well as the rest of the world.

SOUTH ASIAN COOPERATION IN MARINE ARCHAEOLOGY

It is suggested that exchange of inscriptioned, archival, bibliographic and ancient cartographic information between South Asian nations as an essential first step in the direction of regional cooperation in marine archaeology.

Expertise, equipment and facilities available in the countries of the region could be shared for optimum utilisation and avoidance of duplication. For example, a facility for identification, treatment and conservation of water-logged wood is being proposed to be set up at Andhara University, with the help and support of the Institute of Wood Science and Technology of Bangalore. The proposal is at a very preliminary stage, but if it materialises could provide training and technical support to marine archaeologists of South Asian nations who are bound to bring out water-logged wood during their researches. Such cooperative programs could be perhaps undertaken under the umbrella of existing organisations such as the SAARC.

COOPERATIVE SUPPORT FROM OTHER COUNTRIES

In areas of marine archaeology where technical expertise is lacking in South Asian countries, support could be sought from countries such as Australia, UK, USA, and the Netherlands, which have been centres of active progress in marine archaeology in the last few decades. An example is underwater photogrammetry, for which expertise and equipment are lacking in all the South Asian countries. It is suggested that Sri Lanka could perhaps develop such facilities with the help of other countries, which could then be effectively utilised by the countries in the region avoiding expensive duplication.

EPILOGUE

Sri Lanka is now posed to enter into the second century of Archaeology, and development of marine archaeology could be made one of the many new facets of its strategy for the future. South Asian nations stand to gain enormously by meaningful cooperation and efficient coordination in marine archaeology as they all share a common heritage of age-old sea faring tradition, and their maritime past during historic and colonial periods is intimately interwoven.

Acknowledgement

I am most thankful to Prof.Senake Bandaranayake, Director, Postgraduate Institute of Archaeology, Colombo and Prof. Cyril Ponnamperuma, Institute of Fundemental Studies, Kandy for expending invitations to participate in the Archaeological Centenary Celebrations of Sri Lanka and the hospitality of these Institutions in designating me as a Viviting Research Associate.

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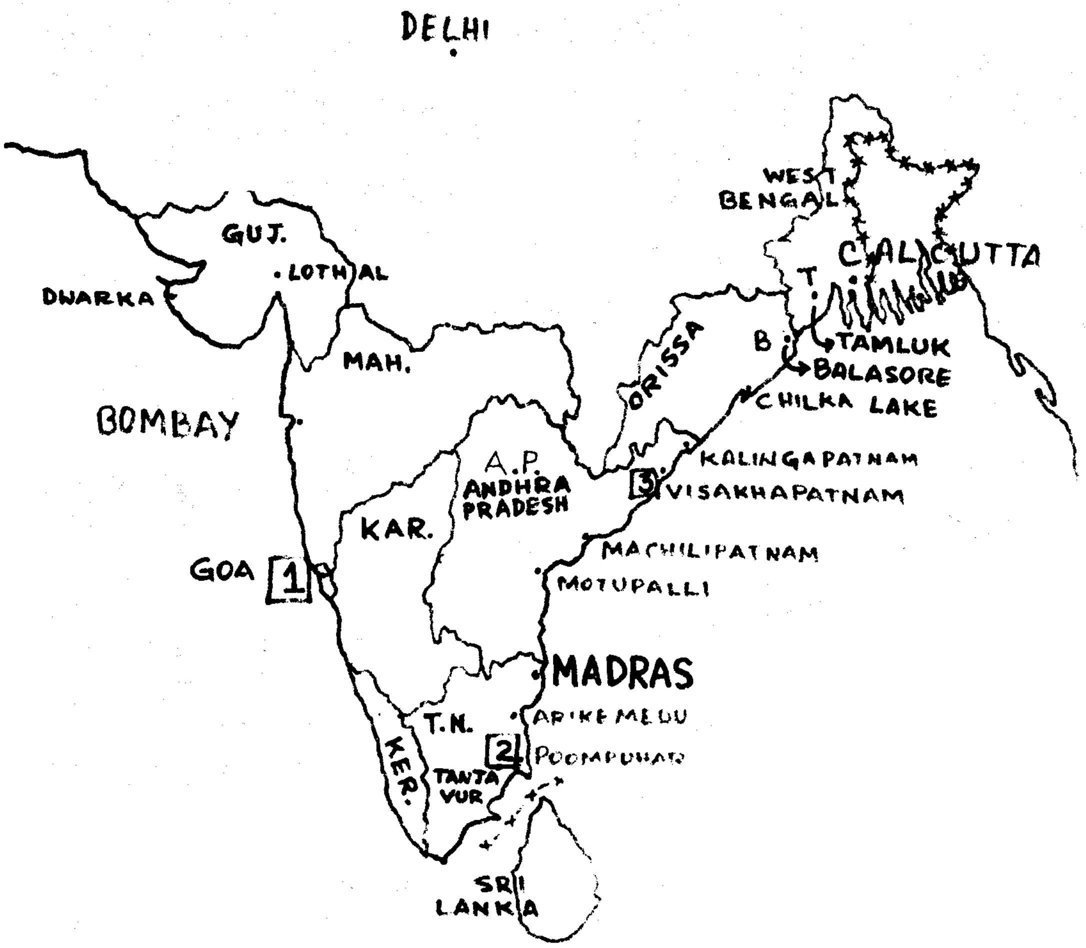
LEGANDS FOR FIGURES

Fig.1 Some marine Archaeological sites and centres of research in India. (1. National Institute of Oceanography,Goa; 2. Tamil University,Thanjarm; 3.Andra University, Waltair)

Fig.2 Sketch map of Submerged Temple Project area, Visakhapatuam.

Fig.3 Digital printout map of Submerged Temple Project area, showing an anomaly in the off-shore region earmarked for search. (Courtesy Prof.S. V. L. N. Rao, Centre for Remote Seusing, Andra University.)

Fig.4 Timber of a wooden ship thought to be of Danish origin, estimated to be 16th century,reacently discovered near Balasole, Orissa.


DELHI
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LOTHAL
DWARKA
MAH.
BOMBAY
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BALASORE
CHILKA LAKE
ORISSA
KALINGAPATNAM
VISAKHAPATNAM
3
A.P.
ANDHRA PRADESH
KAR.
GOA
1
MACHILIPATNAM
MOTUPALLI
MADRAS
T.N.
ARIKEMEDU
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POOMPUHAR
KER.
TANJAVUR
SRI LANKA

Fig.1

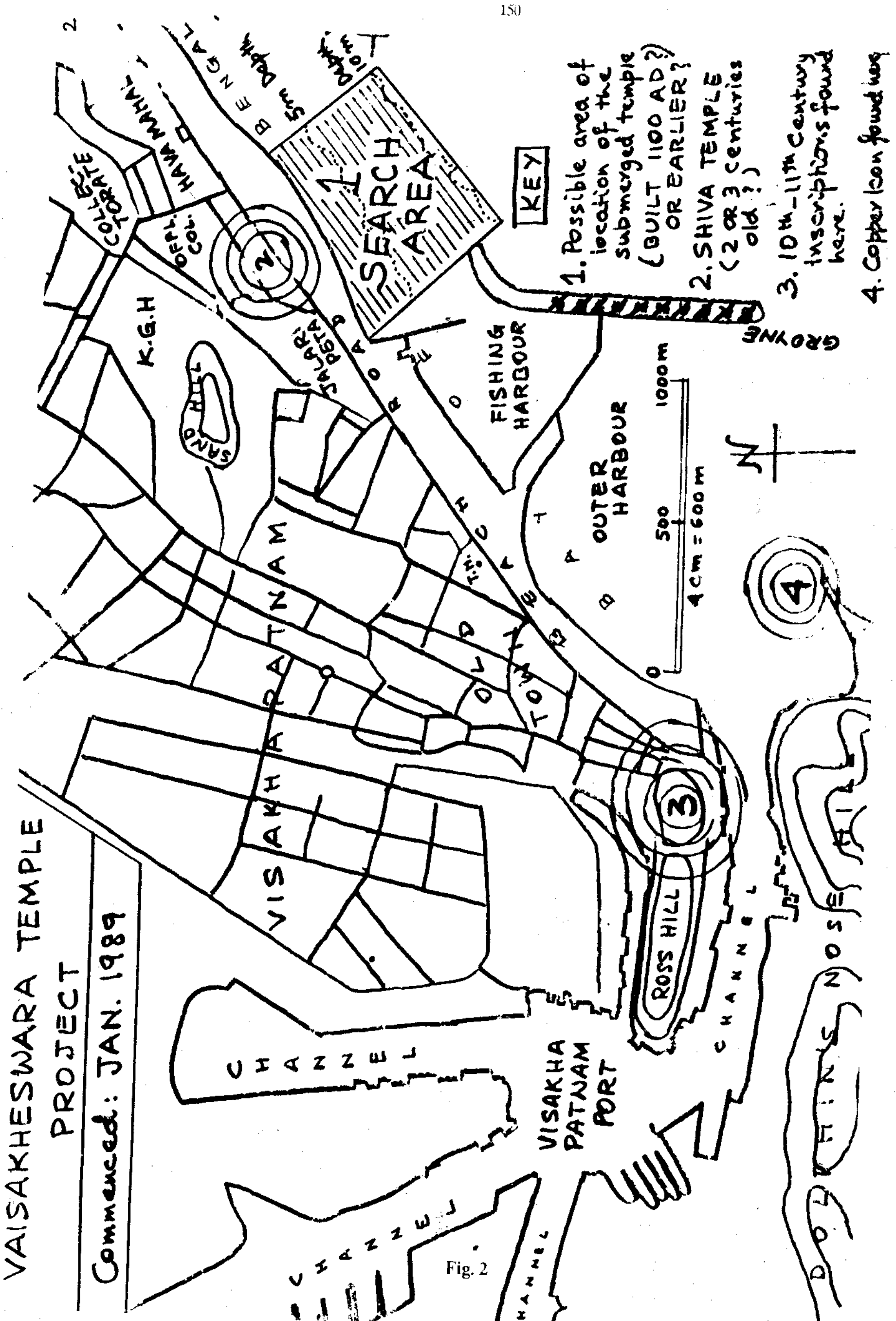
VAISAKHESWARA TEMPLE
PROJECT
Commenced: JAN. 1989
VISAKHAPATNAM
OLD TOWN
BEACH ROAD
K.G.H
SAND HILL
COLLECTORATE
HAWA MAHAL
OFFL. COL.
JALARI PETA
SEARCH AREA
FISHING HARBOUR
OUTER HARBOUR
ROSS HILL
VISAKHA PATNAM PORT
CHANNEL
CHANNEL
CHANNEL
DOLPHINS NOSE HILL
BENGAL
GROYNE
5m
10m
0
500
1000m
4cm = 600m
N
KEY
1. Possible area of location of the submerged temple (BUILT 1100 AD?) OR EARLIER?
2. SHIVA TEMPLE (2 OR 3 centuries old?)
3. 10th–11th Century inscriptions found here.
4. Copper Icon found here

Fig. 2

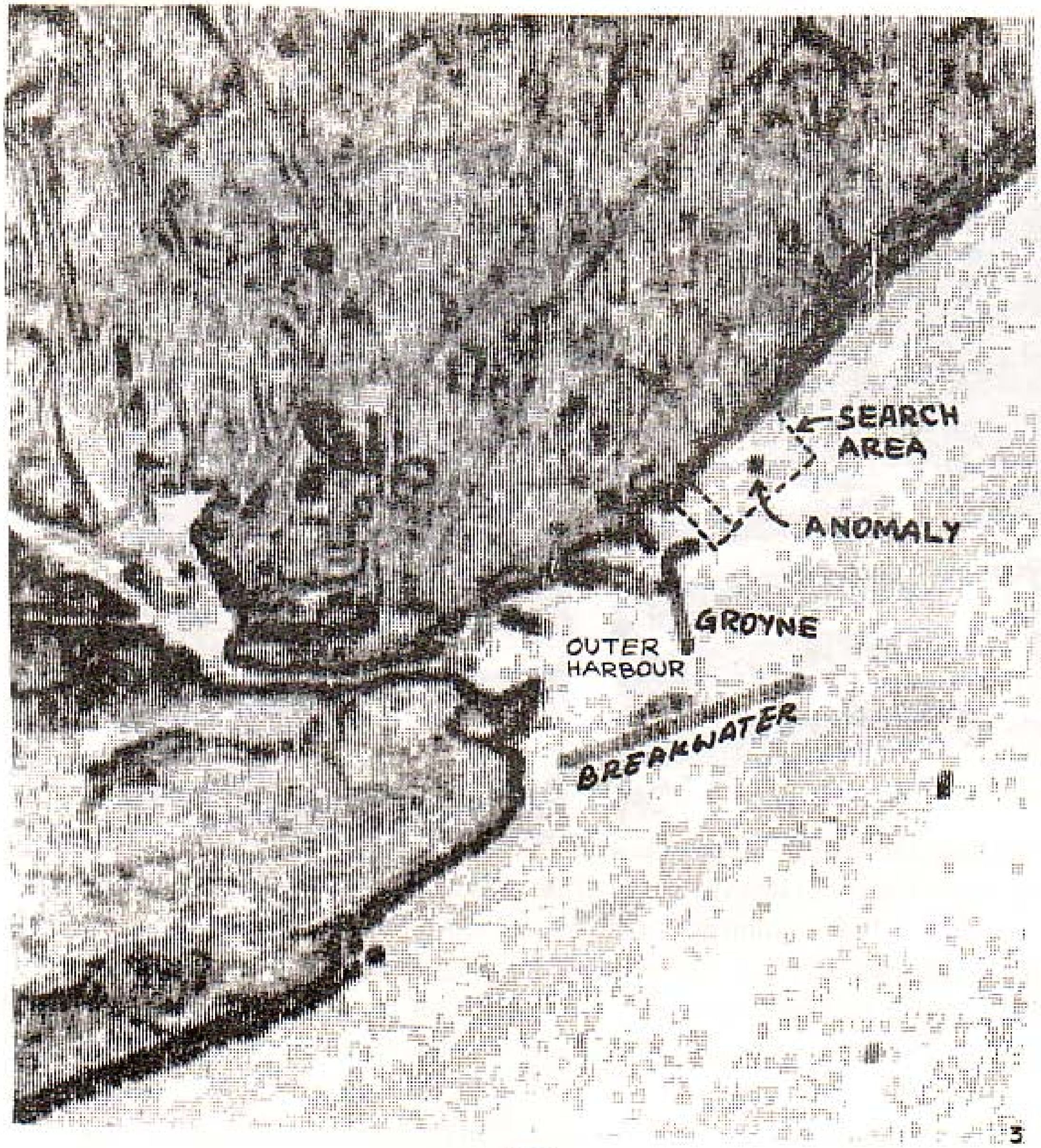

Fig. 3

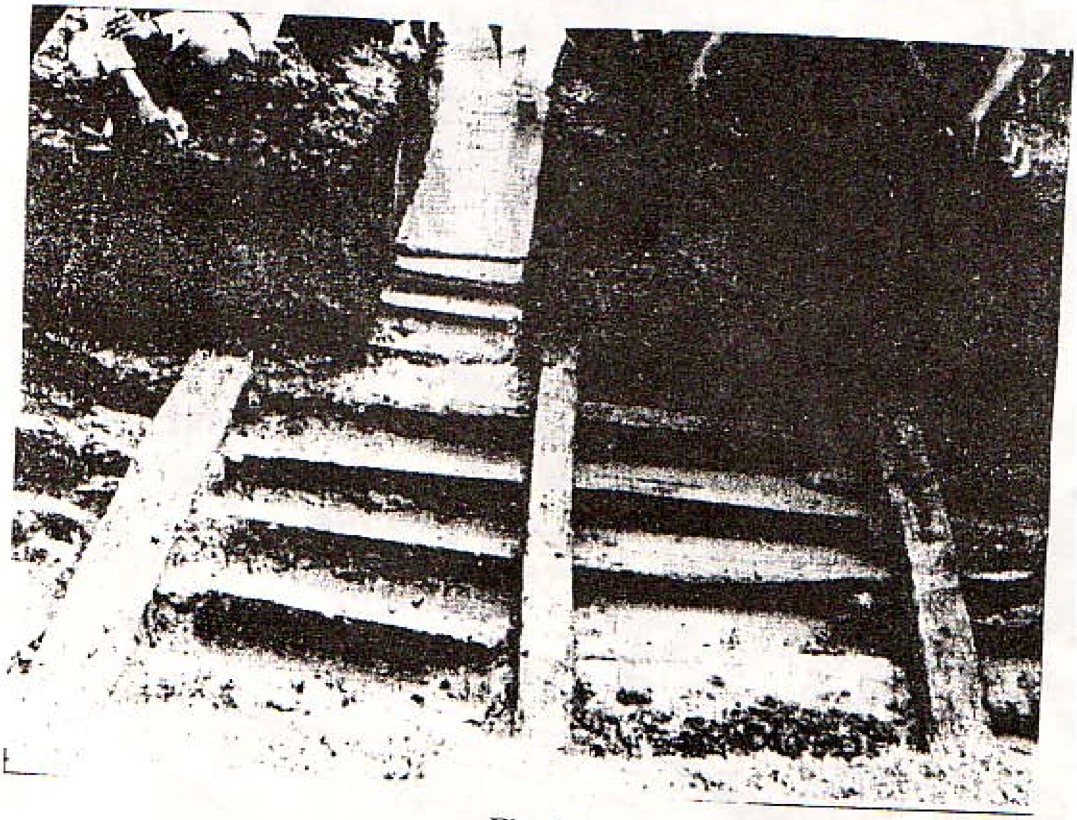

Fig. 4

TWO SCHOOLS OF BUDDHA IMAGE IN SRI LANKA

By

C. Wikramagamage

01 Histrical Background

Theravada or the elders Buddhist tradition also called Vibhajjavada was introduced to Sri Lanka in about 250 B.C. A group of Indian Buddhist misionaries head by Mahinda, a son of Indian Emporer Asoka converted the Sinhalese King, Devanampiya Tissa, the royal family and most of the citizens of the Island to Buddhism. The first Monastery, called Mahavihara was established in the royal garden, the Mahamegha-vana, adjoining the citadel of Anuradhapura and later it became the headquarters of the orthodox Buddhist Community of Monks or the Mahavihara sect.

In about 89 B.C. a group of monks broke away from the Mahavihara and took residence at the Abhayagiri Vihara in the north of the city and later they organized as a separate Buddhist sect under the leadership of Dhammaruci of Vajjiputtaka (Vatso[itroua) sect, a branch of Puggalavadins and known as, Dhammarucikas. This liberal minded Buddhist sect opened their doors to all other Buddhists, and specially studied Theravada Tripitaka as well as Vaitulyavada (Mahayanism).[1]

Vaitulyavada (Mahayanisam) first appeared in Sri Lanka in the third century B.C. King Voharika Tissa (209-231, A.C.) suppressed it. After eighteen years, during the reign of Gothabhaya (249-262 A.C.) there were sixty vaitulyavadins in the island and the king banished them to India.[2] In these two instances Sinhalese kings were influenced by the Mahavihara monks. In the second suppression of the vaitulyavada (Mahayanism) a group of monks left the Abhayagirivihara with the fear of having connections with Vaitulyavadins and settled down at the Dakkhina-girivihara,[3] and later during the reign of Mahasena, younger son of Gothabhaya they formed a new Buddhist sect called Sagaliya under the leadership of a monk called Sagala.[4] The king Mahasena (274-301 A.C.) accepted the Vaitulyavada and destroyed the Monasteries of opponent monks of Mahavihara and gave the building ·erials to the Abhayagirivihara to build more dwellings for the monks · · sect[5] and their friends, Vaitulyavadins. This time the

Vaitulyavadins gained favour of the Sinhalese king and established themselves in the island. This form of Vaitulyavada may be called Mantrayana, one of the two branches of Mahayana Buddhism, Vajrayana being the other. The latter form of Mahayana was introduced to Sri Lanka during the ninth century A.C..[6]

From the time of the king Mahasena onward the monks of the Mahavihar put down the campaign against Vaitulyavadins but they made every effort to protect their scriptures from being mixed with Vaitulyavada and also they themselves kept away even from Dhammarucikas as well as Sagaliyas who also had the influence of the Vaitulyavadins.

The Vaitulyavada ceased to exist during the Chola conquest in the first half of the eleventh century A.C. Vijayabahu I, ascended the throne in 1055 A.C. and soon after he invited the monks who had been in Burma and re-established the higher ordination of the three Buddhist sects namely the Mahavihara, Dhammaruci and Sagaliya. In the twelth century A.C. king Parakramabahu I, dissolved the Dhammaruci and Sagaliya sects and the members of these two sects were asked to accept either to be absorbed into the Mahavihara or seek government employment.8 From that time upto now only the Mahavihara sect is found in Sri Lanka.

02 History of Buddha image in Sri Lanka

Dr. Walpola Rahula (now professor) assumes that the history of Buddha image goies as far back as the third century B.C.. His statement is as follows:

> "...a Sinhalese tradition, current at least in the fifth century A.C., which cannot be wholly ignored, traces the history of the Buddha image as far fack as the third century B.C. In relating the activities of Jattha-Tissa (323-333 A.C.) the Mahavamsa refers to a "great and beautiful stone-image that was placed of old by Devanampiya-Tissa in the Thuparama". If we accept this statement, Ceylon had the earliest Buddha image in the world, whether Devanampiya-Tissa had actually this image made or whether a later tradition attributed to the first buddhist king of Ceylon an ancient image of unknown origin that was found at Thuparama, we cannot be definite. Merely because we do not find Buddha

images among the early sculptures at Sanchi and Bharhut in India, it is not logical to conclude that there were no Buddha images made in the third century B.C. anywhere else either. Was there anything to prevent the birth of new ideas in the island in advance of the continent?".

In support of the above assumpsion Dr. Rahula provides historical records of the Buddha image of King Devanampiya - Tissa:"The great - stone - image" (urusilapatima) mentioned above was a celebrated statue which was held particularly sacred. King Jettha Tissa (323-333 A.C.) removed it from the thuparama and set it up at a monastery called Pacinatissa - pabbata, Mahasena (334-363 A.C.) removed it from there and placed it at the Abhayagiri. Buddhadasa (about the end of the 4th century) set jewels in the eye - sockets of this image. Dhatusena (460-478 A.C.) enected an edifice for it, and as the gems placed by Buddhadasa had been lost, he provided jewels for a pair of eyes which were to be made. He also had the halo and th crest made and the hair studded with blue gems. silameghavanna (617-262 A.C.) repaired its old shelter, adorned it with various gems and dedicated to it the Kolavapi tank, Sena II (851-885 A.C.) restored the ruined temple of the image, and his queen placed a blue diadem on it. this image is repeatedly referred to by various names such as urusilapatima, mahasila patima, silasatthu, silasambuddha. Silamayleuddha, silamayamuninda and silamayamahesi.

It is interesting to note here that the word sila (stone) is invariably used whenever the reference is made to this image. There were other stone images, but this one was particularly known as "the great stone image". The Mihintale inscription of Mahinda IV. (956-972 A.C.) refers to mangul - maha-sila-pilima, (mangala-mahasila patima) "the auspicious great stone image". The Jetavanarama slab inscriptions of the same king refer to a mahasala-pilima, "great stone image" in highly eulogistic terms. These references show that thee was an ancient stone image of the Buddha which commanded unusual great respect, and which was honoured as a relic of immense value. Wickramasinghe thought that the stone image of the Buddha mentioned in the inscriptions of Mahinda IV was probably the one which king Devanampiya-Tissa set up at the Thuparama, and drew attention to the posibility that this image might have been the same which the Chinese pilgrim Fa Hien saw at the Abhayagiri Vihara in the fifth century A.C."

King Devanampiya tissa ruled the Island during the period 250 - 210 B.C. Being the first Sinhalese Buddhist king, he suported the monks and nuns in every possible way. IN the Mahavamsa account of this king there is no reference to a Buddha image that he caused to be made.10 This silence of the author of the Mahavamsa has given the impression that a stone Buddh aimage found at the Thuparama was attributed to king Devanampiya Tissa as he was responsible for the construction of that monastery. But we must see whether there was a possibility that the Buddha image was at least known during the third century B.C.

The earliest record of a Buddha image in the Sri Lankan Pali literature was found in the Mahavamsa and in the Samantapasadika. Of these the Mahavamsa is a Pali translation of old Sihalatthakatha Mahavamsa by a monk called Mahanama somewhere in the end of the fifth or 6th century A.C. It includes the history of the Ialsnd up to the end of the 3rd century A.C. It is evident that from the time of introduction of Buddhism to Sri Lanka, Sinhalese Buddhists had a habit of recording important events and this is still maintained. So the authenticity of the records in the Mahavamsa fro the third century B.C. has been very much proved by archaeological evidence. Therefore we are compelled to accept that the account which refers to a Buddha made by a Naga King of Emporere Asoka in the Mahavamsa[11] was brought by his son Mahinda to Sri Lanka and Sinhalese monks included it in the old Sihalattha katha

Mahavamsa. The same story is found in the Samantapasadika of Buddhaghosa (5th century A.C.).[12] This is also a translation of an old Sinhalese works called Maha Atthakatha of third century B.C. and Mahapaccari Atthakatha which was probably composed during the first century B.C.

The Mahavamsa says that emporere Asoka heard about a Naga King called Mahakala who had seen the likeness of previous four Buddhas and he ordered to bring him to the palace. Having brought him to the palace the emporer placed him on the Pallanka, a seat, under a white umbrella, and offered him various flowers and asked him to show the likeness of the Buddha (Gautama Buddha). Then the Naga king made a Buddha image endowed with thirty two major marks, eighty minor marks, halo, and the ketumala. The emporer was very pleased and he looked at it for one whole week.[15]

All this evidence gives the impression that during the third century B.C. there was a demand for Buddha images and the craftsmen of the Mauryan empire experimented with the Buddha image.

It is recorded that Mauriya rulers were famlous for producing sculptures for sale. No doubt there wee very efficient sculptors during the reign of Emporere Asika as evident from the Asokan Pillars - with beautiful animal figures and other decorations.

It is a fact that during the reign of Emporer Asika Buddhism because a World Religion. So it is obvious in such a situation that there was a great demand for cult objects.

Already there wre two such accepted objects namely saririka (bodily remains of the Buddha) and Paribhogika (Bo-Tree), Cetiyas. The uddesika cetiya or the Buddha image was introduced later in the pre Christian era after a period of experimentation.

The ommission of Buddha or Bodhisattva image in the early Buddhist Art of India indicates that the likeness of the Buddha was still in the experimental stage. Therefore it is reasonable to think that the sculptors of Sanchi, Bharhut, Bodgaya include neither the image of the Buddha nor the image of the Bodhisattva feeling that it is improper to have an image of Buddha or Bodisattva knowing that there was a strong feeling that it is impossible to grasp the likeness of the Buddha. The real Buddha is the Dahmma (Dhammakaya), or the Body of the Law.

It took several centuries after the Parinirvana to transfer the Body of Law into an anthropomorphic form. Three suttas of the Pali Tripitaka include the major characteristics of such as anthropomorphic form of the Buddha. These suttas are older than the third century B.C. so the period between the Parinirvana and the third century B.C. may be considered as a transitional period in which the theory of the anthropomorphic form of the Buddha was formulated. Then naturally comes the period of experimentation. Until about the first century B.C. the model form of the Buddha was not approved. that was the situation in India. As Dr.Rahula argues that situation in Sri Lanka during the third century B.C. may have not been the same as in India.

Several references to Buddha images have been found in the Pali commentories. (1) The Apadana Atthakatha says that the Buddha nature cannot be transfered either to a painting or a sculpture.16 (2) The same belief is reflected in the account of the Buddha iamge of the Manoratha Purani. There it is said that people make images of gold, silver etc. but ther are none who can make an image equal to the likeness ()attabhava) of the Buddha.[17] (3) On the occasion of alms-giving to the sangha "Wise men" used to place an image or a casket with relics and offer food and drink first to the image or the casket.[18] (4) When it was lawful to cut a branch of a Bo-tree, it should be cut only if it interferes with a stupa or an image with relics.[19]

Above mentioned Atthakathas (Pali commentories) are the translations of old Sinhalese commentories which were prepared during the period between the third century B.C. and the first century A.C. These commentoreis were translated into Pali in the fifth century A.C. But the trnaslators did not include any new historical material to their translations. So the Buddha images referred to in the commentoreis belong to the period from the third century B.C. to the first century A.C.

Apart from the above mentioned historical records of Buddha images in Sri Lanka the Mahavamsa gives an interesting account of a Buddha image placed in the relic chamber of the Mahathupa by King Duttha gamani (161-137 B.C.) The relavent portion of the account is as follows:

"In the midst of the relic chamber the King places a bodhi-tree made of jewels, splendid in every way... Around the bodhi-tree ran a vedika made of all manner of jewels; ... on a throne the cost where of was one koti, errected to the east of the bodhi-tree, he placed a shining golden Buddha image seated. The body and members of this image were duly made of jewels of different colours beautifully shining. Maha Brahma stood here holding a silver parasol and sakka curring out the consicration with the vakayuttara shel, Pancasikha with his lute in his hand, and Kalanaga with the dancing firsl and the thousand handed Mara with his elephants and train followers"[20]

The historicity of above account of the Mahvamsa, the Great chronicle, is doubtless because during the second century B.C. there was a practice of recording the historical events and such records were carefully included in a chronicle which was then called Sihalatthakatha Mahavamsa, the Sinhalese commentory of Mahavamsa. This work was translated into Pali by Mahanama in about sixth century A.C. King Dutthagamani was the national hero of Anuradhapura period and the buiilder of large monuments like the nine storyed brazen palace, the Mahathupa and the Mirisavati Stupa. His national and religious activities had given the highest consideration in the first part of the great chronicle. Therefore we are compelled to accept the fact that Sri Lanka produced Buddha images in the second century B.C.

All the existing Buddha images in Sri Lanka belong to two schools on the basis of iconography. One of these schools produced Buddha images without a boney and bleshy protuberence, the Mahayana usnisa on the top of the head. Buddha images of the other school have no such abnormal cranial bump on top of the head following the iconography of the Buddha given in the Pali Tripitaka, and its commentories of the Mahavihara tradition. The latter may be called the Mahavihara school of Buddha image.

The dolamite standing Buddha image at Mahailuppallama, Anuradhapura District has no protuberence on it's head. The Samadhi Buddh a(pl.1) between the twin pond and the Abhayagiri stupa at the Abhayagiri Vihara, and the colosal standing Buddha at Rasvehere, Anuradhapura District also belong to the same type. Another bronze Buddha statue was unearthed by the archaeological team of the Abhayagiri Vihara project of the UNESCO-Sri Lanka cultural Triangle in 1987. Similar two other bronzes have been found earlier and now they are in the archaeological museum, Anuradhapura and in the Colombo National Museum. There is a painted Buddha figure of the same tupe in one of the two caves on the summit of the Dimbulagala, Tamankaduva District. These Buddha images belong to the Mahvihara school which was at the beginning shared even by the monks of the Dhammarci sect.

Bronze Buddha statues found at Veheragala, Anuradhapura District now in the colombo National Museum have no protuberence on top of their heads but they are crowned with a flame-like symbol (pl.2) This symbol has been identified as the ketumala of the Pali commentories and the ramsiculamani of the culavamsa. Now it is called siraspata.[21] The ketumala is one of the eighty minor marks of the Buddha of the Sinhalese Buddhism.[22] The Culavamsa says that some Sinhalese kings set up ramsiculamani to old Buddha images of Mahavihara, Abhayagiri and Jetavana Viharas from the second half of the fifth century A.C. [23] It indicates that the monks of the Mahavihara, Abhayagiri and Jetavana Viharas from the second half of the fifth century A.C.23 It indicates that the monks of the Mahavihara, Dhammarucikas of the Abhayagiri Vihara and the Sagaliyas of the Jetavana Vihara accepted this featuer of the Buddha image. It further indicates that the oldest Buddha images were produced without this symbol.

Buddha images with the protuberence on the top of the head belong to the Mahauana tradition - or the Buddhist sects influenced by Mahayanism. Oldest Buddha images of this tupe found in Sri Lanka have been identified by Senerat Paranavitana as belonging to Andhara school of art.24

The Abhayagiri stupa was built by the King Gajabahu 1 (114-136 A.C.)25 and Kanittha Tissa (167-186 A.C.) built it's Vahalkadas (frontise pieces)26 and made grants to the stupa carvings of these Vahalkadas are quite similar to the bas-reliefs of Amaravati in Andhara. so we are compelled to think that the stone carvings of the Vahalkasas of the Abhayagiri stupa are the creations by the hands of Amaravati sculptors. Carved sculptures of the Vahalkadas of the Jetavana stupa also belong to the same school of art. This stupa was built by the King Mahasena (274-31 A.C.)27 King Mahasena is the first Sinhalese ruler who was converted into Mahayana Buddhism. So the stone sculptures of Abhayagiri and Jetavana Vahalkadas belong to the Andhara school of Art. Sro during the second century A.C. Mahayana Buddha image of Andhra school must have been introduced to Sri Lanka. Three standing Buddha images with the Abhaya Mudra and the protuberance on top of their heads are very much similar to the Mahayana Buddha images of Andhra school. Most probably these three Buddha images may have been produced by Andhara sculptors.

Later Buddha images with the Mahayana usnisa belong to the ..a-Anuradhapura school. This Mahayana oriented school of painting and ..ipture florushed in Sri Lanka between second century to the end of the tenth century A.C. This was the school of art of Dhamaruci sect of Abhayagiri Vihara.

among the finest Buddha images produced by this school are the pankuliya Buddha, Toluvila stone Buddha colossal recumbent buddha in teh Maharaja Vihara cave at Dambulla, colossal Buddha at Avukana, bronze Buddha found in Badulla (pl.3) now in the Colombo National Museum, and the painted Buddha figures at Hindalgala, Kandy District. all these belong to the period between seventh and eight centuries A.C. Among these except th epainted Buddha figures at Hindagala and the Avukana Buddha all others were crowned with siraspatas as indicated by the cavities in the usnisa of each. The original siraspata of the Avukana image was fallen down and there are photographs with a fragment of it at the foot on the lotus pedestal and the modern siraspata of this image was set up in 1870.

In conclusion it is worthy of note that there are two distinctive schools of Buddha image in Sri Lanka; of these the oldest one is the Mahavihara school which seems to be a local one and it's history goes far back to the second century B.C. The other one is the Andhra-Anuradhapura school history of which goes back to the second century A.C. Both the schools developed their techniques and the skills independently and produced excellent pieces of Buddha image. The Mahavihara school strictly adhere to the othodox Buddhism and the Andhara-Anuradhapura school is a Mahayana oriented one. The former is still in existance and the latter ceased to exist by the end of th tenth century A.C.

Notes

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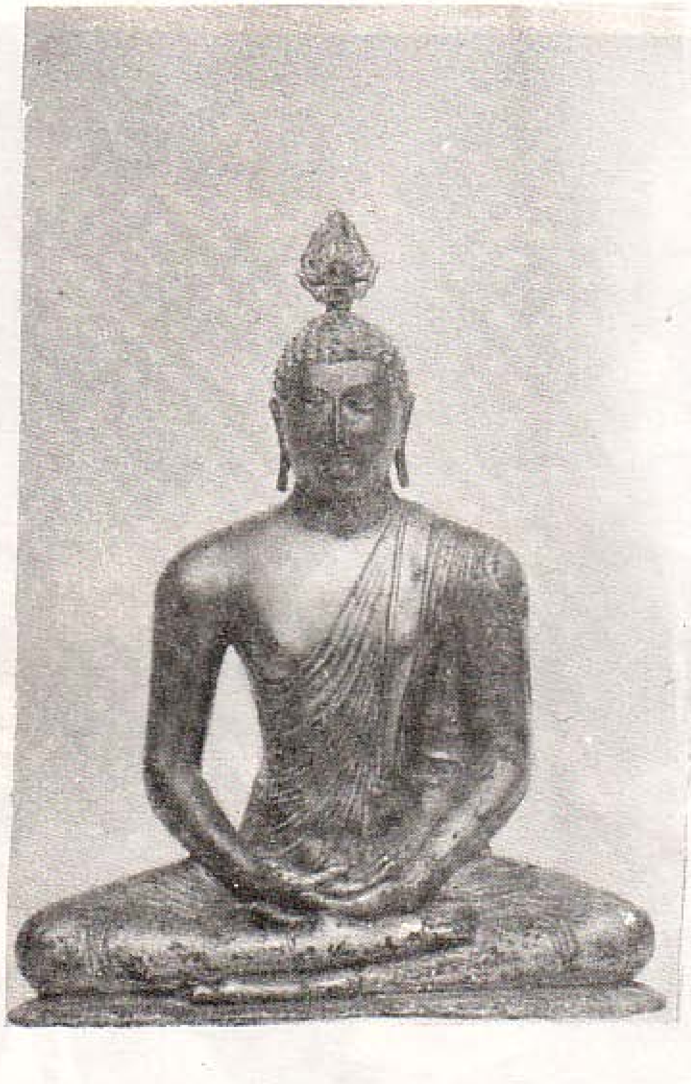
Pl.1



Pl. 2

Pl. 3

An Experiment In The Mathematical Reconstruction of Pottery a case study: Citadel Excavations of Anuradhapura 1969

* Abeyratne M. Abeyratne C. P. C.
* Research Laboratory
UNESCO-Sri Lanka Cultural Triangle Project

1 Introduction

A rapid survey done in 1965 codnvinced Prof. K. De B. Codrington of Institute of Archaeology in London that an excavation in the citadel area of Anuradhapura would yeild the requisite data on the Cultural evolution of the early historic period.[1] The citadel was located by Bell and Parker.[1] The published data, by Deraniyagala who was the first to attempt the formulation of a pottery sequence for Ceylon, indicated that the Gedige area possessed a stratified deposit of considerable depth with pre Christian pottery in its lower levels.

Mathematical Reconstruction of pottery has been reported by Orton C.R (1973)[2] . In this paper we like to outline a way in which the Mathematical recdonstruction of pottery can be applied to the pottery found at the citadel excavations of 1969.

2 Theory and Mathematical Model

1) Establishing the relationship between different rim andd base categories belonged to the same class of vessel. Then each category of vessel can then be defined in terms of a rim and a base category.
2) Establishing the relationship between rim diameter and base diameter in each category of the vessel.
3) Estimating the height of vessels of a chosen category and rim diameter, and reconstructing the profile.

A1 --- Straight or curved rims, with no shoulder neck or lip

A2 --- Horizontal rime with groove for a lid no shoulder neck or lip

A3 --- Everted rims with shoulder, neck or lip

B1 --- Bases with convex profile

B2 --- Bases with concavity in the profile

X = rims X = bases

X = number of vessells represented by rim (X) = number of vesselş represented by base(Y)

J (Different lots) i(different rim categories) h(different base categories

Which category of rim belong to the base

This is done by counti9ng the number of rims and bases of each category in each lot. Because the certain category of base is common in lots where a certain category of rim is common and rare when this category of rim is rare. Then we can say this rim would have combine with the base describe above. We can now build up a mathematical model for this idea.

We start by consideridng number of vessels represented in each lot. If in a lot J a certain proportion P_{11} of the vessel with rim category 1 base category 1 We could write

$$Y_{j1} = X_{j1} \ P_{11}$$

In addition, a proportion P_{21} of the vessels with rim category 2 haad base category 1. We could write instead

$$Y_{j1} = X_{j1} \ P_{j1} + X_{j1} \ P_{21}$$

The proportions P_{11} etc., can be 0 or 1

No vessels of rim category 1 base category 1

All vessels of rim category 1 and base category 1

As there are 2 base categories and 3 rim categories we can express all the relationships in two equatiodns.

$$Y_{j1} = X_{j1} \ P_{11} + X_{j2} \ P_{21} + X_{j3} \ P_{31}$$

$$Y_{J2} = X_{j1} \ P_{12} + X_{j2} \ P_{22} + X_{j3} \ P_{32}$$

P_{i1} + P_{i2} = 1

rim category i   rim category i

base category 1   base category 2

Using Matrix notation:

$$Y = Y\ P$$

Matrix standing for Y_{j1} Matrix standing X_{j1} matrix standing for propotions

* In practice it is not simple. The number of the rim sherds plreesent in a lot will vary from vessel to vessel depending

1) Number of sherds into which each vessel has been broken

2) The propotion of those remain in the lot

* S ome may be lost

* Some may be counted

Equation relates to whole Vessel deposited   To a equation of sherds excavated

We introduce terms f "brokenness" of the different rim and base categories. Therefore we can now relate number of sherds found to the number of vessels represented by means of equations

$$X_{ji} = X_{ji}\ f_i + d_{ji}$$

Random errors

$$Y_{jh} = Y_{jh}\ g_h + e_{jh}$$

Assuming Variables to be uncorrelated d will be equal to $X_{ji} f_1$ and variance e_{jh} will be equal to $Y_{jh}\ g_h$

Therefore can be written in a martrix natation

$$X = Xf + d$$

Initial matrix of X and Y starts here

$$Y = Yg + e$$

$Y = X\ P$ By algebrair manipulation

[Y = BX+C] (B) Calculation show if we estimate $f^{-1} P_g = a$

Then matrix P isestimated by fag-1 (Anova tables checking results significant)

$$(P_{ih} = f_i a_{ih} / g_h)$$

Stage (2)

The relatinship between rim diameter and base diameter in a vessel category by plotting cumalative frequency curves. We can get which rim fits which base.

Stage (3)

Heights of vessels aqnd reconstruction profile

Taking as axes the vertical axis of the pot (X) and a horizontal axis in its base the (Y).

We can fit curves to the shapes of the sherds

$Y_1 = d_1(X)$ (base)

(same gradient at the point they meet)

$Y_2 = d_2 (X - h)$ (rim)

If two curves meet $d_1X=d_2(X - h)$

(Quadratic equations because easy to use and fit the shape)

$Y = a_1 X2 + b_1 X + c$ (base)

$Y = a_2 (X - h)^2 + b_2 (X - h) + C_2$ (rim)

Subscript 1 base

Subscript 2 rim

$$a_1 X^2 + b_1 X + C_1 = a_2 (X - h)2 + b_2 (X - h)+C$$

$$(a_1 - a_2)^2 X + (b_1 - b_2 + 2a_2h)x + C_1 - C_2 + b_2h - a_2 h^2$$

If $h_1 = h_2$ equal roots

neglect $h_1 = -ve$ $h_2 = +ve$

h is height of the vessel

3. DATA TAKEN FROM CITADEL EXCAVATION 1969 REPORT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1 A				4	2		1	2	9	29	36	48	34	55	30	43	42	72	61	118	132	196	173	237	169	189	135	179	102	82
2 A										2	8	7	3	5	5	3	4	6	4	1	3	2	6	5	5		4	2	3	3
3 A							1		1	2	4	8	1	3	2	1	1		1			1					9	9	8	3
1 B			1	5	6	4		1	2	1	3	2	2		1										1					
2 B					7																									

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1 A	52	58	36	30	1	37		21		11		15		6		2		2		4				2						2
2 A	2	1	4	6		4		4		3				3				1		1		1		1		2		1		
3 A	7	5	3	4		5		7				4		1				1								1				

03-Jul-90

EXCAVATION DATA

	A1	A2	A4	B1	B2
0					
1					
2					
3				1.41	
4	0.16			8.45	
5	0.24			16.90	25.00
6				22.54	
7	0.28		1.08	22.54	
8	0.37			23.94	
9	0.73		2.15	26.76	
10	1.91	1.59	4.30	28.17	
11	3.38	7.94	8.60	32.39	
12	5.33	13.49	17.20	35.21	50.00
13	6.71	15.87	18.28	38.03	
14	8.95	19.84	21.51	42.25	75.00
15	10.17	23.81	23.66	46.48	
16	11.92	26.19	24.73	50.70	
17	13.62	29.37	25.81	57.75	
18	16.55	34.13		59.15	
19	19.03	37.30	26.88	66.20	
20	23.83	46.03		67.61	100.00
21	29.20	48.41		67.61	
22	37.17	50.00	27.96	71.83	
23	44.20	54.76		73.24	
24	53.84	58.73		77.46	
25	60.72	62.70		81.69	
26	68.40			87.32	
27	73.89	65.87	37.63	90.14	
28	81.17	67.46	47.31	94.37	
29	85.32	69.84	55.91		
30	88.65	72.22	59.14		
31	90.77	73.81	66.67	95.77	
32	93.13	71.60	72.04	97.18	
33	94.59	77.78	75.27		
34	95.81	82.54	79.57		
35	95.85				
36	97.36	85.71	84.95		
37					
38	98.21	88.89	92.47	98.59	
39					
40	98.66	91.27			
41					
42			96.77		
43					
44	99.51	93.65	97.85		
45					
46	99.59				
47					
48	99.67	94.44	98.92		
49					

50	99.84	95.21		
51				
52		96.03		
53				
54	99.92	97.62		100.00
55				
56		99.21	100.00	
57				
58		100.00		
59				
60	100.00			

4. Calculations and results

rim category

$$\underline{X} = \text{lots} \begin{pmatrix} 431 & 56 & 95 \\ 609 & 38 & 55 \\ 1278 & 18 & 285 \\ 71 & 3 & 4 \\ 69 & 10 & 8 \end{pmatrix}_{5x3}$$

base category

$$Y = \text{lots} \begin{pmatrix} 5 & 0 \\ 6 & 1 \\ 35 & 4 \\ 1 & 1 \\ 1 & 1 \end{pmatrix}_{5x2}$$

$$X'X = \begin{pmatrix} 431 & 609 & 1278 & 71 & 69 \\ 56 & 38 & 18 & 3 & 10 \\ 95 & 55 & 285 & 4 & 8 \end{pmatrix}_{3x5} \begin{pmatrix} 431 & 56 & 95 \\ 609 & 38 & 55 \\ 1278 & 18 & 285 \\ 71 & 3 & 4 \\ 69 & 10 & 8 \end{pmatrix}_{5x3}$$

$$X'X = \begin{pmatrix} 2199728 & 71185 & 439506 \\ 71185 & 5013 & 12632 \\ 439506 & 12632 & 93355 \end{pmatrix}$$

$$|X'X| = 2199728\,(5013 \times 93355 - 12632 \times 12632) - 71185(71185 \times 93355 - 439506 \times 12632) + 438506(71185 \times 12632 - 439506 \times 5013)$$

$$= 2199728(308421191) - 71185(1093635883) + 439506(-1304034658)$$

$$= \underline{2.74612029\ E\ 13}$$

$$\text{Adj}(X'X) = \begin{pmatrix} 308421191 & -1093635883 & -1304034658 \\ -6020115883 & 1.21900834\ E\ 10 & 3499270514 \\ -1304034658 & 3499270514 & 5959932239 \end{pmatrix}$$

$$(X'X)^{-1} = \frac{\text{Adj}\,(X'X)}{|X'X|}$$

$$= \frac{1}{2.74612029\ E\ 13} \begin{pmatrix} 308421191 & -1093635883 & -1304034658 \\ -6020115883 & 1.21900834\ E\ 10 & 3499270514 \\ -1304034658 & 3499270514 & 5959932239 \end{pmatrix}$$

$$= \begin{pmatrix} 1.123[illegible]\ E\ -05 & -3.982476248\ E\ -05 & -4.748643615\ E\ -05 \\ -3.98[illegible]3\ E\ -05 & 4.439020186\ E\ -04 & 1.274259735\ E\ -04 \\ -4.74[illegible]\ E\ -05 & 1.274259735\ E\ -04 & 2.170309968\ E\ -04 \end{pmatrix}$$

$$X'Y = \begin{pmatrix} 431 & 609 & 1278 & 71 & 69 \\ 56 & 38 & 18 & 3 & 10 \\ 95 & 55 & 285 & 4 & 8 \end{pmatrix}_{3x5} \begin{pmatrix} 5 & 0 \\ 6 & 1 \\ 35 & 4 \\ 1 & 1 \\ 1 & 1 \end{pmatrix}_{5x2}$$

$$= \begin{pmatrix} 50679 & 5861 \\ 1151 & 123 \\ 10792 & 1207 \end{pmatrix}_{3x2}$$

$$(X'X')^{-1} X'Y = \begin{pmatrix} 1.1231161 \text{ E} -05 & -3.982476248 \text{ E} -05 & -4.748643615 \text{ E} -05 \\ -3.982476248 \text{ E}-05 & 4.439020186 \text{ E} -04 & 1.274259735 \text{ E} -04 \\ -4.748643615 \text{ E}-05 & 1.274259735 \text{ E} -04 & 2.170309968 \text{ E} -04 \end{pmatrix}_{3x3}$$

$$x \begin{pmatrix} 50679 & 5861 \\ 1151 & 123 \\ 10792 & 1207 \end{pmatrix}_{3x2}$$

$$\hat{B} = (X'X)^{-1} X'Y = \begin{pmatrix} 0.01087208779 & 0.003611260397 \\ -0.132166809 & -0.02500983459 \\ 0.0823007145 & -6.8819446 \text{ E} -04 \end{pmatrix}$$

$$= \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{pmatrix}_{3\times 2}$$

$$\hat{B}' = \begin{pmatrix} 0.01087202779 & -0.132166809 & 0.0823007145 \\ 0.003611260397 & -0.02500983459 & -6.8819446 \text{ E} -04 \end{pmatrix}_{2x3}$$

$$\hat{B}'X'Y = \begin{pmatrix} 1287.051851 & 146.8017514 \\ 146.8017515 & 17.25873683 \end{pmatrix}_{2x2}$$

$$Y'Y = \begin{pmatrix} 5 & 6 & 35 & 1 & 1 \\ 0 & 1 & 4 & 1 & 1 \end{pmatrix}_{2x5} \begin{pmatrix} 5 & 0 \\ 6 & 1 \\ 35 & 4 \\ 1 & 1 \\ 1 & 1 \end{pmatrix}_{5x2}$$

$$= \begin{pmatrix} 1288 & 148 \\ 148 & 19 \end{pmatrix}_{2x2}$$

$$Y'Y - \hat{B}'X'Y = \begin{pmatrix} 0.948149 & 1.1982486 \\ 1.1982486 & 1.74126317 \end{pmatrix}_{2x2}$$

Residual sum of squars

$$Y_{ji} = X_{ji} P_{11} + X_{j3} P_{31}$$

This implies that in lot j, base category 1 combines with the rim category 1 & 3. As there is only 7 base sherd in all lots, it is not feasible to predict the combinations of base 2.

$f_1 = 2458$

$g_1 = 48$

$P_{11} = \frac{2458}{48}\ 0.01087208779$

$= \underline{\underline{0.5567414955}}$

i.e. the 0.55 of propotion the vessels with rim category 1 had base of category 1.

$f_2 = 125$

$g_2 = 7$

$P_{12} = \frac{f_1}{g_2} a_{12}$

$= \frac{2458}{7}\ 0.003611260397$

$= \underline{\underline{1.26}}$

$f_3 = 447$

$g_1 = 48$

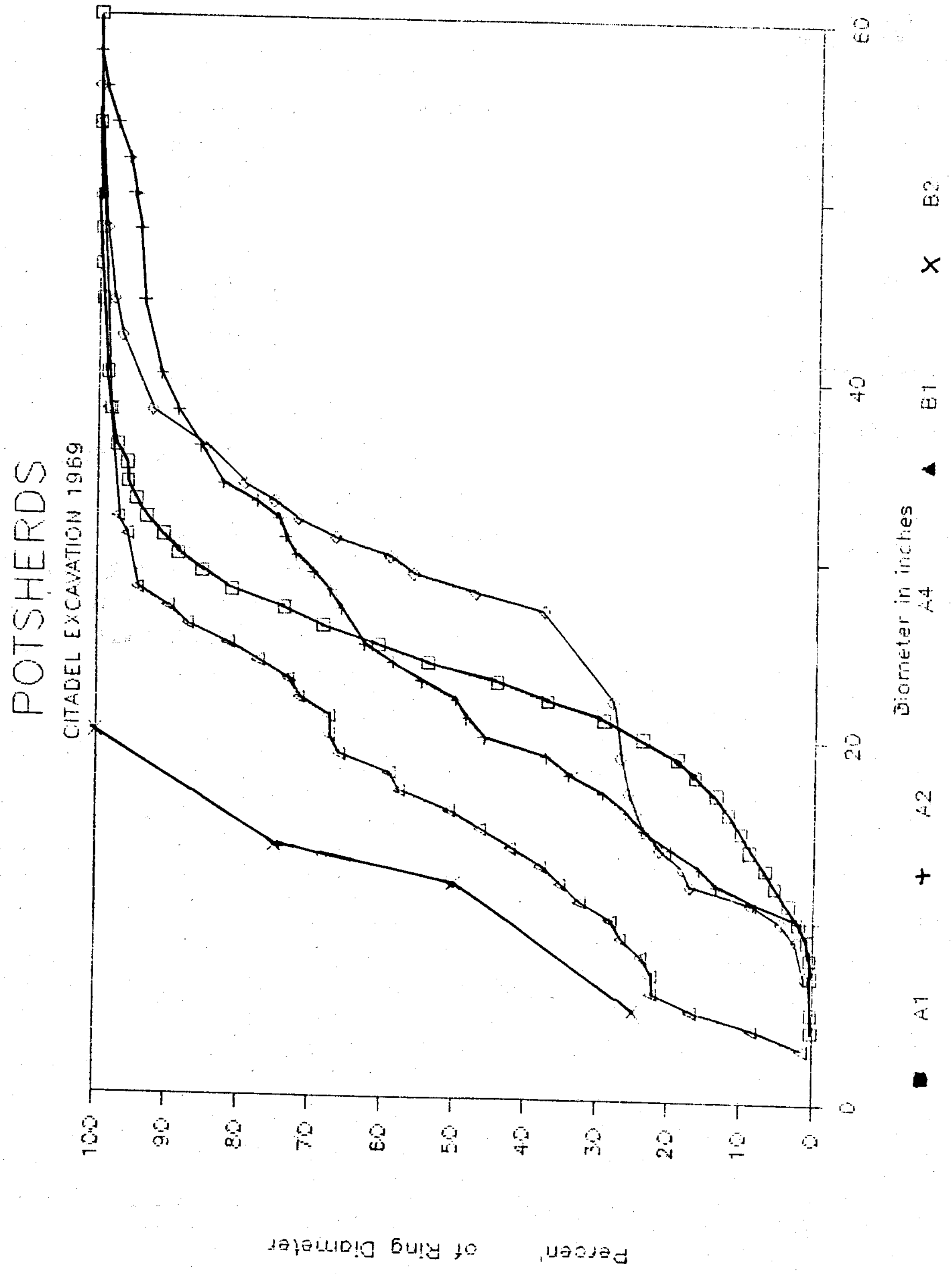
$P_{31} = \frac{f_3}{g_1} a_{31}$

$= \frac{447}{48} 0.0823007145$

$= \underline{\underline{0.7664}}$

i.e. the 0.76 propotio of the vessels with rim category 3 had

(10)



POTSHERDS
CITADEL EXCAVATION 1969
Percent of Ring Diameter
Diameter in inches
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
A1
A2
A4
B1
B2

5 Conclusion

This is a very preliminary approach in solving rconstruction of pottery from the citadel excavations. Specially in stage three in establishing the height of vessels. This has to be worked out in more details in future.

6 Acknowledgements

Thanks are due to Dr. S. Daraniyagala for allowing me to use data from his excavation at citadel Anuradhapura and also to Miss B. Welihinda for preperation of data for calculations.

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AUSPICIOUS SYMBOLS IN DVARAVATI CULTURE OF THAILAND

By

Nandana Chutiwongs

The use of auspicious symbols has been a well-known phenomenon in India since the very early times. Literature and archaeological remains provide much data on the variety of usages,[1] which could be summed up as follows:

(1) in association with the phusical appearance of the Great Man (Mahapurusa) - the denomination which is applicable to the gods, the Buddhas, Tirthankaras and other divine and saintly persons;
(2) as motifs on the ornaments worn by divinities and other exalted personages;

(3) as motifs to attach sanctity and auspiciousness to objects and edifices, and to induce good fortune for those associated with them.

Auspicious symbols of Indian origin appear in all cultures which have received the impact of Brahmanism and Buddhism. They usually became traditional motifs in art, regularly depicted to induce good fortune and properity. They often appear in sets which accumulatively represent the many conceivable aspects of auspiciousness, connected generally with good fortune, fertility and regality. The most usual set, consisting of a symbols, is known as the astamangala, while the later Buddhist tradition often expands the sum total of the most auspicious signs to 108. Different tokens, however, are recorded in different traditions.

In Dvaravati culture - the first homogeneous culture of Thailand we notice a special favour for the wheel emblem, an ancient Indian symbol for the sun, the cosmic cycle and the universe, used extensively by the early Buddhists to represent the Buddha and his Dharma. Dvaravati culture is particularly rich in exquisitely carved, free-standing depictions of stone wheels (PL.1)[2] which probably were important objects pf worship equal in importance to the Buddha images made in the same cultural sphere.

The Wheel symbol also marks the pair of the Buddha's footprints found in Dvaravati cultue.[3] No other auspicious signs accompany it, which feature recalls the earliest depictions of the Buddha's foot-marks in Indian art.

The wheel appears again in the remarkable 7th - 8th century engraving (PL.2) on a stone slab from Nakorn Pathom, once a major centre of Dvaravati culture. Here it forms part of a set of 4 symbols, together with a purnaghata and a conch - both associated with water and fertility, and a srivatsa - the mark that stands for Sri-Laksmi, the Goddess of Fortune. The four signs are positioned around a seated male figure, clad in a simple loin-cloth and wearing simple ornaments. The rather wild look of his loose and curly tresses suggests a yaksa-like personality, and the personage probably represents Kuvera, the king of the yaksas and the god of wealth, popularly worshipped by the Buddhists and Brahmans alike. Images of Kuvera, seated in a similar pose but wearing a crown and other rich ornaments, are well-known features in the Buddhist art of Dvaravati.

Two more sets of auspicious symbols are found in two Dvaravati style stone toilet trays. The first one (PL.3),[4] which is more finely carved and probably dates from ca. 7th - 8th century A.d., is unfortunately incomplete. It was originally a stone slab of 13 cm. square, carved with an open lotus in the centre which was meant to serve as the main receptacle for powder. Above this is depicted the motif of the Goddess Sri-Laksmi sprinkled by the elephants (gajalaksmi). A tree or a thick lotus stalk is seen behind the only elephant figure which remains in tact. A purnaghata with delicate but stylized lotus flowers emerging from its mouth, stands beneath the central lotus, in line with the gajalaksmi. A bird holding lotus bud in its beak, a fluttering flag, a part of an ankisa, and a fish are seen on the existing portion of the slab, among stylized lotus plants and flowers. One of the four subsidiary receptacles for the powder remains to be seen in the one extant corner of the tablet. The motif of gakalaksmi and the lush lotus plants and flowers which appear to have filled the background recall the early depictions of Sri-Laksmi at the stupas at Bharhut and Sanci, while the presence of many auspicious symbols reminds us of some Indian toilet trays from Taxila.[5] The depictions of Sri-Laksmi, nanner, ankusa, fish and purnaghata also regularly form part of some traditional sets of the astamangala found in ancient India and Sri Lanka.[6]

The second toilet tray (PL.4)[7] is rectangular in form and about 15 cm. wide. A full-blwon lotus that was meant to receive the cunna-powder again occupies the centre, while a segment of the same kind of flower is positioned in each corner of the tablet for the same purpose. The entire decorative design appears to have been divided into two halves by teh central flower. One half i practically filled with the enthroned figure of Sri-Laksmi being sprinkled by a pair of richly caparisoned elephants, each of which is holding up a water pot where from a bunch of lotus flowers emerges. The goddess herself holds a pair of long-stalked lotus buds in her hands, and two camaras stand on either side of her lotus throne. Opposite Laksmi, on the other side of the central powder-receptacle and parctically resting upon it, is positioned a purnaghata with a cross-band decoration on the body, supporting what looks like an elaborate lid or a large and stylized flower. Two identical sets of symbols are seen on either side of the purnaghata, consisting of a ceremonial fan, chattram ankusa, vajra, rosary, conch and a fish, all being symmetrically arranged. This toilet tray should be dated around the 8th - 9th century A.D.(8) and not from the 7th - 8th century as has been suggested elsewhere.(9)

Many auspicious symbols found on this toilet tray, viz. The Sri-Laksmi motif, the purnaghata, conch and fish, are common elements one encounters in the traditional sets of astamangazla in all parts of India and also in Sri Lanka.(10) The ankusa, nevertheless, regularly forms part of the astamangala sets known from south India and Sri Lanka while the camara appears to be a special feature pertaining to Sri Lanka only. The fan, chattra and vajra sporadically appear in Indian sets of astamangala[11] and also in Sri Lankan representations of larger groups of auspicious symbols.[12]

Sri Lankan Buddhists showed much favour for the use of the astamangala, and combined this with the 4 directional animals, the sacred lake Anavatapta and the cosmological symbolism in general. In Sri Lanka, the 8 symbols remain to the present day the emblems anf attributes of the 8 planets cum guardian divinities of the 8 cosmic directions who preside over the destiny of man and the entire universe. The schematic arrangement of the 8 symbols in accordance with different points of the compass also served as a standard pattern for the garbhapatra (deposit slab) of the ancient Sri Lankan shrines, that could be systematically expanded to include a larger number of auspicious symbols.(13)

The number of the auspicious symbols found on the second Dvaravati-style toilet tray (Pl.4), clearly exceeds that of the traditional 8, and the svastika and bhadrapitha - the two constant element in all common sets of the astamangala in India and Sri Lanka are conspicuously absent. Nevertheless, the arrangment of the symbols on the Dvaravati toilet tray recalls the pattern of distribution of the astamangala as prescribed by the Manasara text, in which the Sri Laksmi sign and the purnaghata are given the most prominent places while the other objects are grouped around them as auxiliary elements.[14]

This emphasis laid on the Sri Laksmi token and the purnaghata, observed on both Dvaravati-style toilet trays and described in the Brahmanical Manasara text, reminds us of the earliest depictions of the goodess such as sseen at Bharhut and Sanci in North India.[15] In such cases, the goddess-sprinkled by the elephants - is seen seated on a lotus which emerges from a pot that symbolizes the primeval water, the source of life, fertility and felicity. The water plants filling the background of the carving on tray no. 1 (plu. 3) are also reminiscent of the lush background of the Sri-Laksmi scenes at Bharhut and Sanci. But more auspicious symbols emphsizing fecundity (sankha and fish) and regality (camara, chattra, fan and banner) have now been added to the main motifs of Sri-Laksmi and the purnaghata. The custom of applying the most auspicious symbols to the toilet trays existed in India[16] and evidently persisted on in Thailand during the Dvarvati period as shown by these two existing examples. It would be wrong to classify these objects as utensils destined for feminine use. Toilet trays are among articles that could have served secular as well as religious and ritual purposes, and those bearing such an array of sacred tokens would have been most appropriate for ceremonial ablution (abhiseka). The emphsis on the themes of the goodess of fortune and the purnaghata adds up to the measure of good fortune and well-being to be induced by the usage of the object, while paraphernali pertaining to regal might evoke high rank, fame and exalted social status. The cunnapowder, essential for ritual anointment and lustral bath, would have been deposited in the lotus receptacles, surrounded and made sacred by the mainfold auspicious forces.

It is further noticeable that the set of symbols lined up on either side of the cunna receptacle in tray no. 2 (PL.4), contains one particular item which is unknown in available lists of auspicious emblems from India and Sri Lanka : a rosary. The sankha and ankusa standing next to it are among the most common 8 auspicious signs and the vajra is also sporadically found in larger sets of such. The rosary, on the contrary, appears to have no place at all among the traditional tokens of fortune and well-being. We wonder if the sets of 4 symbols flanking the central receptacle for cunna-powder in this case might stand for the emblems and hence the presence of the four most important gods known in Dvaravati culture. Considering the many indications of the coalition of religious elements in Dvaravati Buddhist culture, it is quite conceivable that, in this instance, the sankha stands for Visnu, the ankusa for Siva, the rosary for Brahma and the vajra for Indra. The four supreme divine powers would thus have been invoked to preside over and bless the ablution ceremony.

Indra and Brahma are well-known figures in Dvaravati iconography, attending on the Buddha on various occasions (17) while Siva and Visnu were also made to acknoledge the spiritual superiority of the Buddha.(18) A similar paralledlcan be found in Sri Lanka, where theravanda Buddhism also predominates.

Notes

1 For these see Coomaraswamy 1927, pp. 175 - 188; Joshi 1965, pp. 311 - 317; also Agrawala 1965.

2 See also Yupho 1965.

3 See Diskul 1986, pp.30 - 31.

4 Also published and discussed in Boeles, 1964.

5 See Marshall 1951, Vol. II, pp. 452 and 504; Vol. III, Pls. 134 (NO.56) and 146 (NO.133); also in Van Lohuizen - de Leeuw, 1972, p. 31, fig. 9.

6 See Commaraswamy 1927, pp. 179 - 185; Joshi 1965, p. 314; Longhurst, 1938, PL.XIX(a); sivaramamurti 1983, p. 28, PL.28; Agrawala 1965, Figs. 40-41; Karunaratne 1978, pp. 107-115.

7 Also published and discussed in Boeles, 1964; also in Yupho 1965, fig. 30, quaritch Wales 1969, PL.26B; Krairiksh 1979, cat.no.10.

8 See Diskul 1980.

9 Krairiksh 1979, cat. no. 10

10 See Karunaratne 1978, pp. 107-115. See also te series engraved on a gold vessel excavated at Jetavana.

11 See Fabri 1930 - 1934, PL.xxxvii, d; Coomaraswamy 1927, taf 29, nos. 23-24.

12 Karunaratne 1984, pp. 152-154, pls. 6,7,9.

13 See Karunaratne 1984.

14 See Karunaratne 1978, p. 112.

15 See Coomaraswamy 1956, Figs. 122-124; Yupho 1965, fig. 29.

16 See note 5.

17 See Yupho 1967, figs. 8-9.

18 See Yupho 1967, fig. 4.

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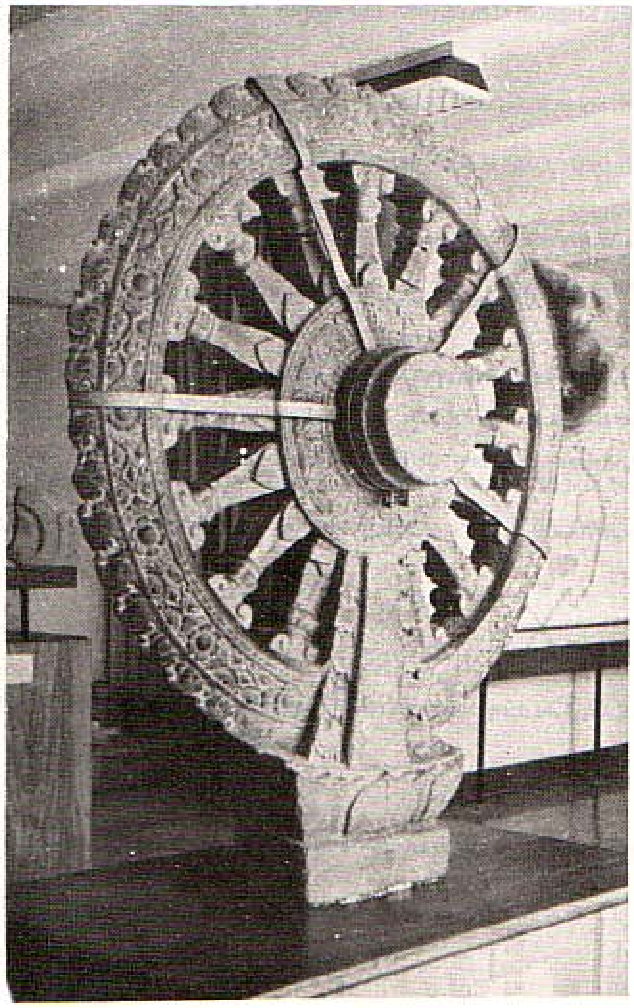

Fig.1

Fig. 2

Fig. 3

Fig. 4

THE ORIGIN OF THE CAVE-DWELLINGS OF THE SANGHA IN SRI LANKA FROM EARLY BRAHMI INSCRIPTIONS

By

Malini Dias

Introduction

The advent of Buddhism to Sri Lanka is placed in the third century B.C., with the arrival of Thera Mahinda, son of Emperor Asoka in the reign of King Devanampiya Tissa (250 B.C. - 210 B.C.). The King's conversion to Buddhism marks the establishment of the religion in the island and it is highlighted in the earliest chronicles - Dipavamsa and Mahavamsa as the most significant event of its history. After the introduction of Buddhism, a large number of early Brahmi inscriptions, incised under the drip-ledges of caves, make their presence for four centuries, from the third century B.C. and bear testimony to the origin of the cave dwellings of the Sangha in Sri Lanka.[1]

Nature of the cave-dwellings

The caves, converted into dwellings are simple abodes and come under the five types of recommended dwellings of the Buddhist sangha. Cullavagga, a Vingya text lists five kinds of lenas or dwellings fit for the sangha under the names:- Vihara, Addhayoga, Pasada, Hammiya and Guha.[2] The caves of Sri Lanka, which could be classified under the Guha-type were once donated by members of all strata of society from the royalty to the ordinary men and women.

In Sri Lanka we do not find chambers excavated into rocks as found in India but caverns made fit for human habitation.[3] The inscriptions of the early Brahmi script describe the caves as lenas in the conventiuonal form of the vinaya. Etymologically, lena means a private abode and is equivalent to layana derived from root li to hide.

Maharajha Gamani Tissa bariya Upasika Kitakaya lene sagasa.

The cave of the female lay-devotee Kitaka, wife of the great king Gamani Tissa [is given] to the sangha.[4]

The above mentioned inscription is engraved on the brow of the cave and records that the lena or the abode was given to the sangha.

These inscriptions do not state any particular purpose of donating caves to the sangha but one or two caves are described as comfortable abodes. The object in view for the donation of caves was to acquire merit for a better future birth.

The early Brahmi cave inscriptions form a class by themselves and carry the stereotyped formula - agata anagata catudisa sagasa (given to the sangha of the four quarters, present and not present.) A similar phrasealogy could be found in donative cave inscriptions of a Buddhistic nature in contemporary peninsular India.

1. Vedidataputasa wekamasa Ramanakasa
2. Chhakalepakiyasa lenam deyadhammam chatude
3. Sasa bhikhu sainghasa niyatitam[1].

The merchant Ramanaka a chhakalepakiya, the son of velidata, made over to the community of monks from the four points of horizon this cave as a meritorious gift.[5]

The epigraphs indicate that the caves on which they appear are donations made by the kings to show their patronage towards the commumnity of monks. Some of these kings are identified in the inscriptions with difficulty as they do not bear the epithts fgiven to them in the chroac.[6] Kings such as Devanampiya tissa and his brothers Uttiya have been identified in the act of donating caves. An inscription of king Uttiya may be quoted here.

De[va] napiya-maharajhaha Gamani U[ti].... ....(ha) nimane

The creation of ..... Gamani Uttiya, the great king, friend fo the Gods ....(7) (plate 1)

Officers of high rank had participated in the practive of offering caves to the sangha. Apart from this class, many thousands of lay-worshippers of both sexes-upasakas (men-lay devottees) and upasikas (women-lay devottees) were prepared to provide the sangha with dwellings and other requisites.

The origin of the cave-dwellings in Sri Lanka The donation of simple abodes such as caves by the kings, nobles and the people should have had some significance to be recorded on the brow of the caves. The chronicles lay emphasis only on the collasal buildings constructed by kings i.e. Devanampiya Tissa, Uttiya and so forth. They fail to mention that a large number of caves were prepared by the kings, nobles and the people for the benefit of the community of monks. On one occasion the chronicles record that sixty-eight caves were prepared by king Devanampiya Tissa for Thera Mahinda and his companions as abodes for the rainy-season. In view of this, it may be conjectured that the caves were prepared Mihintale after the residential buildings were commissioned in the city. therefore, it would be appropriate to consider two factors at this stage - one, that the caves were given as some sort of an abode to the monks as witnessed by the inscriptions - two, at teh same time buildings of royal standards have been constructed for the benefit of the Sangha.

While discussing the nature of the cave inscriptions several scholars have offered explanations on the cave-dwellings of the sangha as well. Senarat Paranavitana in his Inscriptions of Ceylon observes that,

"These caves and the inscriptions indited in them prove that there were numerous members of the Sangha who were so ernest about their spiritual culture as to take up their abodes in caves in secluded spots and spend their time in meditation(8)".

Walpola Rahula in History of Buddhism in Ceylon denotes,

"A cave thus appointed was a residence pleasent to live in for a person of unsophisticated aeathetic sense and quiet temperament: it was be sides an ideal place for deep meditation".[9]

Lakshman S. Perera speculates

"There were however large institutions such as obtained in Anuradhapura and also simple collections of caves removed from the haunts of men in which the monks lived their lives of meditation".

All these scholars subscribe to the view that the caves were dedicated to the sangha for meditation. There is also a consenous of opinion to the fact that monastic residences apart from the cave dwellings were established at the same time. Therefore Paranavitana states;

"At the time caves were being established in secluded places, large edifices, mainly of wooden construction, were being built in monasteries at the capital city of Anuradhapura".[11]

Senake Bandaranayake in his Sinhalese Monastic Architecture observes.

"It is apparent both from the architectural remains as well as from literary records that the caves wre not the only monastic dwellings and that in Anuradhapura and elsewhere a free-standing architecture developed alongside the cave monasteries from an early date.

He agrees that the caves were simple dwellings and wonders why there were sophisticated buildings in and around Anuradhapura at the same time. He speculates thus;

The picture which emerges from all this, despite the miracles and metaphors of the chronicter's poetry, is one of somewhat mixed architectural porspectives - on the one hand, simple, rudimentary dwellings such as the caves at Mihintale, and on the other, buildings of royal standards, normally at a suitable distance from the urban centre".

We may non examine the statement of the Mahavamsa which explains how king Devanampiya tissa commenced the work of building of edifices as residences for the monks on the Maha Megha Vana, the royal park.

Rammam Maha Meghavanna Tissaramana Maha mata Maha Mahinda Thero so patiggayha maliddhiko.[13]

And as the great and most wise Thera, Mahinda of wondrous power, accepted the pleasent Mahamegha-grove, the Tisarama..[14]

A question, as a result, follows: why kings such as Devanampiya Tissa and Uttiya engaged themselves in the donation of caves? The reply may be found in the chronicles as well as in the donative records. Both the chronicles explain how king Devanampiya Tissa initiated the work to prepare caves as abodes for the thera and his companions to spend the vassa or the rainy-retreat at Mihintale. The chronicles specifically state that sixty-eight caves were prepared by the king at the request of Thera Mahinda. The relevant passage from the Mahavamsa is as follows:

Tumhakam gamanasanki agatomhitibhasite Iddheva vassam vasitum agatamhati bhasiya

Vassipanayikani thero khandhakam khandhaki vido kathes, ranno ....

Nitthite lenakammamhi Asathipannamaasiyam gantva adasi theranam raja viharadakkhinam.[15]

The theras answered "we are come to spend the rain-season even here", and hw who was versed in the rules (of the order) expounded to the king, the chapter commencing the vassa ..... when the king on that same day, had made a beginning with the work of building sixty-eight rock-cells about (the place where) the Kanbaka-cetiya (afterwords stood) he returned to the city, ... when the work on the rock-cells was finished, on the full moon day of the month of asalha, the king came and gave the vihara to the theras as a consecrated offering.(16)

The inception of cave-dwellings as Vassa - retreats of the Buddhist monks in Sri Lanka was commenced as a practice that was laid down in the vinaya. the caves were temporary abodes put up for the rainy-season while there were many permanent residences in the city and elsewhere for the monks to reside during the rest of the year. They were not supposed to stay in one place for long periods for their task was to go from one place to the other preaching the doctrines of the Buddha.

Residing in caves during the rainy season and the ceremonies that were performed in them refer to a practive which had come down from the Buddha's time(17). During the formative years of Buddhism the practive was to spend the rainy season in secluded places where the monks could get their food near a village or a town. In India when the heavy monsoon rains set in, people had to stay in doors. The wandering reclusesx spent their time in huts and caves and collected alms from nearly villages and towns. Mahavagga, a vinaya text described how the Buddha made provision for the monks to reside in one place during the rainy season on bearing the people talking maticiously about them going in the rain without any need to the customs. According to both Buddhist and Jain sources, the main reason for the vassa and pajjusan respectively was the fear that when walking in the wet weather the people may trend on and kill the insects and worms that come out during this season.[18] The Brahmanial sannyasins called it the dhruva sila or the fixed abode a fixed residence in the rainy season seems to have been acustomary observance among wanderers of all religious sects in India even before the Buddha's time.

Donation of caves to spend the rainy season for the recluses of various faiths could be traced back to the time of Asoka and his grand son Dasalatha through inscriptions. In the Barabar Hill cave inscriptions of Asoka, the Akivakas were given a cave in the rainy season.

1. Laja Piyadasi ekunavi -
2. Sati vasabhisis[te] ja[lagh]o
3. Sagama thata[me] i[yam kubha]
4. su[p]i[y]e kha ....[di]
5. na

When king Priyadarsi had been anointed nineteen years, this cave in the very pleasent kha[latika mountain] was given by me for (shelter during) the rainy season.(19)

Dasalatha's Nagarjuna hill cave inscription states that the caves were given for the same reason.(2)

The caves allocated to the monks are easy to be prepared at short notice. It was seen in the Mahavamsa statement where king Devanampiya Tissa prepared sixty-eight caves as vassa residences for the monks at Mihintale in one day. According to the chronicle the caves at Mihintale were prepared as vassavasas before the monastic buildings were put up there.[21]

The occurence of the vassavasa in the donative records found on caves suggests that the caves were prepared by people for the minks to reside in the rainy season. A few records found among the early Brahmi cave inscriptions can be treated as prima facie evidence to the indentification of caves as rainy - retreats. the texts of two inscriptions found at a place called Yataha Lena vihara can be quoted as examples. Dusatara-gamsi patake Patalagamasi pa[ta]ke Gamani-Sivasa dane ima le[nasi] na[sa vasita] sama[na]ye A lot in Dusatara-gama.A lot in Patalagama the gift of Gamani siva for the benefit of a monk who resides during the rainy season in this cave.[22] (plate 1)

In another inscription the donor makes a contribution towards the robes for the monks during the rainy-retreat.

1. Uti-teraha lene sava - natikana-ataya niyale
2. Sagah-athaya vasa-vasika sahathake atireka bhiku saga pariblujitu
3. Dakabari-gamaka-vaviya invasaka-Dataha pati ima-lenahi uvanikite.

The cave of the elder Uttiya has been dedicated to the Sangha for the benefit of all relatives. For the purpose of providing of under-garments during the vassa retreat to the members of the sangha, and so that the community of bhikkhus may enjoy what is left [after providing these, the shases of the lay devotee Datta in the tank of Dakabari-gamaka have been given as an endowment to the cave.[23] (plate)

In this inscription an attempt has been made to distinguish the monks who observed vassa from the other medicaments. The monks have been offered the garments to be given for the vassa first while the other mendicants were offered the left-over garments later.(24)

Another inscription reads:
Utaraha vavi Tisateraha kumiya niyate vasavasike ......

The tank of Uttara and the water custern of the elder Tissa have been dedicated for the vassa residence ......[25]

In this inscription, the monks were provided an income from the reservoir and the water cistern for their living in the cave known as rainy-retreat. These monks who settled down in the cave for the vassa were called avasikas and the cave was called an avasa. this leads to an investigation of the two main types of monastic dwellings - arama and avasa. The word arama denotes a pleasure garden, situated not too near and not too far off a city and owned by a king or a wealthy citizen. The first of its kind accepted by the Buddha was Veluvana in Rajagaha which was given to him by King Bimbisara an Avasa was a temperary set-up, which could have been vacated by the monks at any time. In the Mahavagga we find monks setting up avasa as rainy retreats which could be dismantled at any time after evacuation. A long section of the Mahavagga is set apart to describe avasas and it deals with teh demarcation of an avasa, its construction and regulations to the monks who lived in it. The arama in or near a town or a city, situated in its enclosure was looked after by its owner and the avasa in the country-side was built and maintained by the monks themselves.[26] There is evidence in the chronicles that the monastic residences founded in the parks and groves in and around Anuradhapura city were called aramas. the first of its jind was established by Devanam piya tissa in the Maha Megha vana. The Dipavamsa mentions it as a sangharama and gives its name as Tissarama.[27] According to the Mahavamsa, the first buildings offered to thera Mahinda on his arrival were the Hall of the state Elephant and a royal lodge in the Maha Megha Vana. An arama built by the king and named after him was donated to the Thera sometime later.

In the Mahavagga we find monks setting up avasas as rainy-retreats. The description of the caves as vassavasas in the donative records also suggests that they were mainly avasas where the monks could come and go as they pleased. It was possible to vacate the caves once the rainy season came to an end. Apparently monks are mentioned in the donative records as owners of caves. the caves were prepared by the monks themselves and were given to the monks of the four quarters. the following inscription registers the donation of a cave by a monk.

1. Damaruci-terasa lene chatu-disa-sagasa dine
2. Samatapasadake nama

The cave of the elder Dhammaruci is given to the Singhe of the four quarters (the cave) named Samantaoasadika.[28] (plate)

The evidence found in these early Brahmi inscriptions is sufficient to conclude that the caves were temporary dwellings that were donated to the monks who came from the four quarters. On the basis of the information derived from them we beleive that the donation of caves were made as vassavasas and that it was not for the soul purpose of meditation as suggested by Paranavitana, Rahula Perera and Bandaranayake.

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Notes

1. such inscriptions are found, inscribed on caves at sites such as Mihintale, Ritigala, Rajagala etc.About 1500 early Brahmi inscriptions have been discovered so far

2. Cullavagga, (edited) H. Oldenberg, London, 1880, VI, 1,1.

3. The use of simple caves as dwellings was a fairly widespread practice; the evidence emerges from all parts of the island.

4. S.Paranavitana (edited) Inscriptions of Ceylon, Volume I (1970), No.4.

5. Nasik Cave Inscriptions, Archaeological Survey of Western Indian, volume IV, pp. 40-42.

6. For example king Uttiya of the chronicles is 'Uti' in the inscriptions.

7. Inscriptions of Ceyoon, volume I, No.47.

8. Ibid, Introduction, CII.

9. W.Rahula, History of Buddhism in Ceylon, Colombo, 1956, p.114.

10. L.S.Perera, 'The institution of ancient Ceylon from inscriptions (from earlierst times to 1016 A.D.), volume I, (unpublished thesis) 1949, p.279.

11. Inscriptions of Ceylon, volume I, Instroduction, p. CXXII.

12. Senake Bandaranayake, sinhalese Monastic Architecrture,Leiden, 1974, pp. 46-47.

13. P.Buddhadatta, Mahavamsa, 1959, Panca dasamo pariecedha, v, 174.

14. Mahavamsa, (trnaslated) W.Geiger, London, 1934, Chapter XV, V, 174.

15. P.Buddhadatta, Solasamo pariccedo, vv, 8,9,14.

16. Mahavamsa, (translated) W. Geiger, b. 115. known as vassupanayika.

17. The retirement for vassa season lasts for three months and can be entered earlier or later in the month of asatha. The pavarana ceremony solemnizes the conclusion of the vassa season.

18. The Buddhist monks resided in one place for three months during the rainy season. The Jairas observed a four month rainy-retreat. Their rules regarding its observance are laid down in the Kalpa Sutra. See Jaina Sutras (translated) M. Jacobe, Sacred Books of the East volumes XXII, XLV.

19. Hiltzsch, E., (edited) Corpus Inscriptions Indicarum, Volume I (new edition) Oxford, 1925, p. 182.

20. Indian Antiquary, volume XX, p.346.

21. Mahavamsa, (trnaslated) W.Geiger, Chapter 16.

22. Inscriptions of Ceylon, Volume I, No.793.

23. Ibid. No. 796a.

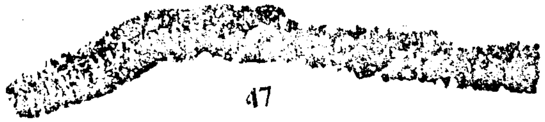
24. It should be noted that two categories of monks have been mentioned in this inscription; sangha and bhikkhu sangha.Paranavitana observes "The word bhikku means 'beggar' and does not appear to have been considered respectful enough for the members of the Sangha in ancient Ceylon " See Inscription of Ceylon, Volume I,Introduction,p cvi

25.Inscriptions of Ceylon, volume I, No.1228. See Foot Note on this inscription. The missing words may have given more details about the vassavasa.

26. See S. Dutt, Buddhist monks and monasteries of India, London, 1962, p.84.

27. Dipavamsa, (edited and tansalated) K. Gnanawimala, colombo, 1959, Chapter 13, vv. 30-34.

28. Inscriptions of Ceylon, volume I, No.552.



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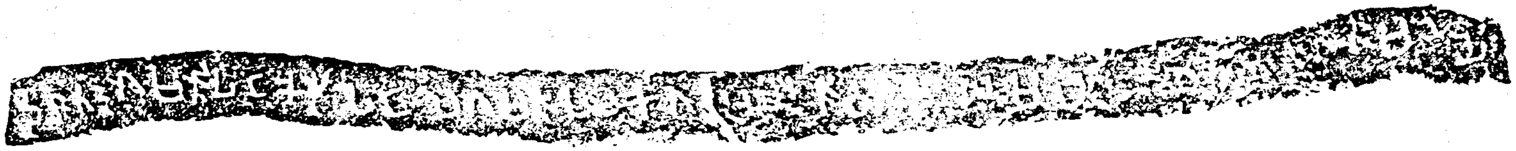
552



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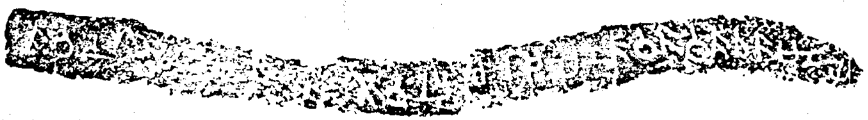

796 (a)

THE DISCOVERY OF TWO NEW BRAHMI LETTERS IN AN INSCRIPTION FROM JETAVANARAMAYA

By

Malini Dias

Of the inscribed slabs discovered from Jetavanaramaya in Anuradhapura, the one we discuss here is a recent find. It was unearthed in an excavation conducted at the premises by the Cultural Triangle. The slab is broken in to two.

The inscription found on the slab consists of two lines and the writing is in a fairly good state of preservation except in three places. The inscribed slab measures 6 ft. 3 in. in length and 7 1/2 in, in breadth. The letters vary in height between 2 to 3 inches. The text of the inscription is as follows:

1. atidi vasana venaja Sivasiha Isi(v)ara ca Dalha.... apa dejanamo.... kasivaya.... Devanapiya-Tisa maha. 2. dagapihi biku-sagahi niyate ekasiyaka kahavana dinamaha mahapala savasata di(nimaha). We, Sivasiha Isi(v)ara and Dalha, the two merchants from Atidi, having spent money (on a meritorious deed) gave one hundred kahapanas for the benefit of the bhikkhu-sangha of the Devanapiya-Tisa monastery. May the merit be shared by all beings.

When deciphering this inscription, assignable to the fifth or the first half of the sixth century, we have come across two characters viz. i and si which are not found in any of the inscriptions of Sri Lanka. The closest that we could find was the i in the Nilagama inscription [1] The letter si is quite foreign to the script of the period. But we find a similarity to the characters of the inscriptions of India; particularly in a copper-plate inscription of the Vakataka king Pravarasena II of the fifth century A.D.[2].

The letters i and si appear in our early Brahmi inscriptions, no doubt. But when compared with these two letters we find that the evolution of the letters in the inscriptions of Sri Lanka has taken place in a different way. In the Nilagama inscription the letter i is a horizontal line curved in the middle two dots appear under the two sides. The letter sa has gone out of vogue in the 5th and 6th centuries A.D. reappears in the 7th century A.D. in the inscriptions such as Kuccaveli.[3]

The monastery, mentioned in this inscription is Devanapiya-Tisa maha Dagapa or the monastery named Devanapiya Tisa. The name Devanapiya Tisa is attributed in the chronicles Dipavamsa and Mahavamsa to king Tissa who reigned when Buddhism was introduced to Sri Lanka. We may infer that this monastery could be the same monastery which king Devanampiya Tissa offered to Thera Mahinda. It may also be suggested that this monastery could have belonged to Jetavanarama where the inscribed slab was unearthed.

Built under the patronage of king Mahasena (276-303 A.D.). Jetavanarama assumed important as the head quarters of the Jetavana fraternity of the Buddhist Order in Sri Lanka, When the monastery was built it was offered to a monk named Tissa whom the king favoured. But he was charged with a grave offence by the monks of the Mahavihara and was expelled from the Order. From the time of its inception, Jetavanarama was independent of the Mahavihara and continued to hold the reputation of a major centre of Buddhist learning. There are not many inscriptions that can give information of the history of the monastery but some tenth century inscriptions refer to it as Denavehera, when making immunities to it. The unique discovery of seven gold plates containing extracts from the Mahayana text, Pancavisati-sahasrika-pragna-paramita in the premises of this monastery reveals that the Mahayana form of Buddhism favoured with the inmates of the monastery.

The merchants causing from India on a visit to the country can be identified in the inscriptions by which they made donation to the monastery. The two merchants named Isivara and Dalha, gave one hundred kahapanas to the monks of Devanapiya-Tisa vihara, as stated in this inscription. Here we are tempted to make an inference that the two merchants who came from India instructed the scribe to use the two characters is write their names.

In India in the contemporary Gupta period, a development in the mercantile corporations was seen.4 We may presume that the mercantile corporations at the principal ports such as Mahatittha, Gokanna in Sri Lanka had dealings with the merchants coming from abroad. A statement made by Fa-hien shows that foreign merchants were involved in the trade activities and that they were residing in the capital city of Anuradhapura . He states .... in the city there were many Vaisya elders and Sabean merchants whose homes are stately and beautiful.[5]

We may add that the merchants from abroad were attracted to the island for its importance as an international trade centre and entreport in South Asia in this period.

Notes

1 Epigraphia Zeylanica, Oxford, 1934-43, Volume IV, No.37.

2 Corpus Inscriptionum Indicarum, Allahabad, 1914, Volume III, No. 55 and plate xxxiv

3 Epigraphia Zeylanica, London, 1933, Volume III, No.18.

4 See K.A. Nilakanta Sastri, G. Sirinwasa chari, Advanced History of India, p. 217

5 J. Legge, The travels of Fa-Hien,Oxford, 1886, p. 104

THE PREHISTORIC CHRONOLOGY OF SRI LANKA

By

S. U. Deraniyagala

Potentially, some of the oldest quaternary deposits in Sri Lanka comprise the Ratnapura Beds (Deraniyagala ip:ch.3.2). These are alluvial sediments filling the strike valleys in the lowlands of the south-western Wet Zone in and around Ratnapura (map). They consist of sands, silts and clays ranging up to 30m or more in depth, with gravel intercalations in the basal levels. These gravels have occasionally yielded artefacts of a non-descript 'chopper' industry, termed the Ratnapura Industry, made on quartz and chert (Fig.1). The gravels also contain a fauna, the Ratnapura Fauna, which includes extinct forms, notably two palaeoloxodont elephants (*Elephas hysudricus and E, namadicus*; identification to be confirmed), two rhinoceri (species to be confirmed) and the hippopotamus *Hexaprotodon palaeindicus* (syn. *H. sinhaleyus*). The last occurs in the second major aggradational cycle of the Pleistocene alluvia in peninsular India, as on the central Narmada tract (v. de Terra and Paterson 1939; Sankalia 1974). this latter depositional episode has tentatively been dated (ibid.) by correlation with coastal tracts in southeast India (and hence by eustatic altimetry) and through the artefactual dating of its Mousterioid industrial complex (overlying Aggradation I with Acheulean artefacts) to ca. 200,000 - over 40,000 BP. A discovery of potential significance in the Ratnapura Fauna is an incisor tooth of a probable hominoid, which has been compared to *Gigantopithecus*, and a hominid premolar, in separate localities of the Ratnapura Beds. The identification of both these forms is controversial. Then there are bovine fossils, smaller than anything assignable to water buffalo or gaur, which could be ancestral to modern *Bos indicus*.

However, despite the indubitably Pleistocene element in the Ratnapura Beds, the chrono-stratigraphy of these sediments is still far from clear. Certain artefactual and faunal inclusions, and somewhat dubious uranium assays, have indicated that some of the beds have undergone redeposition, thereby complicating the stratigraphy.

Moving on to another set of Quaternary sediments, the coastal tracts of the semi-arid ecozone (particularly in the north) are characterised by large expanses of sheet-gravels capped by clayey sands which have undergone latosolic weathering resulting in a distinctive colour range of buff to crimson (ibid.:ch.3.3, map 11). these two beds in combination are referred to as the Iranamadu Formation (IFm). The sands have conclusively been identified as being ancient coastal dunes, weathered into aeoleanities termed Red-Yellow Latosols. The basal gravels are coastal alluvia in facies, and thus hypothetically amenable to eustatic altimetric studies.

As per an explicit sampling strategy (ibid.:ch.2), it was decided to assay the antiquity of three separate sets of deposits of the IFm in and around Bundala in the south: sites 45, 49 and 50 (map). The selection of these sites for investigation was based on the absolute heights of their thalasso-static basal gravels above mean sea level -- ca. 25m at site 45, 15m at site 50 and 8m at site 49 -- since it was hypothesised that each one of these levels represented a discrete altithermal episode during the Pleistocene, such as the Cromerian, main Eem, and final Eem at 75m, 15m (Main Monastirian) and 8m (Late Monastirian) respectively.[1]

Although all three sets of sediments, as well as both the basal gravels and the overlying sands at each site, turned out to be implementiferous, the excavations (ibid.:app.III) yielded only partial chronological resolution as far as the basal gravels were concerned. One could, however, estimate the age of the basal gravel at site 49 at ca. 75,000 BP by correlation with the Late Monastirian. Similarly, the 15m gravel terrace at site 50 is datable to the Main Monastirian at ca. 125,000 BP. As for site 45, its complex depositional environment blurs its chrono-stratigraphic significance. But some 322 artefacts sampled from the lower horizons of the gravels could possibly be as old as the Holstein intergracial at ca. 300,000 BP, depending on whether these gravels are in fact of a thalasso-static facies. Thermoluminescence dating of any burnt artefacts that might occur in these assemblages could conceivably clarify these points.

With regard to the latosolic dune sands overlying the basal gravels at the sites excavated (ibid.:figs.48,50-3), as with the basal gravels no organic remains have been preserved thus precluding radiocarbon assaying. However, the application of thermoluminescence to the dating of sand dunes (Singhvi 1982) made it possible to date the aeoleanites in the IFm. Samples were submitted for assaying from sites 49 and 50 (app.), but site 45 was omitted since its upper member had secondary colluvial admixture. The sands at site 49 yielded an age of ca. 28,000 BP, as did the upper horizon of the sands at 50. The lower horizon of the latter provided two dates of ca. 74,000 and 64,000 BP, and there are indications of a buried soil occurring between the two levels at site 50, suggesting a stratigraphic break (id. et al. 1986).

The above data seem to suggest that a period of high sea level, probably of the last interglacial (ca. 125,000 BP), witnessed the alluvial deposition of the implementiferous basal gravels at site 50. These were sealed by coastal dunes containing prehistoric occupation deposits during a marine regression at ca. 74,000 - 64,000 BP (?Late Monastirian; ?Amersfoort), and thereafter the dunes underwent pedogenesis. An episode of alluvial aggradation would have occurred at ca. 75,000 BP, as represented by the implementiferous basal gravels at site 49. These and the coeval dunes at site 50 were in turn sealed by coastal dunes with occupation deposits during a marine regression at ca. 28,000 BP (end of Paudorf interstadial). Note that the occupation deposits in the sands of sites 49 and 50 did include *in situ* components, thus ensuring the strict contempiraneity with the dune deposition, as against infiltrated elements. Similarly, the artefacts found within the basal gravels would have had to be at least as old as the deposition of the gravels themselves, as infiltration could not occur in the contex of such coarse sediments.

The evidence from sites 49 and 50 does indicate that the latosolic sands of the IFm are amenable to thermoluminescence dating. It appears as if the elevations of the basal gravels within much of their range of distribution are quadri-modal at ca. 50, 30, 15 and 10-8m +msl (Deraniyagala ip:app.III). Hence, it could be hypothesised that the 50 and 30m deposits represent pre-Eem (?Cromerian and ?Holstein respectively) altithermals. There are signs that some of these deposits, as at site 40, are implementiferous. It can be concluded that the IFm bears traces of human settlement in Sri Lanka from at least as early as the last intergracial, as evidenced at site 50, with the possibility of the existence of a Lower Palaeolithic phase assignable to the Holstein at ca. 300,000 BP (eg, sites 45, 40) or even at the commencement of the Middle Pleistocene at ca. 700,000 BP.

Technologically, the lithic assemblages excavated from the dune sands of the IFm at site 49 and the upper levels of the sands at 50, dated to ca. 28,000 BP, are conspicuous for their geometric microlithic component of lunates, triangles and trapezoidals on quartz (fig.2), a few being on chert. The lower horizon at 50 produced backed and form-trimmed non-geometric microliths, which may or may not be as old as 74,000-64,000 BP as postulated for the earlier phase of dune formation at site 50. The basal gravels at sites 49 and 50, with estimated ages of ca. 75,000 and 125,000 BP respectively, yielded lithic assemblages (somewhat water-worn at times) characterised by small flakes and discoidal cores (less than 4.5cm) with a few larger elements. These could be designated Middle Palaeolithic, possibly with Mousterioid traits akin to those displayed in certain surface finds from the gravels of the IFm (fig.3). So far, nothing resembling the Indian Upper Palaeolithic complex, now dated apparently to over 40,000 BP, has been forthcoming.

To the landward aspect of the IFm, in the lowland Dry Zone, is another very characteristic set of sediments, the Reddish Brown Earth Formation (RBEFm). This comprises a basal member of gravels or a stone-line(s), representing a lag deposit, overlain by colluvial clayey loams of the Reddish Brown Earth soil group (ibid.:ch.3.3.3, map 11). The colluvia, usually, are of mixed facies, with artefacts of numerous phases frequently occurring in a single profile. However, some of the basal gravels are associated with prehistoric habitations, as at Anuradhapura and Embilipitiya (site 43).

Site 43 was excavated with a view to securing a techno-stratigraphic correlate between the basal gravels of the RBEFm at 43 and those of the IFm along the southern coast, so as to establish their contemporaneity,[2] which is suggested by the geomorphology and sedimentology of the two sets of deposits appearing to form a continuum with the Hungama Fm constituting a transitional facies (eg, sites 54, 55, 56). The assemblage of artefacts excavated from site 43 (fig.4) proved to be almost identical with those from the ca. 28,000 BP horizons of sites 50 and 49 and a correlative age is proposed for 43. However, latterly, the basal gravel of the RBEFm at Anuradhapura (site AG-85), which yielded a Mesolithic industry (id. 1972), has been radiocarbon dated to ca. 5900 BP which correlates this lag deposit, interpreted as representing a pluvial episode, with the Older Peron high sea level of the Atlantic altithermal and more specifically a rainfall peak postulated for Rajasthan (v. Fairbridge, *after Bryson and Singh*, 1976).[3]

The presence of geometric mucroliths at ca. 28,000 BP at sites 49, 50 and perhaps 43 poses the problem as to how this techno-trait could be quite so early in Sri Lanka, whereas in Europe it does not come into prominence prior to ca. 12,000 BP with the final Upper Palaeolithic and the early Mesolithic. However, there is no reason for concern on this score, as radiocarbon dates on charcoal from Batadomba and Kitulgala caves for strata with geometric microlithic assemblages corroborate the evidence from the IFm at 49 and 50 (v. below). It should be noted that the term Mesolithic is being applied in the context of Sri Lanka's prehistory in a purely technological sense, signifying the occurrence of geometric mucroliths in noticeable proportions among the trimmed artefacts, and that it has no chronological (ie, postglacial) or subsistence-related (ie, small game hunting, fishing, shellfish gathering) connotations as it is apt to have in Europe.

The most reliable radiometric chronology for Sri Lanka's prehistory stems from several radiocarbon dates on charcoal, notably from the habitation contexts of Fa Hien, Kitulagala and Batadomba caves in the lowland Wet Zone (app.). Fa Hien (W.H. Wijepala under prep.) has yielded a series of three dates: ca. 34,000 - 31,000 BP; and another of three for the upper contexts: ca. 7900 - 5400 BP. According to the excavator (W.H.Wijepala 1986: pers. comm.) no geometric mucroliths occur among the artefacts, which may be attributed to the smallness of the sample size while bearing in mind that on an average the proportion of form-trimmed tools in any given assemblage rarely exceeds 0.2 per cent (Deraniyagala ip:ch.5.2.8). But it is noteworthy that human remains were found in the context dated to ca. 31,000 BP. These have been examined (K.A.R.Kennedy 1987) and could well represent one of the earliest assemblages of anatomically modern man known to science, comparable material being from Les Cottes, France (31,000 BP), Nazlet Khater, Egypt (30,000 BP) and Dolni Vestonice, Czechoslovakia (29,000 BP) (id. and Deraniyagala 1989).

The sequence from Kitulgala Beli cave comprises 25 dates, from older than 27,000 up to ca. 3400 BP. The associated artefact assemblages, from the pre-27,000 BP horizon upwards, are Mesolithic with characteristic geometric mucroliths (W.H.Wijepala under prep.). An excellent series of human skeletal remains was found from a context dated to ca. 13,000 BP (Kennedy et al. 1986; 1987). Carbonised remains of plants and malacological evidence have been used for palaeo-climatic studies with pioneering effectiveness (Deraniyagala ip:ch.4). The food-plants are being worked on by M.D. Kajale for data on subsistence practices while similar studies are under way for the faunal remains under the supervision of P.B. Karunaratne.

Batadomba cave has produced a comparable series for the earlier range at Kitulgala, namely 10 dates from ca. 28,500 to 12,000 BP. Once again, the artefacts include typically Mesolithic geometric microliths from the earliest horizon upwards (figs.5-10; Deraniyagala and Perera under prep.). The occurrence of bone points throughout the sequence is noteworthy and so are the beads (on shell) from ca. 28,500 - 16,000 BP, which thus constitute some of the earliest specimens of bone points and beads known from anywhere in the world. As with Kitulgala, a very satisfactory sample of human remains was excavated from secure contexts in this cave. One assemblage, dated to ca. 28,500 BP, represents the oldest anatomically modern humans known from South Asia (Kennedy and Deraniyagala 1989). A much larter assemblage was found in a layer dated to ca. 16,000 BP and this, together with the material from Kitulgala, Bellan-bandi Palassa and recent Vadda relict populations, have been interpreted as displaying a remarkable continuity of morphological traits from at least as early as 16,000 BP up to ca. 6500 BP and thence to the Vaddas (Kennedy et al. 1987). The faunal remains, which includes a lion or tiger at ca. 13,000 BP, are being investigated by P.B. Karunaratne et al. as is the plant material by Kajale.

All three caves, Fa Hien, Kitulgala and Batadomba, are exceptional in South Asia in having yielded large quantities of organic remains from Upper Pleistocene contexts and much can be expected from their interpretation. On the other hand, there is no question about it, technologically Mesolithic assemblages date back at least to ca. 28,500 BP in Sri Lanka, according to the evidence from securely dated contexts in Kitulgala and Batadomba and the thermoluminescence dates from sites 49 and 50. Supporting evidence has been forthcoming from Matupi cave in Zaire, where geometric microliths have been radiocarbon dated (on charcoal) to a similar antiquity (van Noten 1977), the Bambata and Umguzan complexes of southern Africa, dated to ca. 30,000 BP (Sampson 1974) and the Upper Baradostian/Zarzian transition in Iran and Iraq (Hole and Flannery 1967; Smith 1971). These latter occurrences indicate the existence of geometric microlithic industries between 30,000 and 20,000 BP in West Asia and tropical Africa. Systematic sampling in India and Pakistan should serve to fill in the lacuna between Sri Lanka and Iran. It is suggested that caves in the southern western Ghats would be the most likely loci to produce the requisite evidence, basing this hypothesis on the Sri Lankan situation where the caves in the Dry Zone are conspicuously lacking in early habitation deposits whereas the high rainfall region of the southwest (over 2500mm) is replete with them. As van Noten (1983: pers. comm.) has aptly commented, 'the term geometric microlith' has indeed lost its earlier chronological significance' and, certainly with regard to Sri Lanka, surface finds of such microliths may no longer be assigned as a matter of course to post-Pleistocene cultures unless there is firm evidence to indicate that they do not represent Upper Pleistocene cultural horizons. The same applies to the occurrence of small-flake assemblages: these could well be Middle or indeed Lower Palaeolithic (cf. Lower Palaeolithic small-flake components of less than 3cm from the early Middle Pleistocene, at ca. 700,000 BP, onwards (Svoboda 1987). This naturally adds a new dimension to the viewing of surface finds in Sri Lanka and, of course, on the Indian sub-continent as well.

Further radiocarbon dates are available for the Mesolithic in Sri Lanka (app.): (*a*) ca. 10,350 BP for Alu-lena Attanagoda, and (*b*) ca. 8230 BP for Beli-lena Athula;

both caves are in the lowland Wet Zone. (*c*) Matota (Mantai) in the coastal semi-arid lowlands of the northwest has yielded three dates of ca. 4200 - 3800 BP for the levels immediately preceding a Mesolithic camp on the lagoon shore. Radiocarbon dates on lagoon molluscs, the above being on charcosl, are available for three shell middens which may in fact be associated with Mesolithic stone tool technology: (*d*) site 50a IV at site 50, ca. 5260 BP; (*e*) Henagahapugala, site 57, associated with a Grumusol, ca. 3200 BP; and (*f*) Arnakallu, site 30, on a Latosol of the IFm, ca. 2950 BP. Site 57 is overlain by a Mesolithic horizon and provides a *terminus post quem* for the Mesolithic in Sri Lanka. These dates are not very reliable (?too recent) due to their having been secured on lagoon shells, but they suffice to provide a clue as to the range of the more recent dates for the Mesolithic in Sri Lanka, thus supporting the Matota dates. Finally, there is (*g*) a thermoluminescence date of ca. 6500 BP for the Mesolithic habitation at Bellan-bandi Palassa (fired quartz; Wintle and Oakley 1972) which requires to be checked against a radiocarbon assay.

The upper boundary of Sri Lanka's prehistoric period has yet to be chronologically defined. None of the contexts identified so far indicate that the pre- to protohistoric transition is represented. In the caves the relevant layers have usually been stripped for fertilizer and all that remains are tantalising shreds of evidence of the erstwhile existence of such strata, as in the occurrence of early historic Black and Red Ware at Kitulgala and Ravanalla caves. As for the Dry Zone, extensive surveys (eg, Sarasin and Sarasin 1908; Seligmann and Seligmann 1908; 1911; Solheim and Deraniyagala 1972) have once again failed to isolate a transitional horizon, while there is no dearth of discrete pre-proto- and early historic contexts in the form of stone tool assemblages, pottery sites and stone epigraphs.

The closest one can get to locating the chronological upper boundary of Sri Lanka's prehistoric period is to date the lower boundary of its protohistoric episode. This has been effected at only one site so far, the citadel of Anuradhapura (Deraniyagala 1972; 1986; 1990). Probes, designed specifically to elucidate the chronology of this 100ha site, with its 10m thickness of habitation deposits, indicate that by ca. 2800 BP the protohistoric Iron Age had quite superseded the Stone Age, at least at Anuradhapura, with no vestige of stone tools occurring in the numerous Iron Age contexts excavated. Hence, the upper boundary of Sri Lanka's prehistoric period may tentatively be assigned to ca. 3200 - 2800 BP, based on the radiocarbon dates from site 57 and Anuradhapura. It is likely, however, that relict populations continued to employ stone tools. The occurrence of 7 stone flakes associated with the Iron Age cemetery at Pomparippu (Begley et al. 1981) seems to be secondary, derived from the implementiferous IFm and alluvia of this particular area; but a primary context cannot be ruled out. It is hypothesised that the products of iron technology became readily available to Stone Age hunter-gatherers through mechanisms of barter soon after the inception of the former and that their superior eficiency led to the supersession of Stone Age technology rapidly, leaving few vestiges of this process in the archaeological record.

NOTES

1. The nomenclature of Gunz-Cromerian-Mindel-Holstein-Riss-Eem-Wurm is being employed as a heuristic device for clarity of expression (as have Butzer 1971:43-4 and Cooke 1972:7). Recent advances in Pleistocene chrono-stratigraphy (Butzer 1975:862-3; Isaac 1975:876) have cast doubts as to the validity of the definition of the pre-Eem episodes, although the even more recent restoration to favour of the Milankovitch model would appear to revalidate the Gunz et al. scheme or its approximation. Since this is not an attempt at avant garde Pleistocene chrono-stratigraphy at a global scale, and in the absence of a convenient substitute for the classic Gunz et al. scheme, the present writer has had no compunction about employing the latter.

2. This was necessitated by the lack of radiometric dates for the basal gravels of these sediments and the purpose behind establishing this chronological correlation was to be able to transpose the palaeo-environmental interpretation of the RBEFm to the IFm which had for a long time proved resistant to such interpretation.

3. The altithermal = pluvial correlation has been further corroborated at Matota where its sedimentology indicates pluvial conditions at ca. 3800 BP which correlates with the Younger Peron high sea level and humid conditions in Monsoon Africa (v. below; Fairbridge 1976).

APPENDIX

List of Radiometric Dates: Prehistoric Period

The present list sets out the radiometric dates that are available with reference to Sri Lanka's prehistoric period. Calibrated dates are given for the respective radiocarbon dates wherever feasible, including the age range corresponding to the standard error in the ^{14}C age (as per the tables in *Radiocarbon* 28(2B) of 1986). The services of (a) the Physical Research Laboratory (PRL), Ahmedabad, were made available by courtesy of D.P. Agrawal, (b) the Birbal Sahni Institute of Palaeobotany laboratory (BS) through Vishnu-Mittre and B.S. Venkatachala, (c) the Goethe University of Frankfurt radiocarbon laboratory (Fra) through R.R. Protsch and (d) the British Museum radiocarbon laboratory (BM) through R. Knox. The thermoluminescence assays on the Latosols of the IFm were undertaken by A.K. Singhvi of the PRL. The present writer is greatly indebted to these scholars for their assistance. Beta refers to Beta Analytic Inc., the commercial laboratory in Florida.

Site 50, dune sands dated by thermoluminescence (Singhvi et al. 1986):

- 180cm below surface: **28,480 BP**
- 400cm below surface: **64,380 BP; 74,200 BP**

Site 49, dune sands dated by thermoluminescence (ibid.):

- 110cm below surface: 22,600 BP
- 170cm below surface: **28,260 BP. This is the more reliable sample.**

Fa Hien cave (code YF) is situated at 80°12'55"E. long. by 6°38'55"N. lat. in Yatagampitiya village near Bulathsinhala, Kalutara District, lowland Wet Zone. It is probably the largest cave in the country, exceeding even Kitulgala in size. The site was first examined by the present writer in 1968, at the suggestion of the veteran collector H. Jayasundara who had been assisting P.E.P. Deraniyagala for decades in the National Museums Department. Excavations were undertaken by W.H. Wijepala (under prep.), Director (Excavations) of the Archaeological Survey Department, in 1986 and 1988. Two areas A and B were probed. Area A comprised several metres of desquamated rock with vestiges of a prehistoric occupation of considerable antiquity at ca. 6.2m below the surface. It is proposed that this is assignable to an altithermal of exceptional intensity when increased atmospheric circulation resulted in correspondingly intense convectional thunderstorms (for Sri Lanka's palaeo-climatology v. Deraniyagala ip:ch.4.4, app.I) which led to large-scale desquamation. Such an intense altithermal could correlate with the Eem interglacial at ca. 125,000 BP or, more likely, with the Holstein at ca. 300,000 BP. However, no datable material was found in this context. On the other hand, area B yielded ca. 3.75m of habitation deposits rich in charcoal. The context sequence, as supplied by the excavator is as follows:

X	superficial, disturbed	
1		
2	habitation,	ca. 50cm thick
2a	do.	ca. 55cm
3	do.	ca. 25cm
3a	do.	
4	do.	
4a	do.	
5	do.	
6	bed-rock	

Radiocarbon assays on charcoal have yielded the following results:

Context 2, sample YF-86/B-N5(2), lab. no. Beta-33297
    4750 ± 60 BP
    ca. 5400 cal BP (*after* Pearson et al. 1986)
    Associations: fractional human interment of two individuals, coated with red ochre.

Context 3, sample YF-86/B-M6(2), lab. no. Beta-33293
    6850 ± 80 BP
    ca. 7680 cal BP (*after* Linick et al. 1986)
    Associations: fractional human interment, without red ochre.

Context 3a, sample YF-86/B-N6(2a), lab. no. Beta-33298
    7100 ± 60 BP
    ca. 7900 cal BP (*after* ibid.; Kromer et al. 1986)

Context 4, sample YF-86/B-M7(3), lab. no. Beta-33295

24,470 ± 290 BP
ca. 25,200 BP at $^1/_2$-life 5730
Context 4, sample YF-86/B-N7(3), lab. no. Beta-33299
30,060 ± 380 BP
ca. 31,000 BP at $^1/_2$ life 5730
Associations: fractional human interment in lower horizon, without red ochre.
Context 4a, sample YF-86/B-M7(5), lab. no. Beta-33296
32,060 ± 630 BP
ca. 33,000 BP at $^1/_2$-life 5730
Context 5, sample YF-86/B-M6(6), lab. no. Beta-33294
33,070 ± 410 BP
ca. 34,000 BP at $^1/_2$-life 5730

According to the excavator, no geometric microliths were observed in the artefact sample, although context 3a and upwards fall well within the time-range of this category in Sri Lanka. This anomaly could be a function of the meagreness of the artefact sample. It is noteworthy that form-trimmed specimens in most assemblages in Sri Lanka account for no more than ca. 0.2 per cent of the artefact total (ie, 2 specimens in 1000), of which the geometric component is a part. A more representative artefact sample is required on this score.

The human remains from context 4, dated to ca. 31,000 BP, appear to represent anatomically modern humans (K.A.R. Kennedy 1990: pers. comm.) and they equal the antiquity of the earliest such human known so far (Les Cottes, France, ca. 31,000 BP) (v. Kennedy and Deraniyagala 1989). The two red ochre coated individuals from context 2 are exceptional since this practice has not been documented in Sri Lanka, apart from the frontal bone found in Ravanalla cave.

The faunal remains are well preserved and are likely to shed important light on the environment between ca. 34,000 and 25,000 BP. The same applies to the floral remains. This will ideally complement the data from Batadomba, which range from ca. 28,500 to 12,000 BP.

Batadomba-lena cave (Bd) and its stratigraphic sequence has been described by the present writer (ip:ch.3.4, id. and Perera under prep.). Its context sequence for the 1982 season of excavation is as follows:

1 superficial fill

2 disturbed, habitation-derived
3 do. do.
4 habitation deposit, sub-divided into upper (4a) and lower (4b) horizons.
5 habitation deposit
6 habitation deposit, sub-divided into upper (6a) and lower (6b) horizons.
7a habitation deposit in rubble overlying preceding 7b.
7b habitation deposit
7c do. do.
8 bed-rock

The radiocarbon dates, on charcoal, are as follows:

Context 4a, lab. no. PRL-855
11,200 +330/-320 BP
ca. 12,230 cal BP (*after* Stuiver et al. 1986),
ca.11,500 BP at 1/2 life 5730

Context 4b, lab. no. PRL-856
12,770 +470/-450 BP
ca. 13,200 BP at 1/2-life 5730

Context 5, lab. no. PRL-860
13,130 +440/-420 BP
ca. 13,500 BP at 1/2-life 5730

Context 6a, lab. no. PRL-859
13,880 +370/-360 BP
ca. 14,300 BP at 1/2-life 5730

Context 6b, Lab. no. PRL-858
15,390 +610/-570 BP
ca. 15,900 BP at 1/2-life 5730

Context 7a, lab. no. Beta-33281
16,220 ± 300 BP
ca. 16,700 BP at 1/2-life 5730
There is some possibility that this sample is intrusive from 6b.

Context 7b, lab. no. PRL-920
20,150 +740/-680 BP
ca. 20,800 BP at 1/2-life 5730

Context 7b, lab. no. Beta-33282
20,320 ± 500 BP
ca. 21,000 BP at 1/2-life 5730

Context 7b, lab. no. BS-784
22,360 ± 650 BP
ca. 23,000 BP at 1/2-life 5730

Context 7c, lab. *no.* PRL-857
27.700 +2090/-1660 BP
ca. 28,500 BP at 1/2-life 5730

All contexts, 7c - 1, have yielded a geometric microlithic component, making this Asia's earliest reliably dated site with such implements. Small points on bone and antler had a similar time-range and shell beads were found in 7c and 6.

Kitulgala Beli-lena cave (KB) is very extensive and located beside Ing-oya estate in Kitulgala. It has been excavated over several seasons under the field direction of W.H. Wijepala (under prep.*a*). The context sequence as synthesised in 1983 is as follows:

X	superficial, disturbed	
Xa(3)	do.	do.
Xa(2)	do.	do.
Xa(1)	do.	do.
IXa(1)	do.	do.
VIIIa(1)	dump	
VIIa(2)	pit-fill, Mesolithic	
VIIa(1)	do.	do.
VIb(1)	habitation deposit, Mesolithic	
VIa(1)	do.	do.
Va(3)	do.	do.
Va(2)	do.	do.
Va(1)	do.	do.
IVb(3)	do.	do.
IVb(2)	do.	do.
IVb(1)	do.	do.
IVa(3)	do.	do.
IVa(2)	do.	do.
IVa(1)	do.	do.
IIIc(4)	do.	do.
IIIc(3)	do.	do.
IIIc(2)	do.	do.
IIIc(1)	do.	do.
IIIb(1)	do.	do.
IIIa(3)	do.	do.
IIIa(2)	do.	do.
IIIa(1)	do.	do., lowermost Mesolithic habitation.
II	sterile alluvial gravel	
I	bed-rock	

The radiocarbon dates, on charcoal, are as follows:
Context VIIa(2), lab. no. Beta-18448
3640 ± 60 BP
3980 cal BP (*after* Pearson and Stuiver 1986)
4080-4010, 400-3880 cal BP, at sigma = 1 (ibid.)
Context VIIa(1), lab. no. PRL-1012
3170 ± 120 BP
3390 cal BP (ibid.)
3550-3430, 3390-3270 cal BP (ibid.)
Context VIb(1), lab. no. Beta-18446
8160 ± 80 BP
ca. 9070 cal BP (*after* Kromer et al. 1986)
Context VIa(1), lab. no. Beta-18445
7040 ± 80 BP
ca. 7880 cal BP (ibid.)
Context Va(3), sample KB-79(2), lab. no. BS-287
10,200 ± 170 BP
ca. 11,180 cal BP (*after* Stuiver et al. 1986), ca. 10,500 BP at $^1/_2$-life 5730.
Context Va(3), sample KB-79(3) beneath -79(2), lab. no. BS-288.
10,280 ± 170 BP
ca. 11,260 cal BP (ibid.), ca. 10,600 BP at $^1/_2$-life 5730.
Context Va(3), sample KB-79(4) beneath -79(3), lab. no. BS-289.
10,010 ± 160 BP
ca. 10,980 cal BP (ibid.), ca. 10,300 BP at $^1/_2$-life 5730.
Context Va(3), sample KB-79(4) beneath -79(3), lab. no. PRL-861.
11,910 +430/-410 BP
ca. 12,980 cal BP (ibid.), ca. 12,300 BP at $^1/_2$-life 5730.
Context Va(3), sample KB-79(5) beneath -79(4), lab. no. BS-290.
11,550 ± 180 BP
ca. 12,600 cal BP (ibid.), ca. 11,900 BP at $^1/_2$-life 5730.
Context Va(3), sample KB-79 12G planum 9 layer (5), lab. no. Fra-91.
11,780 ± 220 BP

ca. 12,840 cal BP (ibid.), ca. 12,100 BP at 1/2-life 5730.

Context Va(3), sample KB-79(6) beneath -79(5), lab. no. BS-291.

11,570 ± 210 BP

ca. 12,620 cal BP (ibid.), ca. 11,900 BP at 1/2-life 5730.

Context Va(2), sample KB-79(7) beneath -79(6), lab. no. BS-292.

11,520 ± 220 BP

ca. 12,570 cal BP (ibid.), ca. 11,900 BP at 1/2-life 5730.

Context Va(1), sample KB-79(8) beneath -79(7), lab. no, BS-293.

12,240 ± 160 BP

ca. 12,600 BP at 1/2-life 5730

Context IVb(3), lab. no. Beta-33287

11,860 ± 70 BP

ca. 12,920 cal BP (ibid.), ca. 12,200 BP at 1/2-life 5730.

Context IVb(2), sample KB-79(10) beneath -79(8) and (9), lab. no. BS-294.

11,750 ± 390 BP (sample size apparently marginal)

ca. 12,810 cal BP (ibid.), ca. 12,100 BP at 1/2-life 5730.

Context IVb(2), lab. no. Beta-33286

13,210 ± 80 BP

ca. 13,600 BP at 1/2-life 5730

Associations: several; secondary human interments (eg, in grid square 9F, which is directly dated in this instance).

Context IIIc(3), lab. no. Beta-33285. Some probability that this sample is intrusive from IVb(2).

13,150 ± 90 BP

ca. 13,500 BP at 1/2-life 5730

Context IIIc(2), sample KB-79 11I planum 8 layer (8), lab. no. Fra-163.

15,780 ± 400 BP, subject to final confirmation by laboratory.

ca. 16,300 BP at 1/2-life 5730

Context IIIc(2), sample KB-79 11I planum 9 (beneath 8) layer (8), lab.no. Fra-164.

16,400 ± 650 BP, subject to final confirmation by laboratory
ca.16,900 BP at $^1/_2$-life 5730

Context IIIc(2), lab. no. Beta-18443
18,050 ± 180 BP
ca. 18,600 BP at $^1/_2$-life 5730

Context IIIc(1), lab. no. Beta-18442
17,810 ± 170 BP
ca. 18,300 BP at $^1/_2$-life 5730

Context IIIb(1), lab. no. PRL-1013
17,870 +570/-530 BP
ca. 18,400 BP at $^1/_2$-life 5730

Context IIIb(1), lab. no. Beta-18441
18,900 ± 350 BP
ca. 19,500 BP at $^1/_2$-life 5730

Context IIIa(3), lab. no. Beta-33283
20,560 ± 130 BP
ca. 21,200 BP at $^1/_2$-life 5730

Context IIIa(2), lab. no. Beta-18439
Older than 26,425 BP
Over 27,200 BP at $^1/_2$-life 5730
Associations: this is the earliest context dated at this site with geometric microliths. although they occurred in IIIa(1) as well, the latter has not been dated due to the paucity of charcoal -- the application of AMS is a strong possibility.

The occurrence of characteristically Mesolithic type stone tool assemblages from the basal habitation context (IIIa(1)) upwards at KB corroborates the evidence from sites 49, 50 and Batadomba that geometric microliths can be of an antiquity in excess of 27,000 BP in Sri Lanka. There is some probability (*e* 20%) that context VIII (undated yet) represents a transitional episode between the Mesolithic and the Iron Age. However, the depositional facies (ie, dump) does not encourage optimism that it is uncontaminated with later material.

Alu-lena Attanagoda (ALK), near Kegalle, is another large cave in the lowland Wet Zone. It was sounded over a single season by W.H. Wijepala (under prep.b). Only context (3), the lowermost habitation deposit overlying bed-rock, was considered undisturbed. The radiocarbon date is on charcoal.

Context ALK(3), lab. no. PRL-976
9410 ± 150 BP
ca. 10,350 cal BP (*after* Stuiver et al. 1986), ca. 9700 BP at 1/2-life 5730.
Associations: Mesolithic with geometric microliths

Beli-lena Athula is a small cave at Maniyangama near Avissawella. It was excavated briefly by Gunaratne (1971) who encountered a Mesolithic deposit which has been radiocarbon dated on charcoal. The lower boundary of the habitation deposits has yet to be probed.
Context: 45cm below the surface, lab. no. TF-1094
7450 ± 110 BP
ca. 8230 cal BP (after Linick et al. 1986)
Context: 45cm below the surface, lab. BS (no number)
7190 ± 155 BP
ca. 7900 cal BP (ibid.)
Associations: Mesolithic

Anuradhapura citadel, Gedige (AG-85), has a basal gravel of the RBEFm containing Mesolithic artefacts (Deraniyagala 1972; 1986). The uppermost level of this deposit, which is succeeded by a considerable stratigraphic unconformity (erosion surface), yielded a sample of charcoal which has provided the only radiometric dating that we have of an RBEFm's basal gravel.
Context: AG-85 uppermost (13), lab. no., BM-2510
5040 ± 80 BP
ca. 5850 cal BP (a˜ter de Jong et al. 1986)
Associations: Mesolithic stone tools
Context: AG-85 uppermost (13), lab. no. Beta-18435
5040 ± 50 BP
ca. 5850 cal BP (ibid.)
Associations: Mesolithic stone tools
These two dates for context (13) have proved invaluable for corroborating the hypothesis that global altithermals (at least some of them) were represented in tropical South Asia by pluvials caused by an intensification of atmospheric circulation (Deraniyagala ip:ch.4.2.3, 4.4, 4.6.3, app.III). The date of ca. 5850 BP is in agreement with the Older Peron high sea level of the Atlantic altithermal which also witnessed high levels in the mid-Nile and Lake

Victoria and it coincides almost exactly with the Holocene peak of pluviality in Rajasthan (Fairbridge 1976).

Bellan-bandi Palassa is a Mesolithic open-air camp-site near Embilipitiya. It was excavated over several seasons by P.E.P. Deraniyagala in the late 'fifties and early 'sixties (Deraniyagala 1980). It has yielded one radiocarbon date on charcoal which applies to the archaeological deposit.

Context: archaeological deposit, lab. Isotopes Inc., U.S.A. by courtesy of H. Shapiro of the American Museum of Natural History, sample no. 394L.

2070 ± 200 BP

ca. 2050 cal BP (*after* Stuiver and Pearson 1986)

ca. 2335-1825 cal BP (ibid.)

The sample was contaminated by shellac consolidant and cotton wool packing (P.E.P.Deraniyagala 1963: pers. comm.). Hence it has produced a date that is probably far too young or else it refers to the historical stratum that overlies the Mesolithic habitation deposit at this site (for stratigraphy v. Deraniyagala and Kennedy 1972).

Context: burnt quartz found in direct association with Mesolithic human skeleton BP3/15a. This was assayed for thermoluminescence by Wintle and Oakley (1972).

6500 ± 700 BP

The thermoluminescence date may be considered to take precedence over the radiocarbon date for the reasons enunciated above. However, this important site deserves a series of reliable radiocarbon dates.

Matota (MA-82) or **Mantai** is documented in the chronicles as having been Sri Lanka's main port in early and middle historical times. Excavations conducted by J. Carswell, M.E. Prickett and the present writer in 1982 revealed a Mesolithic open-air camp-site on what would have then been the lagoon shore (pit D). Three radiocarbon dates were secured on charcoal from the levels immediately preceding that of the habitation. The stratigraphy was such that these could be interpreted as being contemporaneous with, or almost so, with the latter (for site v. Carswell and Prickett 1984), which, judging by its association with a matrix of an inter-tidal shore facies as

indicated by its fauna, correlates with a 1m high sea level.
Context: upper 40cm of clay stratum (top of which lies 10.20m below mound surface), sample MA-82.D (1), lab. no. BM-2340.
3520 $\pm$ 45 BP
ca. 3830 cal BP (*after* Pearson and Stuiver 1986)
ca. 3860-3820; 3800-3730 cal BP (ibid.)
Context: middle 15cm (40-55cm below top) of clay stratum, sample MA-82.D (2), lab. no. BM-2341.
3550 $\pm$ 70 BP
ca. 3850 cal BP (ibid.)
ca. 3960-3890 cal BP (ibid.)
Context: lowest 20cm (55-75cm below top) of clay stratum, sample MA-82.D (3), lab. no. BM-2342.
3790 $\pm$ 70 BP
ca. 4170 cal BP (ibid.)
ca. 4310-4[illegible]70 cal BP (ibid.)
The uppermost sample provides a firm *terminus post quem* of ca. 3800 BP for the upper boundary of the Mesolithic at Matota. It also correlates with the date of the Younger Peron high sea level (Fairbridge 1976). The sedimentology of this context suggests pluvial climatic conditions correlating with this altithermal as at AG-85(13).

Patirajawela site 50 occurs in the IFm within a few kilometres of Bundala. The prehistoric dune sands constituting the Red Latosol at this site (v. above for TL dating) is overlain by a shell midden (Deraniyagala ip: app.III). A radiocarbon assay has been made on *Meretrix casta* lagoon-habitat shells.
Context 50aIV shell midden, lab. no. PRL-107
4500 $\pm$ 170 BP
ca. 5260 cal BP (*after* Pearson et al. 1986)

Henagahapugala site 57, a Grumusol containing a Mesolithic habitation underlain by a shell midden. The latter was probed and found to be devoid of artefacts. A radiocarbon assay has been made on *Meretrix casta* lagoon-habitat shells.
Context: shell midden (Deraniyagala ip: app.III), lab. no. PRL-108.
2960 $\pm$ 160 BP

3190 cal BP (*after* Pearson and Stuiver 1986)
3370-2880 cal BP (ibid.)

This date provides a *terminus post quem* for the upper boundary of Sri Lanka's Mesolithic. Note however that dates on shell tend to be too young and different spacies from the same context tend to give different ages.

Arnakallu site 30 in the IFm of the northwest comprises Red Latosol dune sands overlain by a shell midden. A radiocarbon assay has been made, by courtesy of R. Gardner, on *Arca granosa* lagoon-habitat shells.
Context: shell midden, lab. no. UM-1534

2830 ± 80 BP
2947 cal BP (*after* Pearson and Stuiver 1986)
3058-2854 cal BP (ibid.)
Associations: no artefacts were found. Suspected of being Mesolithic, although it just could be protohistoric Iron Age.

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Map. Prehistoric sites: ALK Attanagoda Alu-lena; BA Maniyangana Beli-lena Athula; Bbp Bellan-bandi Palassa; Bd Kuruwita Batadomba-lena; KB Kitulgala Beli-lena; Ra Ravanalla; Yf Yatagampitiya Fa Hien's cave.

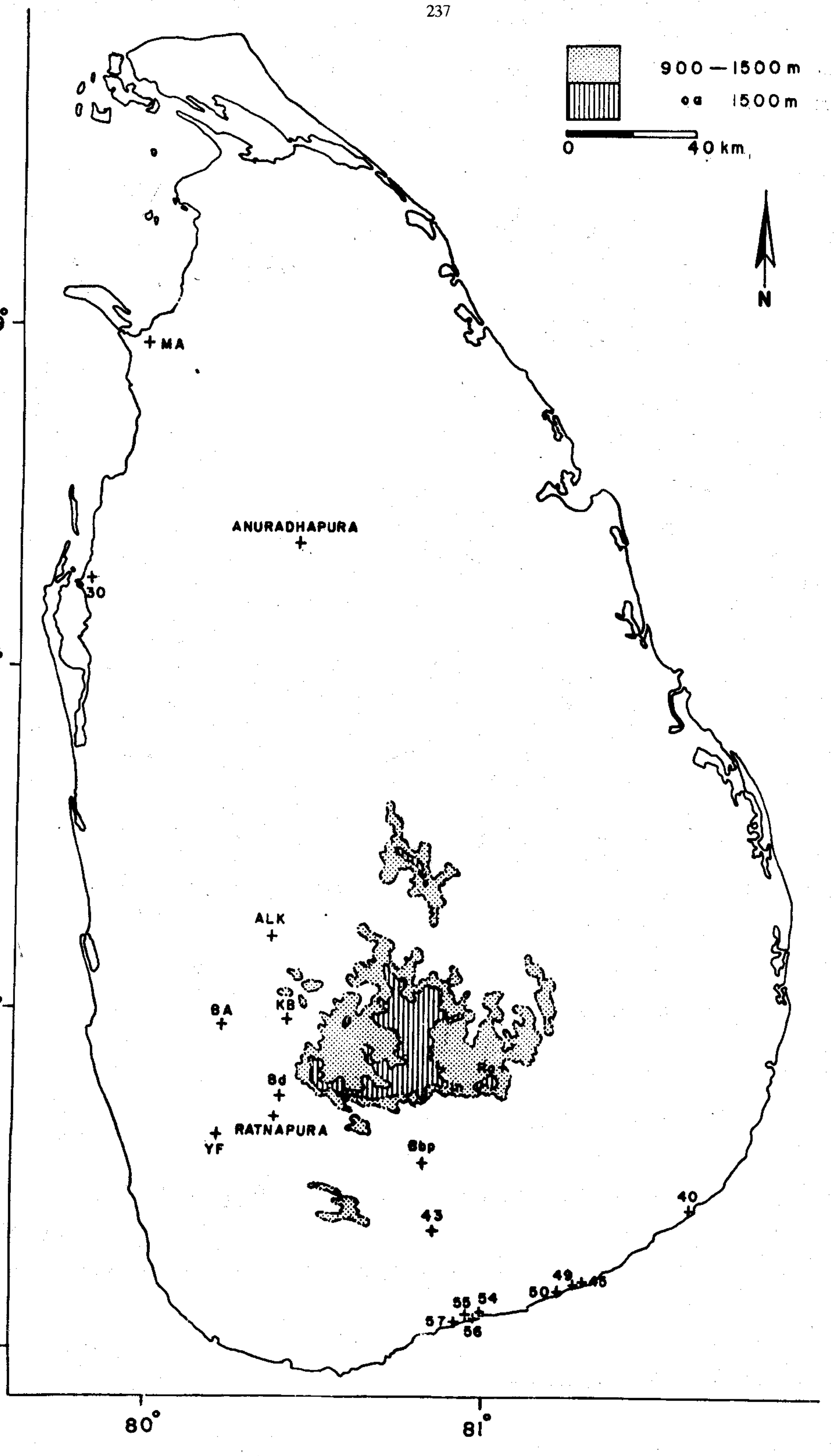
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Fig. 1 Hexaprotodon sinhaleyus (syn. H.palaeindicus): six-incisored hippopotamus, index fossil of Upper Pleistocene, estimated at ca. 150,000 BP (P.E.P. Deraniyagala del.)

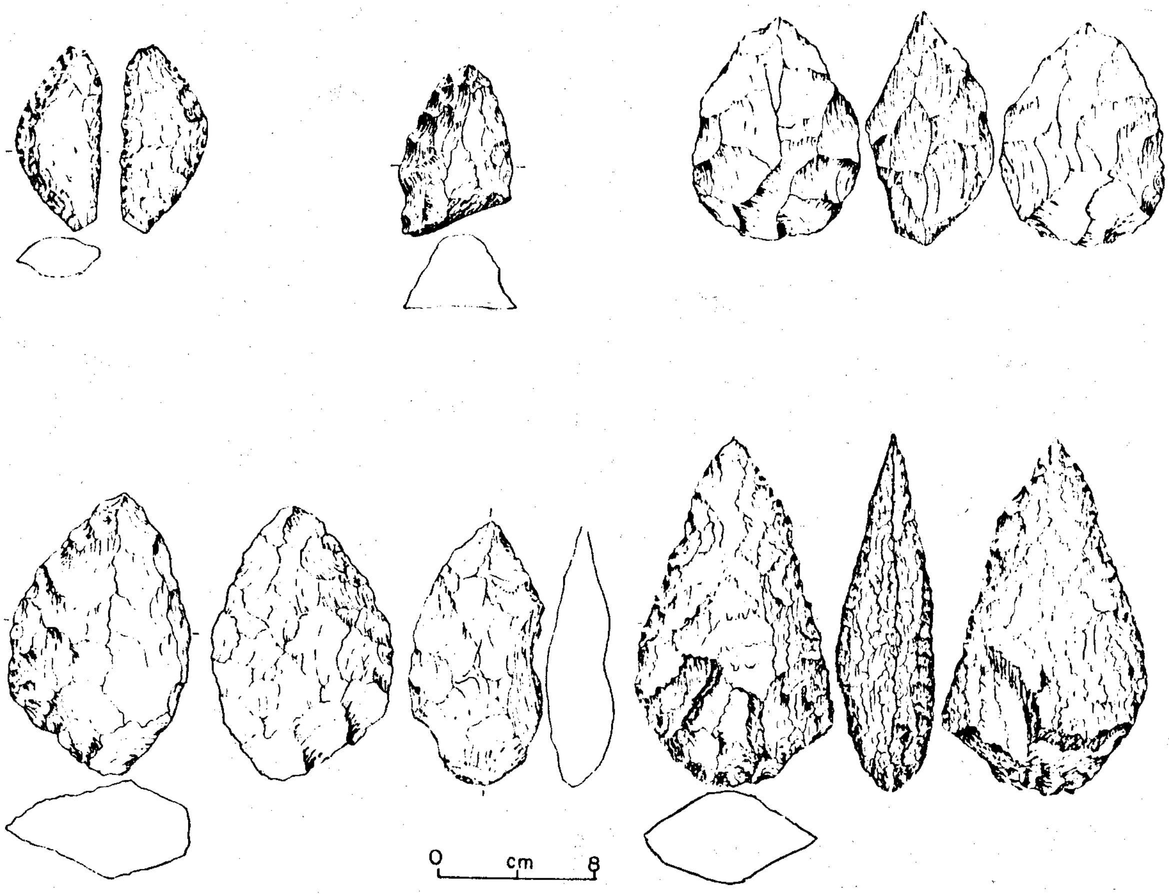

Fig. 2 large stone tools from the Ifm : ? Middle Palaeolithic; estimated age over 100,000 BP.

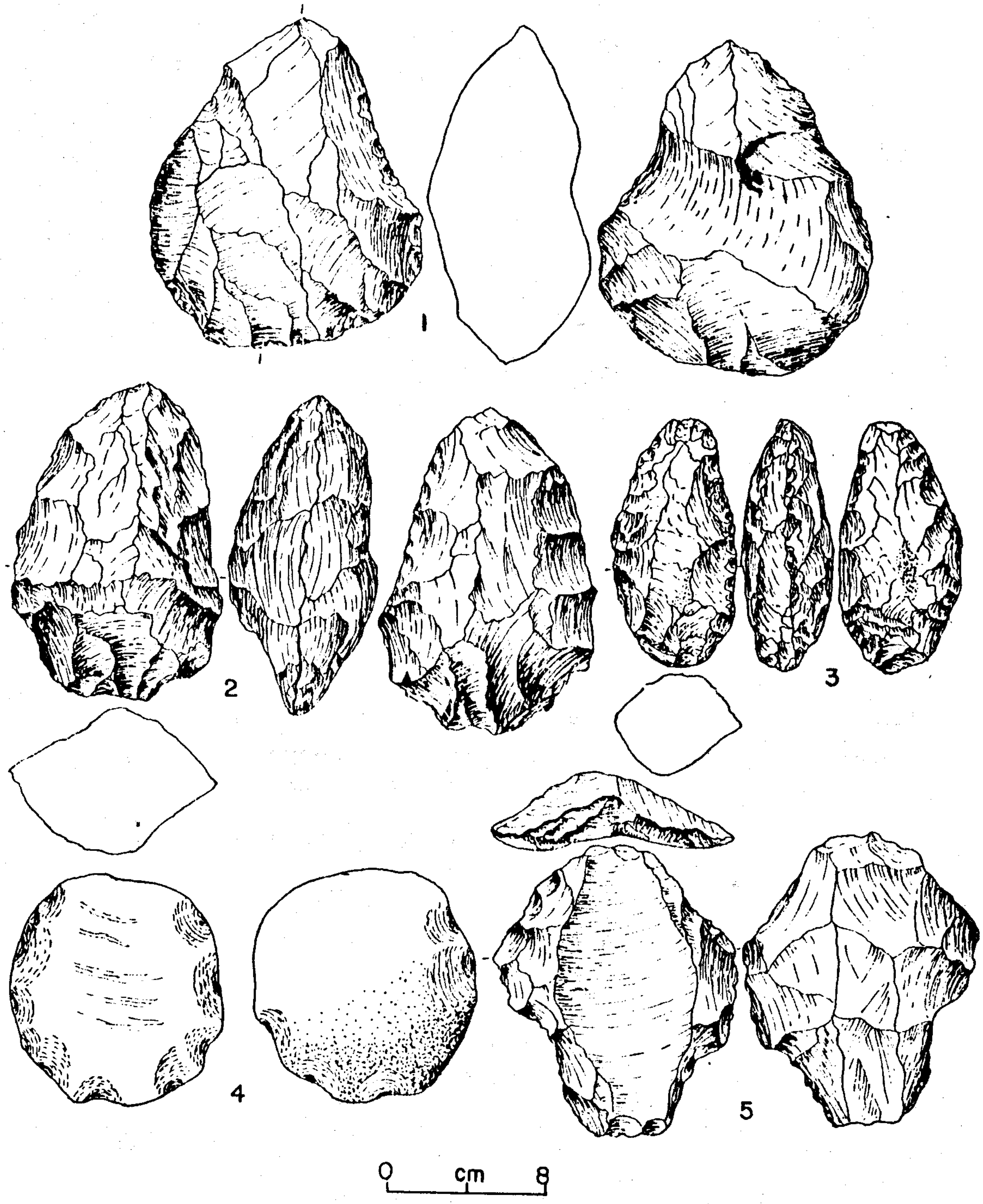

Fig. 3. Stone artefacts from the Ratnapura Beds: the Ratnapura Industry.

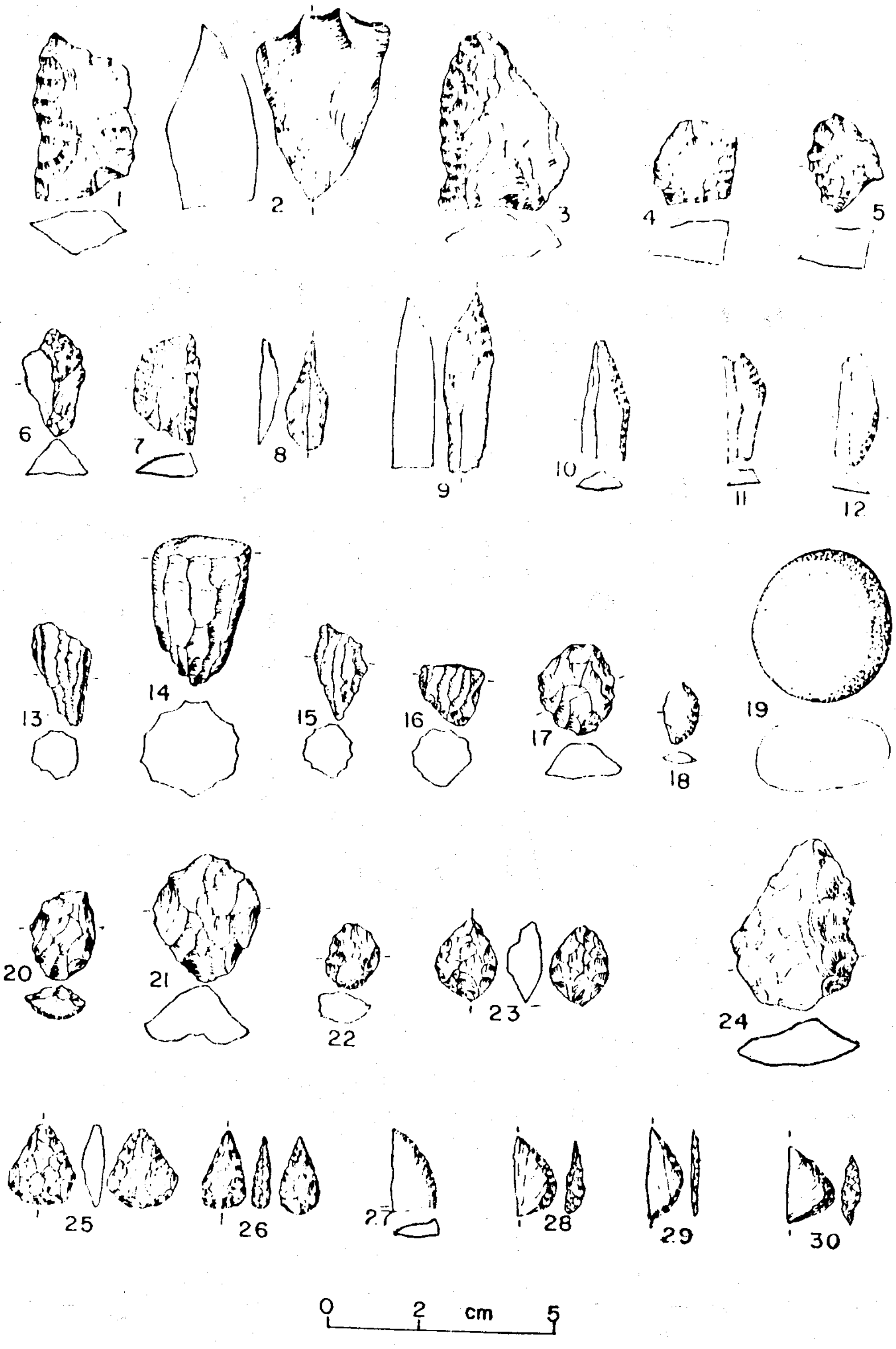

Fig. 4. Small stone artefacts from site 49, ca. 28,000 TL BP: (13-16) bladelet nuclei; (20-23) discoidel micro-nuclei; (26) Balangoda point; (28-30) microlithic lunates.

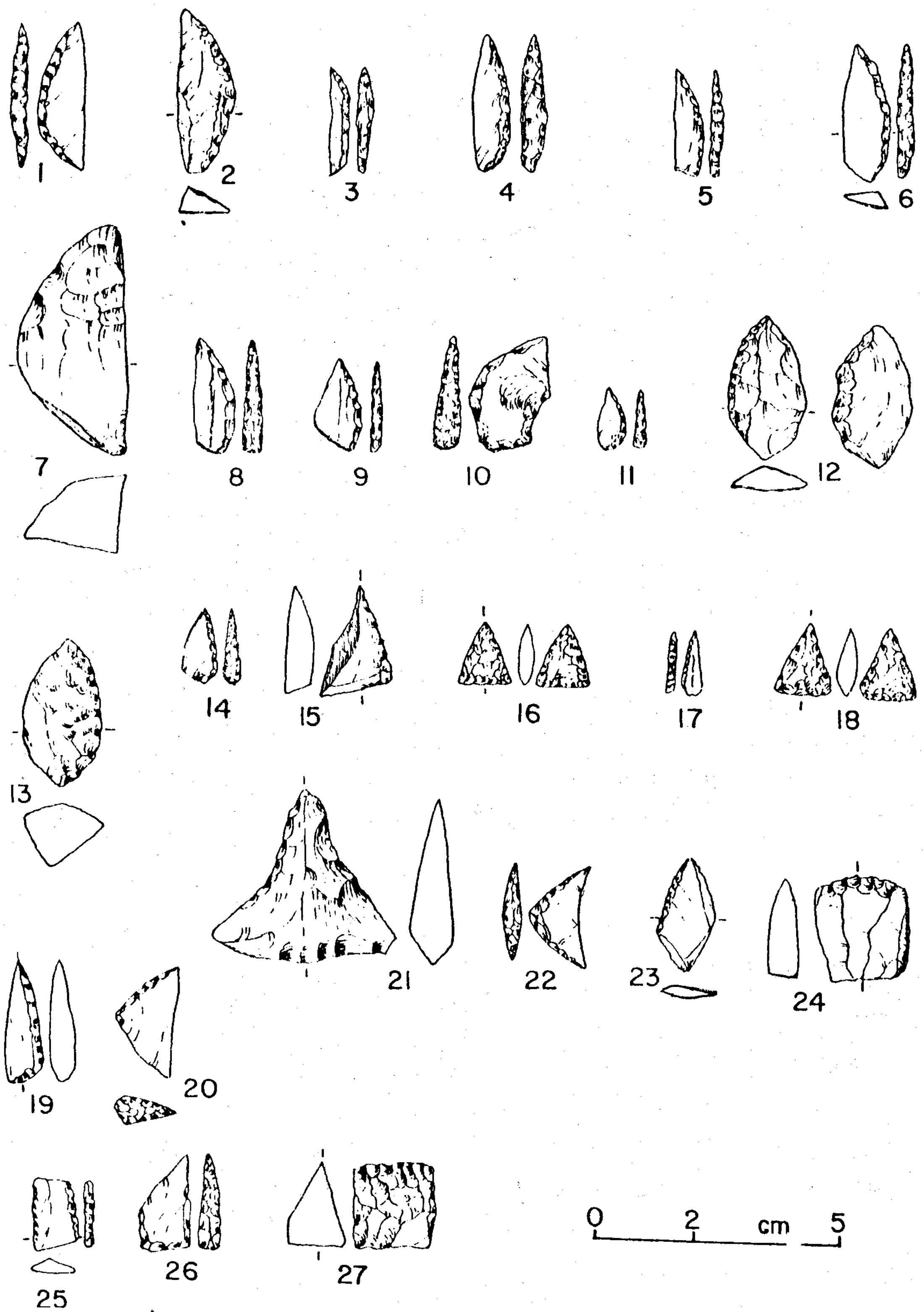

Fig. 5. Small stone artefacts from Site 49 ca. 28,000 TL BP (1,4) microlithic lunates; (5,6,8-10) microlithic semi-lunates; (16,18) Palangoda points; (19,20,22) microlithic triangles.

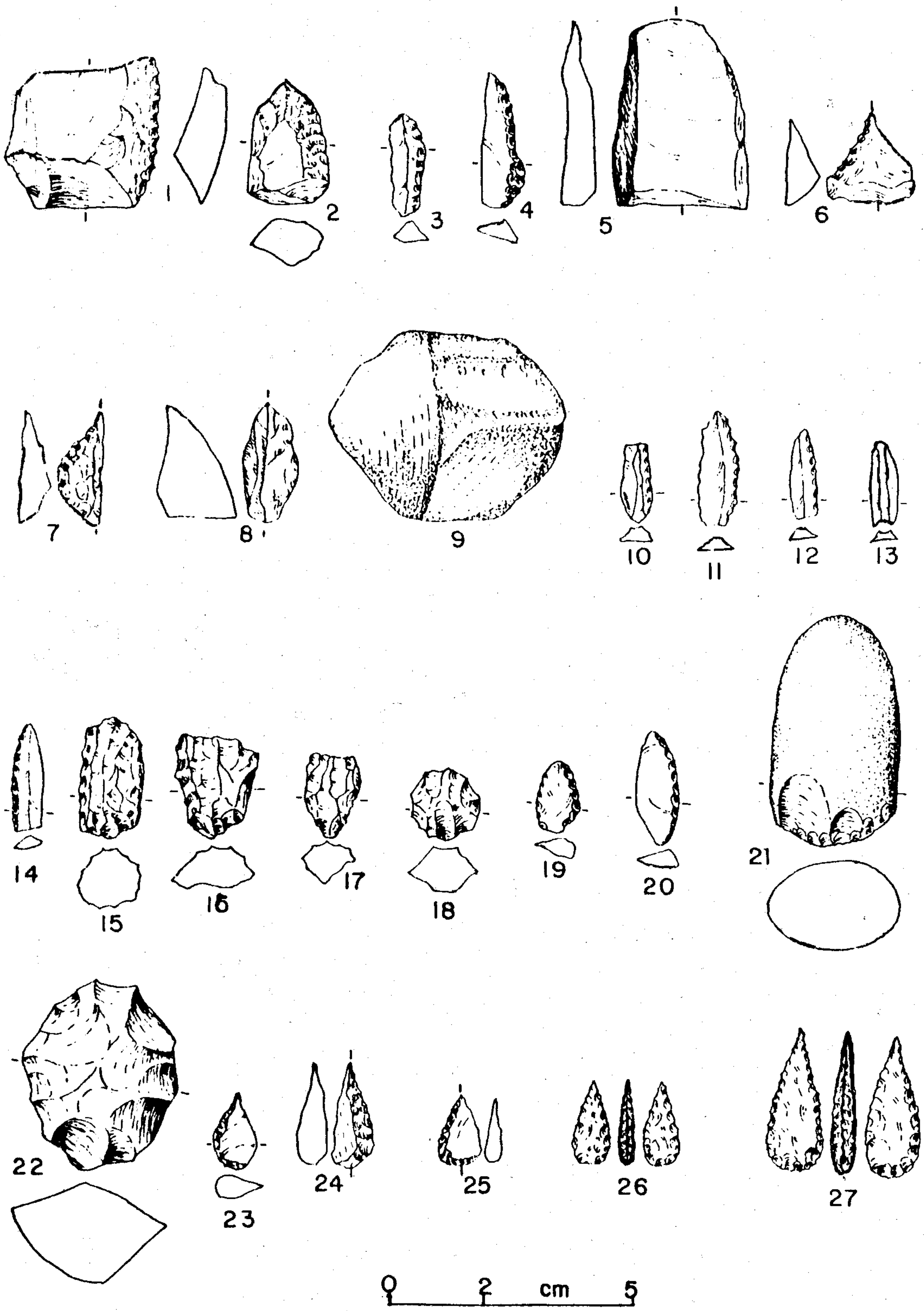

Fig. 6. Small stone artefacts from Site 43: (18) discoidel micro nucleus; (26,27) Balangoda points.

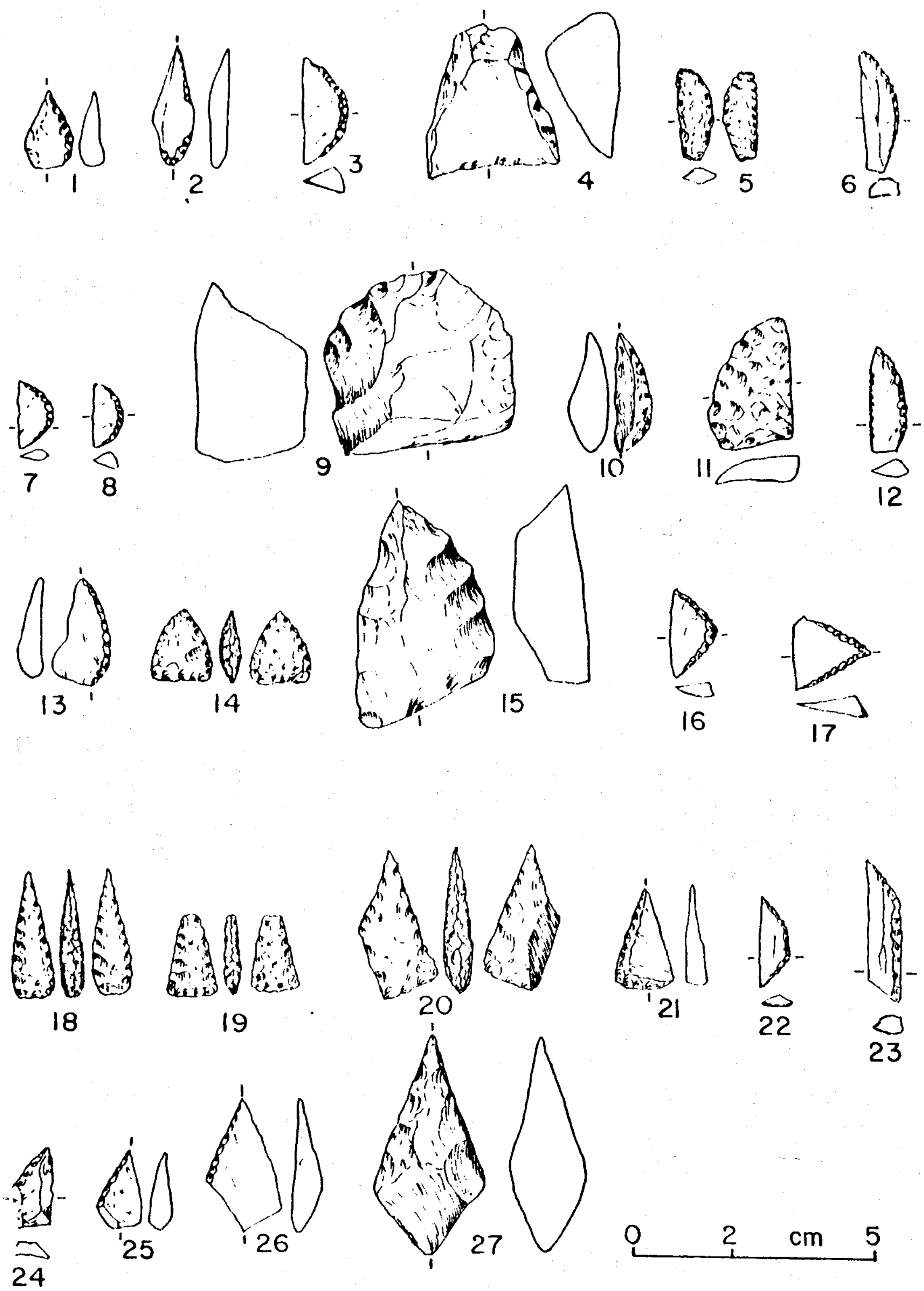

Fig. 7. Small stone artefacts from Site 43 (3,6-8) microlithic lunates; (5,14,18-20) Balangoda points; (16,17-21) microlithic triangles; (22) microlithic trapezoildal.

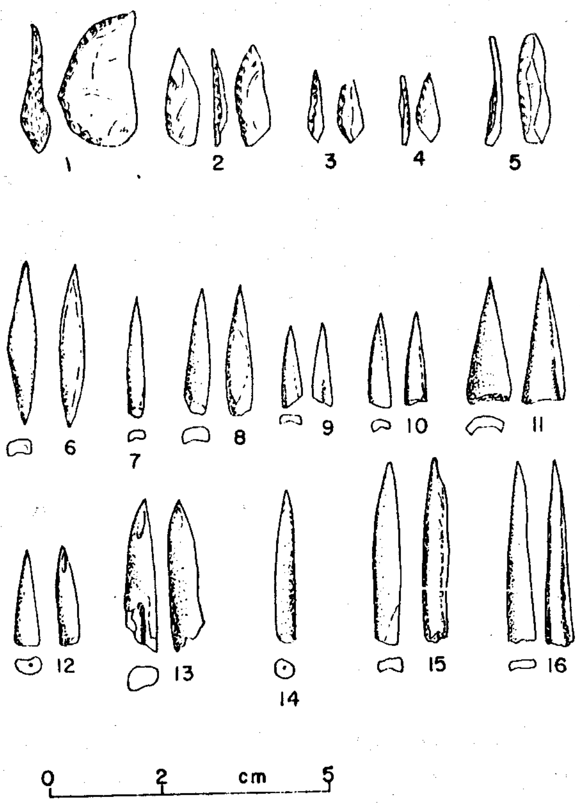

Fig. 8. Batadomba-lena Stratum 4, ca. 13,000-11,500 C-14 BP: (1,3) microlithic lunates; (2,4) microlithic semi-lunates; (5) bladelet; (6-16) bone points.

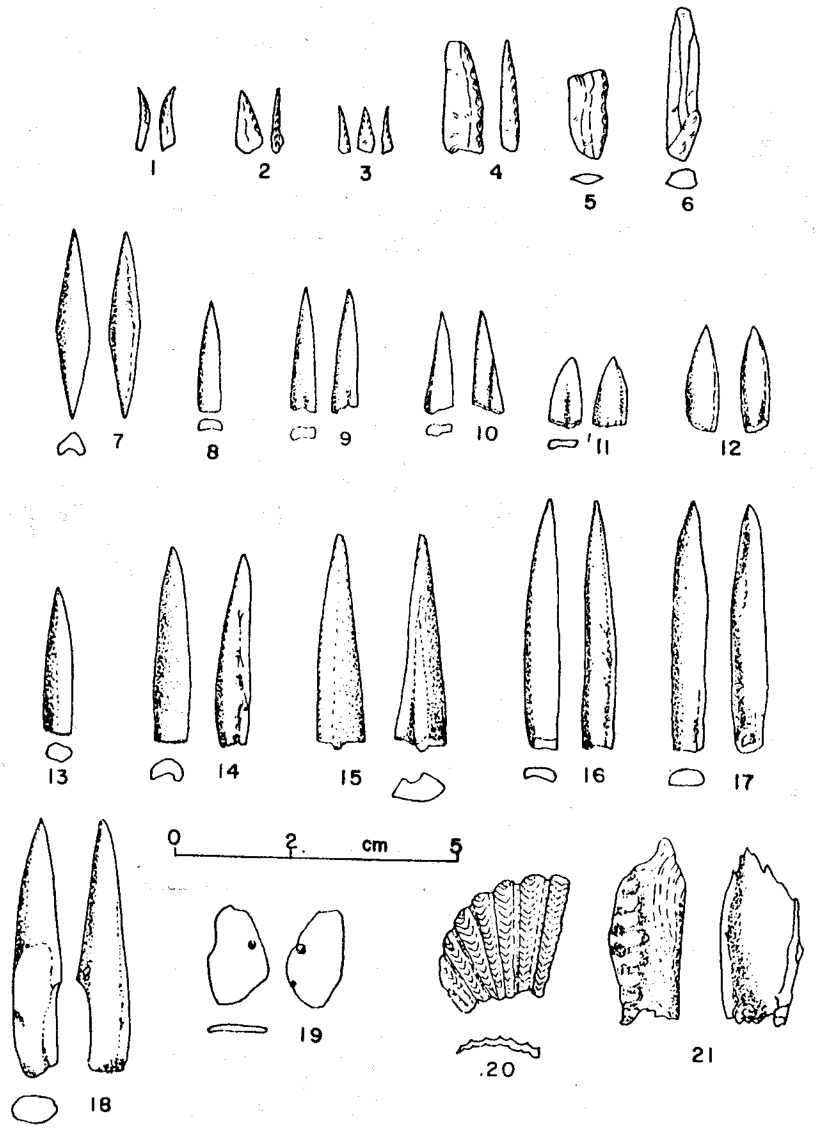

Fig. 9. Batadomba-lena Stratum 5, ca. 13,500 C-14 BP: (1) microlithic semi-lunate; (5) backed bladelet; (6) bladelet; (7-18) bone points; (19) perforated shell; (20) marine bivalve; (21) cowrie.

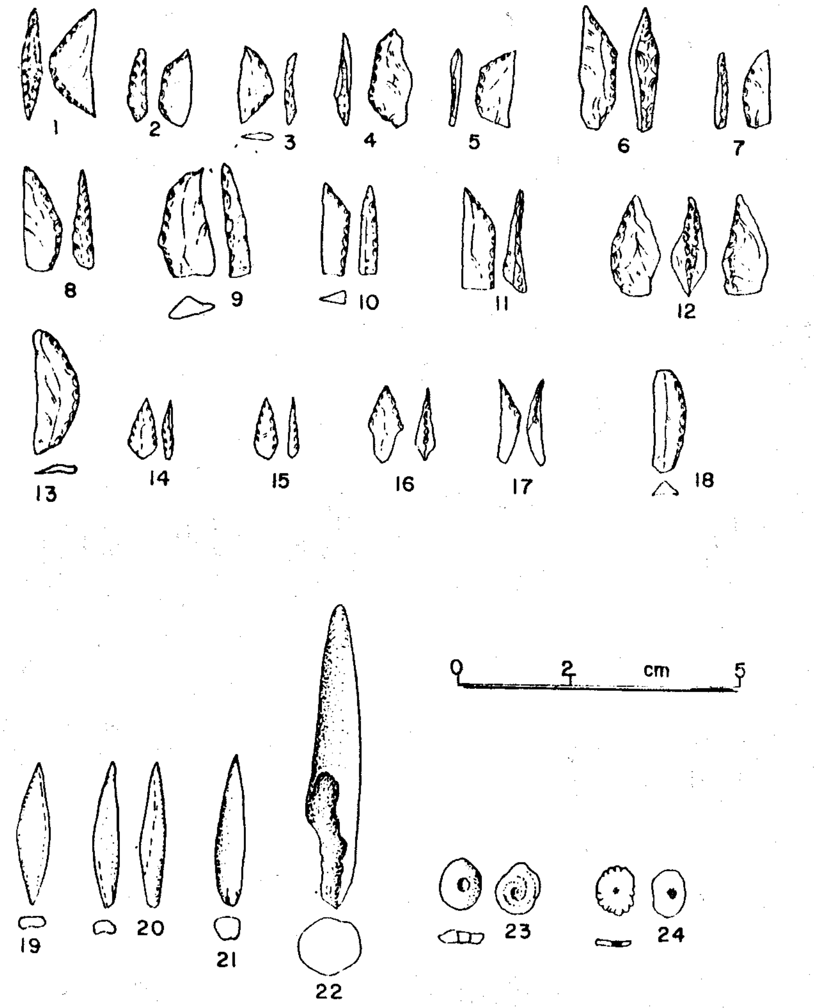

Fig. 10. Batadomba-lena Stratum 6, ca. 16,000-14,300 C-14 BP: (1-4) microlithic lunates; (6) microlithic trapezoidal; (7-9) microlithic semi-lunates; (18) backed bladelet; (19-22) bone points; (23,24) shell beads.

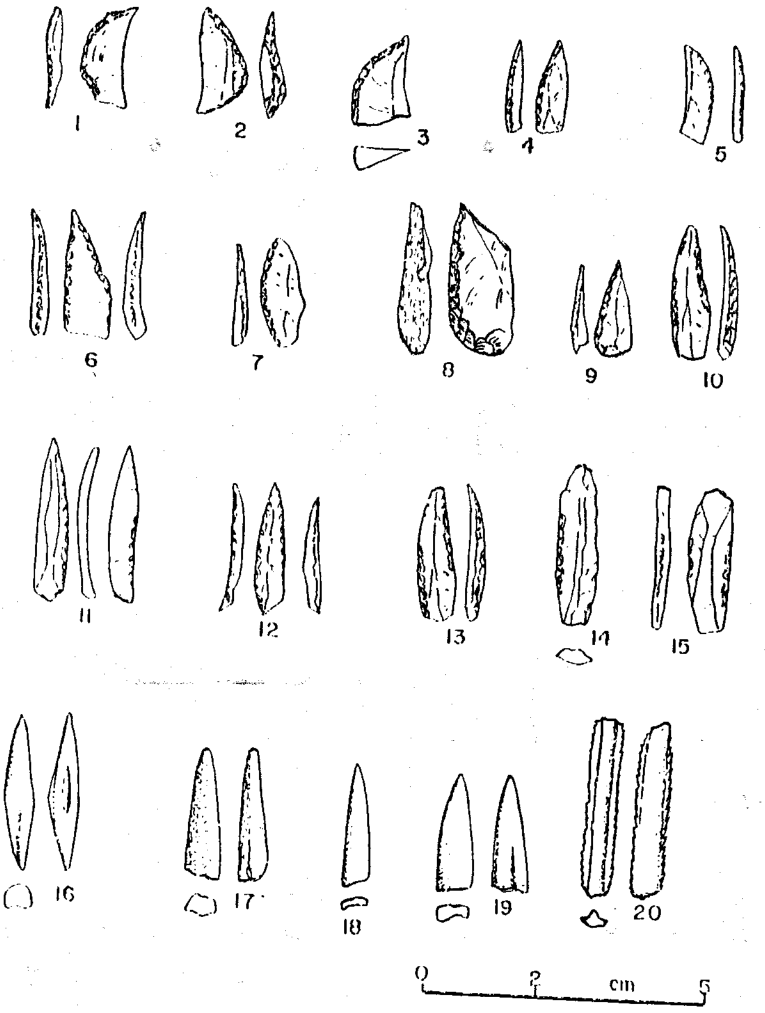

Fig.11 Batadomba-lena Stratum 7a,ca. 17,000 c-14 BP: (1,2) microlithic lunates; (3-6) microlithic semi-lunates; (10,11) backed bladelets; (16-19) bone points;(20) ray's spine.

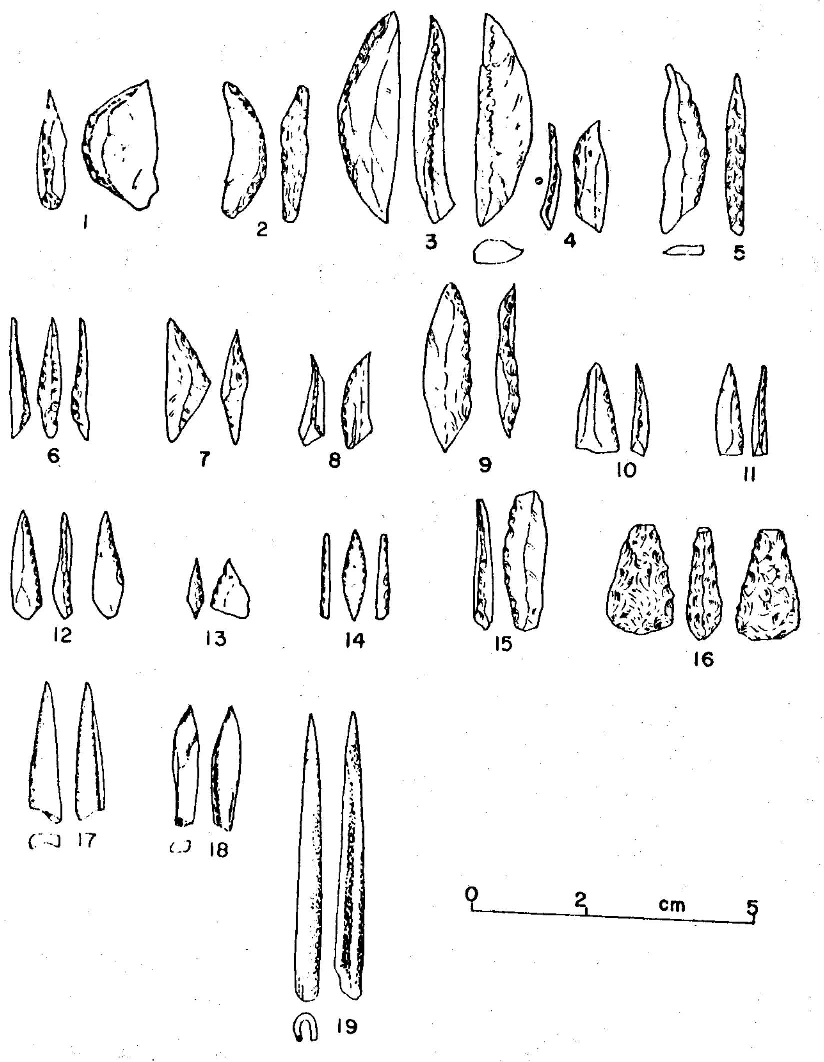

Fig.12 Batadomba-lena Stratum 7b,ca. 22,000 c-14 BP: (1-5) microlithic lunates; (8) microlithic semi-lunates; (15) backed bladelet; (16) Balangoda Point; (17-19) bone points.

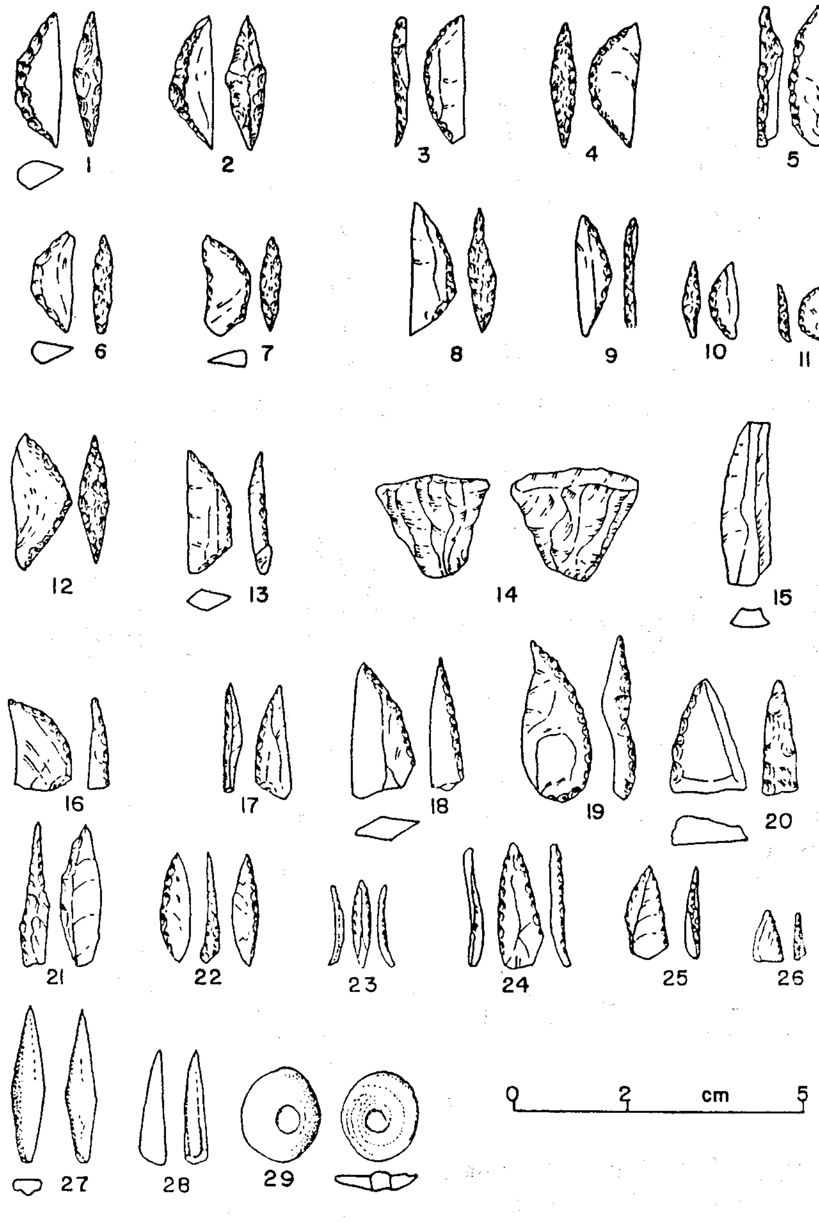

Fig.13 Batadomba-lena stratum 7c,ca. 28,500 C-14 BP: (1-11) microlithic lunates; (12) microlithic triangle; (13) microlithic trapezodAL; (14) bladelet nucleus; (15) bladelet; (16-18) microlithic semi-lunates; (27,28) bone points; (29) shell bead.

THE PROTO- AND EARLY HISTORIC RADIOCARBON CHRONOLOGY OF SRI LANKA

By
S.U. Deraniyagala

The Mesolithic of Sri Lanka was superseded by the protohistoric early Iron Age, as per data from over a century of prehistoric surveys (Deraniyagala 1980). The absence of an intervening Neolithic or Chalcolithic may be attributed to ecological factors, the heavy soils of the island, clothed in rain-forests being unconducive to farming with Neolithic or Chalcolithic technology as manifested in peninsular India (id. ip). However, with the advent of the Iron Age, the new technology proved itself adequate for taming Sri Lanka's recalcitrant environment. The Mesolithic hunting and gathering economy appears to have been rapidly replaced by farming, based on paddy cultivation and miscellaneous swidden crops, supplemented by animal husbandry coupled with a progressively decreasing component of hunting. The hunting and gathering Vaddas continued to survive in symbiosis with the iron-producing Sinhalese and Tamils, bartering forest produce for tools of iron which seem to have quite supplanted those of stone from very early times. However, the mainstream of the island's cultural evolution followed a clear path of evolution from its formative protohistoric episode up into a mature form of urbanism by the commencement of the present era.

The chronology of the Palaeolithic and Mesolithic periods of Sri Lanka has been delineated, bringing into focus the cultural sequence from ca. 130,000 to 1800 BC, the latter being the most recent reliable date available for the Mesolithic. As for the chronology of the proto- and early historic periods, historians and archaeologists have, so far, tended to rely primarily on data incorporated in the ancient chronicles (*Dipavamsa; Mahavamsa*) as set down in the 5th and 6th centuries AD, deriving from earlier histories, and from numerous epigraphs on stone (Nicholas and Paranavitana 1961). The generally accepted periodisation based on these sources comprised (a) the protohistoric period, commencing roughly contemporaneously with the so called arrival of Vijaya and his followers from northern India during the 6th century BC (*Mahavamsa*), succeeded by (b) the early historic period, characterised by the appearance of writing in Brahmi script and other traits thought to have been derived from the Asokan epicentre in the Gangetic valley at ca. 250 BC (v. Deraniyagala 1972). However, it has become increasingly apparent that the acceptance of the orthodox chronology for the lower part of the early historic and the protohistoic periods (when the chronicles become progressively murky) is unsatisfactory without testing its accuracy by independent methods -- which thereby places the onus on radiocarbon dating.

A review of Sri Lanka's proto- and early historic archaeology indicated, in no uncertain terms, that the citadel of Anuradhapura was the most suitable site to assay for securing the requisite information. While one may discuss protohistoric/early historic cultural configurations and their dynamics in the abstract, by way of hypothesising in the absence of an adequate data base, the fact remains that (apart from the cemetery complexes assigned to the protohistoric period, and possibly the recently discovered small village beside the Ibbankatuva cemetery) the citadel of Anuradhapura happens to be the only site to have revealed the existence of a protohistoric habitation component. The probes sent down into the early historic levels of the port at Matota and in the ancient sub-capital at Tissamaharama in the south (map 1) have not indicated the presence of protohistoric horizons, and nor has Kandarodai in the Jaffna peninsula (app.). Hence, a series of 13 sondages have been excavated (with meso-stratigraphic definition) in various sectors of the ca. 100ha citadel of Anuradhapura. These test pits average ca. $10m^2$ each, and 11 such have been sent down to bed-rock through ca. 9-10m of occupation deposits (figs. 1,2,4,5). The sample of cultural material thus secured has been adequate to meet the requirements of the primary research goal, that of establishing a preliminary radiocarbon chronology for the site in the context of its cultural evolution as represented in its artefact assemblages.

A total of 45 reliable radiocarbon dates have been secured on charcoal from Anuradhapura. The results are set out in the appendix that follows, with the calibrated ages as estimated on the basis of the tables published in *Radiocarbon* 28 (2B) (1986). Each sondage is dealth with separately and the results synthesised into a general treatement of the site. The radiocarbon chronology for the habitation sequence at Kandarodai is also considered in the context of the more wide-ranging and consistent one from Anuradhapura. The periodisation of Sri Lanka's proto- and early historic episodes, based on the calibrated dates secured on charcoal from sealed contexts, is as follows:

Period I, Mesolithic, with geometric microliths. The most recent date available is for Matota at ca. 1800 BC (Deraniyagala ip*a*).

Period II, Mesolithic/Iron Age transition. This episode has not been isolated as yet at any of the sites investigated so far. The stone tools found in association with Iron Age burials at Pomparippu (Begley et al. 1981) are being interpreted as being in secondary contexts. The supersession of stone tool technology with that of iron appears to have been a rapid process, thereby leaving few discernible vestiges of this transition in the archaeological record.

Period III, protohistoric Iron Age[1] : ca. 900-600 BC. This period is distinguished by the appearance of iron technology, pottery (notably the Sri Lankan variant of protohistoric Iron Age Black and Red Ware (BRW)), the horse, domestic cattle and paddy cultivation. None of the numerous contexts assignable to this period at Anuradhapura has yielded stone tools, thus signifying the total predominance of iron technology over that of stone by ca. 900 BC.

The earliest known protohistoric settlement at Anuradhapura exceeded 10ha in extent by ca. 800 BC, as per the evidence from the widely spaced scatter of sondages. More of the latter could reveal that the settlement was much larger: after all, 11 pits of $10m^2$, each, totalling some $110m^2$, constitute a tiny sample from a site that exceeds 1 million m^2. Nonetheless, 10ha is a considerable size for an early Iron Age settlement. It is estimated that the earliest among such settlements in Sri Lanka would have been villages with an area of less than 3ha and that these could be as old as ca. 1100 BC, thus conforming with the earliest Iron Age horizons of southern India.[2] It is possible, but somewhat unlikely (v. below), that such a settlement exists within the perimeter of the citadel at Anuradhapura: many more sondages (over 30) need to be excavated down to bed-rock in a wide-ranging scatter within the site before it is possible to decide on this point.

By ca. 700-600 BC the protohistoric settlement at Anuradhapura had extended over an area of at least 50ha. This could thus be designated a town. The apparent spectacular increase in size between the 9th and 8th centuries BC could have been a concomitant of increased centralisation of authority in what appears to have been the 'capital' settlement of the island. Its location, equidistant from the major ports of the northwest and northeast, within reach of the mineral-rich zones of the hinterland, (notably Seruvila, the island's premier iron and copper ore deposit[3]) surrounded by irrigable and fertile Reddish Brown Earths amenable to being worked by iron tools, and defensible against invaders with its deep buffer of forests right up to the coasts, would suggest deliberate selection of locus by a centralised authority. In other words, the positioning of Anuradhapura as the capital does not indicate an organic growth from humble origins at village level with a small-scale site catchment; it does seem to have been a sophisticated imposition on the landscape. If it was so, the chances of discovering a pre-9th century BC settlement within the citadel would be slim.

As to the processual elements which gave rise to the protohistoric Iron Age of Sri Lanka, little can be said in the absence of an adequate corpus of data from the sub-continent. It is proposed that iron technology was not an indigenous growth and that it was imported, perhaps during the final part of the 2nd millennium BC, probably in association with the horse which is a steppe animal alien to the equatorial rain forest habitat of Sri Lanka. This iron technology had gained dominance by ca. 1000 BC in most of India and it seems as if there too the horse was a closely associated (if not invariable) concomitant.

The basic early Iron Age cultural matrix seems to have manifested itself in regional variants and sub-variants, unsurprisingly. One may tentatively postulate that these were represented by interacting and overlapping 'culture spheres'. The hierarchical model may be roughly formulated as follows:

MACRO-SPHERE

I. Protohistoric Iron Age of India and Sri Lanka.

Sub-spheres

1. Southern India and Sri Lanka

    Variants

    (a) Sri Lanka
    (b) Tamilnadu
    (c) Kerala
    (d) Andhra Pradesh
    (e) Karnataka

2. Western India

    (a) Maharashtra
    (b) Gujarat
    (c) Saurashtra

3. Central India

    (a) Madhya Pradesh

4. Northern India

    (a) Rajasthan

(b) Uttar Pradesh
(c) Bihar

5. Eastern India
(a) Bengal
(b) Orissa

6. Pakistan, with its a array of early Iron Age complexes

The above model requires adjusting based on a pan-Indian comparative study of the early Iron Age, to be subsequently fine-tuned into sub-variants and perhaps smaller taxa. It does not suffice to effect such a comparative investigation by limiting it to a modal analysis of selected discrete traits such as those pertaining to mortuary traditions (eg, 'Megalithic' complex) or certain ceramics. While it is necessary to examine these intensively, the resultant interpreations can easily mislead unless the totality of the cultural assemblages are analysed and compared and the interpretations synthesised into progressively bigger-scale hypotheses and thence into a hierarchy of models. This having been achieved, it would be necessary to view the Indian context against the West and Central Asian early Iron Age scene, thus further expanding the scale of conceptualisation into a supre-regional model. Unless such an expansive approach is adopted, the present hide-bound orthodoxy of lumping everything relating to the southern early Iron Age into the 'Megalithic' complex will continue its unimaginative existence to the detriment of progressive archaeology.

Period IV, basal early historic : ca. 600-500 BC. This constitutes th transition from/protohistoric to the lower early historic episode. The evidence from AMP-88 context 75 in Anuradhapura indicates that writing in the Brahmi script was extant during this phase (fig.3), thus qualifying its being termed basal early historic. Corroborative evidence of the occurrence of Brahmi in contexts otherwise assigned to the protohistoric Iron Age ('Megalithic') stem, notably, from Arikamedu (Casal 1949), and possibly Kodumanel (Ragupathy 1990).[4] There is further corroborative evidence, although circumstantial, in the occurrence of a well-defined category of bone point in India (types 1a, 1b of AG-69; Deraniyagala 1972), which is at times found with a protective cap to its delicately rounded working tip, dated to ca. 1000-600 BC (eg, Painted Grey Ware levels of Hastinapura and pre-Northern Black Polished Ware horizons of Ujjain and Nagda). These could well be writing styli and they are ubiquitous from early historic contexts throughout the sub-continent. The above-mentioned strands of evidence do seem to indicate that claims of a ca. 600-500 BC antiquity for early Brahmi in Anuradhapra are not fanciful and that they need to be regarded as deserving of further systematic enquiry.

Two ceramic traits occur for the first time (in very small numbers) in contexts assigned to the basal early historic: (a) rim type 8 of AG-69 (ibid.) on necked vessels; and (b) a low-lustre, fine paste, medium-light grey ware, of which the only from that can be recognised is an 'archaic' variant of bowl type 22b(i) of AG-69.[5] It is hypothesised that the occurrence of Brahmi and these two ceramic traits are linked in some manner to an extraneous cultural impulse which reached Sri Lanka during this period, and it is tempting to see a connection with the legend of 'Vijaya and his followers' an event attributed to the 6th century BC as set down in the ancient chronicles.[6] Should the inscription on figure 3b (*...tayakute*) be interpreted as representing Prakrit (vs. Tamil) it would add credence to the latter speculation.

Period V, lower early historic: ca. 500-250 BC. This represents the half-blown phase of what was perceived as incipient in period IV. Diagnostic is the profusion of rim tupe 8 of AG-69 and the supersession of roof-tyle type 35b(i) with its dense febric and characteristic from by type 35a(ii) with its porous body.[7] So far, no specimens of Brahmi have been recorded from this period at Anuradhapura, although bone 'styli' were indeed found in Ag-69 3 which is assigned to the lower early historic. The Brahmi found on a seal at Anaikkoddai could also (conceivably) be of this period.

The sondages in Anuradhapura indicate an extent of over 50ha for period V. More reliance can be placed on the chronicles when it comes to the lower early historic. Worthy of special note is the reference to Pandukabhaya (late 5th century BC) and the formal planning of the 'city' at Anuradhapura, complete with gates and a quarter for the *Yonas* who are thought to have been Ionian or West Asian traders (*Mahavamsa*). The last, if true, would indicate the presence of people acquainted with Aramaic, the dominant trading script of this period from as early as 850 BC. When Alexander the Great's naval captain Onesicritos described Sri Lanka, with specific reference to 35-ton boats plying on 20-day voyages along the west coast of India (v. Nicholas 1959; 1959*a*), it is probable that he might have had access to information from sailors already trading between the island and West Asia. Contact with the Gangetic valley is evidenced in the occurrence of Northern Black Polished Ware (NBP) in period V, albeit in small quantities. What is particularly intriguing is that there are some indications that the ceramic popularly referred to as Rouletted Ware (RIW) had its inception (as a ware, devoid of the rouletted decoration) quite early on in this period. If this point should be confirmed, one could postulate that RIW had its origins in the medium-fine grey ware of period IV and that its characteristic gun-metal lustre reflected technical inputs from the NBP tradition of the Gangetic valley and perhaps others from further afield in West Asia and the Mediterranean.

The radiocarbon dates from Kandarodai, and my personal observation of rim type 4 of AG-69 occurring in one of its lowermost contexts, indicate that the two sondages excavated down to bed-rock in KTD-70 did not reveal a protohistoric horizon, unless the two anomalously early dates are taken seriously -- which is scarcely permissible. The earliest levels at KTD-70 are assignable to the lower early historic period. It is also probable that correlative horizons exist at Tissamaharama and Matota, if one is to trust the accounts in the chronicles. However, excavations down to sterile in MA-80, MA-82 (Carswell and Prickett 1984) failed to reveal anything pre-dating the mid-early historic (with the exception of the Mesolithic in one trench) and it must be assumed that the traces of the lower early historic (and perhaps of periods IV and III) lie concealed somewhere beneath the massive middle historic accumulation that blankets the mound. Horizens referred to as 'early historic' at certain sites in southern India have radiocarbon dates dates which fall within the range of period V at Anurdadhapura: eg, Kanchipuram at ca. 500 cal BC and Amaravati at ca. 400 cal BC (v. Seneviratne 1984). Presumably the cultural assemblage found in association with the latter sites is typically early historic (vs. 'Megalithic') and hence lends firm support to the present scheme of periodisation.

Period VI, mid-early historic: ca. 250 BC -100AD. The early historic citadel of Anuradhapura was full-blown by now, covering an extent of ca. 100ha or more according to the survey being conducted by M. Choya from Tokyo (1990:pars comm). It thus would have represented one of the largest cities of its time in South Asia, and it is worth bearing in mind that mid-early historic Arikamedu was but a fraction of this size. Historically, this period is relatively well documented, with ample evidence of close cultural interaction with the Asokan empire centred about Bihar. Archaeologically, however, surprisingly little is known from Sri Lanka, and once again the primary evidence stems from Anuradhapura (to be complemented by the KTD-70 site report which continues to pend). The index fossils for this period are RIW [9], Brahmi script (on pottery, seals and stone), coinage (eg, punch-marked and 'elephant and swastika' types), lakshmi plaques, a proliferation of bead types (notably type 10b(i) of AG-69), glass, gaming dice, and the gradual rise to prominence of burnt brick as a building material (vs. the predominance of compressed mud, and wattle and daub, in the preceding periods). It is significant that ceramics attributed to Hellenistic sources (types 21a(i), 23a(i), 24a(i) of AG-69 (4a)) have been discovered in contexts assigned to period VI (Bouzek and Deraniyagala 1985; identification confirmed in Paris, J. Gaucher 1985:pers. comm.). Trade contacts with India on the one hand and West Asian and thence the Mediterranean on the other appear to have expanded tangibly, a topic deserving quantitative treatment of its data for Anuradhapura (under prep.). The surpluses thus created would seem to have been at least partially channelled into the initial phase of mega-irrigation projects for paddy cultivation and for the building of large-scale public monuments such as the Mahathupa (Ruwanwelisaya). The citadel appears to have reached its maximum extent during this period, as attested by the surface scatter of RIW. However, the great dearth of sites, apart from Tissamaharama, Ambalantota, Matota and Kandarodai, that can be assigned to the mid-early historic period suggests centralised administration from such nodes, as against the hierarchical network of settlements that characterise the middle historic period. This supports the view that the idea of a town or city was an alien element that had been initially imposed and then developed in the Sri Lankan context. There is a noteworthy lack of an organic hierarchical continuum of settlements between centre and periphery from the commencement of period III up to the end of period VII. This could well represent a function of inadequate surface surveys, but pending evidence to the contrary the above hypothesis must necessarily take precedence.

Period VII, upper early historic: ca. 100-300 AD. This was when burnt brick achieved prominence, at least in the citadel of Anuradhapura, as the prime building material. The bricks themselves are usually large and tend towards a uniformity in size.[10] The stratigraphy in the citadel for this period is complecated by extensive robber trenches from antiquity with jumbled fills of brick residue and artefacts from numerous contexts which only serve to provide *termini ante quem* as dating evidence (eg, AG-69(6)). The index possil in Red Polished Ware (RPW) and its variants which make there first appearance in the sequence. Coins tend to be rather numerous: 'tree and swastika', Indo-Roman and Roman types. Pale blue 'Sassanian' glazed ware appear for the first time as forerunner to the darker blue glazed varieties of middle historic times, and there is some evidence of their being coeval with the appearance of glazed roof-riles (type 36a(i) of Ag-69) which are said to be unique in South Asia and which could have had their origin in Sassanian glazing techniques (v. chemical analysis in Deraniyagala 1972). RIW is frequently found in period VII contexts at Anuradhapura, although possibly in a derived state. However, it does appear as if BRW was indeed in use up to the end of the upper early historic at ca. 300 AD, as appears to be corroborated by the finds from the eastern ports of Kuchchaveli, Ilankaiturai and Panama-moderagala (id.ipc; id. in Solheim and Deraniyagala 1972); and the analysis of finds from the undisturbed lower contexts of MA-84 trenches G and H should clarify this point. (Carswell et al. under prep.).[11] The end of the 3rd century AD appears to represent the upper boundary of the BRW tradition in Sri Lanka, with the inverted firing technique cross-cutting the evolution of pottery shapes from ca. 900 BC to 300 AD, noteworthy being the changes in BRW forms in the transition from proto-to early historic periods. (This latter distinction is often ignored and there is a popular tendency to categorise all BRW as 'Megalithic'.The postulated upper age boundary of BRW at ca. 300 AD synchronises (coincidentally or otherwise) with the end of the Mahavamsa dynastic succession of Sri Lanka as enunciated in the chronicles, and one wonders if there could be some link between these two phenomena.

Period VIII, middle historic : ca. 300-1250 AD, up to the end of the Polonnaruva period which witnessed the commencement of the final devolution of the Dry Zone civilisation of Sri Lanka, the causal factors of which have frequently been speculated upon by armchair archaeologists but the evidence for which awaits retrieval in the massive upper levels of Matota. Once again, robber pits have damaged much of the stratigraphy in the citadel beyond redemption. These are even more extensive than in period VII and appear to have been dug to extract pillars and other structural members of ashlar, as can be adduced from the frequent occurrence of stone fragments among the residual pit-fills.[12] The supersession of brick by ashlar could reflect increased affluence. The latter is clearly in evidence at Matota which displays evidence of massive expansion during the middle historic period, with a profusion of West Asian ceramics making their appearance in the 8th and 9th centuries AD, supplemented by Chinese wares from the 9th to 11th centuries (Carswell and Prickett 1984). This affluence, which is so visible in the middle historic monuments of the religious complexes in Anuradhapura as one sees them today, was probably the direct result of the East-West trade with Sri Lanka, specifically Matota, acting as an entrepot.

It appears to have been during the latter part of the middle historic period, contemporaneously with the onset of the brisk East-West trade, that several new settlements crop up in various parts of the Dry Zone, notably in the eastern sector (v. Solheim and Deraniyagala 1972), establishing for the first time what could have been a vertically integrated hierarchy in a settlement network covering the entirety of the agriculturally fertile Reddish Brown Earth regions. The infertile parts of the Dry Zone (notably bintenne) seem to have provided the final refuge for the hunting and gathering life-style of the Vadda bands.

Conclusions: The periodisation of Sri Lanka's proto- and early historic episodes as derived from the calibrated radiocarbon dates for Anuradhapura, with supplementary evidence from the lower early historic occupation at Kandarodai, in effect has succeeded in radically transformaing the orthodox chronology that has been extant for these periods. The protohistoric Iron Age (referred to as Protohistoric A in Deraniyagala ip) is now considered to span the 'pre-Vijayan' period of ca. 900-600 BC. There are strong indications (awaiting final confirmation) of the dawn of the historical period at ca. 600-500 BC, the basal early historic, with what appears to be the appearance of writing in the Brahmi script, accompanied by new traits in ceramic technology. The latter are clearly in evidence in the lower early historic period (Protohistoric B of ibid.) of ca. 500 - 250 BC, which is also represented in the basal levels of Kandarodai and possibly in the 'early historic' horizons of Kanchipuram and Amaravati.

The full-blown early historic i.e, mid-early historic period) of ca. 250 BC - 100 AD conforms with the orthodox view of Mauryan impulses deriving from the north registering in southern India and Sri Lanka, although to what degree this phenomenon was polycentric as against diffusionist has yet to be accurately assessed. During the the early part of the mid-early historic period, there is evidence of a hitherto unsuspected degree of contact with West Asia and the Mediterranean as indicated by the occurrence of Hellenistic-derived ceramics. This contact with the West appears to have been accentuated in the upper early historic period of ca. 100-300 AD as clearly evidenced by the numerous finds of Roman coins of this period.

The settlement data from Anuradahapura indicate that it was a town of some considerable extent already during the protohisotirc Iron Age at ca. 800-600 BC. The causative factors behind this phenomenon have yet to be systematically evaluated, in the light of parallel data from Indian contexts. It is suspected that a major factor would have been the manufacture and export of high-quality iron from Sri Lanka and perhaps southern India as well. For the mid-early historic period this point has been succinctly argued by Schoff in his seminal paper (1915) [13] and it is here hypothesised that it had its beginnings in the protohistoric period. Corroboration of this proposition lies in the widespread occurrence of metal-working slag in every sondage that has been excavated in the citadel of Anuradhapura, from the basal protohistoric levels upwards into the upper early historic, as exemplified in AG-69, AG-84, AG-85 (Deraniyagala 1986) and ASW-89(76). The metallurgical analyses that are being conducted on samples from these contexts (G. Juleff under prep.) would no doubt shed the requisite light on ths topic. On suspects that we are on the edge of a vast and unexplored field of research which, if assayed incisively, could serve to transform our perception of cultural interaction processes in South Asia during the latter part of the 2nd millennium BC.[14] The protohistoric Iron Age in Sri Lanka and southern India was probably not manifested in a mere scatter of small village-scale settlements based on rudimentary irrigated farming, as is generally assumed, but by an extensive and sophisticated network of settlements linked by trade in manufactured iron with West Asia and beyond.[15]

FOOTNOTES

1. The term 'Megalithic' culture has been loosely applied to the protohistoric Iron Age (syn. early Iron Age) of Sri Lanka. The Megalithic mortuary traits associated with certain early Iron Age settlements, such as Brahmagiri, in southern India (Wheeler 1948) need not necessarily be a concomitant of the protohisotric Iron Age of peninsular India and Sri Lanka. Hence, to refer to the latter as 'Megalithic' can be misleadeing and the present writer has opted to dispense with the term until its general usage as a synonym for the protohisotirc Iron Age complex of southern India and Sri Lanka can be justified. It is quite possible that the Megalithic mortuary traits applied to a mere facies of the overall culture, representing, for instance, a certain social group. This stance towards the terminology is validated by the absence of any trace of a Megalithic cemetery complex in association with Anuradhapura -- although one needs to concede that it could await discovery or that the known cemeteries, situated at considerable distances from the site (Seneviratne 1984), could have serviced Anuradhapura as *loci* with specific ritualistc connotations which functioned as centres of secondary interment. Considering that there appears to have been a tendency

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   for protohistoric cemeteries to have retained their ritualistic associations in early historic times, as instanced by the Buddhist complexes at Kokebe Weli Vehera (near Pomparippu) and Kiri Vehera (Kataragama), thus demonstrating a certain continuity of function, it is proposed that the site of the earliest Buddhist complex at Anuradhapura, the Thuparama, could yield evidence of a protohistoric cemetery if excavated down to its basal cultural levels.

2. For example, Halingali in Karnataka at 955 $\pm$ 100 14C BC (TF-573), Veerapuram

   in Andhra Pradesh at 1200 $\pm$ 140 14C BC (PRL-728) and 920 + 40 14C BC (PRL-730). and Korkai in Tamilnadu at 805 + 95 14C BC (TF - 987).

3. The masses of slag visible at Seruvila suggest mining and melting operations on

   a bigger scale than is archaeologically in evidence elsewhere om the island. The neighbouring part of uankaiturai (deraniyagala in Solhein and dDeraniyagala 1972) probably serviced the export of coin, steel and copper to the eastern seaboard of India whereas Matota, controlled from Anuradhapura, would have monopolised the western trad which would have been on a much bigger scale.

4. The site of Anaikkoddai in the Jaffna peninsula is another possiblility, although

   the present writer's brief examination of the site with its extended primary burials and early historic potterm forms (eg, rim type 8 of AG-69) inclines him to assign this site to a mid-early historic (or at earliest, lower early historic) phase. Absolute dates are required for both Kodumanel and Anikkoddai before concluding on their status in the present scheme of periodisation.

5. One cannot help but remarking (*pace* anti-diffusionists!) on the paralledl rise of

the PGW-NBP fine ware tradition in northern India, It is conceivable that further parallels await discovery in protohistoric Iron Age peninsular India.

7. Vijaya is chronicled as having sent written missives to South India. Although one may not set too much store by such possible anachronisms, they deserve to be noted as within the realm of possibility.

7. Further investigations could reveal that, as with rim type 8, roof-tile type 35a(i) made its first appearance in period IV.

8. There are considerable deviations fromthe town planning norm as classicised by Kautilya in his *Arthasastra* and it is unlikely that the chronicles indulged in anachronistic plagiarism in this regard. It might be possible to trace a lower early historic city wall beneath the middle historic south wall that is visible in places.

9. Over 1000 sherds of RIW have been secured from the 13 sondages in Anuradhapura.

10. One wonders if there could be a correlation between t he rise of Saka and Satavanana influence in peninsular India and the increase in the scale of brick architecture in Anuradhapura. It would be interesting to compare the sizes of bricks from 100-300 AD in western India, Andhra Pradesh and period VII in Anuradhapura. The occurrence of RPW in period VII suggests that this is not idle speculation.

11. Note the total absence of BRW in the 5th, and perhaps 4th, century AD contexts of Sigiriya (S. Bandaranayake 1989:pers. comm.).

12. Unlike in period VII, the residual matrix in the robber pits of VIII is a dark greyish brown, devoid of the pervasive brick-dust and redeposited gravelly construction fills of the former.

13. The term *Hund* - (*sic, ?Hind-*) *waney* which the Arbs used for the finest Indian steel they used on their famous Damascus blades (Schoff 1915) is an obvious reference to the Sinhalese term *wane for steel.*

14. It is proposed that an intensive comparative study of beads from Sri Lankan protohistoric Iron Age contexts (eg., the cemeteries) would provide subfailure evidence on this score.

15. Who were the authors of the early Iron Age in southern India and Sri Lanka? While politely avoiding the Aryan/Dravidian controversy, in the absence of written records during this period, one may not duck the issue of the physical traits of early Iron Age man in this region. Kennedy's comparative work on skeletal material (eg, in Begley et al. 1981) has apparently convinced him that there are major differences between the physical traits of Sri Lanka's Mesolithic

Balangoda Man on the one hand and early Iron Age man on the other (1989:pers. comm.). This signifies a major intrusion of new blood into the local scene with the date of the skeletal series from Bellan-bandi Palassa at ca. 4500 BC as a *terminus post quem*. While not directly postulating that horseriders with iron technology swept into Sri Lanka at the commencement of the Iron Age, one needs to be aware that anti-diffusionism is not the answer to all such questions (*pace* again!).

APPENDIX

List of Radiocarbon Dates: Proto- and Early Historic Periods

The present list sets out the radiocarbon dates that are available with reference to Sri Lanka's proto-and early historic periods, supplemented by the few that have been secured for the middle historic period. Calibrated dates are given as per the tables published in Radiocarbon 28(2B) of 1986, including the age range corresponding to the standard error in the 14C age. On occasion there are two or more potential calibrated dates and the ones that fit the respective series best, or are otherwise supported by contextual evidence, will be denoted with asterisks. The present writer is obliged to R. Knox of the British Museum (BM) and D.P. Agrawal of the Physical Research Laboratory in Ahmedabad (PRL) for securing dating facilities at the radiocarbon laboratories in their respective institutions. Beta refers to Beta Analytic Inc., the commercial laboratory in Florida.

The bulk of the dates stem from the excavations conducted in the citadel of Anuradhapura (code, A). The ones from Kandarodai cannot be evaluated adequately until the excavation report is available; although a tentative correlation is set out based on personal communications with B. Bronson (1977) who directed the project with V. Begley. The citadel of Anuradhapura extends over ca. 100ha with ca. 8-10m thickness of habitation deposits. It was first sounded in 1969 (Deraniyagala 1972) and subsequently probed with 10m2 sondages at various loci so as to delineate an overall chronology for the site (map 2). Several radiocarbon dates have been secured on charcoal for some of the more important contexts. These are set out below, with the listing of each series ordered as per the context matrix with the most recent uppermost and the earliest lowermost. The cultural associations, all of which have been interpreted as being within sealed habitation contexts,are sketched in wherever feasible, pending the the completion of the final site reports and they need to be viewed as preliminary statements that are accurate as regards context but which require filling out by quantification.

Anuradhapura Gedige (AG-85): the excavatin pits of the 1969 season were enlarged (minimally) so as to secure a representative sample of charcoal from the major cultural horizons (id. 1986). The radiocarbon dates, on charcoal, are as follows:

Context 11 (middle), sample AG-85(4a), lab. no. Beta-18438.
2060 +/- 80 BP
ca. 96 cal BC (after Stuiver and Pearson 1986)
187 cal BC - 16 cal AD, at sigma = 1 (ibid.)
Associations : Rouletted Ware (RlW) early historic
Correlation: stratum 4b of 1969 excavation (AG-69)

Context 11 (lower), sample AG-85 (4a), lab. no. Beta-15347.
2110 +/- 70 BP
ca. 160 cal BC (ibid.)
308-250, 213-54* cal BC (ibid)
Associations. RlW Mid early historic
Correlation : stratum 4b of AG-69

Context 13 (upper), sample AG 85(5), lab. no. Beta-15346.
2050 +/- 70 BP
ca. 73 cal BC (ibid.)
169-26 cal BC (ibid.)
Association : RlW, seal with Brahmi inscribed Mid early historic
Correlation : stratum 4b of AG-69

Context 14 (upper), sample AG-85(6), lab. no. Beta-15345.
2290 +/- 90 BP
ca.390 cal BC (ibid.)
405-352, 305-232* cal BC (ibid)
Associations: RLW, Kakshmi plaque. Mid early historic
Correlation : stratum 4A of AG-69

Context 14 (middle), sample AG-85(6), lab. no. Beta-18437.
2140 +/- 60 BP
ca. 187 cal BC (ibid.)
354-304, 238-105* cal BC (ibid.)
Associations : RlW.
Correlation : stratum 4a of AG-69

Context 14 (middle), sample Ag-85(6) , lab. no. BM-2505.
2130 +/- 50 BP
ca. 178 cal BC (ibid)
308-263*, 213-104 cal BC (ibid.)
Associations: RlW
Correlation: stratum 4A of Ag-69

Context 15 (upper), sample AG-85(7), lab. no. BM-2506
2170 +/- 50 BP
ca. 265 cal BC (average ; ibid.)
362-258*, 254-164 cal BC (ibid.)
Associations: Lower early historic NBP,
Correlation: stratum 3b of AG-69

Context 15 (upper). sample AG-85(7), lab. no. Beta-18436.
2270 +/- 100 BP
ca. 383 cal BC (ibid.)
403-270 cal BC (ibid.)
Associations: NBP (n=1) Lower early historic
Correlation: stratum 3b of AG-69

Context 15 (lower), sample Ag-85(7), lab. no. Beta-15342.
2360 +/- 70 BP
ca. 402 BC (ibid.)
506-412 cal BC (ibid.)
Associations: rim type 8, roof-tile type 35a of AG-69. Lower early historic.
Correlation: stratum 3b of AG-69

Context 17, sample AG-85(8), lab. no. Beta-15348
2440 +/- 70 BP
ca. 523 cal BC (ibid.)
768-404 cal BC (ibid.)
Associations: first appearance of rim type 8 and roof-tile type 35a overlapping with final occurrence of roof-tile type 35b. Early historic/protohistoric transition.
Correlation: stratum 3b/3a transition of AG-69, AMP-88(75), ASW-88(88).

Context 21 (upper), sample AG-85(9),lab. no. Beta-15341.
2220 +/- 80 BP
ca. 362*, 282, 258 cal BC (ibid.)
392-186 cal BC (ibid.)
Associations: protohisotric Iron Age
Correlation : stratum 3a of AG-69

Context 21 (lower), sample AG-85(9), lab. no. Beta-15340.
2370 +/- 60 BP
ca. 404 cal BC (ibid.)
506-416 cal BC (ibid.)
Associations: protohistoric Iron Age.
Correlation: stratum 3a of AG-69

Context 26 (upper), sample AG-85(10), lab. no. Beta 15339.
2340 +/- 60 BP
ca. 399 cal BC (ibid.)
408-387 cal BC (ibid.)
Associations: protohistoric Iron Age
Correlation: stratum 3a of AG-69

Context 26 (middle), sample AG-85(10), lab. no. BM-2508
2520 +/- 50 BP
ca. 770 cal BC (after Pearson and Stuiver 1986); ca. 767, 674, 662 cal BC (Stuiver and Becker 1986)
795-757,693-596* cal BC (after Pearson and Stuiver 1986)
Associations: protohistoric Iron Age
Correlation: stratum 3a of AG-69

Context 26 (lower). sample AG-85(10), lab. no. Beta-15338.
2410 +/- 60 BP
ca. 428 cal BC (after Stuiver and Pearson 1986)
758-690*, 546-400 cal BC (ibid.)
Associations:protohistoric Iron Age
Correlation : stratum 3a of AG-69

Context 29 (middle), sample AG-85(11), lab. no. BM-2509.
2470 +/- 50 BP
ca. 758*, 692,571 cal BC (after Pearson and Stuiver 1986).
774-472*, 441-421 cal BC (ibid.)
Associations: protohistoric Iron AGe
Correlation : stratum 3a of AG-69

Context 33 (upper), sample AG-85(12); ploughed clayey top-soil with probable intrusions from overlying protohistoric contexts; lab. no. Beta - 15336.

2390 +/- 60 BP
ca. 407 cal BC (after Stuiver and Person 1986)
640-546 cal BC (ibid)
Associations: metal-working slag, horse. Basal context of the protohistoric Iron Age.
Correlation : stratum of AG-69, ADB-88(99), AMP-88(85), ASW-88(97)

Context 35 (upper), sample AG-85(13), lab. no. Beta-18435.

5040 +/- 80 BP
ca. 3900 cal BC (after de Jong et al. 1986)
Associations: Mesolithic geometric microliths, bone (n=1)
Correlation: stratum 1 of Ag-69 This context comprises the basal gravel member of the Reddish Brown Earth Formation which has hither to defied radiometric dating. The dat peak of the Atlantic altithermal in Scandinavia, the older Peron high sea level, a humid phase in Monsoon Africa and the Holocene rainfall maximum at ca. 4250 BC in Rajasthan (v. Fairbridge 1976; Deraniyagala ip, ipa).

Context 35 (upper), sample AG-85 (13), lab. no. BM-2510.

5040 +/- 50 BP
ca. 3900 cal BC (after de Jong et al. 1986)
Associations : Mesolithic
Correlation : stratum 1 of AG-69 (v.above)

The series of calibrated radiocarbon dates for AG-85 suggests the following periodisation:

I: Ca. 3900 BC, Mesolithic (for cultural data v. Deraniyagala 1972). The correlation between pluvial conditions at AG-85 during this period and the global altithermal peak confirms the hypothesis (id. ip) that many (if not most) Quaternary altithermals witnessed pluvial conditions in tropical South Asia. A considerable stratigraphic hiatus intervenes between this context and the ones that succeed it.

II. Ca. 800-500 BC, protohistoric Iron Age distinguished by the occurrence of wheel-made pottery, particularly Black and Red Ware, iron technology, paddy cultivation, the horse and domestic cattle.

III. CA. 500 BC, transition between the protohistoric Iron Age and the lower early historic period, as instanced in context 17. Rim type 8 in necked vessels and roof tile type 35a make their first appearance. This episode is inadequately defined and could have commenced as early as the 8th century BC, as per the evidence from the calibrated age range.

IV. Ca. 500-250 BC, lower early historic. This period is characterised by the disappearance of roof-tile type 35b and the predominance of type 35a. There is also a pronounced increase in rim tupe 8. The ceramics, in general, appear to display a higher technological standard than in the preceding Iron Age. Noteworthy is the occurrence of NBP, which suggests contact with the urban complex of the Gangetic valley.

V. Ca. 250 BC-100 AD, mid-early historic, with RIW as its index fossil. The present series of radiocarbon dates for AG-85 finally clinches the issue concerning the lower age boundary of RIW. It confirms the hypothesis (Deraniyagala 1972) that this ceramic category dates back to ca. 200 BC (at least). Early Brahmi of the Asokan type is in evidence inscribed on pottery and of particular significance is the occurrence of pottery of Hellenistic derivation (Bouzek and Deraniyagala 1985). The latter appears to stem from as early as the 3rd century BC in AG-85 (14).

Anuradhapura Gedige Shrine (AGP-87) is a stone building, of ashlar with carved guard-stones, which adjoins AGP-85. Charcoal was secured from the foundations of this structure for dating.

This context cannot be correlated with AG-69,85, but it appears (almost certainly) to post-date AG-69(6) of the upper early historic period.

Context AGP-87, lab. no. Beta-19624.
1630 +/- 70 BP
ca. 416 cal AD (after Stuiver and Pearson 1986)
332-448 cal AD (ibid.)
Associations: ashlar shrine with carced guard-stones, although the foundations from which the charcoal sample was excavated could conceivably antedate it.
Lower middle historic.

Anuradhapura Dingiri Bandage Watte (ADB-87/88) is located a few hundred metres south of AGP-87.
Context 54, lab. no. BEta-36612.
2080 +/- 60 BP
ca. 105 cal BC (ibid.)
187-35 cal BC (ibid.)

Associations: RIW and NBP. Mid-early historic.
Context 57, lab. no. Beta-36613.
2150 +/- 70 BP
ca. 192 cal BC (ibid.)
362-243*, 254-108 cal BC (ibid.)
Associations: lowermost horizon of RIW. Mid-early historic
Context 65, lab. no. Beta-36616.
2240 +/- 70 BP
ca. 370 cal BC (ibid.)
394-267 cal BC (ibid.)
Associations : rim type 8. lower early historic
Context 91, lab. no. Beta 36617.
2470 + 50 BP
ca. 756, 692, 544 cal BC (after Pearson and Stuiver 1986)
774-472*, 441-421 cal BC (ibid.)
Associations:one of the lowermost contexts of the protohistoric Iron Age.
Context 99, lab. no. Beta-36614.
2420 +/- 60 BP
ca. 484, 438,423 cal BC (after Stuiver and Pearson 1986)
760-683*, 657-637, 592-585, 553-402 cal BC (ibid.)
Associations: lowermost context of the protohistoric Iron Age. However, the context represents a ploughed topsoil with possible intrusions from upper horizons.
Correlations: AG-85(33), AMP-88(85) ASW-88 (97)

The series of calibrated radiocarbon dates for ABD-87/88 suggests the followint periodisation:

II. Ca. 800-5-- BC*, or ca. 550-400 BC, protohistoric Iron Age.
IV. Ca. 400-250 BC, lower early historic
V. Ca. 250-0 BC, mid-early historic

Anuradhapura Mahapali Hall (AMP-88) is located a couple of hundred metres to the south of ADB. It was excavated under the supervision of C. Raymond of the Ecole Francaise d'Extreme Orient, Paris, and A. de Mel, Head Excavator of the Archaeological Survey Department.

Context 44, lab. no. Beta-35710.
2090 +/- 70 BP
ca. 122 cal BC (ibid.)
230-102, 196-30* cal BC (ibid.)
Associations: rim type 8, buff ware heavy storage vessels with internal ?resin residue (probably imported). Mid early historic.
context 49, lab. no. Beta - 35711.
2060 +/- 60 BP
ca. 96 cal BC (ibid.)
169-1 cal BC (ibid.)
Associations: mid-early historic
Context 54, lab. no. Beta-35712
2320 +/- 60 BP
ca. 395 cal BC (ibid.)
405-378 cal BC (ibid.)
Associations: rim type 8. Lower early historic
Context 67, lab. no. Beta - 35713.
2660 +/- 100 BP
ca. 818 cal BC (after Pearson and Stuiver 1986)
910-790 cal BC (ibid.)

Associations: contextually within the lower early historic, but the cultural contents appear to be of the protohistoric Iron Age, suggesting a case of inverted stratigraphy or the actual age falling outside the radiocarbon age range (which is more likely)

Context 72, lab. no. Beta-35714.
2320 +/- 90 BP
ca. 395 cal BC (after Stuiver and Pearson 1986)
447-404*, 416-366 cal BC (ibid.)
Associations: medium-fine paste light grey low-lustre ware (n=?1). Lower early historic.

Context 75, lab. no Beta-34392
2350 +/- 110 BP
ca. 400 cal Bc (ibid.)
757-693, 538-370* cal Bc (ibid.)
Associations: first appearance of rim type 8 at AMP(n=3); potsherds inscribed with an early Brahmi script (n=8); otherwise assemblage thoroughly protohistoric. Noteworthy is the occurrence of a fine grey ware with low-lustre surface (n=1). Lowermost horizon of lower early historic.
Correlation:AG-85(17) at 768-404 cal BC and ASW-88(88) at 799-638 cal Bc, both of which witness the first appearance of rim type 8.

Context 75, lab. no. Beta-35715.
2560 +/- 70 BP
ca.793 cal Bc (after Pearson and Stuiver 1986)
807-763, 679-662, 627-579* cal BC (ibid.)
Associations: v. Beta-34392 above
Correlation : v. Beta-34392 above

Context 79, lab. no. Beta-35716.
2530 +/- 110 BP
ca. 778 cal BP (ibid).
813-473 cal BP (ibid)
Associations: one of the lowermost protohistoric Iron Age horizons.
Correlation: ASW.88(96), ASM-89(76)

Context 85, lab. no. Beta-35717
2690 +/- 90 BP
ca. 832 cal BC (ibid)
932-843, 920-802* cal BC (ibid)
Associations:top-soil incorporating basal horizon of protohistoric Iron Age.
Correlation : AG-85(33), ADH-88(99), ASW-88(97)

The series of calibrated radiocarbon dates for AMP-88 suggests the following periodisation:
II. Ca. 900 - less than 800 BC, protohistoric Iron Age
III. Ca. 600 - 400 BC, lower early historic
IV. Ca. 200-0 BC, mid-early historic.

Of the greatest significance for the periodisation of the sub-continent, is the discovery of writing in Brahmi script on 5 sherds (belonging to 5 different pots) in context 75.(fig.3) The associated cultural assemblage indicates unequivocally that it is transitional from the protohistoric to the early historic period, and hence assignable to the basal early historic. This implies that the context is pre-Asokan and that the antiquity of the radiocarbon dates for AMP-88(75) cannot be rejected simply because of the discovery of Brahmi within it. Hence, it is opportune to evaluate the calibrated radiocarbon dating of context 75 in some detail, on a comparative basis.

AMP-88(75) has two dates: Beta -34392 at 757-693 or 538-370 BC; and Beta-35715 at 807-763,679-662 or 627-579 BC. How do these dates compare with others associated with similar cultural assemblages, although only AMP-88(75) has, so far, yielded evidence of Brahmi in association? The first criterion is the initial appearance of rim type 8, which at AMP-88 occurs in context 75, at AG-85 in 17 and at ASW-88 in 88. AG-85(17) has an age range of 768-404 BC, and ASW-88(88) of 799-638 BC. The second criterion is that the final occurrence of roof-tile type 35b, which characterises AMP-88(75), has been isolated in AG-85 and assigned to context 17. The third is the occurrence of a rare fine grey ware in AMP-88(75) and in ASW-88(89), dated in the latter instance to 818-754 or 700-540 BC. Hence there is general correlation between AMP-88(75) on the one hand and AG-85(17), ASW-88(88) and ASW-88(89) on the other. These correlations suggest that AMP-88(75) has a valid age range within the 7th and 6th centuries BC, with a possiblility of the earlier ranges of 807-763 and 679-662 BC being applicable. Considering that the present writer has postulated the existence of writing as early as 1000-600 BC in India, as per the indirect evidence from bone 'styli' fro contexts such as the Painted Grey Ware levels at Hastinapura and at the pre-NBP ones Ujjain and other sites (Deraniyagala 1972), it is entirely feasible that the earlier time range of around the 8th century BC is indeed aplicably to AMP-88(75). However, I have deemed it appropriate to favour the more recent range, pending the accumulation of further data pertaining to this subject.

It could, of course, be objected that there is a likelihood of the inscribed sherds being intrusive into context 75, through for instance pitting. While a few pits do indeed cut through 75,(fig.1) these were carefully dealt with by the excavators Raymond and de Mel so as to avoid contamination. An examination of the total assemblage of artefacts from 75 has not yielded any indication of stratigraphic admixture, there being not a vestige of mid-early historic artefacts such as roof-tile type 35a or RIW. What is most telling is that the statistical probability of finding 5 sherds inscribed with early Brahmi in a single meso-stratigraphic unit the size of context 75 is exceedingly small: based on the total sample of less than a dozen specimens secured from all of the mid-early historic contexts excavated in the citadel so far, this probability has been estimated at less than 1 per cent. It is highly unlikely that five such specimens derived from five different vessels be found in such close association unless there was a functional relationship between these artefacts and their matrix; and the latter appeared homogeneous enough so as to preclude the possibility of the sherds intruding en bloc from an overlying context.

Anuradhapura Salgaha Watte (ASW-87/88) is located ca. 300m to the we of AMP-88 at what appears to be the centre of the citadel mound on he main east-west axis. The radiocarbon dates are as follow (coins identified by A. Siriwardhana of the Archaeological Survey Department).

Context 49,lab. no. Beta-36621.
1850 +/- 60 BP
ca. 135 cal AD (after Stuiver and Pearson 1986)
82-234 cal AD (ibid.)
Associations: a pale blue-green 'Sassanian' glazed ware of West Asian origin. It is noteworthy that this ware has been found at another as yet

undated sondage in association with glazed roof-tile type 35a(i) and the present date of the 2nd century AD may be assigned to the latter in this context. The occurrence of such glazed roof-tiles at the Jetavanaramaya monastic site in a horizon dated by a Roman coin to the mid 4th century AD (Ratnayake 1984) confirms the upper early historic status of 'Sassanian' war and glazed tiles, and there is some suggestion of a genetic link between these two categories of glazed artefacts. Two Lakshmi plaques a 'tree and swastika coin and BRW were also found in context 49 , as were two Roman coins in 40 (overlying 49).A Lakshmi plaque and 'tree and swastika' coin were found in 53, directly underlying 49. Note also that a Lakshmi plaque and a few sherds of BRW were also found in the mid-4th century Ad context at Jetavanaramaya and , should it be possible to be certain that these are not derived frome arlier strata, it would establish the upper age boundaries of both of them at the 4th century AD. Upper early historic.

Context 58, lab. no. Beta-33275.
2080 +/- 70 BP
ca. 105 cal BC (after Stuiver and Pearson 1986).
192-18 cal BC (ibid)
Associations: A late occurrence of RLW in this sequence, although this need not be considered to represent the terminal age of this ceramic in the citadel. A Lakshmi plaque and 'tree and swastika' coin were found in 58, as was a unique circular copper coin with a walking bull on the obverse and two fish on the reverse. A square 'elephant and fish' 'Pandyan' coin occurred in context 56 overlying 58 and antedating 53. Mid-early historic.

Context 62, lab. no. Beta-36622.
2100 +/- 70 BP
ca. 151*, 149, 117 cal BC (ibid.)
200-42 cal BC (ibid.)
Associations:a Lakshmi plaque was found in this context and in 59 which overlies it. Four Roman coins are attributed to contexts 60, 52 and 59 which succeed 62 and precede 58. Two large 'elephant and swastika' coins were found in 52 and 59, thus corroborating Codrington's 1924 hypothesis that these coins are datable to the 2nd century Bc, the proposed age range in contexts 52 and 59 being 150-100 BC. It is also noteworthy that stratigraphica the 'tree and swastika' types succeed the 'elephant and swastika', as proposed by Codrington (i Mid-early historic.

Context 64, lab. no. Beta-36623.
2210 +/- 70 BP
ca. 358, 294, 247* cal BC (after Stuiver and Pearson 1986)
387-184 cal BC (ibid.)
Associatins:RIW; noteworthy lack of Roman coins. Mid early historic.

Context 78, lab. no. Beta-36624.
2250 +/- 60 BP
ca. 375 ca; BC (ibid.)
394-346*. 316-219 ca; BC (ibid.)

Associations:Two sherds of RlW, which may be considered intrusive
if the earlier age range of 394-316 is favoured.
On the other hand there is some suspicion that the
BIW fabric (ie, without the concomitant of
rouletting) is earlier in its inception than the
estimated ca. 250 BC postulated by the present writer
so far. There is a possibility of its
being contemporaneous with both the middle and copper
age ranges of NBP (the latter having been established
at Sisupalgah in India). Should it be confirmed that
RIW does indeed extend back into the fourth and fifth
centuries BC, evolving perhaps out of the fire grey
wear found in AMP-88(75) and ASW-88(89)
it would become necessary to consider
the subject of contacts with West Asia during the lower
early historic period in a new light - which could in
turn tie in with the appearance of writing in
Brahmi in pre-Asokan times (v. AMP-88 above). Lower
early historic mid early historic ition.

Correlations:AG-85 context 15 (AG-69 stratum 3b).Note the occurrence
o one sherd of RIW in association with NBP at AG-85(15)
and of Helleristic pottery in Ag-85(14) which directly
overlies(15). The radiocarbon ages of ASW-88(78) and
AG-85(15) are in close agreement.

Context 79, lab. no. Beta-33276.
2430 +/- 70 BP
ca. 504 cal BC (ibid.)
765-472 cal BC (ibid.)
Associations:one sherd of RIW, possibly intrusive but it would
be worth bearing in mind the discussion with regard
to the occurrence of this ceramic in ASW-88(78) and
of a 'proto RIW' in AMP-88(75) and ASW-88(89).
Lower early historic.

Context 88, lab. no. Beta-33277.
2520 +/- 70 BP
ca. 770 cal BC (after Pearson and Stuiver 1986)
799-637 ca; Bc (ibid.)
Associations:the first appearance of rim type 8 in the ASW-88 sequen
Basal lower early historic.
Correlation : AG-85(17), AMP-88(75)

Context 89, lab. no. Beta-33278
2560 +/- 100 BP
ca. 793 cal BC (ibid.)
818-754. 700-540* cal BC (ibid.)
Associations: a medium-fine grey ware with low lustre (n=1)
Final protohistoric Iron Age.

Context 96, lab. no. Beta-33279.
2690 +/- 60 BP
ca. 833 cal BC (ibid.)
906-807 cal BC (ibid.)
Associations: lowermost protohistoric Iron Age habitation
Context in ASW-88 sequence.
Correlation: ASM-89(76) AMP-88 (79)

Context 97 lab. no. Beta-33280
2640 +/- 60 BP
ca. 809 cal BC (ibid.)
839-797 cal BC (ibid.)

Associations: top-soil with protohistoric Iron Age artefact assemblage.
Correlation : AG-85(33), ADB-88(99), AMP-88(85)

The series of calibrated radicarbon dates for ASW-88 suggests the follwing periodisation :

II. Ca. 900-750 BC, protohistoric Iron Age
III.Ca. 750-500 BC, protohistoric lower early historic transition
IV. Ca. 500-250 BC, lower early historic
V. Ca. 250-0 BC, mid-early historic
VI. Ca. 100-250 AD, upper early historic

ASW-87/88 was selected for excavation on account of its being located at the centre of the citadel mound where the archaeological deposits are likely to be the thickest, thus representing a more complete sequence than on the periphery of the site.
It appears as if this surmise was

correct: it has yielded dates from undisturbed contexts spanning a wider time span than at the other sites. Besides, it has been particularly rich in coins and has provided hints that the transition between the lower and middle phases of the early historic period might have occurred a couple of centuries earlier than hitherto estimated. Similarly, it has corroborated the evidence from AMP-88 that the transition between the proto-and lower early historic pahses was also much earlier than has been taken for granted up to now. We now have evidence of a fine grey ware coming in around the 7th century BC (corroborated by AMP-88), which probably evolves into RIW in the 5-4th centuries BC. This evidence, one cannot gainsay, is slender, but it does open up intriguing possibilities ... deserve to be followed up-to a disappointing or thrilling ...usion. The British sub-project in the citadel of Anuradhapura, under ...ponsorship of the British Academy (Society for South Asian Studies) ...ing just that. R. Coningham of Cambridge University (in ...abora...on with the Archaeological Surevey Department and the ...men... of Archaeology, University of Peradeniya) currently ...ating an area of 100m2 about ASW-88 and within an year it should be po... to comrlete the testing of these initial hypotheses.
A... ...dhapu...a Sanghamitta Mawatha (ASM-89) is located about 300 m... ...the south of ASW-88 on the main north-south spine of the citade...

Con...t 76, lab. no. Beeta-36620.
2610 +/- 80 BP
ca. 803 cal BC (ibid.)
834-778 cal BC (ibid.)
Association: one of the basal habitations deposits of the protohistoric Iron Age. Slag from metal-working.
Correlation: AMP-88(79), ASW-88(96)

The above calibrated radiocarbon date may be considered to represent the following period.
II. Ca. 850-800 BC. protohistoric Iron Age.

The number of radiocarbon dates secured for the citadel of Anuradhapura area: 19 for AG-85; 1 for AGP-87; 5 for ADB 87/88; 9 for AMP-88; 10 for ASW-88; and 1 for ASM-89. Thus, a total of 45 dates on charcoal from sealed habitation contexts. Most of the assas have been conducted at Beta Analytic, a commercial laboratory of considerable repute .

internatinally. These, when compared with the results from the radiocarbon laboratory at the British Museum, may be pronounced reliable, there being excellent agreement between the two sets. When calibrated, using the tables published in Radiocarbon 28(2B) of 1986, the following periodisation crystallizes for the Mesolithic,protohistoric and early historic episodes in the citadel of Anuradhapura:

1.Mesolithic (2 radiocarbon dates): ca. 3900 BC, in sediments representing a pluvial correlating with the peak of the Holecene altithermal on a global scale.(AG-85).

II. Protohistoric Iron Age (17 radiocarbon dates): ca. 900-600 BC (ASW-88, AMP-88, ASM-89).

III. Transition from protohistoric to lower early historic, which may be referred to as the basal early historic (4 radiocarbon dates): ca. 600-500 BC, possibly with an earlier commencement. (AG-85, AMP-88, ASW-88).

IV. Lower early historic (8 radiocarbon dates): ca. 500-250 BC (AG-85, ADB-87/88, AMP-88, ASW-88)

V. Mid-early historic (16 radiocarbon dates): ca. 250BC-100AD (AG-85, ADB-87/88,AMP-88, AS-88).

VI. Upper early historic (radiocarbon date) ca. 100-250 AD(ASW-88)

VII. Middle historic: ca. 400 AD (AGP-87)

The protohistoric isosochrons of the citadel seem to indicate that the area encompassed by ASW-88, AMP-88 and ASM -89 had basal settlement at ca. 900-800 BC. The sondage at AGW-87 has a radiocarbon date of 2590 +/- 80 BP, 799 cal BC, 824-768 cal BC (Beta-36618), which has not been included in the present listing since the context (32) displayed signs of disturbance, but which suggest that the early protohistoric settlement extended towards the southern extremity of the citadel as well. ASW-88, AMP-88 and ASM-89 are dothd over an area of ca. 10 hectares, and up to 15ha if AGN-87 is included. This defines the mininum extent of the early component which might well have extended into the south-western sector. It was hypothesised that since the structure identified as the last palace of Anuradhapura (ascribed to Bijayabahu of the late 11th century AD) occurs in this Sector, there would have been a tradition of early elite habitation in this area which in turn could suggest that the first settlement in the citadel was located here; Hence two sondages AWP-86 and AMG-87 were excavated beside the palace. The resultant evidence was tellingly negative: both loci were occupied by robber pits which extended down to bed-rock and which did not leave a trace of undisturbed habitation strata in the ca. 10m thickness of cultural deposits that occur as robber-residue. There must habe been material of great value to whoever dug those pits, possibly long stone pillars which required large excavations prior to their being lifted. If the latter was the case, as seems likely, the south-western sector would have had monumental architecture close to bed-rock during - mid early historic or middle historic times, since such structures (to the best of our knowledge) were non-existent in lower early historic or protohistoric times. This

would suggest that the earliest settlement did not extend into the south-western sector, On the other hand, ASW-89 is within a couple of hundred metres from the Vijayabahu Palace and one wonders whether the reasoning set down above is on the right track. As for the north-eastern sector, the radiocarbon dates for ADB-87/88 and AG-85 suggest that the earliest components
were established at ca. 750-600 BC, thus postdating
the central sector by about a century. The sondages being excavated currently in the north-western (A1BW-89, A2BW-89) and northern (ARW) secyors should add to the extant knowledge concerning the extents of the protohistoric settlement phases; but there is sufficient evidence to support the hypothesis that by ca. 700 BC an area of over 50ha was being occupied, which should qualify its being designated a town. It is postulated that growth in settlement size did not progress at an even rate and that it was punctuated by acceleration at the interfaces between (a) protohistoric and lower early historic; (b) lower early and mid-early historic; (c) mid-early and upper early historic; (d) upper early historic and middle historic, reflecting progressive expansion and intensification of contact with the Indian sub-continent at (a), possible as far afield as West Asia at (b), intensified contact with west Asia at (c) and further intensification with India and beyond afield at (d). However, it is also postulated that these increments were no spectacular until perhaps the mid-middle historic phase which witnessed a great increase in trade contacts between West Asia and China with Sri Lanka as an entrepot. This latter event appears to be reflected in the island's archaeological record in what shows up as a considerable prolifieration of sites in the Dry Zone during the 7th to 9th centuries AD.
As for the citadel of Anuradhapura, it does not seem as if it expanded significantly in size after point (d); rather it would appear likely that a hiving-off process of establishing new settlements or of increasing the size of existing settlements was set in motion to fit an enhanced carrying capacity resulting from the in-flowing wealth accompanying the East-West trade.

Kandarodai (KTD70) is the site of a large (?ca. 25ha) mound on the Jaffna peninsula, about 3km to the west of Chunakkam. It was first investigated by P.E. Pieris (1922; 1925; 1925a) who excavated several Buddhist antiquities at this location. Pieris' results indicated that this site constitutes one of the four most important early historic settlements in Sri Lanka which prompted V. Begley and B. Bronson of the University of Pennsylvania to send down three sondages designated A (25m2), B (4m2) and X (4m2) in 1970 (report pending). Of these Ba and X were excavated down to bed-rock while A, due to its extensiveness could not be completed. A series of radiocarbon dates have been secured on charcoal from the University of Pennsylvania radiocarbon laboratory (P) and these are set our below with a tentative periodisation (Bronson 1977:pers. comm., id in Deraiyagala ip):

Context Trench A (Stratum IV,), lab. no. P-2521.
2020 +/- 50 BP
ca. 36 cal BC (after Stuiver and Pearson 1986)
101 cal BC - 22 cal AD (ibid.)
Associations: RIW, KTD-70 III, mid-early historic.
Correlation: AG-69(4b).
Context A (IV/V transition), lab. no. P-2518.
2290 +/- 50 BP

ca. 390 cal BC (ibid.)
399-370 cal BC (ibid.)
Associations: KTD-70 II/II transition, lower early historic/ mid-early historic transition.
Correlation: AG-69 uppermost (3b), AG-85(15)

Context A (V), lab. no. P-2520.
2180 +/- 60 BP
ca.,339, 323, 203 cal BC (ibid.)
371-167 cal BC (ibid.)
Associations:KTD-70 upper II, lower early historic
Correlation: upper levels of AG-69(3b)

Context B(V), lab. no. P-2514.
2250 +/- 60 BP
ca. 375 cal BC (ibid.)
392-351*, 306-232 cal BC (ibid.)
Associations: KTD-70 upper II, lower early historica
Correlation: upper levels of AG-69(3b)

Context X(III), lab. no. P-2529.
2350 +/- 200 BP
ca. 401 cal BC (ibid.)
790-195 cal BC (ibid.)
Associations: KTD-70 (upper II), lower early historic
Correlation: upper levels of AG-69(3b)

Contest A(VI), lab. no. P-2524.
2340 +/- 50 BP
ca. 399 cal BC (ibid.)
407-390 cal BC (ibid.)
Associations: KTD-70 middle and lower levels of II, Lower early historic.
Correlation: middle levels of AG-69(3b)

Context B(VI), lab. no. P-2515.
2990 +/- 60 BP
ca. 1261 cal BC (after Pearson and Stuiver 1986)
1376-1345, 1318-1133 cal BC (ibid.)
Assocations: KTD-70 (middle and lower levels of II), lower early historic.
Correlation: middle levels of AG-69(3b)

The age is far too early with regard to context and one suspects that it refers to a hitherto unidentified proto-historic component at KTD-70 or, more likely, that it reflects sampling or dating error.

Context B(VI), lab. no. P-2516.
2070 +/- 60 BP
ca. 101 cal BC (after Stuiver and Pearson 1986)
178-18 cal BC (ibid.)
Associations:KTD-70 middle and lower levels of II, lower early historic.
Correlations:middle levels of AG-69(3b), in terms of stratigraphy as reported; but note that date is too recent.

Context B(VII), lab. no. P-2522.
2110 +/- 60 BP
ca. 160 cal BC (ibid.)
200-73 cal BC (ibid.)
Associations: KTD-70 middle and lower levels of II, lower early historic.Correlations: middle levels of AG-69(3b).
As with P-2516, the age is too recent.

Context B(VIII), lab. no. P-2523.
2060 +/- 50 BP

ca. 96 cal BC (ibid.)
161-75 cal BC (ibid.)
Associations: KTD-70 middle and lowere levels of II, lower early historic.
Correlation: middle levels of AG-69(3b).
As with P-2516, -2522, the age is too recent.

Context B(VIII), lab. no. p-2525.
2730 +/- 220 BP
ca. 897 cal BC (after Pearson and Stuiver 1986)
over 1140 - less than 780 cal BC (ibid.)
Associations: KTD-70 middle and lower levels of II, lower early historic.
Correlation : middle levels of AG-69(3b)
The age is somewhat too early for this context and should be viewed with reservations.

Context B (IX) lab. no. P-2519
2290 +/- 60 BP
ca. 390 cal BC (after Stuiver and Pearson 1986)
401-366 cal BC (ibid.)
Associations: KTD-70 I, lower early historic
Correlation: lower levels of AG - 69(3b)

Context B(X) , lab. no. P-2526.
2090 +/- 50 BP
ca. 111 cal BC (ibid)
185-57 cal BC (ibid.)
Associations : ITD -7C I, lower early historic
Correlation: lower levels of AG-69(3b)
The date is too recent for KTD I

Context X (IV/V), lab. no. P-2517
2250 +/- 50 BP
ca. 375 cal BC (ibid.)
392-351*, 306-232 cal BC (ibid.)
Associations: KTD -70 I, lower early historic
Correlation: lower levels of AG-69(3b)

Context B(XI), lab. no. P-2528
2370 +/- 60 BP
ca. 404 cal BC (ibid.)
475-394 cal BC (ibid.)
Associations: KTD -70 I, lower early historic
Correlation: lower levels of AG-69(3b)
The series of calibrated radiocarbon dates for KTD -70 suggests the following periodisation:

I. Ca. 500-400 BC, lower levels of lower early historic at this site.
II. Ca. 400 BC. Only P-2524 appears to be reliable, P-2515 and -2525 being too early which, considering the overall range of dates from bed-rock upwards in B and X, almost certainly reflects sampling or laboratory error. On the other hand, P-2516, - 2522 and - 2523 constitute a consistent sub series which seem to refer to a mid-early historic context, thereby suggesting sampling error. Middle levels of lower early historic.
III. Ca. 400-250 BC, upper levels of lower early historic, Correlating with AG-85(15)
IV. Ca. 100-0 BC, mid-early historic, correlating with Ag-69(4a). Bronson affirms that this macro-context displayed signs of admixture with middle historic cultural traits. Noteworthy is the discovery of a fragment of RIW with a Prakrit inscription from this period (reg. no.271, Bronson in Deraniyagala ipb).

The above periodisation, based on Bronson's communication (1977), appears
to be scarcely tenable. In many instances the context sequence does not fit the radiocarbon date series. What does emerge, however, is that a protohistoric Iron Age component is lacking in the sample. The naomalously early dates can almost certainly be attributed to faulty sampling or laboratory error since they are so very out of context. The earliest cultural horizons, both in B and X which were excavated down to bed-rock, comprises lower early historic traits and would thus correlate with AG-69(3b) and Ag-85 period IV: it is this period which is sub-divided above into KTD-70 periods I-III. KTD-70 IV, although apparently not isolated adquately, correlates with AG-85 period V. Of course, it is possible that a protohistoric component does exist at Kanderodai but this has yet to be located.

matota (Mantai: MA-84), located some 6km southeast of Mannar, has been chronicled as Sri Lanka's main port from at least as early as the mid-early historic period. Excavations conducted in 1984 by J. Carswell of the Oriental Institute, University of Chicago, have yielded the following radiocarbon dates on charcoal from two of the trenches, G and H (for related site data v. Carswell and Prickett 1984).
Both locations were not excavated down to the basal cultural horizons: but excavations conducted in 1982 revealed sterile sands overlain by mid-early historic contexts characterised by RIW, there being no evidence of a protohistoric component.

Context G 150, lab. no BM - 2588
    1690 +/- 50 BP
    ca. 362 cal AD (after Stuiver and Pearson 1986)
    256-322*, 323-410 cal Ad (ibid.)
Context G 260 , lab. no. BM-2587
    1700 +/- 50 BP
    ca. 343 AD (ibid.)
    252-355 cal AD (ibid.)
Context H 59 post 2, lab. no. BM-2589
    1810 +/- 50 BP
    ca. 221 cal AD (ibid.)
    128-250 cal AD (ibid.)

The cultural associations of these three contexts have yet to be evaluated (Carswell and A. Graham under prep.).
BM-2588 is from the middle
levels of G, BM-2587 from the lower levels and BM-2589 from lower H (M.E. Prickett 1989: pers. comm.). It is likely that the two latter are from upper early historic layers characterised by the final occurrence of at this site. It is significant that, as stated
above with regard to settlement processes and Anuradhapura, Matota provides unequivocal evidence of the massive expansion of settlement area during the middle historic period, coevally with the rise of large-scale East-West trade with Sri Lanka as an entrepot.

Maduru-oya Reservoir dam revealed two horizons of charcoal incorporated within it at the site of the ancient sluice. The lower of these at ca. 3m below the surface has been assayed and the result is as follows:

Context, ca. 3m -gl, lab. no. PRL - 828.
    1420 +/- 140 BP

ca. 637 cal AD (after Stuiver and Pearson 1986)
725-490 cal Ad (ibid.)
Association: dam of reservoir, lower middle historic Samanala-Wewa reservoir on the 2nd peneplain beyond Belihul-oya is about to inundate a large area of archaeological by uncharted territory. Hence, at the suggestion of G. Juleff of the Institute of Archaeology, London University, the construction engineers, Balfour Beatty & Co., sponsored a survey of the area in collaboration with the Archaeological Department of Sri Lanka. The results of this project are set down by Juleff in another paper in the present volume and it suffices to briefly list the radiocarbon dating results on samples of charcoal secured from several metal-working sites into he survey area:

SM 11-3-2 sample 1, lab. no. BEta-31775.
1310 +/- 60 BP
ca. 677 cal AD (ibid.)
657-772 cal Ad (ibif.)
Associations metal working site, mid-middle historic

SM 11-3-2 sample 2, lab. no. Beta - 33289
1010 +/- 50 BP
ca. 1015 cal AD (ibid.)
985 - 1032 cal AD (ibid.)
Association matal working site, upper middle historic

SM-11-3.-2 sample 3, lab. no. Beta 31776.
1150 +/- 50 BP
ca. 889 cal Ad (ibid.)
820 -949 cal Ad (ibid)
Associatins: metal working site, mid-middle historic

SM 11-2-2 sample 4, lab. no. Beta 33288
960 +/- 50 BP
ca. 1030 cal Ad (ibid.)
1015-1104 cal Ad (ibid.)
Associations : metal - working site, upper middle historic

SM 11-14-5 sample 5, lab. no Beta - 33290
1570 +/- 80 BP
ca. 452 cal AD (ibid)
404-579 cal Ad (ibid)
Associations : habitation site, lower middle historic

SM 11-30-1 sample 6, lab. no. Beta - 31777
210 +/- 50 BP
ca. 1663 cal AD. possibly up to 20th century (ibid.)
Associations: steel-making site, modern historic

SM 11-12-2 sample 7, lab. no Beta -31778
1060 +/- 50 BP
ca. 985 cal AD (ibid.)
929-1016 cal AD
Associations: metal-working sit,e upper middle historic

The above dates indicate that settlements had been established in lower middle historic times and that by the mid-middle historic period metallurgical activity was pronounced in this area. It is as yet not possible to affirm whether there was a continuum in metal-working up to modern historic times.

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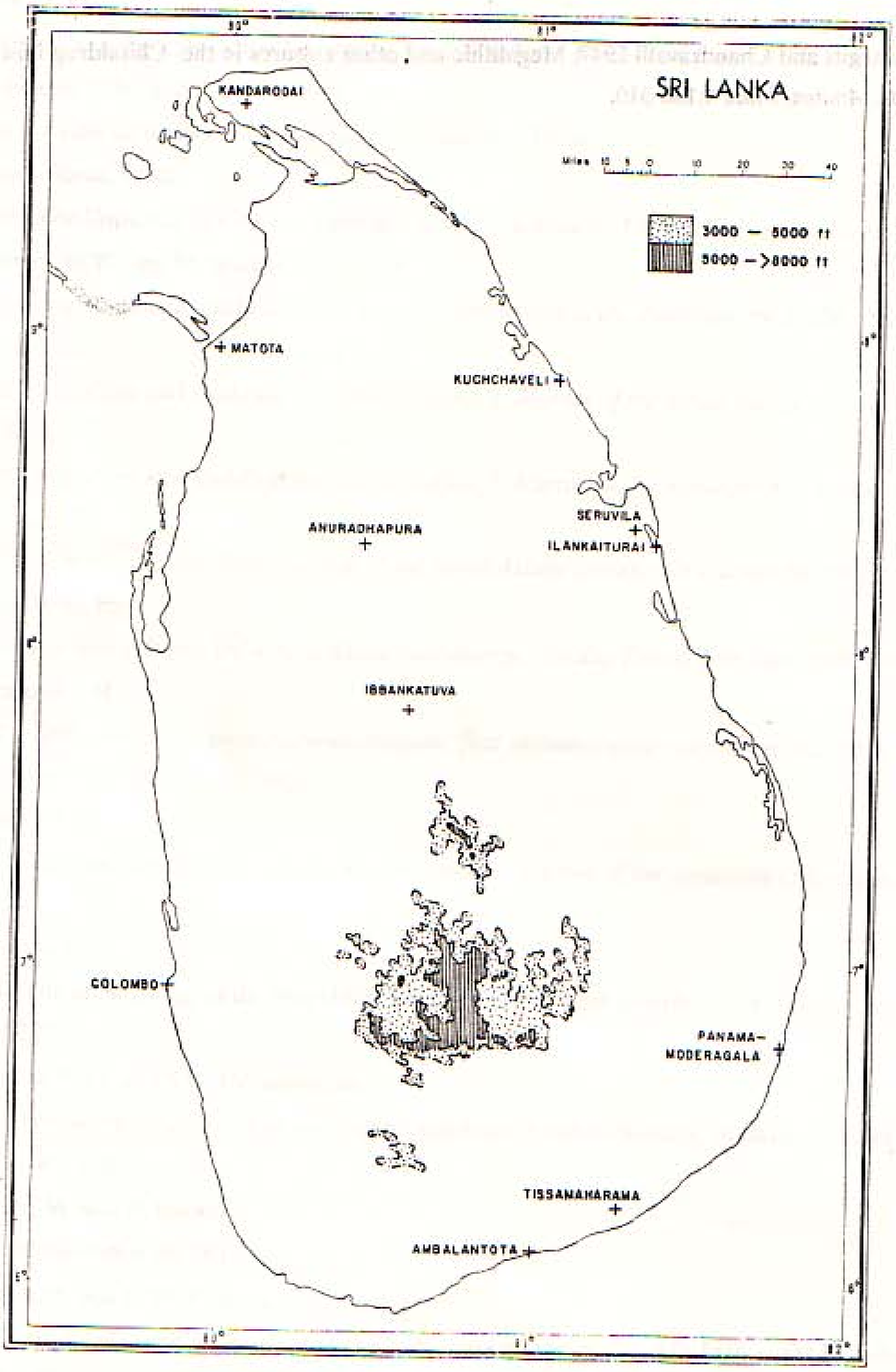
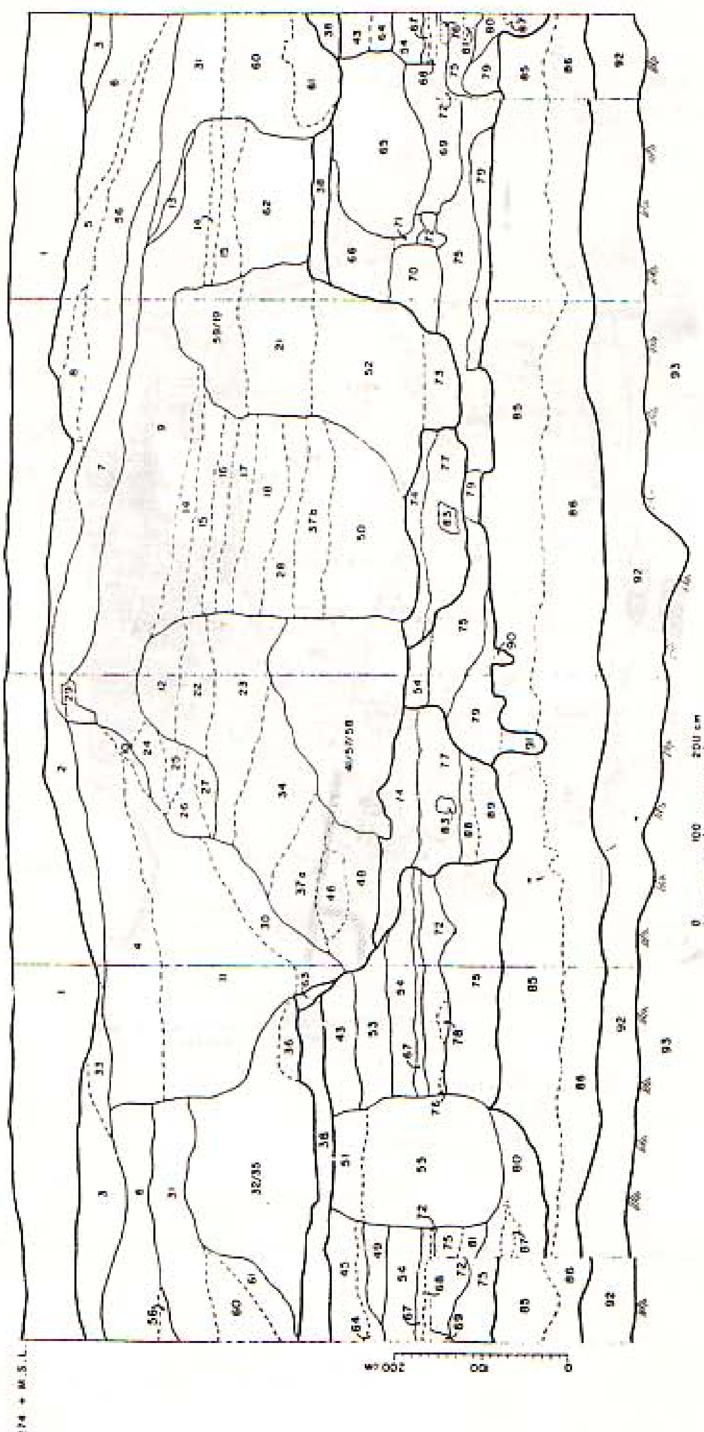


Map 1. Proto and early historic habitation sites in Sri Lanka.

Map 2.The Citadel of Anuradhapura -
location of Sondages.


NORTH
EAST
SOUTH
WEST
BI 274 + M.S.L.
200 cm
100
0

A.M.P

Fig.1 Contexts Ecavated at AMP-88

Fig.2 Context Matrix of AMP-88

Fig.3 Early Brahmi inscriptions on pottery from AMP-88(75)

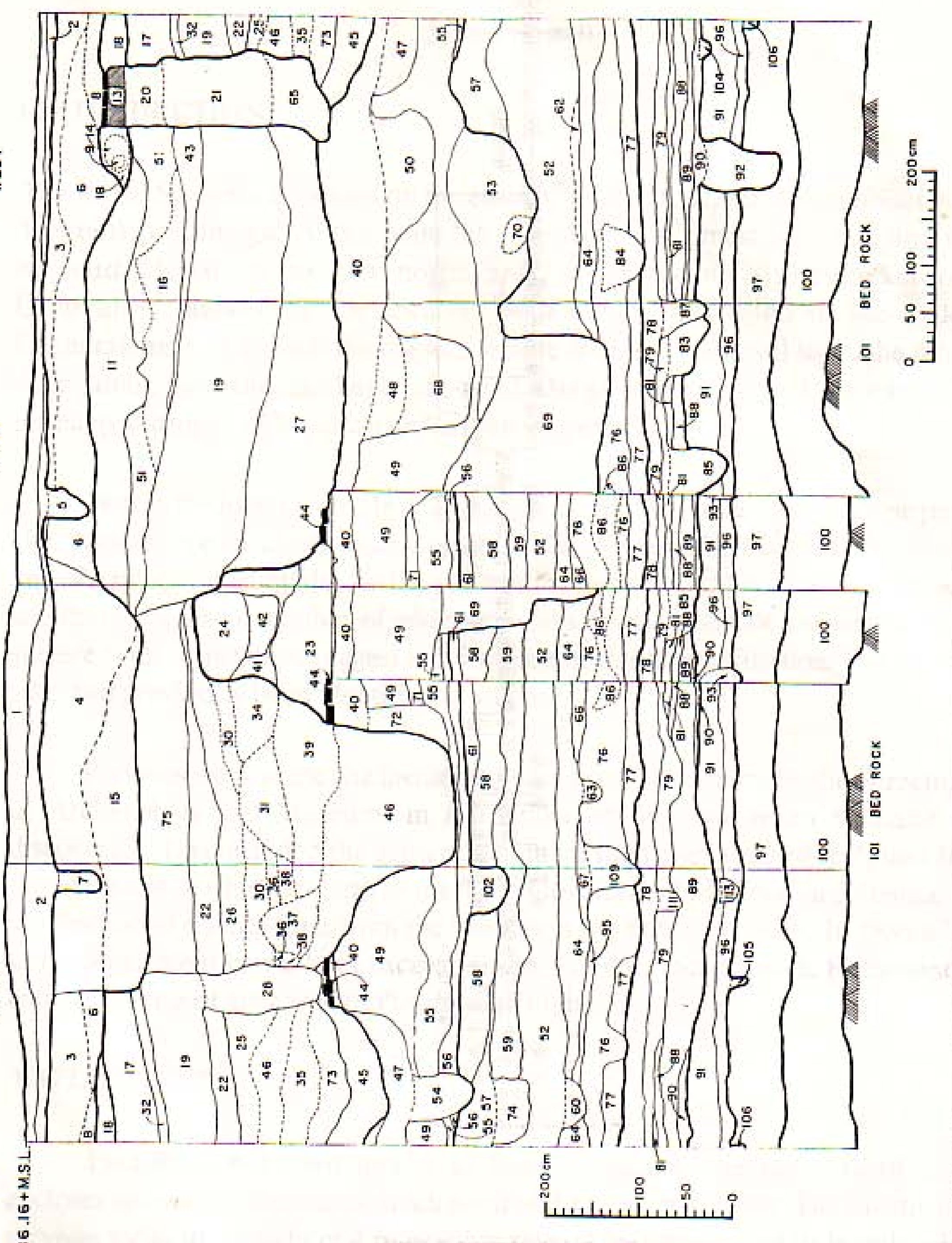


Fig.4 Contexts excavated at ADM-II

ASW

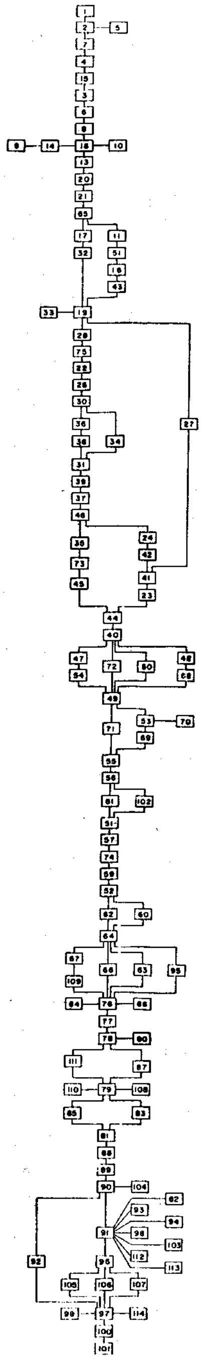


Fig.5 Context matrix of ASW-88

Fig.4 Contexts excavated at ASW-88

SOME CONCLUSIONS ON THE SIGNIFICANCE OF SANNATHI, AS A RESULT OF EXCAVATIONS AT THE SECOND STUPA

By
James Howell

1.INTRODUCTION

The site of Sannathi is located on the eastern bank of the river Bhima about 60 km due south of gulbarga. At this point the river makes an almost complete turn from its southerly course to flow northwards, an auspicious situation known as Uttarvahini marked by the location of a temple dedicated to the goddess Chandralamba. Although the present temple is of late medieval style, the plinths, door-jambs, and the mitilated life-sized Durga image, suggest an early date, probably during the Cahlukian or Rastrakuta period.

Within the loop created by the river lie the remains of an early historic period city. Today there are clearly visible on the surface the remains of a brick fortification and of a raised inner citadel, on the point of the bend. In addition to this habitation site there are also a number of additional sites, located outside the city walls, the surface finds from which suggest that they are of Buddhist affiliation. Two of these sites had previously been identified as stupas.

Previous work at the site including a survey of the remains by the Directorate of Archaeology and Museums in Karnataka, at the time when Sannathi was discovered. This included the gathering of more than one hundred sculptues from the site, most of which are now in the State Government Museum in gulbarga, and a collection of surface finds from the habitation site now in Mysore. In 1986/87 the same department carried out excavations in the inner citadel area, Ranamandala and a brief report appeared in Puratatva, Volume 17.

EXPLORATION

Fortification known locally as Seturajanakatte, the outer fortification encloses an area of 60 hectares, at teh point of the bend in the river. The fortification survives today to a height of 4 m, and has several breeches along its length, whcih may corespond to the ancient gateways. In places where it has been cut into, it can be seen to be constructed of large bricks usually associated with the Satavahanas.

The outer city - No structures can be made out on the surface of the outer city though there is clear evidence of habitation from the amounts of artefactual material spread right across the area.

The inner Citadel *(Ranamandala)* - The elevated area known as Ranamandala, covering 25 hectares the inner citadel of the city, and shows the highest density of surface finds including lead die struck coins of Satavahana kings bearing the legends Ramno Siri Satakanisa, Rano Siri Satavahana and Mahara Siri Satavahana. Terracotta figurines, beads, bangle fragments and a vast array of pottery have been found.

Stupa No. 1 and associated monastic complex - Although the Satavahana kings were Hindus, they were tolerant of Buddhists. The King Satakarni is mentioned on an inscription on the Southern Gateway of the Great Stupa at Sanchi, as a patron of the artisans who carried out the work.

The remains of the first stupa identified at Sannathi lie close to the river bank approximately 1.5 km downstream from the city site. The circular foundation of the stupa, which is all that survives today, indicates that the structure had a solid dome faced in ashlar blocks, and an overall diameter of approximately 25 m. It was surrounded by an elevated pradaskins patha, the paving of which still survives in places. Several undecorated pillars are standing in the field, just to the south of the stupa. Though many of the pillars have gone they appear to be in four lines, each of four pillars, probably representing the remains of a sixteen pillared mandapa, a part of a monastic establishment associated with the stupa. In a small Durga shrine, located beside the remains of the stupa, is a sculpted panel very typical of the type most common at Sannathi.

Many of the sculpted relief panels, which are now in the State Government Museum in Gulbarga, were recovered from this site.

Stupa No. 2 Excavation site. this mound thought to be a second stupa, is where the

Society, in association with the Archaeological Survey of Inaia, has been carried out three seasons of excavation, between 1986 and 1989.

Stupa No. 3 - This mound, not quite as large as stupa No. 2, lies 3.5 km north east of the city. The are no sculptures, or other indications, on the surface but its similarity to stupa No.2 suggests that thsi must also be a stupa mound.

Tile manufacture site - Located right on the river bank close to stupa No.1, is a site which may represent a tile production area. there is a large built-up platform upon which there is evidence of neatly arranged stacks of tiles, similar to those found in the excavation. In mahy cases these tiles have become fused together, and are often heavily oxidised. They might therefore be the tiles that were fired at the edges of a kiln and therefore have been discarded. If the excavation of this site produced the remains of a tile kiln it would render valuable information about the technology and development of this industry.

Bathing ghat - On the other side od the river, opposite the bottom end of Ranamandala is a bathing ghat, which does not relate to any modern settlement, but also has no dateable features.

Monastic complex (Benagutti) - On the river bank upstream from the city is another group of buildings on a low mound known as Benagutti, this literally means "mound of stones", though it seems more likely that the name derives from Benakappagutti, relating to the Chalukyan period figure of Lord Ganesha in black granite located in the field close by. The brick structures of this cimplex have recently been exposed by local people in order to dismantle them for building material. To date most of the damage has been the removal of the fallen bricks around and within the structures rather than the walls themselves, which can now be seen standing to a height of 0.8 m in places. The structures are small cell like rooms, often with interconnecting doorways.

Area around the Chandralamba Temple - Most of the fragment of sculpture found during the explorations came from the area immediatelty around the temple. In most cases it is clear that they were not found in situ, but have been gathered from the locality in form to build terrace walls to stabilise the platform upon which the temple sites. However there is evidence of ancient structures at the site on the far side of the rain gully between the temple and the PWD inspection bumgalow. Exposed on the surface is the top of a brick wall, once again constructed of Satavahana bricks.

In the course of the 1988/89 excavation season extensive repairs and rennovations were being made to the Chandralamba temple. Amongst these was the dismantling of an old Devi shrine, adjacent to the main temple building, in order to replace the old broken image of Chamunda. During this work, members of the Archaeological Survey's team at Sannathi noticed that the slab, into which the old image was fitted, was inscribed. The inscription proved to be an Asokan Rock Edict. The Edicts on the slab were not complete, but clearly formed parts of the 12th and 14th edicts of Asoka. On removing the slab it was found tohave further inscriptions on its reverse. Once again they had been damaged, presumabluy at the time of transplantation, but were identified as the special Rock Edict 1, known as the Kalinga Edict. These discoveries suggest that it was a free standing slab, inscribed on both sides, and as such it is unique find. The details of the discovery are discussed in greater detail elsewhere in this report, but its implications can not be ignored. While the material from the excavation of the second stupa suggests a Satavahana dating, the presence of the edict confirms that the city must have had its origins in Mauryan times. One silver punch marked coin from Ranamandala supports this view.

Occupied mound south of Chandralamba Temple - In the fields between the Chandralamba Temple and the fortification there is a raised area, very rich in surface finds, especially pottery. This may be a habitation or occupation site outside the city wall.

EXCAVATION

The excavations have concentrated on three major area:

-Central sectional cutting

-Deep transectional cutting

-Peripheral excavations

1. Central sectional cutting - Around the projected centrepoint of the mound an area measuring six metres square was taken up for excavation, with the intention of taking it right down to bedrock, and of recording in plan any structural activity that occurred in this vacinity. The cutting also provided a deep section through all of the make-up of the mound and an area sufficiently large enough to sample artifactual material from successive deposits.

The sectional cutting revealed a deposit of lime or mortary material in the very centre of the mound at a depth of 2.40m. This material appeared to be a random spread with no structural associations. Its excavation yielded some carbonised seeds (yet to be identified) and a small quantity of charcoal.

The rest of the deep trench produced little, other than the occasional small fragment of pottery or brick, supporting the theory that the mound is indeed completely man-made. It also showed the sequence of the build up of the mound to a total height of 9.50m above the natural bedrock, in a series of successive dumps of mud and shale and mixed deposits of the two. The core of the mound appears to be primarily of soil, whilst the later material is almost pure shale. At the very bottom of the trench and cutting into the natural bedrock was a small cut feature, possibly a posthole, but there was nothing else within the area of the trench to it.

2. Deep transectional cutting - A transectional cutting was made from the centre of the mound to the northern cardinal point. The trench was cut down to the level of the apparently undisturbed black cotton soil. It showed clearly that the mound was built up in a series of dumps, from a mud core redeposited from the cutting of a large circular foundation trench presumably to level the ground for construction.

3. Peripheral excavations - All of the structural activity that was found associated with the mound was located around its prophery. The excavated material can be divided into several distinct phases.

First construction in stone masonry of the revetment wall - The earliest phase of construction is a stone revetment wall extending from the north cardinal point, where it is sealed by the later brickwork to the eastern cardinal point of the stupa. Around its length it can be seen in various stages of disintegration. At the point wherer it is best preserved, twenty courses of stone work survive to a height of 1.60 m. The stone blocks from which it is constructed vary in size and proportion, and hence there is no regular coursing, aside from the concentration of larger stones at the bottom of the wall. Although certain areas of collapse could be identified there were cimparatively few fallen stones around the wall, suggesting that unless there had been considerable robbing activity on the site, the wall never stood to a much greater height than was found.

In the extreme west of the site evidence of the foundation trench of this wall was found. This is cut directly into the natural black soil of the area, supporting the hypothesis that this wall represents the earliest phase of the monuments construction.

The natural soil, known locally as black cotton soil, has not been formed in situ, but has been transporte by fluvial action to the lower lying areas, It has an enormous capacity to expand when wet, and similarly to contract when dry. Such movements may have been a contributory cause of the disintegration of the wall.

Before the insertion of the wall into the foundation a hard core fill was placed into the construction cut. this consisted of densely packed limestone fragments, and may have been an attempt to consolidate the ground to avoid the problems associated with the plasticity of the black natural deposit. Evidence from the deep transect cut into the core of the mound suggests that the material from this foundation cut was mixed with the limestone chippings to form the mid core of the structure.

Construction of periferal structures on the north west of the stupa - Several brick structures were identified, running concentrically around the stone revetment. These are a series of fragmentary walls. Some run approximately parellel to the revetment wall, each having a slightly different alingnment around the circumference. They are also not equidistant from the wall, but alternately set forward and back fgrom it. Other wall fragments form returns linking these walls together.

Although the survival of these walls is very poor, being close to the surface and hence subject to plough damage, it is apparent that they have well faced exteriors, whilst the interior sides are unfaced. This suggests that they formed a series of projecting platforms around the perifery. No evidence of Ayaka pillars, or their settings was found, but it seems likely that these would represent devotional or dedicatory platforms of some kind.

Rebuild in brick of the revetment wall - The north eastern side of the drym is encased in a brick revetment, coming to an end at the northern cardinal point where the stone wall emerges from beneath it. The stone wall can clearly be seen as the earlier of the two structures. One possible explanation for this phenomena is that the brick represents a facing for the more roughly finished stone revetment wall. If this is the case the absence of the brick facing around the western side of the site must be explained. It is possible that it represents and unfinished facing operation. An alternative explanation is that it represents a later phase of construction, for some reason limited to the north eastern side.

At the point where the stone revetment wall is sealed by the later brickwork, it has been substantially disturbed in a different way to the later disintegration which can be seen further to the wast. The disturbance has occurred without the loss of entire courses of the wall, rather it has been subjected to subsidence as a result of the lower courses being forced outwards by the pressure of the unstable material behind them. This seems to suggest that the entire method of construction was unsatisfactory, and therefore in the area where the greatest disturbance had occurred the wall had been rebuilt in brickwork.

Associated with this brick rebuild, is a small platform applied to the front of the wall. It can be assumed to relate to this phase of construction, rather than to the later structures, because the brick drum wall has been constructed straight in this area to accomodate the structure implying that the intention to build the platform was there at the time of construction.

The platform is reached by three steps, from the north. At the base of which there is a small undecorated pillar which may represent a fragment of a stone balustrade, or a guard stone.

The function of this platform is unclear, its narrow width suggests it was not a shrine applied to the front of the stupa, and no evidence remains of anything that it could have been an access to.

Construction of a pillared structure - The wall which has been cut through by the series of postholes, is also later than the brick drum wall. It may represent the formalisation of a "pradakshina patha" or circumambulatory passage associated with this phase of the stupa, but one might expect it to follow more precisely the curving line of the drym wall. In total ten postholes were found in two alignments which formed the northern and eastern edges of an area from which large quantities of tile were found. The postholes can be divided into several types. The largest group, are all cut into the south side of the straight wall. these four postholes all have approximately the same dimensions c. 0.75 m in diameter, and one of them had a pentagonal stylobate block in its bottom with brick packing around it. The columns that were sited in these fouyndations may have been very large, and supported a considerable load. this can be suggested because there has been significant subsidence in the wall, at the points where it has been cut through by the postholes.

The second group of postholes are also cut through the same wall. these are very much smaller, c. 0.2 m in diameter, and do not cut right through the wall. they clearly do not have the load bearing capacity of the first group, but there adherence to the same alignment and there comparable stratigraphic position suggests that they must related, possibly in a less functional manner to the larger group.

The final group form a different alignment running north south and may represent the return of the edge of the structure to the south.

The distribution of the postholes, and its spatial coincidence with the tile debris horizon suggests that the function of these postholes was to support a roof. The absence of any siumil;ar evidence on the inside of the area in question may imply that the strucrture was a lean-to against the drum of the stupa, or that it covered the lower portion of the drum, and that the postholes were cut into the drum itself and the evidence for them has vanished in the natural weathering process.

The area covered by this structure was also subjectedf to a further change, namely the addition of a partition wall running north from the frum wall of the stupa to the northern wall of the structure. This addition may also relate to the posthole structure, sub-dividing it into two sections. There is an entrance through this partition wall which would have allowed access between the rooms. Running under the partition wall is a drain, set at an angle to facilitate the flow of water from east to west. the drain has been constructed of limestone slabs over which the wall has been built. The drain runs into pit against the drum wall, which may have functioned as a soak away.

The platform at the south cardinal point

The first evidence of a platform at the south side of the mound was a low wall constructed over the core of the stupa separating the back of the platform from the body of the mound, which is only faced on its southern edge. Returning to the south, from each end of this wall are two further walls, again built up over the mound. In these two cases the walls are only faced on their outer edges, and act as tetaining walls to a make-up dump of shale fragments, which raise the level of the centre of the platform. Unlike the core of the mound this material has been regularly and horizontally laid. The outer faces of the east and west walls are decorated with a series of offset, and quarter round moulded courses. Both of these walls have disintegrated to2wards athe south, and there is evidence that the east wall was partially robbed away at a later date.

The southerm wall of the platform has almost completely disappeared. A single course of brickwork, extending for less than a metre is all that survives. However the extent of the platform was traced through the survival of the shale dump that filled it. Unlike the core of the stupa, which was irregularly dumped, the make-up of the platform is very regular in both size of fragment and bedding. It was therefore possible to remove all of the material that than slumped down the slopem or been disturbed dyrinbg robbing. The alignement of the end of the regular make-up, corresponded closely with the few surviving fragments of brickwork. From this it is clear that the platform is square.

The platform is reached from the west by an entrance, applied to the face of the retaining wall, half way along its length. this entrance takes the form of a smaller plat form ascended from the north by a flight of two limestone steps. At the base of these steps there is a moonstone and at its western side a guardstone. There is also evidence that this entrance was roofed over. This is found in the form of three postholes cut into the west wall of the platform, three postholes to the west of the structure, and two larger ones cut into the entrance platform. There was also a great deal of tile debris in the deposit that sealed the moonstone and lowermost step.

Although teh surface of the platform was very disturbed, there were a series of cut features, which might give an indication to the function of the platform. In the very centre of the platform was a group of four large cuts. These probably represent the robbuing out of the main featrure of the platform. The excavation of two of these cuts revealed clear features in the bottom, which suggest that a large slab might have been set in them. The dimensions of these foundation cuts are very similar to the dimensions of the memorial slabs, commonly found at Sannathi. they also imply that if such slabs were in place on the platform almost one metre of them would have been below surface level. A fragment of such a piece, found to the west of the platform, and another complete sculpture in the Karnataka State Museum at Gulbarga, attest the fact that the sculptures often had blank sections of upto and over a metre at their bottoms.

Around these foundations wre another series of cut features. these were longditudinal cuts, with deeper circular sections at each end. They may represent double postholes, for some form of canopy over the assembly of memorial stones.

There is very little evidence to suggest a function for this platform. It may represent some element of a vihara complex associated with the stupa or possibly a later embelishment to the stupa itself. The extent of the intrusive activity around the drum, which may represent extensive robbing activity, means that there is little surviving material with which the platform can associate.

On the northern side of the stupa there were several phases of structural activity, but none that can be directly or stratigraphically linked to this platform. Its construction over th core of the mound, indicates that it does not belong to the earliest phase, the stone wall running around the north-west side of the mound. The usage of similar building material may however link it with the later strucrures, the brick rebuild of the drum wall, or the later pillared structure to the north-east. The retaining walls of the platform have been built with bricks measureing 50 X 25 X 7 cm., similar to those used in the drym wall rebuild, whereas the pillared structure seems to have been constructed of bricks of less regular size, suggesting that they may have been re-used from elsewhere. However there are also some bricks of smaller size in the walls associated with the moonstone entrance to the platform entrance, though this may mean that entrance does not belong to the original phase of construction of the platform.

Cutting activity around the drum wall - During the later occupation of the site, after the construction of the platform, a number of cuts were made following the circymference of the mound. In different places these cuts took various forms. At the east an dsouth-east sides of the site the cuts are almost semi-circular in plan, but around the south, and rynning up to the platform these have run together to form a trench with an undylating bottom. The cuts are later than the platform, stoping at the east wall, but a similar cut is again found to the west of the platform. In places these have intruded right into the shale core and have removed allo relationship between it and the surrounding material. The purpose of these cuts is not clear, though they presumably relate to the destruction phase of the site. One possible indicator to their function may be the presence of a pair of large sculpted fragments, discovered in the south-west of the site.

These two fragments are the only sculptures discovered at the stupa site during two seasons of excavation work. They may be part of the same piece, since one is clearly the bottom of a larger fragment, the remainder of which may be represented by the second. The first fragment, is almost completely undecorated, except fot the very top which portrays a pair of human legs at the extreme left and a series of undefinable lower limbs at the right. The second panel is fully decorated, portraying two scenes set one above the other and divided by an inscription. The upper portion shows a seated couple flanked on either side by female attendants. the lower depiction, is of a horse, being led by a groom and preceeded by an attendant carrying an umbrella. there are two possible interpretations for this scene. The first refers to the similarity between this depiction and another common scene from th4 sculptures from Sannathi, which portrays an unyoked bullock cart. This bullock cart is commonly thought to represent the end of a journey, in this case the journey thought life of the person or persons depicted in the upper half of the panel, whose names may be recorded in an inscription. these panels may therefore be memorial stones, erected to people after their deaths,. The unridden horse in a similar setting may be interpreted in the same way. The second possibility is that this may be a scene from the Buddhas renunciation, depicting his horse Kanthaka, and groom Chandaka. This panel is very alike the sculpture incorporated into the wall of the small durga shrine close to Stupa No.1.

The presence of these two sculptures suggests that the stupa is not completely aniconic and that there mught have been more sculpture at the site. If this is the case it would be reasonable to expevt to find such sculptures around the circumsference of the stupa. A possible explanation for the series of cut features recorded around the base of the mound may therefore be a systematic robbing of such pieves, and there removal from the site. The fact that a broken fragment was not removed may mean that teh robbing was not simply in search of building material, but in order to reuse the material at another site.

FINDS

A significant proportion of the antiquities discovered, both in excavation and exploration, can be classed as jewellery. there are four main types of find in this classification namely bengles, rings, ear studs and beads. In addition to these a jewellers mould, made of stone was discovered in the Ranamandala area. This stone tablet has a series of carved lines running along its length, and is therefore probably for making gold, silver or copper alloy wire. It also has a series of holes to facilitate the pouring in of the molten material, and peg holes to attach it to the other half of the mould. Another indication that fine metal working was taking place at Sannathi was the discovery of two small copper alloy crycibles. The two bucket shaped recepticles are only 20mm in depth, and would therefore only hold very small quantities of the molten metal. A Sundara in his excavations in the Ranamandala area in 1986-87 discovered a small hearth which he suggests is that of a coppersmith.

1. Bangles

The most common tupe of bangle found is made of whsll, but examples in terracotta and glass were also found. The shell jewellery industry was well developed at Sannathi, with the entire site liberally strewn with shalle bangles, rings and beads, as well as partially worked shell cores. The shell bangles are all very plain, square or rectangular in section, with occasionally rounding or chamferring of the edges. The glass bangles are generally circular in section, with one exception which is D-shaped, and are blie, green and yellow in colour. One fragment is red on the surface but where it is broken it can be seen to be white inside. Two terracotta bangles were found in the Ranamandala area, the first of these is spiralled, whilst the second is fluted.

2. Rings

In all twenty-two rings, or ring fragments were found, seventeen of which came from the excavation. The rings are of two main types, complete rings which are probably finger rings, and open ended copper alloy rings, which may be toe rings. The finger rings are found in a variety of materials. There are sic shell rings, three of which are plain. A fourth is decorated with inscribed lines. The remaining two have raised faces and decorated bands. Very similar to these is a carved cornelian ring, with high shoulders below the face which have been decorated with fine incised lines.

The rest of the rings are made of copper alloy, five of them being an alloy of copper and gold. Of these the finest example is a toe ring with open ends, and one edge of it is crenellated. The outside of the band is decorated with a series of incised lines running around the ring. Although none of the rings have settings for stones, one small rectangular fragment of rock crystal was found, which may represent a ringstone or an intaglio.

3. Ear studs

There are three ear studs, made of stone, shell and a lead/tin alloy. The largest of these is fifteen milimetres is diameter. Two more objedts might also be interpreted as ear studs, having approzumately the same spool shape. However these are both considerably largerm with diameters of up to thirty-seven milimetres. However their large size should not necessarily discount them, since a study of the sculpture and the terracotta figurines shows that very large ear ornaments were worn. They are however both made of lead, and it seems likely that some other explaination is required for them.

4. Beads

Beads are the most common type of artefact found at Sannathi. Two hundred and eighteen beads in eleven different materials were found. The most frequent materials used are shell, agate or cornelian, and glass, but there are also beads of jasper, lapiz lazuli, amethyst, rock crystalm bone, clay and terracotta. On examination there were found to be twenty-five distinct types of bead shape. The shapes of the beads are not always confined to a single material, but occur in several different materials. The disgram below shows the variouys forms, and the numbers of beads of each material found in each.

Copper Alloy Objects

The identifiable copper alloy objects include three kohl applicators, with long shafts and bulbous ends, and a long pin (147 mm.) with a square head. Four copper alloy artefacts from the excavation were found in close proximity to each other, within the same context, inditating that they are possibly fragments of a larger object. Each fragment is formed from thin copper alloy sheet, was bent to give a convex outer surface decorated with a series of fine horizontal lines. All the fragments display a slight curvature. Four fragments of thin copper alloy sheet with perforated edges were also found adjacent to the curved segments. Cleaning of these artefacts revealed that they were all an alloy of copper and gold. It would seem possible that the fragments were part of a frame or an edging for a box or a composite objeft having a wooden base.

There are also five cast copper clloy discs, with the crescented three arched hill symbol on them. This symbol is commonly associated with coins, but in this case it is quite clear that no attempt has been made to cast, or subsequently to inscribe, any symbols onto the reverse. An alternative interpretation is that they might be pendants, suggested by the clear lug at XII o'clock on one. However examination of others show that there are several of these around the circumference of the disc and therefore that this is not a lug for suspending a pendant, but residual traces of the casting proceedure. It should be noticed that in one case these lugs have been removed, which might suggest that the rest are unfinished. the discs are generally heavier than the coins found at Sannathi, weighing between 4.98 and 8.75 grams and all seem to be the same size, 23 mm. in diameter.

Terracotta Figurines

From the earliest exploration at the site, it was known that there was a thriving terracotta figurine industry. The Department of Archaeology and Museums of the Government of Karnataka, has an excellent collection of terracottas from Sannathi, including human and animal representations. Most of these are of the double moulded variety which are common from all Satavahana sites. During explorations, especially in th eraised inner citadel or Ranamandala area many more terracottas were discovered. Ten headsm all with elaborate hairstyles, seven feet, and six other body fragments were found.

Other objects were also made of terracotta. There are two fragments of wheels, presymably from childrens toys. There is also a tablet bearing seven parallel rows of indentations on each side. The purpose of this tablet is not clear, though it may be a scouring block.

Iron Objects

During the course of excavation thirty-one fragments of iron nails were found. The relatively small number found, compared to the number of tile fragments found, suggests that iron nails were not used for afficing tiles to a roof. this might have been achieved using wooden pegs, which would account for the large size of the holes found in the tile fragments. The state of preservation of the iron is not bad: so in certain deposits, where the proportion of tile fragments was particularly high, such as those associated with the later structures to the north-east of the mound, one would have expected a far greater number of nails to survive.

Other iron objects include a long sewing needle with an eye, measuring 95 mm in length, and an iron spear or arrow head, 78 mm in length.

8. CONCLUSION

The discovery of an Asokan Edict and occasional finds suggest that the origins of Sannathi may go back into the Mauryan Period. Teh explorations, and the specific information gathered from the excavation at the second stupa, clearly establish Sannathi as a fortified township of the Satavahana period. A total of 53 lead and 11 copper alloy coins of the second century A.D. attest this fact. There has however been considerable controversy over the dating of the Satavahanas kings. the controversy is based upon differing readings of the Puranic lists, according to which the Satavahanas could have reigned for either 260 years, or 460 years.

The earliest view was that teh Satavahanas rose to fill the void left by the fall of Asoka in 232 BC and ruled for 460 years until c230 AD. An alternative to this view interprets the Puranas as saying that the Andhras, or Satavahanas came to power after the Kanuvas, who ruled for 45 years. The Kanuvas succeeded the Sungas, who ryled for 112 years and came to power 137 years after the accession of Chandragupata Mayrya in 324 BC. That means 294 years after 324 BC or in other words 30 BC. Taking the shorter reading od the Satavahana kings from the puranas, this interpretation also has the Satavahana Rule ending around 230 AD.

Gautimaputra Satakarni can be independantly dated through his syncronbism with Nahapana, a Governor of the Kanishkas who came to pre-emminence in Maharastra in 78 AD. Nahapana has several inscriptions, the latest of which is in the 46rh year of Kanishka. The inscription at Nasik records that, in the eighteenth year of his reign he defeated Nahapana. If we assume that this defeat ended Nahapanas rule it must have taken place in 128 AD, and Gautamiputra Satakarni therefore ruled from 110 - 130 AD. Vasishthiputra Pulumavi, who succeed him reigned to 159 AD. There are two coins ascribeable to tgis Pulumavi from the second stupa at Sannathi. However the majority of the coins from the stupa are inscribed Rano Siri Satakanisa. It seems unlikely that these coins belong to the early Satalarnis, as the inscriptions from Sannathi seem to suggest that the site is associated with the later sequence of Satavahana kings.

There are three known royal inscriptions of the Satavahanas from Sannathi. the first, recorded by Dr. M.S. Nagaraja Rao belongs to Vasishthiputra Sri Satakarni, who succeeded Vasishthiputra Pulumavi. A second inscription to the same king was recently discovered buried in a field behind the Chandralamba Temple. To add to this a third inscription was foundm, reused in a wall in Sannathi village. This inscription refers to Vasishthgiputra Siva Siri Pulumavi, who is the next in line. It is therefore likely that the coins from the excavated stupa belong to Vasishthiputra Sri Satakarni, and that the mound belongs to the second half of the second century AD.

The period of rule of the Satavahanas saw the spread of urbanism throughout southern India, and at the same time the build up of an extensive trade network, reaching beuond the limits of the Sub-continent. The discovery of the Monsoon winds, recorded by Hippalus in 44 AD brought southern India within the range of traders from the Roman Empire. There are many isntances of Roman coinage appearing in Southern Indai. wheeler found coins of Augustus and Tiberius at Chandravelli and many more have been found since at Dhawar, Bahgalore, Waddamanapur and Kollapur where a statue, possibly of Neptune, was also found. Inscriptions referring to Yawanas, or foreigners suggest that there may be settlements where traders from outside the area congregated. Ter, thought to be a central gathering point for such trade is only about 250 KM north from Sannathi.

Within this framework of expanding trade and urbanism, Sannathi must be seen as extraordinary for the size of its fortification, which has survived so well. It corresponds with a time of considerable stability within the region, and cannot therefore be explained as necessary for defence. It may be that Sannathi holds a position of local importance, possibly as a focal centre for this trade, but only considerable excavation within the city can clarify this.

The large number of sculptures now recovered from Sannathi place it within the development of Buddhism in the Krishna valley. The sculptural style, though more cudely executed, has similarities to both the Amaravati and Nagajunakonda schools and the Brahmi inscriptions on some of the pieces, from the first to third centuries A.d., support this position chronologically.

The second stupa is very different from the other stupas at Sannathi, and also differs from the most common tupes of Stupa found elsewhere in the region, apparently having no continuous drum wall, no integfral structrural foundations such as spokes and no formal Pradaksina Patha. Its identification as a stupa could even be questioned in the light of these differences. However the fact remains that it is a man-made circular structure, which has been formalised by several phases of additiona and rebilds. It is located at a site of known Buddhist activity, and has sculptural evidence that places it very much in this tradition. Its identification as a stupa therefore raiseds interesting questions about its position in the development of stupa architecfture. It is considerably larger than most of the stupas of the region, and also much more simple in its mud-core construction. It may represent a crude excample in the early tradition of suimplicity of form in stupa architecture, opr equally an experiment in construction to attempt to achieve gfreater size. Only with the discovery and excavation of more examples, which do not conform to the previouysly accepted more uniform patterns of design, can these questions be answered, Thge importqnce of the second stupa at Sannathi therefore lies in the simplicity of its construction, rather than the more traditional values of artistic or architectural appreciation.

A final note on Sannathi, is that under consideration at the moment, by the Government of India is an irregation proposal that will innundate the entire settlement. If the project is approved the information available from the first site of proven Buddhist affiliation in the State of Karnataka will be lost. In addition to this Sannathi offers the archaeologist the opportunity to explore the chronology of the Satavahanas, with the possibility of taking it right back to the Mauryan Period, and thus to study stratigraphically the crucial question of the dating of the their occession to power.

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Figure 1. Location of Sannathi

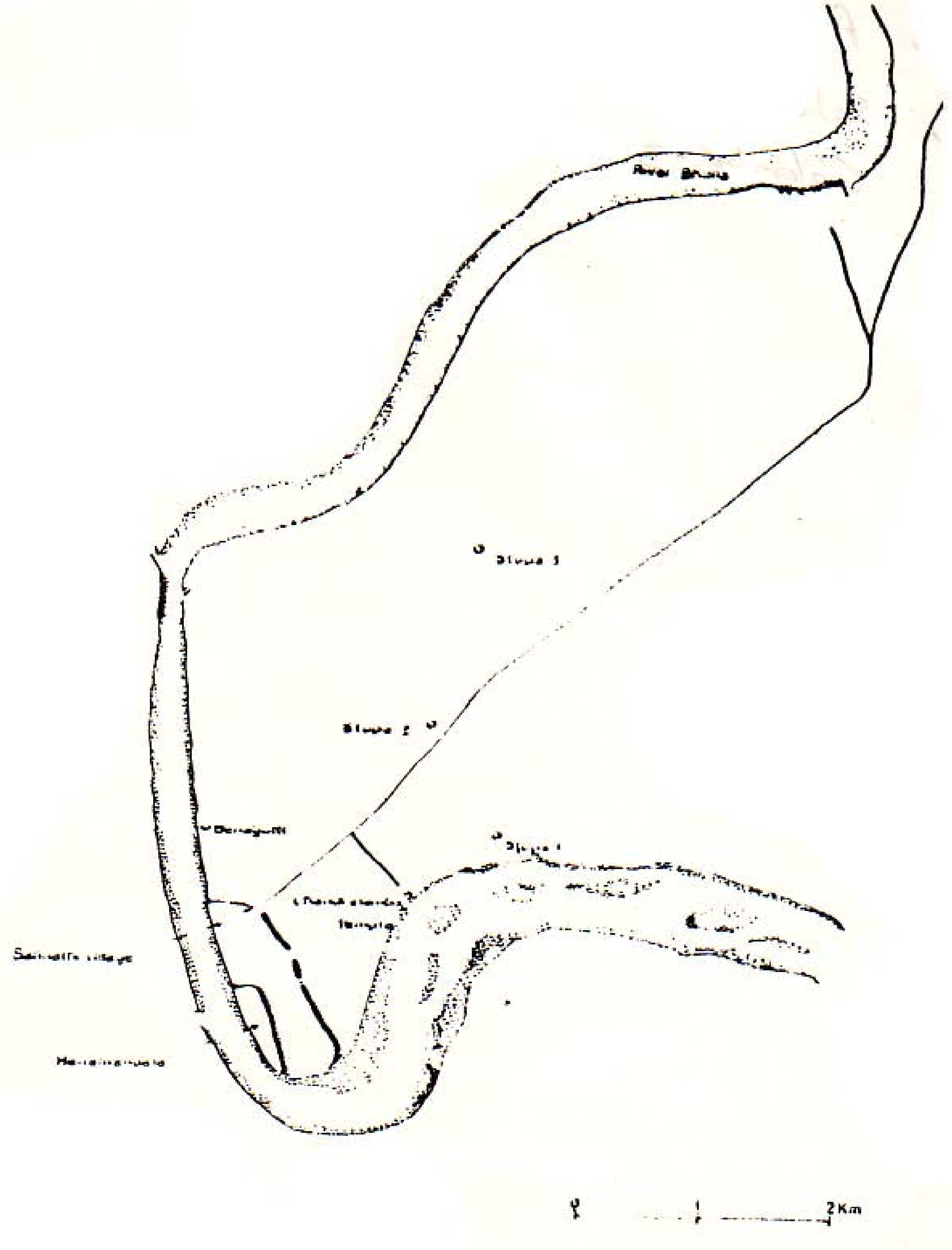

Figure 2. Plan of Sannathi Area

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Team

1. D. A. Rasika Dissanayaka.
2. H. D. Leena Damayanthi.
3. M. W. Indraseeli.
4. A.D.Jayawardhana.
5. K. K. S. Manatunga.
6. Hiroshi Ratnaweera.
7. P. B. A. Senaratna.
8. R. K. Sunethra.

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