

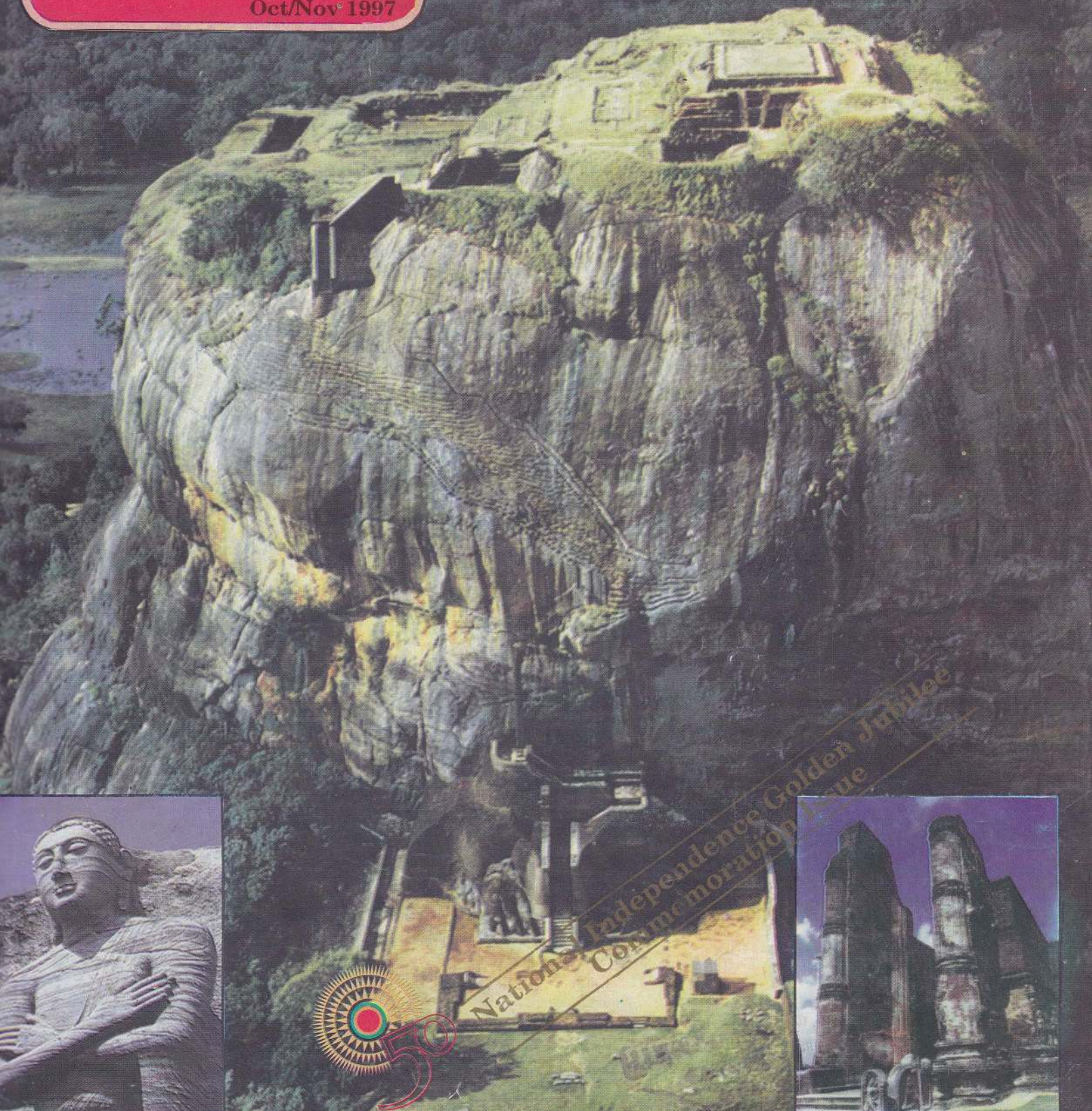
ECONOMIC REVIEW

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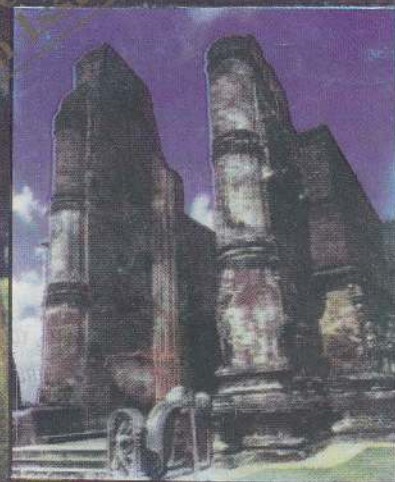
Ancient Economy & Society

A Retrospect of Heritage

357



National Independence Golden Jubilee
Commemoration



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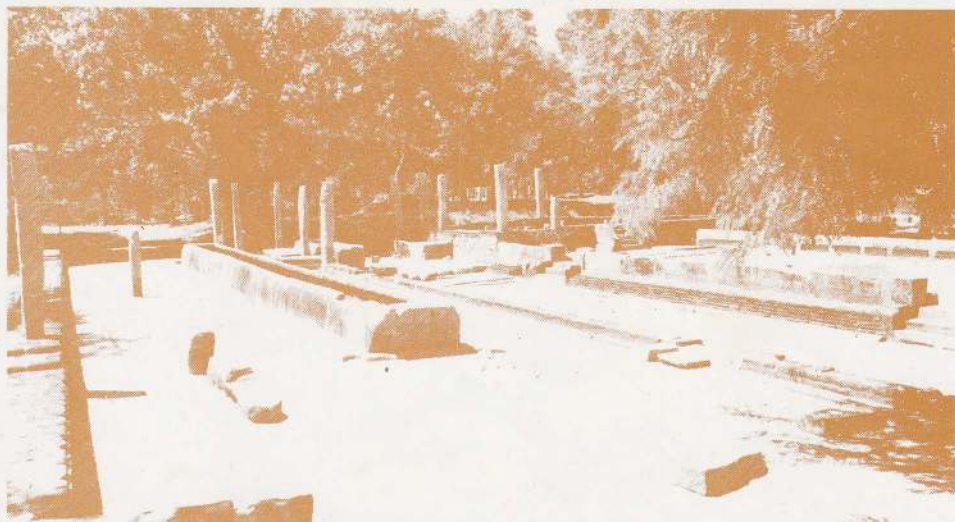
King Mahasen built Jetavana stupa in the 3rd century AD. The diameter of the stupa is about 1147 feet. It's height had been 405 feet at the beginning. The length of the terrace is about 576 feet.



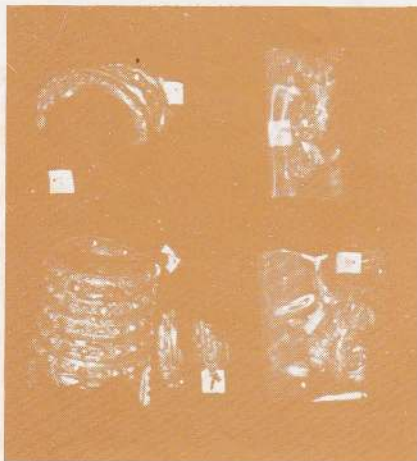
A well in the form of a Bo leaf excavated and exposed by the Jetavana Project. there is a flight of steps to descend and collect water. The brick work done without any mortar is a reflection of the technology of the period. This belongs to the 5/7 century AD.



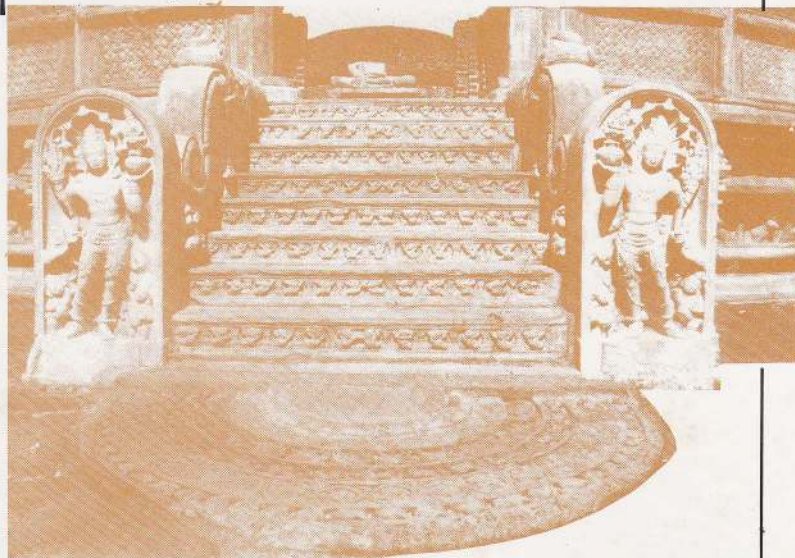
Pottery. Several of this type of large clay pots were excavated from the Abhayagiri project. It is possible that they were placed one above the other. These have been used for the urinals to collect disposals. (5/7 century AD).



Ruins of a dining hall found in Abhayagiri excavation at Anuradhapura



A jewel made with gold and gems recovered from an excavation at Sigiriya, similar to orn worn by the Sigiriya Maidens in frescoes (473-491 AD)
Sigiriya is world famous for its paintings. These apsaras are represented in singles and doubles. These paintings have been decorated with paint pigments collected from the natural environment. There is an article on the subject.



Vatadage. This building found in Polonnaruwa symbolises the developed architecture of the period. This is a circular building. The guard stone symbolises the security. The vertical part of the steps carry carvings of Vamanas. The moonstone reflects the complete picture of a moonstone of the Polonnaruwa period.

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THE ECONOMIC REVIEW is intended to promote knowledge of and interest in the economy and economic development process by a many sided presentation of views & reportage, facts and debate. THE ECONOMIC REVIEW is a community service project of the People's Bank. its contents however are the result of editorial considerations only and do not necessarily reflect Bank policies or the official viewpoint. Signed feature articles also are the personal views of the authors and do not represent the Institutions to which they are attached. Similar contributions as well as comments and viewpoints are welcome. THE ECONOMIC REVIEW is published monthly and is available both on subscription and on direct sale.

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Financial Markets - Recent Trends

Page Layout : M. P. Edmund Pathirana

Cover: Sigiriya - Citadel Summit

1. Granite Standing figure of the Buddha in Polonnaruwa age.

2. A buddhist temple namely, The Tivanka Pilimage showed the

architectural skill during Polonnaruwa age
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Overview

To mark the golden jubilee celebrations of Sri Lanka's independence, the 'Economic Review' decided to deviate from its routine reporting and analysing of contemporary socio-economic issues and delve into our past. In this issue we will present the various facets of Sri Lanka's rich heritage, which has existed for over 2500 years of recorded history, as a tribute to the pioneers who created and sustained this civilization for many centuries, and, to inform and awaken the younger generation to the challenging tasks of the next millennium, so that a peaceful and prosperous era can be ushered in our motherland. Tangible evidence of our heritage remains in the form of a unique architecture, irrigation infrastructure, building construction, artifacts, culture and a high level of literacy.

Further evidence of this well developed economic and social status of ancient Sri Lanka is also found in the historical writings of other Asian countries such as China, Burma, Thailand and India as well as in European countries.

One of the well known oldest Indian great epic poems, the Ramayanaya, which was composed in Sanskrit, probably about 300 BC by the poet Valmiki around a legend that was prevailing among Indian people of a warrior in Lanka by the name of King Rawana and the epic God Rama in India. It has described the use of space vehicles by Rawana of Sri Lanka in the war between Rama and Rawana.

The travellers of ancient times exaggerated the size of Ceylon (Sri Lanka or Serendib) because of its fame. For example, Greeks had reported the Island to be nearly 20 times its actual size. The main reasons for the fame, which spread wide, especially in far eastern countries were the precious stones found in the country's hinterland and the pearls found in the coastal area.

The iron plough had been used in agriculture,

the principal grain being rice.

The recorded history of the country begins in the 6th century BC with the settlement of an Aryan people called Sinhala who migrated from India.

However, evidence has been found that even in that period a group of inhabitants had been living here. It is believed that the "Veddhas" who are still living in Sri Lanka, belong to that group.

Sinhalese, the language of the majority in the island today, has been for over 20 centuries, confined to Sri Lanka. Sinhalese is a mixed dialect deriving from North West and North East India and later influenced by the Tamil language (Dravidian).

The Buddhist doctrine which was first introduced to Sri Lanka in the 4th Century BC influenced the developments in ancient Sri Lankan economy and society.

"Mahavansa" the great chronicle of the Sinhalese, written in the Anuradhapura period is a unique source of historical evidence of Sri Lankan heritage. The notable attainment in the field of literacy is also found in inscriptions since the 3rd century BC.

The articles in this issue, written by eminent scholars in the field, review some of these aspects of archaeological importance.

Pre-and proto-historic settlements in Sri Lanka

by

Dr. S. U. Deraniyagala

Director - Department of Archaeology, Sri Lanka

Sri Lanka is an island off the southern tip of India. There is secure evidence of settlements in Sri Lanka about 130,000 years ago, probably by 300,000 BP and possibly by 500,000 BP or earlier. Palaeo-environmental investigations indicate that interglacials correlated with increased atmospheric activity over the island - which was manifested in correspondingly increased rainfall on the windward aspect of the central mountains and increased desiccation on the leeward side due to drying foehn effect of katabatic winds. This model has been transposed to the eight major eco-zones of the country with their respective pre-historic carrying capacities fluctuating in phase with climatic shifts. Population densities in these eco-zones have been estimated for the Quaternary on the basis of ethnographic analogy. Subsistence strategy has also been assessed through archaeological evidence against a backdrop of ethnographic analogy and postulated biotic resources that would have been available for exploitation by Quaternary foragers.

At the commencement of the 1st millennium BC, there are indications of a rapid transition from a geometric microlith-using Mesolithic culture to the Early Iron Age, with horse, cattle, pottery and paddy cultivation. It is proposed that with iron technology (for clearing hitherto intractable equatorial rainforest), a greatly enhanced food production capability increased carrying capacity several-fold, thus attracting long distance links with India. The latter probably involved migrations, of which the Indo-Aryan Sinhalese language (which was in use in Sri Lanka since at least 500 BC) could be but one manifestation.

Palaeolithic

During the last one million years,

when humans are known to have existed in various parts of India (v. Mishra 1995), Sri Lanka was connected to the sub-continent on numerous occasions. The rise and fall of sea level (due to cold/warm fluctuations in the global climate) determined the periodicities of these connections, the last separation having occurred at ca. 7000 BP (Deraniyagala 1992:167). Hence it is impossible to view Sri Lanka's pre-history in isolation from India.

It is very likely that the first India had reached Sri Lanka at least as early as one million years ago - perhaps earlier. So far, evidence on this score has not been forthcoming, but this need not signify that there were no humans in Sri Lanka at that period. Environmentally there would have been no hindrance whatsoever to hominid settlement, in terms of both accessibility and exploitable food and water. There are, however, ancient coastal sands in the north and southeast of the island which could be as early as 250,000 (or even 700,000-500,000) BP (ibid. : 686,688). Whether these sands contain evidence of human habitation has yet to be determined, a prime research goal for the future.

By about 125,000 BP it is certain that there were prehistoric settlements in Sri Lanka (ibid:686). The evidence stems from excavations conducted in coastal deposits near Bundala. These people made tools of quartz (and a few on chert) which are assignable to a Middle Palaeolithic complex (ibid:252-4,458, 688). Apart from such tools, no other vestiges of their culture have survived the ravages of time and tropical weathering: we do not know what these people looked like, although it can be guessed that they were early *Homo sapiens* akin to anatomically modern South Asians. Even the sizes of their settlements are not known due to the limited scale of the evaluation excavations; surface indications are ca.

50 square metres or less per site. That they lived by hunting and gathering is obvious and it is probable that this conformed to the pattern discernible in the activities of their descendants some 100,000 years later.

We do know, however, that the physical and biotic environments of these early humans, from the Middle Pleistocene onwards, fluctuated between pluvial and interpluvial episodes (ibid. : 178-82, 436-40; id. 1991 : 14-7) with corresponding oscillations in animal and food-plant resources which would have been reflected in shifts in human population densities. It is estimated that during certain pluvial episodes in South Asia, as at ca. 125,000 BP. The population density in the Dry Zone of northern, eastern and southern Sri Lanka (for ecozones v. ibid. : app. I) could have ranged between 1.5 and 0.8 individuals per square kilometre, whereas the Wet Zone in the west would have had densities of 0.1 or less. It has been hypothesised that interpluvials witnessed a narrower dichotomy in the zonal population densities, the respective estimates being less than 0.3 for the Dry Zone and over 0.1 for the Wet Zone. These figures are derived from ethnographic sources pertaining to South and Southeast Asian hunter-gatherers. Given the postulated densities of the food supplies, it is unlikely that large communities in excess of a couple of nuclear families were the norm, except perhaps along the northern and eastern coasts with their rich resources of marine foods (id. 1992:178-82, 436-44).

Mesolithic

From about 34,000 BP onwards the prehistoric record is very much more complete. The information stems from a series of cave excavations in the lowland Wet Zone : Fa Hien Lena near Bulathsinhala (34,000-5,400C-14BP), Batadomba-lena near Kuruwita

A R C H A E O L O G Y

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(26,500-11,500 C-14 BP), Beli-lena at Kitulgoda (over 27,000-8,500 C-14 BP), Alu-lena at Atlanagoda near Kegalle (10,500 C-14 BP). These data are supplemented by those from the open-air site of Bellan-bandī Palassa near Embilipitiya (6500 TL BP). The dating is based primarily on radiocarbon assays on charcoal, checked independently against thermoluminescence dating in the case of Beli-lena. There are over 50 such dates from various contexts at these sites and the chronological framework may be pronounced secure (ibid.: 695-701).

Fa Hien Lena has yielded the earliest evidence (at ca. 34,000 ± 14 BP) of anatomically modern man in South Asia, followed by Batadomba-lena at 26,500 and 16,000, Beli-lena at 13,000, Fa Hien at 6000, Bellan-bandī Palassa at 6500 and Fa Hien again at 4500 BP. These human remains have been subjected to detailed physical anthropological study and it has been affirmed that the genetic continuum from at least as early as 16,000 BP at Batadomba-lena to Beli-lena at 11,000 BP to Bellan-bandī Palassa at 5,500 BP to the warm, viable aboriginal population is remarkably pronounced (ind.: 266-9, Kennedy 1974; Kennedy et al. 1987; the earlier material from Fa Hien Lena is too fragmentary for such comparative study). This suggests a backwater in terms of population dynamics. It appears to have been a remarkably static situation over so long a period, relatively undisturbed by the arrival of new populations with diverse physical traits. These anatomically modern prehistoric humans in Sri Lanka are referred to as Balangoda Man in popular parlance (derived from his being responsible for the Mesolithic Balangoda Culture first defined in situ near Balangoda).

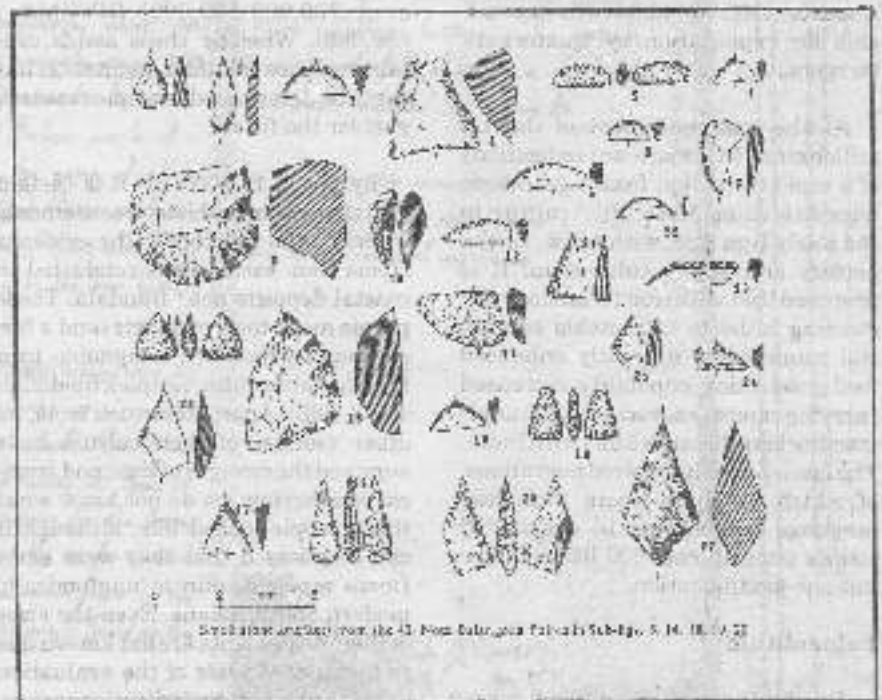
He stood at an estimated height of ca. 174 cm for males and 166 cm for females in certain specimens, which is considerable when compared with present day populations in Sri Lanka (v. Deniroyagala 1992: 330-4). The bones are robust, with thick skull-bones, prominent brow-ridges, depressed noses, heavy jaws and short necks. The teeth are conspicuously large. These traits have survived in varying degrees among the Vaddas and certain Sinhalese groups, thus pointing to Balangoda Man as a common

ancestor. It needs to be borne in mind, however, that there would have been unimpeded gene flow between southernmost India and Sri Lanka in both directions from the Palaeolithic onwards, and that future research will probably reveal a whole range of genetic clusters in the prehistoric populations of this region which would invalidate the concept of Balangoda Man as a homogeneous 'race' (cf. id.: 1990: 17,20).

Meanwhile, Balangoda Man continues to be a useful working concept, referring to the island's late Quaternary humans. He appears to have settled in practically every nook and corner of Sri Lanka ranging from the damp and cold High Plains such as Nuwara-eliya (Horton Plains) to the arid lowlands of Mannar and Vilgatta, to the steamy equatorial rainforests of Nuwara-gamuwa. The artefacts were invariably small, rarely exceeding 50 cm in area, thus suggesting occupation by not more than a couple of nuclear families at most (ibid.: 1992: 351). This lifestyle could not have been too different from that described for the Vaddas of Sri Lanka, the Kadar, Malapantaram and Chenchus of India, the Andaman Islanders and the Sentang of Malaysia (ibid.: 412-21,451-7). They would have been moving from place to place on an annual cycle of foraging for food. The well preserved evidence from the caves and Bellan-bandī Palassa

indicates that a very wide range of local plants and animals were exploited. Among the former, canarium nuts, wild breadfruit and wild bananas are prominent. It is probable that dioscorea yams, such as *Dioscorea spicosa*, *D. pentaphylla* and *D. oppositifolia* were staples in the diet, as they were among South Asian hunters and gatherers in recent times. It appears as if every conceivable type of animal had been eaten, ranging from elephants to snakes, rats, seals and small fish (ibid.: 451-2). This diet would have been well balanced as attested by the robusticity of the human skeletal remains. The degeneration of bone that accompanies a specialised starchy diet and a sedentary lifestyle had yet to set in.

The tool kit of Balangoda Man is distinguished by the occurrence of geometric microliths, comprising small (less than 4 cm long) flakes of quartz and (rarely) chert fashioned into stylised lunates, triangular and trapezoidal forms (ibid.: 266-70, 488-94). Such geometric microliths have traditionally been considered the hallmark of the Mesolithic period as first defined in Europe. The earliest dates for the geometric microlithic tradition in Europe are around 12,000 BP. Hence it came as a surprise when such tools were found as early as 26,500 C-14 BP at Batadomba-lena, 26,000 BP at two contexts in the Bundala and over 27,000 BP at Beli-lena. Sri Lanka has yielded



Style drawings of microliths from the 41 Neolithic sites (see text) (ibid. Fig. 5, 14, 18, 19, 27)

evidence of this sophisticated technological phase some 16,000 years earlier than in Europe. However, this apparent anomaly has been resolved by the discovery of geometric microliths in various parts of Africa, such as Zaire and southern Africa, from contexts in excess of -27,000 BP, thereby suggesting that Europe was late in manifesting this techno-tradition due to as yet undefined reasons.

Apart from stone tools, artefacts of bone and antler are quite prolific from 28,500 BP onwards, notably small bone points (ibid. : 278-81). Beads of shell have also been discovered from these early contexts and the occurrence of marine shells in inland sites such as Batadomba-lena points to an extensive network of contacts between the coast and the hinterland. There is evidence from Beli-lena that salt had been brought in from the coast at a date in excess of 27,000 BP (ibid. : 326).

Sri Lanka has yet to produce unequivocal evidence of Stone Age art. The cave art observed in various parts of the Dry Zone are the works of Vaddas, as demonstrated by ethnographers, although a certain proportion of it could conceivably be pre-historic (ibid.: 465). Similarly there is little evidence of manifestations of ritual. There are, however, clear indications that the norm was for Balangoda Man to inter his dead as secondary burials within his camp floors, having selected certain bones for this purpose; and at Ravanalla cave and Fa Hien Lena red ochre had been ceremonially smeared on the bones. Both these practices have been matched by the mortuary customs of the Andaman Islanders, but not by those of the Vaddas. It is possible that the latter, through a process of cultural retrogression, ceased to practise the more elaborate mortuary customs of their ancestors (ibid. : 465-7, 696).

Neolithic/Chalcolithic

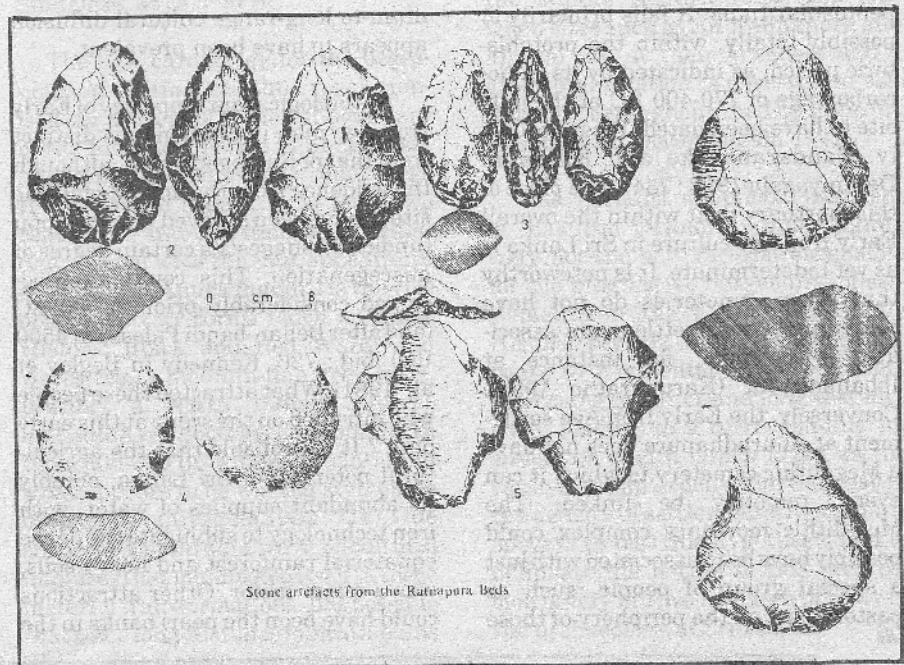
The transition from the Mesolithic Balangoda Culture to the proto-historic Early Iron Age has been inadequately documented in Sri Lanka. Almost invariably, the relevant transitional deposits have been disturbed due to the extraction of fertiliser from pre-historic cave habitations. Recent excavations in the cave of Dorawaka-kanda near Kegalle could somehow have re-

solved this impasse. According to the excavator, W. H. Wijayapala, there are indications at this site of pottery (together with stone stools) being used as early as 6300 C-14 BP, and possibly the cultivation of a cereal in these contexts (ibid. : 734; W.H Wijayapala 1992 in id. ip). The final analyses and the site report pend. The excavator's views are plausible since (a) the southern Indian Neolithic period is at least as old as 2000 BC and (b) a plain red ware precedes the ceramic termed Black and Red Ware at Dorawaka-kanda. The latter ware has been dated to ca. 900 BC at Anuradhapura and hence the red ware might predate it at Dorawaka-kanda. The typical polished axes, pottery and cultivants of the peninsular Indian Neolithic have yet to be discovered in Sri Lanka, and one can but assume that until the Dorawaka-kanda data prove it otherwise the existence of a Neolithic period on the island has not been established as yet.

The most recent radiocarbon dates to provide a chronological upper boundary for the 'Mesolithic' geometric microlithic industry in Sri Lanka are ca. 1800 BC at Mantai and ca. 1500 BC at Beli-lena (Deraniyagala 1992 : 698, 701). The latter could have domesticates or pottery in association (report pending). The discovery of a few pieces of copper-working slag from this 'Mesolithic' context at Matota could signify the first identification of a Chalcolithic horizon in Sri Lanka, con-

temporaneous with the securely dated Chalcolithic of peninsular India. The slag, however, could have intruded into the sample from this otherwise carefully excavated context, perhaps through incorrect labelling. No pottery was found in association. Further sampling is required to clarify these points. It is now known that the only major source of copper ore south of Madhya Pradesh in central India is located at Seruvila in eastern Sri Lanka (Seneviratne 1994). It is very likely that this was known to the Chalcolithic peoples of India and that Sri Lanka exploited this resource. Mantai could well have been a port for shipping copper to India.

Neolithic settlements in northern India are said to occur as far back as 6,500-5,000 BC (Misra 1989 : 26). It is probable that peninsular India and Sri Lanka have yet to discover parallels. By 2000 BC, if not much earlier, peninsular India was fully fledged Chalcolithic. The search for Neolithic/chalcolithic settlements in Sri Lanka needs to focus on finding faunal or plant domesticates, pottery or evidence of copper-alloy working, in contexts predating the Early Iron Age. It is probable that these would be found in association with geometric microliths which would otherwise be assigned to the Mesolithic. It is noteworthy that the Neolithic/Chalcolithic stone artefacts in peninsular India display microlithic (Mesolithic) vis a vis blade (Neolithic/Chalcolithic) traits progres-



sively as one moves southwards (ibid., 295-6, 297; Alchin and Alchin 1974: 1974a).

Early Iron Age

The proto-historic Early Iron Age appears to have established itself in South India by at least as early as 1200 BC, if not earlier (Plasset 1990; Deraniyagala 1992: 734). The earliest manifestation of this in Sri Lanka is radiocarbon dated to ca. 1000-900 BC at Anuradhapura and Aligala shelter in Sigiriya (Deraniyagala 1992: 709-29; Karunaratne and Adikari 1994: 58; Mogren 1994: 19; the Anuradhapura dating is now corroborated by Coningham 1996). It is very likely that further investigations will push back the Sri Lankan lower boundary to match that of South India.

The settlement at Anuradhapura exceeded 10 hectares in extent by ca. 800 BC, and it was at least 50 ha by ca. 700-600 BC and thus already a 'town' (cf. Alchin 1989: 3). So far no other settlements of the Early Iron Age have been located in Sri Lanka (with the exception of the very small-scale deposit within the rock-shelter at Aligala). Potential sites are Kandambei, Matota, Maota, Pilapitiya in Kelaniya and Tissamaharama, but the evidence has yet to surface (Deraniyagala 1992: 730-2, 735).

The 'Megalithic' Early Iron Age mortuary complex of Sri Lanka (Senewiratne 1994) is akin to that of peninsular India. It falls primarily or possibly totally, within the proto-historic period, as indicated by its radiocarbon age of 770-400 BC at the only site to have been dated, Ibbankatuwa (v. Bandaranayake and Killion in Deraniyagala 1992: 731). The place of this mortuary tract within the overall Early Iron Age culture in Sri Lanka is as yet indeterminate. It is noteworthy that these cemeteries do not have contemporaneous settlements associated with them, for instance at Ibbankatuwa (Karunaratne 1994). Conversely, the Early Iron Age settlement at Anuradhapura does not have a Megalithic cemetery to which it can even remotely be linked. The Megalithic mortuary complex could possibly have been associated with just a special group of people, such as pastoralists, on the periphery of those

who occupied Anuradhapura (cf. Ireshnik 1974).

In short, what this signifies is that the Megalithic mortuary tract is but a discrete facet of the proto-historic Early Iron Age culture complex of India which had its distribution from the Gangaic valley down to Sri Lanka with regional variations. Hence it is misleading to refer to a megalithic culture, as several scholars do (up to), since this mortuary tract is not necessarily a concomitant of the Early Iron Age of peninsular India or Sri Lanka. Similarly, the Black and Red Ware ceramic tradition is a hallmark of much of the sub-continent's Early Iron Age (except in the north-west) and is not confined to the Megalithic mortuary facies in peninsular India, a point that is frequently overlooked.

There is a tendency to equate the Black and Red Ware ceramic with the Megalithic complex on a one-to-one basis, thereby distorting the basis of interpretations from the outset. It is important, therefore, that the nature of this interrelationship between (a) the total Early Iron Age complex of the sub-continent, (b) its Black and Red Ware ceramic complex and (c) the Megalithic cemetery complex in southern India and Sri Lanka be kept clearly in mind, so as to avoid confusion in interpreting the archaeological record (Deraniyagala 1992: 734). The Sri Lankan data need to be interpreted against the backdrop of the total sub-continent Early Iron Age, since medium-to long-range cultural diffusion appears to have been prevalent.

The biological anthropology of Early Iron Age man in Sri Lanka is distinct from that of Balangoda Man, although the evidence from the only Megalithic site to have been assayed, Pamparippu (undated), suggests a certain degree of unimagination. This could have occurred considerably prior to 500 BC (and after Bellanacandi Polnasa at 300 BC; *ibid.*: 736; Kennedy in Dogley et al. 1981). What attracted these people who included on the scene at this early date? It is probable that the agricultural potential of Sri Lanka, notably its abundant supplies of water, with iron technology to subjugate the dense equatorial rainforest and heavy soils, was a major factor. Other attractions could have been the pearl banks in the



northwest of the island (for Early Historic v. Mahroof 1992: 110), the major copper ore source at Seruvila, and island's location as an entrepot for long-distance trade between South-east Asia and West Asia (note that black pepper in pharaonic Egypt of the 2nd millennium BC could only have come from Kerala, Sri Lanka or Southeast Asia).

Thereafter, Sri Lanka's attraction for settlers from further afield than South India appears to have gained rapidly. This went coincided with the so-called Second Urbanisation of the Indo-Gangaic Plain (v. Alchin 1995). As mentioned earlier, Anuradhapura was at least 10 ha in extent by ca. 900 BC (perhaps much more). By then pre-historic stone tool technology had been completely superseded by that of iron at this site, other advanced trails being the manufacture of copper-alloy artefacts, high-quality pottery (notably Black and Red Ware), the breeding of cattle and horses, and the cultivation of rice. By 700-500 BC, Anuradhapura exceeded 50 ha. The phenomenon of the Indian Second Urbanisation would whenever adequately complete to be linguistically diagnostic, not in Indo-Aryan Prakrit. This sanction is repeated in the earliest inscriptions found in Megalithic Kadurantal, and possibly in the lowermost levels of Arakkamedu as well, in South India (*ibid.*: 745-6; Casal 1949; Rajan 1990). So far, none of them are in Dravidian. It appears to corroborate the view that Indo-Aryan was predominant form at least as early as 500 BC in Sri Lanka, as affirmed in

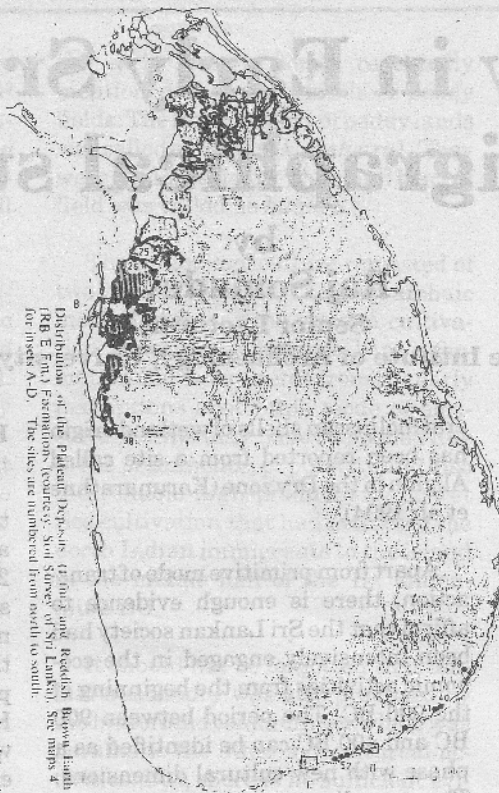
the chronicles concerning an Aryan impulse associated with Vijaya. The views of Parpola (1984; 1988; v. Deraniyagala 1992:749-8) are relevant in this regard. They are bold and provocative, and they merit serious consideration. He postulates long-distance southward migrations of ruling Indo-Aryan elites at ca. 500 BC and argues his case well.

The prime mover for these impulses is difficult to isolate. The urban centres of the Ganges plains could well have constituted the nodes from which they went out, centrifugally, to be developed in the provinces and returned centrepetally to those original nodes as a feedback phenomenon, thus creating a relatively closed interactive system. On the other hand, one cannot discount the possibility of inputs at the same time from West Asia, the Mediterranean and China. It is probable that this latter aspect has been greatly underestimated. The idea of devising the Brahmi script might have arisen through contact with Semitic trading scripts from West Asia (Deraniyagala 1992 : 744; note the passing reference above to postulated long-distance trade during the proto-historic Early Iron Age extending into Southeast Asia and West Asia).

Whatever the mechanism for the onset of urbanism in Sri Lanka, by 500 BC it was ready to accelerate into the Early Historic period. By the time of Emperor Asoka in the third century BC, the city of Anuradhapura was nearly 100 ha in extent (ibid.: 712-3), making it (on present estimates) the tenth largest city in India/Sri Lanka at that time and the largest south of Ujjain and Sisupalgarh, both in northern India (Allchin 1989:3, 12). Buddhism had appear to have manifested itself unexpectedly early in Sri Lanka, either through rapid stimulus diffusion, or convergent evolution due to a stimulus from further afield such as long-distance trade, or (more likely) a combination of both.

Transition to the Historical Period

The Early Iron Age of Sri Lanka, at ca. 1500-500 BC, is referred to as proto-historic since there is no evidence of writing in this period. At ca. 600-500 BC, the first appearance of writing (in



Distribution of the Paleolithic Deposits (1) and Early Iron Age Excavations (2) and Sites of Sri Lanka (3). The sites are numbered from north to south.

Brahmi almost identical to the Asokan script some 200 years later) heralds the commencement of the Early Historic period (Deraniyagala 1992 : 739-50). This writing, radiocarbon dated on charcoal and checked by thermoluminescence dating, is inscribed on potsherds signifying ownership. Among the names was Anuradha, which, coincidentally or otherwise, is stated in the ancient chronicles to have been the name of a minister of prince Vijaya, the purported 'founder' leader of the Sinhalese, at ca. 500 BC.

The new chronology for the beginnings of writing has thus revolutionised our concept of the lower boundary of the historical period of South Asia (for revised periodisation v. ibid.: 714). It has pushed it back by at least two centuries – into the times of the Buddha. Coeval with the first appearance of writing at Anuradhapura is the rise of new pottery forms (such as Early Historic Black and Red Ware) and wares (eg, a medium-fine grey ware, possibly a North Indian import), *mutisalah* red glass beads (from North India 600-400 BC v. Basa 1992:97) and what appears to be writing styli made of bone (Deraniyagala 1992 : 714). One suspects a pan-India wave of cultural impulses that manifested itself in these material transformations. It is possible that some long-distance migrations, as

evinced in the legend of Prince Vijaya's arrival in Sri Lanka from North India, were concomitant to this phenomenon.

The earliest (600-500 BC) inscriptions on pottery at Anuradhapura, by then taken root as the formal belief system of the island and technologically the concept of irrigated agriculture, probably introduced during the Early Iron Age, developed into sophisticated and large-scale systems which served as the economic foundation of the correspondingly complex settlement configurations of the Early Historic period.

Discussion

The pre-historic population densities in Sri Lanka during the Upper Pleistocene and much of the Holocene would have been sparse, estimated at ca. 0.1-0.8 individuals per square kilometre. These densities might have increased with the advent of iron technology and farming at ca. 1000 BC. However, there is a pronounced scarcity of Early Iron Age sites on the island. This does not simply reflect inadequate sampling, although perhaps partially so. It signifies that, despite iron and farming technology, Sri Lanka's attraction for an Early Iron Age economy was not compelling enough to manifest itself in numerous settlements. The number of the latter increases very markedly during the succeeding Early Historic period (500 BC - 300 AD) and much more so during the Middle Historic (300-1200 AD) when sites such as Anuradhapura and Mantai are at their grandest and a great proliferation is observed in settlements throughout the Dry Zone (cf. Solheim and Deraniyagala 1972).

One, perhaps simplistic, comment is that iron technology and farming were not the only factors responsible for the progressive burgeoning of settlements in the Early and Middle Historic periods. A third element appears to have entered the equation: increasing medium-and long-distance trade leading to a corresponding increase in wealth which acted as the catalyst for an exponential increase in the density of settlements. Systematic surveys to test this hypothesis and to delineate the nature of this progression is very much a research priority in the archaeology of Sri Lanka.

Economy in Early Sri Lanka : an epigraphical survey

by
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Sri Lanka has a great tradition of written sources of historical information extending from about 250 BC until end of the Kandyan regime in the second half of the 19 century AD. This significant tradition of literacy can be divided into two main parts. The most archaic part of this tradition represented by the inscriptions carved on mighty rock boulders and drip-ledges of the natural cave shelters which were used by the ascetic monks right after the advent of Buddhism in the latter half of the first millennium BC (Paranavitana 1970). The main intention of inscribing most of these inscriptions was to register the donations made by the rulers to the Buddhist religious institutes. However, among the texts of those records it embodied incidental information of different aspects of the contemporary society such as politics, economy etc. The main objective of this article is to survey the information that would help to reconstruct the nature of the early economic development in Sri Lanka.

The Phases

In a broad sense, the history of the incipient economic activities of Sri Lanka can be traced back to even up to the prehistoric age. Several ecofacts reported from different locations by the archaeologists are the main sources of information of those activities. For instance, the molluscan shells with marine origin found from Kitulgala, in the wet lowland area can be regarded as one of a mode of exchange or otherwise someone may have determinedly transported them across to two different eco zones. Most probably this would have been a primitive way of transaction between the Mesolithic communities at that time (Deraniyagala 1990). In the same manner, sev-

eral molluscan shells of wetland origin has been reported from a site called Aligala in the Dry zone (Karunaratne et al 1994).

Apart from primitive mode of transaction, there is enough evidence to affirm that the Sri Lankan society had been intensively engaged in the economic activities from the beginning of the 900 BC. The period between 900 BC and 400 BC can be identified as a phase with new cultural dimensions. The preceding stone technology had been transformed to a more advanced metal technology at that time. Settled incipient agricultural villages emerged as a result of the change in the subsistence pattern from hunting and gathering to the basic arable cultivation (Begly 1980), (Deraniyagala 1990).

After the discovery of iron and the introduction of incipient agriculture to the local society, several measures of basic economy have been gradually evolved. The materials unearthed from two main excavations at the iron age sites have revealed artifacts that would confirm this statement. The artifacts found from the excavation at Ibbankatuva iron age cemetery situated in the Mutale district of the Central Province included an elaborately designed necklace consisting of more than 300 beads made out of semi-precious stones such as Carnelian, Onyx which were not available in Sri Lanka. Those exotic items may have been imported from peninsular India which is the closest place of origin of those semi-precious stones in about 700 BC according to the 14C determinations obtained from the Ibbankatuva materials. From that period until the emergence of literacy in circa 250 BC, the economy of the inland society has continuously become more complex.

Economy in early historic phase.

Approximately, 4000 literate inscriptions have been found in Sri Lanka aggregating to the period between 250BC-50AD. These inscriptions bear short statements relating to the donations of the natural cave shelters to the Buddhist clergy by the various people in the contemporary society. However, some valuable information which could help in reconstruct the economy and the related phenomena in the social fabric can hardly ever be extracted from the scantiness of these inscriptions.

The authority

The authority of manipulating and controlling the economy of the entire island appeared to have been not properly centralized during that period. The inscriptions frequently mention a title of an official called *paramaka* that held the power of exploiting inland revenue. For example the *paramaka* named Uttara that had been mentioned in the Kandulama cave inscription of the Matale district, it referred to as a tax collector of the adjacent ferry. Paranavitana has pointed out that these *Paramakas* were from the land based elite group that corresponded to the leadership of the groups of people who were independently isolated in the various locations of the contemporary settlement areas (Paranavitana 1970: Lxxii). There were about 400 individuals who bear the title *paramaka* that had been referred in the inscriptions belonging to the period of 700 years. Gunawardhana (1985) argued elsewhere that these *paramakas* can be considered as those dispersed in the decentralized politics exercising economic power before the emergence of the centralized State.

Apart from the *parumakas* there were other personal manes *gamikas*² and *gahapatis*³ who were also mentioned in these inscriptions. But the true nature of these characters in relation to the Island's economy is still obscure.

After the ascendance of the *Lambakarna* dynasty, a clear catastrophic development in the authority of the economic activities had been observed. At that time the economic authority became centralized under the powerful *Lambakarna* rulers. It was also at this time that the political power of the Island had been transmuted to centralization according to the archaeological and historical evidence.

Agriculture

Agriculture and trade were the main sources of income of Sri Lanka at that time. Any indication of irrigated agriculture has very rarely come to light through the contemporary inscriptions. Small tanks were widespread all over the dry zone areas. The authority of maintaining such tanks was sometimes in the hands of private owners. The term *vapihamika* (*Skt. vapi + swamika*, lit. "Proprietor of the tank") was used to denote the private tank owners.⁴ However, it should not mean that the sole authority for the construction and the maintenance of tanks was vested in private enterprises.

The word *avarana* was used in the Gallenavivahara cave inscription of the Kurunegala district to denote a dam constructed across a canal for irrigational purposes.⁵

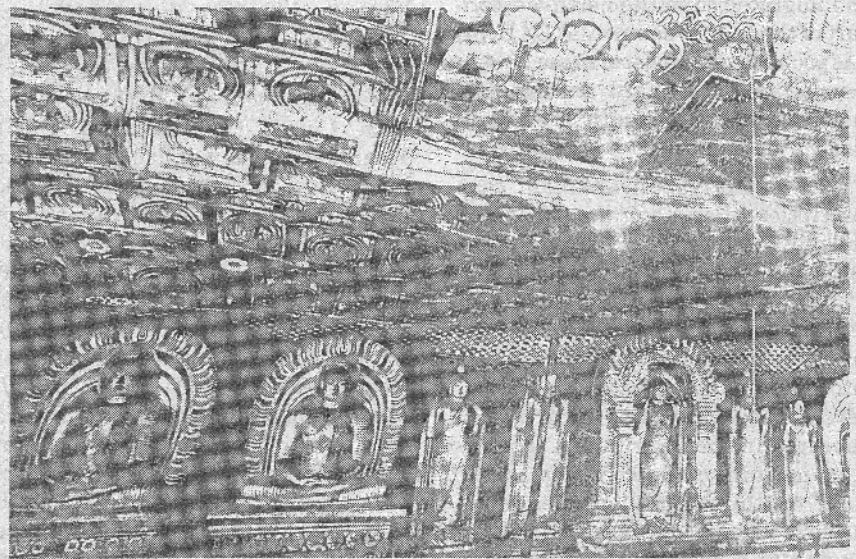
The mode of land utilization is also vital in agricultural activities. Inscriptions show that there were two methods of dividing land for agricultural purposes in the early stage. The first was based on the sowing extent of the land. The above mentioned Gallenavivahara cave inscription indicated a term *ada karihi bumi* which means "half a *karisa* of land". The other method of dividing the land was directly breaking them into allotments. The Lenagala cave inscription of the Kegalle district mentioned about several land allotments itself termed as *pataka*⁶ (Paranavitana 1970 : 60). The wet rice cultivations was always associated with the paddy fields. The inscriptions of

the early historic period repeatedly mentioned about two kinds of paddy fields. The first category of paddy lands was called as *keta*⁷ (*Skt. kshetra*). They were the large fields. The small tract of field was called as *kubura*.⁸

The inland agriculture consisted of two types of systems. The most archaic method of it was the *sweden* cultivation. However, unfortunately no information can be extracted from the early inscriptions about this mode of agriculture. This may have happened due to the prominence, popularity and also the reliable high productivity of wet rice cultivation that had attracted the north Indian immigrants to the island in the middle half of the 1st millennium BC.

It should not be forgotten that animal husbandry was also practised by the hinterland communities which was parallel to the other agriculturual activities. But, there is no sufficient evidence from the inscriptions to infer which varieties of animals were used at that time. However it is reasonable to assume that the cow was the main creature which was utilized by the farmers at that time. A cave inscription found from Avukana in the Anuradhapura district indicates a term *tanabumi* which is derived from *Skt. Truna + bhumi* meaning "pasture land" or "grassland" probably used for animal husbandry.⁹

The practice of horti-culture may



The resplendent world of the interior of Cave 2 (Maha Raja Viharaya) embellished with the artists' imagination in painting and sculpture. Rangiri Dambulla Rajamahavihara, Matala District, Eighteenth Century.

have also played a vital role in the regional economies in the early period. Some references of *gebim*.¹⁰ (*Skt. gruha + bhumi*, lit. "home gardens" or "lands") can be seen in the later period inscriptions (Buddanhehela Pillar inscription, EZ Vol. I : 198, 23-24).

Apart from the cultivation of paddy and other cereals such as *undu* (*phaseolus mungo*), *ma* (*vigna cylindrica*), *mun* (*phaseolus anreus*) *kurakkan* (*eleusine coracana*) *tala* (*corypha umbraculifera*) *amu* (*paspalum scrobiculatum*) etc. some other plants were also cultivated in the estates (Siriweera 1978). For example the Mihintale rock inscription of King Mahadatik Mahanaga (7-19 AD) mentioned about a coconut grove situated in the village called *Agnagama*¹¹ (Paranavitana 1983 : 31).

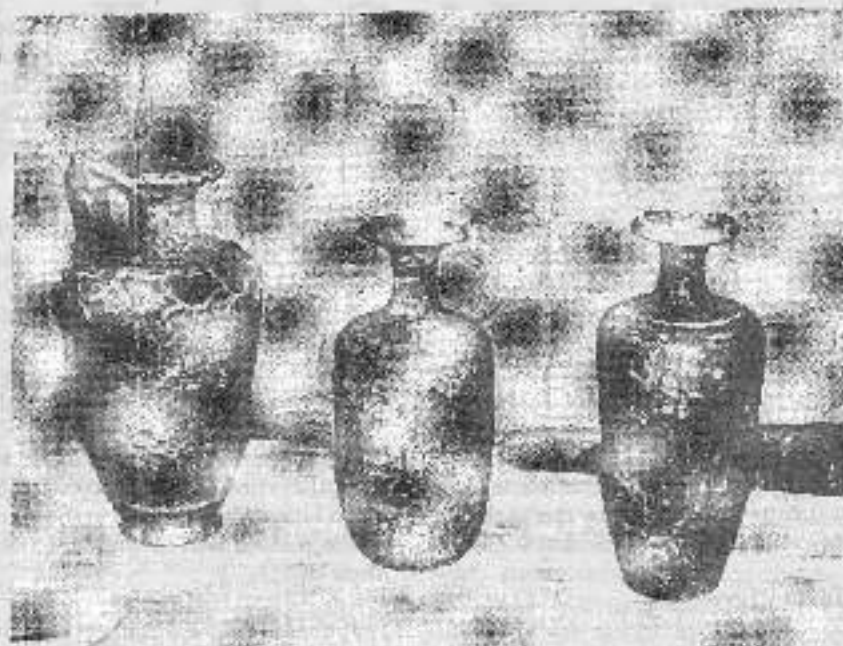
Trade

There is enough evidence in the inscriptions to understand the nature of the trade carried on in the early Sri Lankan society. Trade was the main source of wealth of the people. The distinction between inland and long distance trade was distinctly visible. The term *vaniya*¹² which was used to denote the merchants appeared in a number of times in the early inscriptions. A cave inscription found from Sigiriya of the Matala district mentions of such a merchant who was then engaged in selling *Tamarind*¹³

(*tamarindus indicus*) (Parasvitana 1970 : 1186). Mostly the inland trade activities operated across the different eco-zones due to the non-availability of some resources in some areas. For instance, precious and semi-precious stones were transported from the gem bearing areas of the wet lowlands and the intermediate zone of the island to the other areas. More than 15 varieties of such precious and semi-precious stones were found from the excavations at Anuradhapura (ASCIAM 1951 : 48-59) making a strong testimony to this factor. Conch shells, pearls and salt were brought from the maritime littoral areas to the hinterlands. However, the inscriptions do not furnish enough information about this system of exchange. On the contrary, more information can be extracted from the literature such as *Attakathas*, the commentaries of the Buddhist canon compiled in later centuries.

Long distance trade exclusively handled by the foreign merchants. The Diaspora settlements inhabited by migrated merchant communities had been dispersed along the coastal belt especially in the areas associated with the down reaches of the main rivers and their tributaries. Reference to these alien merchant communities have been inserted in the inscriptions with their own ethnic identities. Bovattegala cave inscription of the Hambantota district described a group of merchants called *Kambojas*. Parasvitana has identified in a later instance that these *Kambojas* had migrated from the north-western part of the Indian peninsula (EZ II:74). It is probable that most of these foreign merchants were Tamil traders who migrated from the south Indian region.

The Periyapuliyankulam cave inscription (Parasvitana 1970:356) and the Kuduvil cave inscription of the Batticaloa district mentions them as a group of such Tamil traders. It is evident that most of these merchant communities have organized themselves into guilds in their course of operation. Several times the word *puga* or *pugha* appears in the inscriptions. The literary meaning of the word *puga* is 'the guild' or 'the corporation'. Veherakema cave inscription shows a guild belonging to a corporation of weavers. Also the Kuduvil cave inscription has mentioned that such a merchant guild had operated in the Dighavapi area.²⁷



Glass-Persian vases found at the Jetavana Stupa, Anuradhapura, 4th century A.D.

The contemporary inscriptions do not tell us about kind of goods that had been exchanged between these foreign merchants and the host communities. As indicated above, the literature compiled in later centuries included enough information in connection with trade items then exchanged. The archaeological excavations also revealed much data to widen the knowledge about the items exchanged. Perera has pointed out elsewhere that spices, gems, ivory and pearls had been exported and mostly ceramic, silk and aromatic items had been imported to the island (Perera 1952). One of the poems indited at the 5th century AD. complex in Sigiriya mentioned about silk clothe imported from China²⁸ (Parasvitana 1966). Weerakkody has published extensive literature regarding foreigners engaged in long distance trade with Serendib or Sikkandina (Weerakkody 1984). Recently Gunawardhana and Prickett have also dealt with this subject (Prickett 1990) (Gunawardhana 1990). An rare information about a mariner who sailed to a place called *borakavata*²⁹ from Sri Lanka has rendered a cave inscription which was found at Bagaralena of the Kandy district (ASCIAM 1933: 17). *Borakavata* referred to in the existing inscription was the famous port situated on the western coast of India which appeared as *Borjakavata* in Indian literature and presently called *Boroch*.

Crafts

Other than the agricultural and the trade efficacy, craft specialization was also vital for the economy. In the early stage Sri Lankan society had enjoyed several specializations in craft production. The contemporary inscriptions have not been able to give us a whole set of information in this regard, but occasional references are reflected in their texts.

According to the information revealed by the early inscriptions it seems that the main crafts at that time were directly associated with natural resources which were exploited from their different locations. Therefore, the extraction of mineral resources may have played a crucial role in the contemporary economy.

The word *kubara*³⁰ (*Skt. Kambari*) which appeared in the Mutugalla cave inscription had been used to describe an ironsmith (IRASCB NS V : 29). The same ironsmith named *Naga* who made this cave donation to the Buddhist sangha in the Ganekandavihara was a senior member of a merchant corporation named *Siddhiya*³¹ (IRASCB NS V : 71).

Iron was not the only metal that was utilized for crafts. Copper was then a subsidiary metal for iron. The

world *Tabakara*²⁰ can be seen in early inscriptions to signify the coppersmiths (Paranavitana 1970 : 350). In very rare instances, tinsmiths were also mentioned in the early inscriptions.²¹

There is uncertainty about gold mining in ancient Sri Lanka. There was only one inscription in respect of goldsmiths. If gold had not been mined in the island, it may have been imported from the available countries. In the later periods of the history there was enough evidence to show the extensive use of gold for various purposes. In another cave inscription found at Mandagala mention of a goldsmith²² has also been made. (ASCAR 1934:21).

Apart from metals, natural rock minerals had also been exploited considerably. Among them the important rock minerals were precious and semi-precious stones. Those who exploited natural rock minerals have not only handled gem industry but also gem crafting. These craftsmen were described as *manikaras*²³ (Paranavitana 1970 : 546).

Crafting ivory objects had also been practised at that time. Sri Lanka was famous for Ivory from the early years of first the millennium BC. Vegiriya Devala cave inscription in the Kandy district mentions about in ivory worker²⁴ (Paranavitana 1970:807). There is no information concerning ceramic manufacture as a craft in the early Sri Lankan society. But potters were abundant. Most of the domestic utensils may have been made out of clay. Potters had been described in the early inscriptions as *kubakaras* (ibid).

As specifically mentioned in an earlier instance, weavers may have enhanced the cotton industry to certain standards. Some literary works compiled in later centuries indicated a world such as *kapu hen* which denotes chena cultivated cotton (Siriweera 1978 : 43).

Professions

The professions that had been practised during that time can be divided into two categories. They are institutionalized professions and individualized professions. Both categories were vital for developing the island's economy.

An extensive list of institutionalized professions can be compiled with information found in these inscriptions. There is no sufficient space in this article to provide a complete account of all these professions separately. It is however appropriate to discuss here briefly about the officers who were directly involved in the day to day economic activities.

The Periyakadu Vihara cave inscription in the Kurunegala district has referred to the very important profession of coin minting. The inscription itself has termed it as *rupadaka*.²⁵ The word *rupadaka* is derived from two Sanskrit words *rupa* + *adyaksha* meaning the mint master (CJSG II : 214). The subject of minting coins will be discussed later in this article.

It is important to note that several professions had been mentioned in the inscriptions of the early period that formed an essential part of the contemporary economic mechanism. The main professions of this kind are the *badakarikas* (Skt. *bhandagarika*, lit. "treasurer"). The most noteworthy persons in some instances were the *badakarikas* and also the *parumakas*.²⁶ They would have been the chief responsible officers for storing and distributing agricultural products of the hinterland area of the island. But unfortunately the inscriptions do not give any further clues to understand how they organized and managed the distribution of the goods.

Ganakas (Skt. *ganaka*, lit. "accountant") are the other officers who have occasionally been mentioned in the early inscriptions. There had been eight such *ganakas* during the period between 250 BC to 10 BC. In the Silavakanada cave inscription of the Hambantota district mention had been made of a joint donation made by such *ganaka*²⁷ to the Buddhist sangha (JRASCB NS II : 137).

The individual professions were numerous. They varied from painters (*citakaras*), dancers (*natas*), arches (*danugas*) to the *nagara sobhinis*²⁸ ("she who lends charm to the city") (Paranavitana 1970 : 1010).

Inland revenue

From the period between 250 BC

upto the end of the 1st century AD, the development of the inland revenue system in Sri Lanka was vary clear. This development occurred parallely to the centralization of the political structure of the island. In the period after 40 BC, it can be seen that a system of taxation had gradually been evolved. There were three kinds of taxes that had been described in the contemporary inscriptions.

Among those three taxes, the prominently described tax was the *bojakapati*. This had been derived from a Sanskrit word *bhojaka prapti* meaning tax gathered from the land consumers of the island.²⁹ It was the main tax had been collected by the state. This tax was 1/6 of the entire income obtained from the property.

Another tax frequently mentioned in the inscriptions during the period was the water tax. It is termed in the inscriptions as *dakapati*. Etymologically this word had been derived from Sanskrit word *udaka prapti* to mean that the tax levied had been from the users of the water of the state owned reservoirs.

The third tax called *mataraja baka* in the inscriptions was the tax levied from the people who caught fish in the water courses (ASCAR 1955 : 35). *mataraja baka* is a derivation from the combination of the Sanskrit of the Sanskrit phrase *matrika matsya bhaga* meaning these tax was levied for catching fish in the minor canals or water courses.

Godavaya rock inscription of the Hambantota district contained a word as *suka suriyi* giving us another kind of revenue of the contemporary period. Paranavitana states that the meaning of this word indicates : "custom duty". This duty has been levied at the port situated in the vicinity of the inscription named *godapavata patan* (*goda pabbata pattana*, "the port of Gota parvata").

Currency, Exchange and Banking

Medium of exchange is a vital character in all economies. According to the factors already discussed in this article it is evident that the economic activities of early Sri Lanka were well organized and rather complex by their

nature. One cannot understand this without reference to a systematized media of exchange. Both literally and archaeologically there is ample evidence to help one to understand the nature of the media of economic exchange at that time. According to the information furnished by literary sources and the archaeological materials, the mode of economic exchange of the early period of Sri Lanka can be divided into three categories as follows:

1. use of metallic coins (with adopted values);
2. use of metallic coins and metallumps (for weight value);
3. system of bartering.

The inscriptions of the early period bear a word 'satapana' (skt. *satapaṇa*) which is the earliest type of coin used in Sri Lanka. Some numismatists thought that these coins were originally issued in the Northern Indian region and subsequently circulated in south India and Sri Lanka (Jayasinghe 1997). If this idea is plausible this circulation of the coins was promoted by the merchants who continuously operated their activities in the southernmost part of South Asia. More than 4000 of early coins which numismatists termed as punched marked coins has been found from different sites of the island. The first indigenous coin of Sri Lanka emerged during the first or the second century AD.

The manipulation of coins of weight standards may have been more complex than using metallic coins with the adopted values. Most probably this method would have been applied for manipulating foreign coins and also rare metals such as gold and silver. More than 50,000 Roman coins have been found from different places in the island (Walburg 1985).

Barter system had been mainly operative among local communities. The people who settled in ecologically distinct zones exchanged the products which characterized their own regions. This systems of bartering which operated between the alien merchants and the local traders was sometimes called 'the silent trade'.¹⁹

The earliest references to the systems of banking can be attributed to

the fourth century AD. Tongala rock inscription of king Kirti Sri Meghavarnabhaya (801-828 AD) mentioned about such a bank named *kalatama-naka*. This inscription itself described this bank as a *kalatamavaharayanama-lara* indicating a merchant guild named *Kala Samana*. Deva a son of Minister named *Palaja*, had deposited his own harvest in this *kalatamavaharayanama* merchants guild and the interest of his deposit has been granted to the *Yachiva parvata* monastery for religious purposes. There is enough evidence to show further developments of this system in late centuries.

The discussion, in this article explains the nature of the economy in the early phase of the historic period in Sri Lanka. The information given by the inscription in this regard not sufficient to give a complete picture of the economy. But it provides a rather reliable source of information of the economy of this remote period.

Notes

1. Total gold coins in the Kalatama-naka inscription... The word 'satapana' is derived from the Sanskrit word 'satapana'...
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ANCIENT IRRIGATION AND ITS IMPACT ON EARLY HISTORIC SRI LANKA

by

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Two important factors were responsible for Sri Lanka's renowned ancient prosperity. These were maritime trade and agricultural success. Maritime trade was facilitated by the island's central position in the Indian Ocean astride the seaborne trade routes of East and West and its own sought after resources of pearls, spices, gems and elephants. The island grew in importance as a land that offered safe anchorage for ships carrying goods in the international maritime trade between the ancient cultural centres of Imperial Rome and China. Agricultural success was a direct result of the development and spread of a remarkable irrigation network. The scope of this paper is however limited to the role of irrigation in ancient Lankā and its implications.

The remains of pre-historic people on the island of Sri Lanka have been radiometrically dated by Deraniyagala's work to 28,000 years ago. There is other solid archaeological evidence that points to the pre-historic presence on the island to be far older such as dated stone tools, shell middens etc. which can push the dates back to 300,000 or even 500,000 years ago (see Deraniyagala 1992). The well represented mesolithic period of Sri Lanka curiously transits into the proto historic iron age around 1000 BC without evidence for a Neolithic period with the possible exception of evidence from an excavation of a cave site by Wijeyapala. (The Neolithic is characterised by the prevalence of stone tool technologies together with pottery use and domestication of plants and animals). The

beginning of iron use in Sri Lanka can be argued to be the beginning of the dominance of agriculture. Irrigated agriculture primarily the cultivation of wet rice can be seen to be the bedrock of the Sri Lankan early historic period beginning about 250 BC and continues to be such for many subsequent centuries till the collapse of Polonnaruwa in the 13th century AD. Iron tools and later steel together with suitable soils and landform can be seen to foster the spread of large scale agriculture based on irrigation which was to largely replace the more ancient subsistence oriented slash and burn form. This increasing carrying capacity of the land can in turn be seen to give rise to early urbanism both in the North Central

and South Eastern dry zone areas.

In dry zone Sri Lanka to get beyond the subsistence level of agriculture, irrigation is a necessity. This truism is not based on an overall lack of rainfall, but more on the marked seasonality of the rains. Too much rain during the short sharp North East monsoon which brings rain and often flooding to much of the dry zone and not enough or none during the other months. Given these climatic limitations storage of rain water for use in year round agriculture becomes imperative. The origins of irrigation in Sri Lanka are however not so obvious. Some scholars argue that ancient Sri Lankan irrigation is an indigenous development of the proto historic peoples of the island, while others believe it arrived from India together with rice growing settlers. The difficulty of dating ancient irrigation works compounds the problem of origins.

One thing however remains clear to us upto the present day. The remains of ancient irrigation works in the island bear eloquent testimony to a people whose use and control of water for agriculture was unsurpassed in the context of the pre-industrial world. Sixty three years have passed since R.L. Brohier published *Ancient Irrigation works in Ceylon* in 1934, but it still remains the most comprehensive survey of ancient irrigation works in the island, particularly for large and medium works and importantly for those that have been subsequently damaged or obliterated. However, as a research tool, Brohier's data is fraught with the pitfall of statistical inaccuracies. This is often a result of having to compile

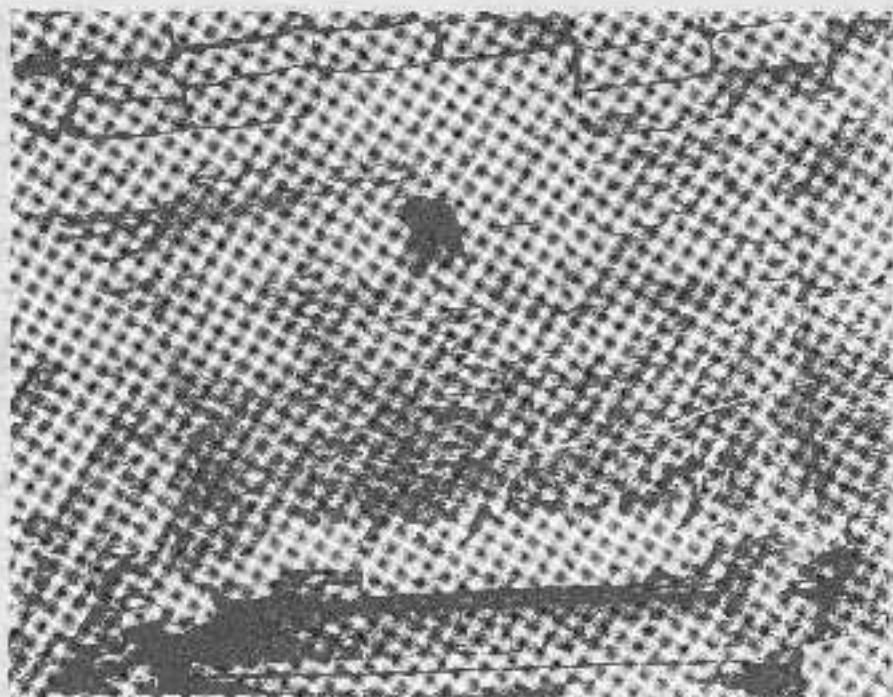


The Naga, the serpent - the guardian of water

A R C H A E O L O G Y

secondhand knowledge from earlier authors and inadvertently repeating their mistakes.

The main components of the ancient irrigation network are still to be seen scattered in the dry zone districts of the island. Indeed many of the larger tanks (reservoirs) some of the smaller ones and the largest canals have been renovated and are once again in use throughout these areas. The most visible remains are the massive earthen embankments of the large tanks and the large canals. The irrigation related elements associated with a tank are first the bund or dam, second the built in sluice, third the cut stone or natural rock spill incorporated into the bund, third the canals leading from the sluice exits and in the case of larger tanks wave breaker banks along the inner slope of the bund. Three types of tank sluices are known to have existed in ancient Lanka going by literary sources (see H. A. L. H. Gunawardana 1979), these are namely in descending order of scale the *Bisokotuwa sorowwa* or cistern sluice. The *Rajmohol sorowwa* or piston sluice and *Keta Sorowwa* or Pipe sluice. The last of these sluice types the *Keta Sorowwa* is still in use in some of the more rural small tanks. Though it is believed to be a British colonial design, both literary and physical evidence exists to say that the colonial Irrigation Department merely mass produced in concrete the ancient terra-cotta *Keta Sorowwa*. The second type of sluice the *Rajmohol Sorowwa* is known from examples in India, but archaeological evidence from Sri Lanka is still lacking. The *Rajmohol Sorowwa's* location within the tank waters may have contributed to its poor survivability. A piston made of perishable material such as wood may also contribute to its absence from the archaeological record. The first mentioned sluice incorporating the *Biso Kotuwa* or cistern sluice is still to be seen in various states of preservation in some of the larger unrenovated ancient tanks and even in the occasional small tank, giving an indication of its versatility. More importantly the *Biso Kotuwa* sluice can be considered as a master work of ancient Lankan hydraulic engineering. Current evidence points to the *Biso Kotuwa* being a Sri Lankan invention. The *Biso Kotuwa* functions like a modern surge chamber in allow-



The remains of the old *bisokotuwa* at Maduru Oya, rediscovered in 1978 by modern engineers who had themselves chosen this site for their dam.

ing the controlled and timely release of water from large reservoirs, while guarding against sudden surges that may pose a danger to the sluice barrel. It is safe to surmise from the existing evidence that sluices incorporating the *Biso Kotuwa* were in use in the island during the first half of the first millennium AD or more than fifteen hundred years ago. Such a device was not in use in Europe or North America till after the 18th century (see Needham 1975).

Canals on the other hand are less visible in their state of abandonment, unless they are giant canals or *Yoda Ela* many of which have been renovated and are in use today. *Mudpe Ela* on the eastern edge of the Central province and *Jaya ganga* between *Kalawewa* and *Anuradhapura* are two excellent examples. Ancient canals are of many types. They have either a single or double embankment begin at an anicut across a river or lead from one tank to another. They go from river to tank or from tank to fields. They functioned to augment tanks, irrigate fields and the largest of them undoubtedly facilitated the transport of goods and people and effected the trans-basin delivery of water. Tracing and studying the canals is where they originate and where they terminate is the key to understanding the inter-

connected nature of the ancient irrigation network. Some ancient canals have today become natural water courses while others have all but disappeared due to sand and debris infill. The study of ancient canals therefore requires painstaking and time consuming field work.

Anicuts or *Anunas* are cut stone (granite or gneiss) weirs or barrage dams built across perennial or seasonal water courses and by the Polonnaruwa period even across the island's largest rivers. They were built of dressed blocks, several courses wide and high, sometimes weighing close to half a tonne articulated together with the use of lipping to form a wall across the river. The ends anchored to the banks show the use of bricks, while at least in later anicuts the use of a water resistant lime and quartz-pebble concrete has been used. The function of an anicut was to channel water from a river or stream into a man made canal. The anicut hurls up the river behind it for some distance, which raises the river level hence even when natural flow levels in the river are low the canal mouth can be fed due to the artificially raised water level. Due to the erosive power of flowing water many ancient anicuts have been wholly or partly washed away. Some of the better preserved examples have been

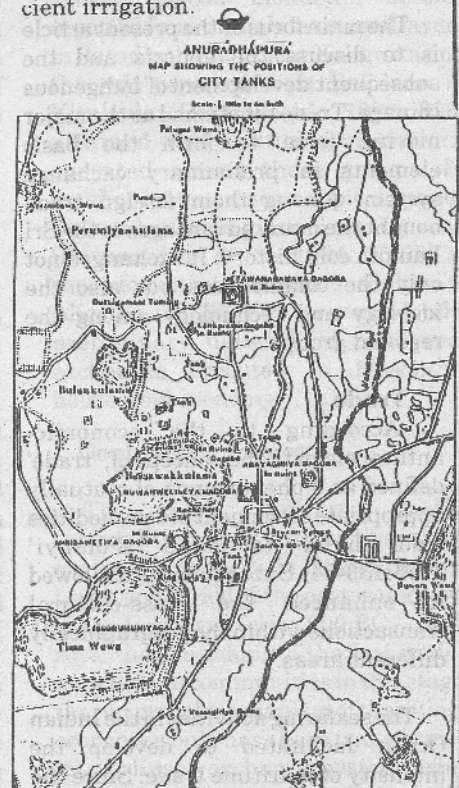
regretably destroyed by the Irrigation Department during the last hundred years without proper study or recording. Today their sites are occupied by modern concrete anicuts that use the same ancient canals served by modern canal headworks. However enough physical evidence of ancient anicuts remain scattered across the country to give one an idea of the skill of ancient hydraulic engineering. Galkadawela Amuna across the Malvatu Oya in Anuradhapura and Ridi Bendi Ela Amuna across the Deduru Oya near Wafiyapola are two of the better examples.

The study of ancient irrigation in the island reveals that the architects of the system were well versed in rainfall patterns landform, soil properties, construction materials, their limitations and application and above all an amazing grasp of hydro-dynamics. From our stand point in a technologically advanced computer age we may be prone to devalue the achievements of ancient Sri Lankans. However, there is every indication that more than a millennia before the words scientific and engineer were coined. Sri Lankan irrigation involved 'engineers' who probably underwent formal training in techniques that formed a body of knowledge that required a understanding of the sciences that are familiar to most of us of the post industrial age. Not only the loss of ancient knowledge but the loss of material hampers the proper understanding of how some of the ancient irrigation structures functioned. Canal headworks, gates within the Biso Kotuwa, gates in anicuts - all these have left behind tantalising traces of their presence (eg - slots, grooves) but due to the perishable nature of the materials used (e.g. wood, iron) nothing remains of the mechanisms themselves. Using modern analogies it is possible to arrive at conjectural hypotheses of the designing function of some of these ancient structures. In the absence of good dates from a wide cross section of ancient irrigation structures it is not possible to arrange them in any evolutionary sequence. In a very general sense one can state that the technique of building small tanks and simpler sluices (Keta Sorowwa) preceded the construction of large tanks and more sophisticated sluices (Biso Kotuwa - Sorowwa).

The growth of irrigated agriculture; the buildup of grain reserves in particular can be seen to increase the carrying capacity of the land. This in turn is an impetus to early urbanisation and can be seen as a worldwide phenomenon. In Sri Lanka too there is evidence for linking the growth of irrigation with the rise of urbanisation. Early centres such as Anuradhapura and Mahagama are examples. The large body of Brahmi inscriptions written from the 3rd century BC - 3rd century AD that have been copied from rock shelters throughout the island throw some light not only on early urbanisation but also political centralisation social stratification and change in Buddhist practice. The earliest Brahmi inscriptions refer mainly to the simply prepared rock shelters and the names of their lay donors. The later Brahmi increasingly refers to the donation of tanks fields and revenue to the Sangha. In this increase in material donations can be seen a gradual change in Buddhist practice among the Sangha of the early historic period. The asceticism stressed by the Buddhist missionary Arahat Mahinda is being gradually replaced by a more "domesticated" or worldly form of Buddhist practice. I would argue for the first 150 years of Buddhism in the island to be typified by Vipassanadhura Bikkus the bulk of whom lived in forest hermitages such as Mihintale and Vessagiriya. The Sangha can be seen to become a chief beneficiary of the gradual growth of irrigated agriculture and the resultant prosperity. This change in Buddhist practice culminates in the large scale abandonment of forest hermitages with rock-shelter kutis and the rise of large urban monastic centres such as Anuradhapura's Mahavihara and the proliferation of small village temples who have constant interactions with lay village dwellers, and a change in emphasis from meditation oriented to ritual oriented. The early Brahmi inscriptions refer to named Gamikas and Parumukas and other village notables but the later inscriptions are often by known kings. Implied in these noted changes is the increasing social stratification Royal legitimation and the political centralization of the island.

Water is used as a commodity from early times. In the form of irrigation works it is bought, sold, and gifted.

Those who controlled irrigation works can be seen to wield real power in early Lankan society. Reciprocal relationships that are obligatory in this increasingly stratified society are consolidated by the growth of an irrigation network and the manner of its functioning and control. When viewing the level of sophistication and inter connectedness of the developed phase of the ancient irrigation network, one has to conclude that trained professionals, a bureaucracy and central control was necessary to maintain and run the whole even when it is assumed that only 75% of ruined irrigation works functioned at the best of times. Irrigated agriculture was the bedrock on which this islands civilization was founded and the success of irrigation lead to a cultural architectural and technological florescence. Therefore irrigation can be seen as a force for social evolution. Without studying ancient irrigation and its social impact a proper understanding of the people or history of this island is 'impossible. It is ironic that much of the destruction of ancient irrigation works that had withstood the test of time remarkably well have been at the hands of personnel of the Irrigation Department whose professional heritage happens to be ancient irrigation.



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Introduction to the Basic Formation in Inland Monetary System as an Impact from the Long-Distance Trade

by
Chandrika Neelamani Jayasinghe

When the transformation of the non-complex societies towards the more advanced urban life style, a number of internal socio-economic changes and affiliated trends were emerged in every historical societies. Most of these cultural achievements directly or indirectly associated with the production mechanism and its offshoots. Among the other trends of the new urban atmosphere, long-distance trade played a crucial role.

The main focus of the present article is to discuss the genesis and the subsequent development of indigenous coinage. Trade functioned as the major moving force to form the basic elements in preliminary exchange system. Among them foreign trade brought the many advantages to the Sri Lankan coin history. It exchanged not only the commodities but also the ideology and technology among the regional groups.

Trade

According to the economic-anthropologists the concept of 'trade' defined as a phenomenon of mutually appropriate movement of commodities from hand to hand [Polanyi² 1975:133-64]. Subsequently, it allowed to enhanced the cross-cultural transactions within the geographically different areas.

The seafaring activities in the Indian Ocean facilitated to develop the intensity of maritime trade. Since the latter half of the first century BC these trade links became a main source of

the growth of cultural intercourse in this region. Major ports and port towns emerged in Andhra Pradesh [Ray 1986] and Tamil Nadu [Sastri 1993; Ramani 1988] provided the easy access to the exports of Sri Lankan products that later redistributed to the western and eastern countries.

Sea-borne trade was begun in the south China Sea and the Bay of Bengal concurrently. Evidently, in around the 2 century BC the activities of the trade-routes between China and Mediterranean came to its zenith, both over sea and by land. Enormous relations were maintained between Persian Gulf in the west via India and the southeast Asia to China and to Japan in the Far east through this channel [Carrin 1981:101]. In this extremely complex cosmopolitan atmosphere, the Roman traders played an important role in the south Asian markets respectively, at the time of Augustus (27 BC-14 AD) [Warrington 1927; Casson 1950:21-36; Begly 1991:3-7]. Apparent to the numismatic and archaeological sources Roman participation in the maritime trade in the Indian Ocean gradually declined with the fall of the Roman empire in about 5 c. AD [Casson 1980:25].

In later centuries the Roman absence was replaced by the Muslim merchants who established their trade colonies in many parts of India until the European conquest. According to the evidence the Persians, Jews, and Mesopotamian traders actively engaged with the south Asian markets before the Muslim domain emerged [Spuler 1970].

Relevant that situation, the distribution and the changing pattern of the maritime settlements in Sri Lanka bear a testimony to the trade in the southernmost segment of south Asia. There are sufficient literature, both historical [Perera 1952: 611-13; 192-204; *ibid* 164, 301-320; *ibid* 161-2; 14-22; Siriweera 1994; Weerakody 1986: 417-451] and archaeological [Bandaranayake et al. 1990] to prove the volume of maritime trade executed by the Sri Lankans. Champakulakshmi [1996: 25-8] elsewhere states that the process of urbanism in the Ganges Valley and the Krishna Valley in south east were the most prominent, who provided the main influence to enhance the economic and social activities in Sri Lanka with peninsula India. Particularly the archaeological excavations of the last two decades in Anuradhapura [Deraniyagala 1992:709-13] in the central dry zone and the Tissamaharama [Weisshart et al. 1993] in the southern dry zone of the island revealed much evidence to prove this nature. Senewiratne states, in this regard as follows,

... the synthesis of all these cultural elements and an interaction of the culture zones in Sri Lanka may have been responsible for the relatively rapid spread of the cosmopolitan culture, at least engulfing the elite groups, and providing some resemblance of a homogeneous uniform cultural matrix within the island during the post 3 c. BC. period..... [1981:292].

When considered to whole these factors it is clearly emphasized that the inward dynamics generated towards

1. He further analyzed the trade into three varieties, as 'Gift trade' which refers to a reciprocal relationship between each members; 'Administrative trade' which facilitated other legalised arrangements; and 'Market trade' in the significance to economy based on supply and demand, price to value mechanism [Hirst 1993:247].
2. There is a different conceptual usage of this word in literature which focused to be research studies in 'regional theory' and 'indigenous evolution' [Bandaranayake 1992: 15-20].
3. According to the archaeological journals, *Journal of the Archaeological Society of India*, New series, Foundation, *Journal of Archaeology and Ethnology*, Calcutta, 1962, 34(7) 11 (1) (2): 129-70.

Sri Lanka since about the first millennium BC. One of the essential outcomes of this process appeared in the organized economy was the growth of mercantile authorities. They were accompanied with the individual or the groups of merchants and artisans from local and foreign origin. They required a unique media to represent their own identity with the legitimacy in their exchanges. Gradually, such requirements necessitated to monitoring the whole set of micro and macro scale economic transactions. The first indigenous coins have been invented to fulfill that requirements in most acceptable manner.

Monetary Values

Studying the ancient money as a source of history, it disclosed the many vistas in human behavior. Therefore the modern numismatists considered in elsewhere,

..... the real history of money lies not in statistics, nor even in numismatics, but in human attitudes and behavior [Williams et. al. (ed) 1997:13].

The initial forms of the pecuniary mechanism in Sri Lankan economy is appeared in the beginning of the Early Historical Period [500 BC-300 BC]. Preliminary structure of these transactions were evolved from the reciprocal system of barter. Since then it passed the various stages of monetary systems comparative to their technological improvements. Most curious among them was the invention to metallic coinage which derived around the late 3 c. BC. That was formed as a long-range cultural diffusion from mainland India which prevalent in many other contexts of the past. Because of the inspiration from Indian tradition, the studies on Sri Lankan coinage should have to concentrated within the broad south Asian context as a macro scale comparatively.

However the available historical sources in Sri Lanka did not furnish the enough explanations about the natural process of the metallic coinage. In fact some epigraphical sources described the various value systems which operated by the legalized measurements and weight standards.

If summarized the evolutionary process of the whole mechanism in inland currency system it developed under three main explicit categories as follows. They are,

I. the commodity money [reciprocal exchange of different commodities],

II various weight standards and measurements of legalized objects served as nominal values,

III. metallic coins [made of copper, bronze and leaded alloys and precious metal (gold)] that used as a mediation of intrinsic value.

The above classified first two groups of 'commodity money' and the 'legalized measurements' can be introduced as the 'primitive money' of the island. They are important sources to understand the principal forms of indigenous value system prior to the invention of metallic coins.

The usual characteristic of the 'primitive money' is it's adopted value. That adopted value is depended on the technological advances and socio-cultural determinants of each society.

According to the discoveries by the ethnographers and anthropologists, who worked on this subject have been introduced the numerous varieties of objects used as primitive money by the pre-modern societies to facilitate their exchanges. Therefore the unit of any object used as money by one society could differ from the other.

On the contrary, the modern numismatists who considered the both evidence of anthropological and numismatic presented the new definition about the concept of money. In that regards Cribb [1986:11] describes, anything can be used as money which particularly guaranteed as monetary values. Also an acceptability of that guarantees and values of such primitive money should be managed upon the social states and own accustomed of each society.

Generally such regulations are governing by the political or mercantile authority or sometimes defined by the exchangers as well. Owing to these circumstances Cribb [ibid] further defined 'money' means as the,

..... any object or record of objects which made the economic transaction between two groups or individuals.....

However previous studies on the preliminary value systems which used prior to the metallic coinage has long been neglected. Although that stage is essentially functioned as the "formation period" of the economic exchanges. Sometimes certain remaining elements on early coin types have been derived from that preliminary levels. Subsequently, many characters appeared in the later developments can be inherently connected to the preceded period. According these reasons it is essential to trace the comprehensive observation about the values functioned before the use of coining metals as well.

The earliest formation of the primitive transactions in Sri Lankan society goes back to the hunter-gather communities in Mesolithic period [3900 BC]. It was the reciprocal exchanges between the interior groups of the coastal and the hinterland inhabitants. Some artifacts discovered in the cave excavations in such hinterlands clearly proved these events. For instance, several lagoon molluscan species reported from the habitation soil layers in Batadomba-lene near Kuruwita and the salt reported from Beli-lena in Kitulgala [Deraniyagala 1992: 326] affirmed the mutual transactions operated among these groups. In another instance, some typical species for wet lowlands found from dry zone [Karunaratne et. al. 1994: 55-62] at the excavations in stone shelter of Aligala in Sigiriya revealed the preliminary network of reciprocal exchanges executed in Mesolithic house-hold economy.

I. Commodity money:

The initial evidence to the commodity money used in the inland exchange system is found in the transition period of the pastoral society in the Iron Age² [circa 900 BC -7 BC]. After the flourishing of the first settled agricultural communities in this stage, the reciprocal mechanism of the village economy would have been transformed into a linear exchange system using livestock and agricultural products. Subsequently when the emerged of the

4. It can be assumed pottery types in different origin of foreign techniques would have been used as the valuable and luxury utensils in household economy. Circular shapes of clay discs made of such pot shreds probably mean that previous tradition of their value which continuously concern by the society.

5. Iron was the main industry that prevailed in the whole context of the Iron age settlements in the island which evolved as the most popular house-hold production in the contemporary period. Moreover copper production also established as a part of the metal industry. (Senewiratne 1985 ibid).

craft specialization in the late Iron age cities generated the value system in the exchange of their production.

By the growth of the sea-faring activities in this period developed the long distance relations with the mainland groups. The main monetary values used in these transactions were directly adopted into 'commodity money', existed with different merchandise. Some artifacts discovered from the Megalithic cemeteries (Highly 1981: AC 4, 49-55) and several habitation sites of this period (Seneviratne 1954: AC 5, 287-307) revealed the nature of the earliest local craft community² evolved in that phase. For instance considerable evidence of some imported goods, such as pottery³, metal⁴ objects (copper, iron) and precious and semi-precious stones⁵ (Seneviratne *ibid*) were discovered. Moreover according to the radiocarbon dating on the recent discoveries of inscribed potsherds found in Anuradhapura excavations indicates the Indo-Aryans were predominant since at least as early as 500 BC in Sri Lanka (Deraniyagala 1992: 788-80). Presumably foreign commodities attributed to these groups would have been used as primitive values or measures substitutes for monetary values in the contemporary transactions.

Both functions of the preliminary transactions in market economy, and the introduction of metal technology emerged in Iron age given the great advantages to the later proceedings in metallic currency system. However commodity money was used until the Mauryan silver punch marked coins which supplemented or substituted the former.

If compare the regional trails relating to the commodity money, used in the Indian subcontinent represent the correlation with the Sri Lankan evidence. Indian numismatists described that the evolution of Indian coinage also derived from commodity money and metallic weights.

II. Legalized measurements of numerous objects and metallic weight standards:

As a result of the metal technology emerged in the later half of the first millennium BC, the previous system of

'commodity money' has been already transformed into the more systematic method, by using the legalized standards of metallic weights. The main guarantee of such prescribed metal units were dependent on their metallic purity and the weight. This process made a significant landmark in the Sri Lankan monetary history.

The earliest evidence on legalized measures were apparent in the inland transactions at least around the circa 700 BC - 600 BC, which remarked the transition phase from the Iron age to Early Historical Period. That interface society has achieved very important developments in many fields. It was identified as the period accompanied by small scale village communities sustained by paddy cultivation using the minor-scale tank irrigation system. Particularly the social formation of this period created the strong conscious leaderships to manage their activities (Bandaranayake [1992: 15-23] presumably generated by the irrigation and agricultural economy.

As discussed by the archaeologists, from the early proto historic levels upwards (Deraniyagala 1990: 261) metal industry became very common production in rural economy. Coughman described such a pattern of achievements represent as a simple self-sufficient economies based upon individual households which is very similar in South Indian contemporary settlements when it became a capital (Coughman 1997: 54). Social complexity appeared in such forms of interface societies has analyzed as a 'commercial development model' (Brongton *et al.* 1987: 1, 1-2) which existed main characteristics of minor scale craft production and the primitive agricultural economy. It is noteworthy, that the origin of some religious symbolic designs appeared on early indigenous coin devices would have been derived from the traditional ideology of this stage. As an example, similar forms of some symbols that resemble to the coin designs found in the contemporary graffiti marks on pot sherds and the stone inscriptions (500-300 BC) further considered this idea.

Since the Early Historical Phase there were enough sources referred about the statistical records of metallic values of gold and silver and some

particular objects of precious values (pearl, gems and jewels). Historical sources constituted many of these objects have been used as the legalized measures for the payments and the donations by the state. Presumably when the mass scale construction projects of the monasteries, stupas and reservoirs launched by the state had been used these both modes of legalized measures of metals and material values for the payments in different purposes; as purchasing the lands, expenses for goods and the labor charges etc.

(a) numerous objects used for values:

As discussed in the above paragraphs that whatever kind of objects or metals, precious stones or any other materials adopted into currency values, may indicate the evolution of primitive monetary system in the inland economy. Some relative artifacts found as the remains of reliquary deposits discovered in the ancient stupa sites dated to 3rd BC - 2 c. BC given very important clues to understand this event. Particularly reliquary deposits of the stupas in Higawapi, Jetavana, Kanavilhera in Deliwala and Yatala included numerous objects constituted with precious stones and metallic objects (gold, copper and silver), ivory shells, ivory pincus, terra-cotta and glass objects. The above group of materials indicate the rudimentary value system used in contemporary period preceding to the metallic coinage.

It seems even after the invention of coins, that the major mode of transactions executed in the general society still followed the traditional method of reciprocal system. The measures of consumable objects have been legalized as the values among the layman society. Legal share of the annual production in agriculture (paddy or other cultivation) or selected amount of the income from craft productions (weaving, potting, metal production) or any other employment (fishing, gem mining etc.) have been weighed out or counting into legal tenders. For instance the ancient inland reciprocal system was derived from the gradual process of this primitive money system (Codrington 1936). Historians widely comprehended similar

6. The report of Gemelaka, near Rajawel, Rajapala from Anuradhapura has been referred in the excavations at Anuradhapura (Highly *ibid*, loc. cit. 191-275 BC) (Coughman 1997: 24, 72).

7. The report under the dated a considerable amount of the metal objects, such as the silver vessels and the pincus, which were highly cooperative with the state evidence it shows the large craft and its products. (Coughman 1997: 54) and the archaeological evidences that the other parts of the country.

exchanges referred in early texts and inscriptions [Rhys Davids 1877; Siriweera 1994].

(b). terra-cotta units:

As opposed to the above discussed legalized values, there are some significant terra-cotta units made into different shapes and sizes came to light in the excavations from the historical contexts belonged to 3-1 c. BC. Conclusively they can be classified into two varieties as follows. They are;

I. the different sizes of circular shape discs probably made from the broken potsherds, and

II. the different weights and sizes of spherical and hemispherical clay balls.

According to the physical features and the pattern of the discoveries in hoards and stray finds, it can hypothesized these remains have been served as the legal values pertaining to the measuring or counting system.

However a comprehensive study on such terra-cotta objects has not been attempted yet. Evident to the hitherto known evidence, they are randomly characterized in four to six varieties of their different sizes and scales.

Wide distribution of those terra-cotta discs and balls were came from main market cities in central and southeastern plains in Anuradhapura and Tissamaharama⁷. They are discovered by the archaeological excavations and also yielded as the large hoards of casual finds as well in the Buddhist monasteries [Wickramagama 1984: 58-61, fig. 6, pt.6] and the citadel premises in both cities. In addition there were some stray finds recorded from Jaffna peninsula in Tiruketisvaram and Kantarodai [Peris 1919]. At the first glance, many scholars identified them as the units used for the games but later assumed them as the kind of measures. According to the multiple sizes and different weights of these terra-cotta discs and balls, it is reasonable to argue that they would have been used for indicate distinct nominal values, probably substitutes for coins. Presumably it can be argued here, those clay discs and balls would have been influenced from the contemporary value system of copper globules used by the south Indians [400-300 BC].

(c) numerous metallic weight standards:

The exchange mechanism in the rudimentary form of reciprocal system and the use of different measures of objects, have been gradually improved into a more developed linear form of metallic weight standards.

There are very few evidence about the finds of metallic objects find as the hoards. Among them a hoard of the different sizes of copper rods came in Kantarodai [Peris 1919: pt. 1] is significant. Probably it indicate the wealth of the collector who owned that collection. Sometimes it suggests except to the basic purpose of the tools, they might been used as the values in their barter exchanges.

A major dynamics remarked in the metallic weight standards was denoted by the Indian silver punch-marked coinage, which flourished at least early as the 3c. BC. Before then the principle forms of the inland transactions were basically concentrated on short distance trade among the inland groups with the coastal communities of south Indians who sailed by the shallow water. At that stage metal has been just used as the material of production. And possibly a lesser amount of surplus in metal production had been exchanged in the reciprocal trade. But the preliminary experience and the principle knowledge about the use of metals as legalized value in the commercial transactions were diffused from the mainland immigrants.

(d) bullion money:

Sometimes a coin issued in one society can be adopted as a bullion money in another society in terms of their intrinsic value.

Even in the south Indian sub continent, before the arrival of Indian silver and copper punch-marked coins, the earliest metallic money system was consisted with copper globules⁸ and the uniform weights of copper ingots [1.06 gm] which dated to 400 BC [Loventhal 1888].

Resultant to the great diffusion of Gangetic valley urbanization towards the southern extremity [Thaper 1990:70] considerable amount of

Mauryan Imperial punch-marked coins scattered all over the regions in peninsula India and Sri Lanka [Sirisoma et. al. 1986]. Moreover the expansion of the long-distance maritime trade with the south Asian territories came out in the early Christian era opened a new access to the flourish of a large quantities of Roman Imperial copper coins⁹ towards the eastern markets. Evidently these coins accepted as a legal tender in the local money market in south India and Sri Lanka. According to the metallic purity and the more availability of the both types of coins in the inland markets, encouraged the indigenous to use them in a most convenient and legalized manner. Therefore that foreign coins provided many improvements in Sri Lankan monetary system by facilitating much privileges.

Transition to the Metallic coins:

Gradual process of the intrinsically valuable metal pieces of definite weight with devices finally became as the coins in many societies. The initial steps in coin production by the indigenous have been set variously in the period between 3-2 c. BC. They were the forgery issues of copper coins of the above mentioned Mauryan punch-marked silver coins. Some terra-cotta moulds which used to cast them found from Anuradhapura [Sirisoma 1972: AC 2,147-150] and Akurugoda revealed the preliminary practice followed by them. Correlative evidence of similar coin moulds found in Sisupalagarh, a main large city situated in Mahanadi Delta in central eastern India affirmed these relations.

After the decline of the Imperial Mauryan power, in around the 185 BC [Thaper 1990 [reprint]:V, 92] that the overland trade through the north-west India was badly hampered by successive occupation of foreign and regional subordinators. Cause of the political fragmentation of the sub-continent, there was a disintegrated political and economical power created under the different identities of dominators between the period of 2 c. BC to 3 c. AD. According to these reasons Indian trade system became decentralized under the various guilds and co-operations of merchants and artisans. They were wealthy and powerful bodies who fixed rules of work and the quality of the products and the

8. These pieces are made of two different forms as bean shaped and spherical, weighing between the sizes of 0.60 gms to 2.50 gms.

9. Large quantities of Roman Imperial coins recorded from Sri Lanka (Walburg 1986) in all over the geographical areas in the coastal and hinterland settlements.

10. Majority of the Satavahana coins recorded from Sri Lanka were the coins of Sri Satakarni (IAD) (Rapson 1908) which also flourished by the merchants from Andra regions in the contemporary period. Hitherto, known findings came from inner city area and the Buddhist monasteries of Anuradhapura.

relevant prices as well. Large varieties of coins have been issued by those communities settled in the different regional parts of the peninsula India. Indian numismatists termed their coinage as the 'tribal coins', 'local series' or 'lanapada coins' [Allan, 1936]. The basic elements appeared on the Sri Lankan coin designs were evolved from some of these 'tribal coins'.

Apparent to the numismatic sequence the earliest Sri Lankan coins [Jayasinghe 1997, nos. 13-14] bear the indigenous characteristics, can be dated to the later half of the 2 c. BC. They were made of copper alloy by using the double die in striking method. If considered the regional dynamics belong to the long distance relations both practices of casting and die-struck systems followed in this stage were experienced from Indian examples.

Either Sri Lankans followed the casting method in the introductory stage, but the earliest attempt on indigenous coinage had been evolved from die-struck method of copper coins. Preliminary forms of this first coin were derived from the late Mauryan copper die-struck coinage which decorated with 5-8 symbols that organized into overall design which resembled to the regional coinages of Ujjain, Taxila and Brno [Allan 1936: 241, 214, 140]. Sometimes that late Mauryan coins included the name of the issuer as well. Both characters of classical Mauryan tradition of Indian coinage has been influenced not only on the origin of local coinage but also on the south Indian and suburbs.

However the trade network beyond the Vindyan region has been dominated by the south Indian merchant communities of the number of small Deccan subordinates who settled in south-east and south-west coast. As discerned by the economic historians in elsewhere, these merchant groups were more familiar with large-scale maritime trade. The Polas and the Pandyans of early Sangam period and the coastal Andhas became prominent in that regard. The most profitable of the overseas trade was the Roman trade with south India. Merchants from western Asia and Mediterranean region in south Indian and Sri Lankan early trade as the 'yavanas'. Alien colonies of their settlements who worked as the

intermediaries in east-west trade discovered in many parts of the coastal regions in India and Sri Lanka.

Gradual growth of these maritime activities in Indian Ocean, already encouraged to develop the local market. Evidently merchants lived in this period as individual or guilds in Sri Lanka became rich enough to buy an entire village or bank and donate it to the monasteries. Interaction between the guilds and the state has been evidenced by their own policies under the taxation which levied by the money and commodities.

These activities generated the multi-faceted participation of merchant bodies in inland trade system. They introduced the numerous types of coins bear the foreign origin to their transactions in the local market. Majority among them attributed to south Indian and Andra coinages of Indian origin. For instance there were enough coin types of Pandyans in early Sangam Period [2-1 c. BC] [Jayasinghe 1997, nos. 1-6], and the coins of early Satavahana dynasty¹¹ recorded in the contemporary market cities. Subsequently the gradual competition among the foreign and local authorities in trade, generated the complexity and created the regional varieties on coinage.

According to these accounts since the early 1 c. BC new modes of coin system bear the indigenous features had been evolved in the Sri Lankan mint. That new mode of local coinages were centralized in radiant to the major market cities in Anuradhapura and Rohana which made the easy access to the port centers.

Meantime different traits of inscribed and un-inscribed coinages made of leaded alloy¹² by cast method produced in southeastern mint. That was the coinage bearing the ritual *swastika* symbol, which particularly represent the native identity. It was continuously served in a long duration including with many varieties of coins [Jayasinghe 1997, nos. 13-25] until the second influence of the Pallava coinage in 2 c. AD. For instance that the recent finds of new leaded coins from Alcurugoda, reminded the regional event in Sri Lankan trade economy and monetary system. Those coins

bearing the names of individuals written in early Brahmi characters of Prakrit language who participated in the minting initial period. Among them some were belonged to the royal families as well as the general groups of merchant communities. There is an interesting factor of a coin issued by the female dancer named Alurappu who also engaged in the trade in this city. Evident to these accounts revealed the independence policy regulated for the trade and economy in the major market cities.

On the contrary metallurgy and the technology of coinage give very important clues about the crucial events in the economic evolution. Local coin system has been basically evolved on the different metallic alloys of copper, bronze, lead and gold. The technological improvements in the coin production also created on such mode of metallic variety. If examined the whole process in the metallurgy three main stages of transitions were occurred.

1. The earliest transition was identified in around 2 c. BC which was from silver coinage to the copper coins. When the decline of the Mauryan Empire silver punch marked coins became gradually interrupted. It made a scarcity of silver coins where it circulated as the bullion. Therefore Sri Lankan coinage shown a new adaptation to copper coins in that period. Since then copper coins proceeded until the turn out of the gold coinage in 7 c. AD.
2. Second movement was appeared in around the 1 c. BC which was introduced as a regional dynamic of the innovation to leaded alloy. But meantime lead amount of copper coins also increased. It is noteworthy, this cast method of leaded coinage given the considerable advantage in the technology to obtained a large capacity of production in a short period. Although it was not established in a long period, probably due to the scarcity of lead, which would have been presumably imported from Andra and Deccan regions.

Cont'd on page 32

11.

Apparent to the numismatic sequence in the Sri Lankan coins, the earliest coinage, regard to the leaded alloy, have been dated 2 c. BC onwards which was mainly derived from the South-eastern mint. It was mentioned in Sri Lankan coins in the last part of the 1990s, are comparable series of inscribed and un-inscribed leaded alloy coins that been discovered from Alcurugoda (Jayasinghe, 1997). The leaded alloy coins were probably manufactured for the posturing regional event in South Indian markets.

Ancient Coins in Sri Lanka

by
Dr. Osmund Boppearachchi

More than seventy years have gone by since Codrington's monumental publication of **Ceylon Coins and Currency**. Like any other science, numismatics has developed by leaps and bounds. It has evolved from the simple discipline of making catalogues to a means of interpreting history. When Codrington wrote his book, Sri Lankan archaeology was still in its infancy. Many discoveries have been made since then.

Since the 1940s the Archaeological Department of Ceylon has been involved in major excavations. New data have been obtained by Sri Lankan and British archaeologists from the excavations conducted at Salgaha Watta 2 in the ancient citadel of Anuradhapura. This collection is of great value to numismatic study as it represents an almost unique stratified collection of coins straddling over a millennium and half at a South Asian settlement site. The Sri Lanka UNESCO Central Cultural Fund launched massive excavations at the Buddhist monasteries of Abhayagiriya and Jetavanarama, at Anuradhapura the pleasure gardens at Sigiriya and Alahana Parivena at Polonnaruwa. Even minor excavations conducted by the Archaeological Department at Yapahuwa, Damba-deniya, Kandy and Kotte brought to light new numismatic evidence which enabled us to understand the currency pattern of Sri Lanka during the period immediately before or after the colonial occupations.

Apart from the ones attested in an archaeological context, a large number of coins were found accidentally in hoards. The clandestine diggings at Akurugoda (Tissamaharama) have brought to light hundreds of hitherto unknown coin types. The hoards from Trincomalee and Minuwangoda containing hundreds of punch-marked coins and ones with thousands of Roman and Indo-Roman coins from

Lunama (3,000), Hungama (20,000) and Godawaya (75,000) are only few of them. In order to show the importance of these discoveries, one may point out for example, that Codrington catalogued only about 30,000 Roman and Indo-Roman coins, since then more than 200,000 coins of this class have been found in the island. The number itself changes completely the idea that one may have about the circulation of Roman and Indo-Roman coins in the island.

The main aim of this article is to give the general pattern of ancient coins in Sri Lanka by placing the new discoveries in a more elaborate chronological sequence. Most of the observations made here are based on the one hand on the already published material, and on the other on unpublished coins entrusted to us by Dr. Robin Conningham from the ASW 2 excavations at the citadel of Anuradhapura, by Dr. Hema Ratnayake, from the Jetavanarama excavations, and by private collectors, especially Messrs Siri Munasinghe, Dilip Samarasinghe and Mr. Rajah Wickramesingha. I am most grateful to all of them for kindly authorising me to examine their collections.

Coins which enjoyed legal tender in ancient Sri Lanka can be divided into two major categories: local issues and coins of foreign origin. A dominant feature of foreign coins circulated in ancient Sri Lanka is their large diversity, they are not only characterized by their geographical, dynastic and chronological heterogeneity, but also by their diversity of metal (gold, silver, billon and copper), and denominations which vary according to the country, the dynasty and the period of issue. Since most of these coins were found either in stratified layers of the excavated sites or in coin hoards, it is reasonable to believe that, whatever their geographical, dynastic and chronological origin may be, they were accepted by Lankans as coins, in other

words as means of exchange. All the coins of foreign origin were certainly brought to Sri Lanka by traders of different horizons. In spite of their differences, these coins may have represented a nominal value corresponding to the exchanged merchandise.

Sri Lanka, because of its geographical situation, naturally established its first trade relations with the Indian sub-continent. Proto-historic Sri Lanka was more closely linked with South India. In the excavations conducted at Gedige (Anuradhapura), Pomparippu, Kantarodai and Ibbankatuwa, substantial quantities of potsherds were found which parallel the Iron Age and early historical wares of South India, such as Megalithic Black and Red Ware and the Rouletted Ware of the Arikamedu types.

The second part of the early historic period of Sri Lanka begins with the introduction of Buddhism to the island by *Thera Mahinda*, the envoy of the Mauryan King Asoka during the reign of Devanampiyatissa (c. 250-210 BC). It was from this period onwards that close political, cultural and commercial relationships were first established with North India. It is interesting to note that in the citadel of Anuradhapura, as in India, Grey Ware and Northern Black Polished Ware were found in successive strata. Likewise, most of the finest imported ceramics of this period found in Sri Lanka were from North India.

The earliest epigraphical evidence to the circulation of the *karshapana* in the island dates back to the end of the 3rd century BC (see nos. 1-3). The inscription of Mampitavihara (Kagalla District in the wet zone) written in early Brahmi script referring to *Kahapanas* indicates that trade even in early days was not barter alone. Codrington has assembled most of the epigraphical and literary references to payments done by kings in thousands of *Kahapanas* on different occasions,

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such as construction of religious monuments and donations to monastic communities. It should be noted that the third structural period I of the Sri Lanka-British Excavations at Salgado Watta 2 in the ancient citadel of Anuradhapura dated to between the third and second centuries BC brought to light three Punch-Marked coins. Indian and classical literary sources refer to Sri Lankan exports, especially pearls, precious stones and textiles for which there was a good Indian market. So, the Indian early issues cannot be isolated from the other Indian imports attested in the same area.

Namismata divide punch-marked coins, known in ancient India as *karsapanas* into two major groups. The first is composed of locally minted coins that circulated in a limited area, known as *karapada* series. The second, which was minted over a vast area of India under the protection of a unifying authority, is known as Imperial series. The Imperial series first appeared during the formation of the Magadha empire and developed fully during the Mauryan empire. These Imperial coins can also be divided into two important classes according to the workmanship: on the one hand there are some fairly large, thin coins, attributed to the pre-Mauryan and early Mauryan periods, on the other, some smaller and thicker coins, attributed to the middle and late Mauryan periods. With a few exceptions, all the coins found in the island belong to the second category.

As Codrington correctly suggested, the absence on these coins of any symbol which can be attributed to Sri Lanka alone, leads us to assume that all the genuine punch-marked coins found in the island were imported from India. He also correctly observed that they were in circulation until the end of the 3rd century AD. This is now proved by the discovery of many terracotta moulds with *Karsapanas* imprints in the excavations at Gedige (Anuradhapura) and recently at Akurugoda. They show that some of these coins were cast in Sri Lanka. These moulds are identical to the ones found in Haryana in North India. Like in India, Sri Lankan mint masters may have made these coins by casting methods, completely different from the original punching technique, during a period when no coins (*Karsapanas*) were issued.

Codrington correctly noticed that

some of the punch-marked coins from Sri Lanka have a copper core with silver coating. This phenomenon can be noticed in most of the coins found in the excavations of the Anuradhapura citadel and at Jelasagararam. The technical aspects of cast and silver coated or silver-washed punch-marked coins should also be studied with the help of modern technology. We are under the impression that most of the punch-marked coins found in Sri Lanka were made according to method known as 'silver amalgam'. This technique consists of dipping the copper flans into an amalgam of silver dissolved in mercury, which clings to its surface. It is then gently heated, to just above the boiling point of mercury, 357 degrees C, when the mercury is driven away and the silver is left behind as a plating.



Many of the symbols depicted on Elephant and Swastika series (see nos. 4 & 5) are also attested on Punch-Marked coins. For example the tree within an enclosure symbol appeared right from the beginning on the *karapada* series attributed to the kingdom of Kalinga located in the lower Mahanadi valley and adjacent Deccan coastland. It becomes the most common symbol along with the sun and six-armed symbols of all the Imperial punch-marked coins struck under Mauryas. Calya of three or six cells becomes one of the commonest symbols of the Imperial punch-marked series of the Mauryas, from the 4th century onwards. Most of these symbols thus become very popular on early Indian copper coins, such as Eran, Ujjain, Satavahana, Yaudheya and Mahasamprata.

The coins labelled as elephant and swastika, horse and swastika, lion and swastika, tree and swastika (see no. 11) and especially Lakshmi plaques depicting the goddess Lakshmi seated or standing (see nos. 6-9), belong to the category of local issues. Most of the symbols depicted on these series were either directly copied or imitated from early Indian copper coins, such as Eran, Ujjain, Satavahana, Yaudheya and Mahasamprata (cf. J. Allan, 1936: xcv-

cxlix). It is also interesting to note that 26 of 42 'Lakshmi plaques' published in the excavations as ASW 2, were found in the structural phase G. All of them were recovered from the last three phases of the period, 18 from the last phase (G). Abhisheka Lakshmi becomes popular in Indian Coinage from the third century BC. A number of Lakshmi plaques found in recent years, near struck on the 'Elephant and Swastika' type show that either both series were contemporary issues or 'Lakshmi plaques' were struck at a later date (see no. 9). It may not be an accident that all the Lakshmi plaques of ASW 2 were unearthed from the third phase of the structural period G onwards. It should be remembered that the earliest identified 'Elephant and Swastika' type was attested in the preceding structural period H, and that an even earlier, worn example might have been identified in structural phase.

One of the commonest coin series found generally in Anuradhapura, known as 'Maneless lion' type is attested by nine specimens in the ASW 2 excavations (see no. 10). Drawing attention to the fact that this coin type is almost unknown in India, Codrington argued that they may well be Sinhalese, so the latter's dynastic emblem is a lion. Whatever the interpretation given to this type, it is noteworthy that the two coins attested in the structural phase of period G, in other words close to the end of the phase, confirming Codrington's dating of this type to the early centuries of the first millennium AD.

It seems that the Southern coast of the island had its own inscribed coinages. This is revealed by recent discoveries made at Akurugoda. Most of the coins are of lead and can be classified into seven main groups according to their obverse types: 1. standing or sitting divinities (Abhisheka Lakshmi); 2. seated or standing lion; 3. elephant, 4. horse; 5. fish; 6. tortoise and 7. wheel. Some of them bear a legend in early Brahmi. The most interesting coin in this context is the one with the legend *rajahimaha*. The Honanegala inscription (cf. S. Paramavitana, 1970: no. 406) refers to a king named *Majhimaraja*. These new coins which enlighten the whole numismatic history of the island will be published in detail in the near future.

Punch-marked coins were no longer

issued in India after the decline of the Mauryan empire, and India's earliest coins were then replaced by the issues of the Indo-Greeks followed by the Indo-Scythians, the Indo-Parthians and the Kushans who occupied the north-western provinces of the Mauryan empire. A certain number of coins belonging to these dynasties of different political and cultural origins are found in Sri Lanka. No doubt, as far as Sri Lanka is concerned, compared to the thousands of *karshapana*, the coins issued by the successors of the Mauryas are quite rare. Yet one cannot deny their economic implications. The most ancient coin, next to *kahapana* found in the Sri Lankan soil, is an Indian-standard drachm of the Indo-Greek Menander. We have seen in private collections, about ten coins of Soter Megas, which were hitherto unknown in the Sri Lankan context. Most of them were supposed to be stray finds from the southern coast of the island. Soter Megas had been considered an anonymous ruler calling himself "the king of kings, the Great saviour".

Thanks to recent discoveries we know today that Soter Megas' dynastic name was Vima Taktu and that he was the grand-father of Kushan king Kanishka I (cf. J. Cribb, 1996 B). Two gold coins of the Kushan king Huvishka were found in recent years at Akurugoda. The coin of Kanishka II of the Kushan dynasty found in the excavations conducted at Jetavanarama is significant in this context. We have seen at least ten more coins of the same kings in two private collections, and all of them were found on the southern coast of the island. Kanishka II was one of the successors of Kanishka I and his reign can be placed around 200-215 of our era. It should be noted that although H. W. Codrington mentions four specimens of king Vasudeva bought in Colombo, these are the first coins of Kushan kings ever found in Sri Lanka in an archaeological context.

These coins issued by Indo-Greeks and Kushans from Central Asia and North-West India cannot be isolated from the lapis lazuli and carnelian beads and intaglios attested at Ridiyagama and Akurugoda. The only known source for lapis lazuli in antiquity was Badakhshan (in northern Afghanistan). Among the products exported from Barbaricum, the author of

the Periplus mentions lapis lazuli (periplus, 39). This precious material doubtless travelled along the sea route to reach the southern coast of the island. The presence of lapis lazuli at Ridiyagama and Akurugoda cannot be an isolated event, because epigraphical evidence bear witness to the fact that the southern coast had close relationships with the regions of Afghanistan. 'Kaboja' occurs as a proper name in three inscriptions from Koravakgala (Situlpavua) in the Hambantota District, south-eastern part of the island, in ancient Rohana (cf. S. Paranavitana, 1970: n° 622:). S. Paranavitana (1970: xc) believes that the Kabojha, Kabojhiya and Kabojhika are to be connected with the ethnic name Kamboja, occurring in Sanskrit and Pali literature as well as in the Vth and XIIth inscriptions of Asoka, Kabojhiya being equivalent to the derivative term Kambojiya and Kabojika to Kambojika.

The Brahmi inscription from Bovattegala at the southern border of the Amparai District, a few miles from north-east limit of the Hambantota District, also in the ancient Rohana, refers to *Kabojhiya-mahapugiyana* i.e. 'those who were members of the great corporation of the 'Kabojhivas' (S. Paranavitana, 1970, n° 553). The Brahmi inscription from Kaduruva in the Kurunegala District, to the southwest of Anuradhapura, mentions a *parumaka* (Chief) of the Gota-Kabojikana, i.e. of the corporation of the Kobojikas (S. Paranavitana, 1970, n° 990). These inscriptions indicate that Kambojas had organised themselves into corporations, in other words certainly engaged in trade.

The *Sihalavattu*, a pali text of about the 4th century attests that a group of people called Kambojas were in Rohana. In the third story of this text, called *Metteyya-vattu*, we are informed that the Elder named Maleyya was residing in Kamboja-gama, in the province (Janapada) of Rohana in the Island of Tambapanni. The Kambojas are often mentioned together with Yonas (Yavanas), Gandharas and Sakas. The Kambojas are a native population of Arachosia at the extreme west territories of the Maurya empire, speaking a language of Iranian origin. The finding of lapis lazuli from northern Afghanistan and various coins of Soter Megas, Huvishka and Kanishka

II struck in Central Asia and India in the southern coast of the island and the references to Kambojas of Arachosia compel us to believe that there were close relationships with the maritime communities of North-West India.

A silver coin of Viradaman of the Western Ksatrapas (c. 234-239) was found buried at the foot of one of the frontispieces of the Stupa along with the coin of Kanishka II. A coin of Nahapana restructed by Gautamiputra of the Satavahanas should be added to the list of coins of the Andhra Dynasties found in Sri Lanka. The silver drachms of the Andhras and the gold coins of Samudra Gupta, Chandra Gupta and Skanda Gupta (from c. 325-480 AD) of the Gupta Dynasty catalogued by Codrington were the last issues of the ancient North Indian dynasties so far attested in the island.

The diminution of coins struck in Northern India found in Sri Lanka during the period starting from the first century onwards, corresponds to one of the periodical domination of the South Indian dynasties over the island. Apart from the coins already published by Codrington, a number of new series of Pandya coins have been attested in recent years. The South Indian mercantile and military communities, like Cholas (see nos. 15 & 16) Pallavas, Pandyas (see nos. 13 & 14), Cheras, Virakkotiyar, Nanadesis and Velaikkarar, in different periods played an important role in the economic and political history of the island. The earliest references to *Damilas* in the Mahavamsa, is in connection with Sena and Guttika, who described as *assanavika*, i.e. traders who came in ships bringing horses for sale from South India. The epigraphical evidence for the active role played by the Tamil merchants in the early phase of Sri Lanka's history is numerous. Apart from the epigraphic and literary evidence, the commercial activities of these South Indian communities are known to us through their coins found especially at Anuradhapura, Polonnaruwa and other ancient sites of the island.

The inscription in early Brahmi script on a boulder in the area to the north-west of the ancient Abhayagiri Dagaba at Anuradhapura, records that the terrace (Pasade) was of the Tamil

householders (gahapattana) and was made by Samana, the family of Hiharata. The record states that the Tamil ship-captain Nivaha-Karava-asara, who visited the seat of government probably was the leader of the Dameda householders (cf. S. Paranavitana, 1970, p. 91).

The Sri Lanka-British excavations at Soligala Wata in the ancient citadel of Anuradhapura brought to light some interesting coins of the South Indian dynasties. The most noteworthy specimen found in this period is the Pandya inspired multi-type coin (see no. 11). This coin is the only known specimen of this type depicting a deity surmounted by a chariot, recalling the earlier type of stamps in India and Sri Lanka. Three types on the reverse: elephant, temple and, on the reverse, fish symbol, depicted on this coin are similar to the ones attested in South India. M. Mitchiner (1978: 828) incorrectly dates this series c. 210-175 BC arguing that "The earliest coinage of Ceylon shows many parallels with that of the Pandyas, by which it was inspired".

He further argued that "The initial Pandyan issues have been divided into two consecutive series of multi-type coins c. 240-210 BC that preceded the Pandyan campaign in Ceylon during the second century BC. The earliest coins in Ceylon bear designs derived from the second series of Pandyan multi-type coins struck during the period circa 210-175 BC and bear a group of symbols on the obverse among which an elephant normally figures". It is interesting to note that this coin was found in structural period G which dates to the second century BC. The Pandyan fish symbol is also borrowed and appears on the reverse of these earliest Sinhalese issues. "The Obverse of three or 0's surmounted by a chariot, depicted on this coin is probably an addition of the Sinhalese coin engraver.

It is also interesting to note that the South Indian coins attested in the island, along with the local issues, resulted from the intermediary role played by the South Indians between Roman traders and Sri Lankan merchants. The presence of a good number of Pandya coins at the excavated sites of Anuradhapura and many other places in the northern part of the is-

land, shows that Sri Lanka's trade relations with South India were important to a certain extent, albeit the political implications were quite different. The two Pandya coins found in the fills of the robber pits which represents structural period G, D & E of the ASW 2 excavations are very significant because layers in which they were found are attributed to the fourth and fifth centuries.

It is possible that the two Pandyan coins may have entered the circulation in the ninth century. K. Chattopadhyaya (1977: 83) supporting the hypothesis put forward by his previous son, argues: "To the second phase of Pandya currency may be assigned a number of types mostly with the 'Lion and flower vase', 'bull and fish' (see no. 14) devices. The majority of these coins have been found in Ceylon and this phenomenon together with the fact that the Pandyas of the second empire almost invariably minted coins of the standing figure / seated figure type would indicate that they were in all probability minted by the Pandyas of the first empire. A broad dating may be made in terms of the political supremacy there of the Pandyas before its conquest by Rajaraja I towards the close of the tenth century".

It is well known that the large quantities of late Imperial Roman coins found in Sri Lanka coincide with the rise in eastern trade in the fourth and fifth centuries, with the circumnavigation, connected with Sri Lanka. One of the main reasons for the abundance of these coins in Sri Lanka is the gradual shift of the focus of trade from the Malabar and Coromandel coasts southward to Sri Lanka, which became the main centre of trade in the Indian seas by the 5th century.

Unfortunately we know almost nothing about the eight Roman Republican denarii mentioned by Codrington (1924: 36 & 240-241), found in Sri Lanka, which correspond to the period between 144 to 49 B.C. Truly, on the other hand, compared to thousands of early Imperial coins found in India, fourteen silver coins from Sri Lanka have very little significance. However it is interesting to recall here recent findings of Parthian and Roman coins, found in the island, belonging to this early period. A bronze coin struck un-

der Trajan in the city of Dora found in the excavations at Jetavanarama leaves no doubt about the possibility of finding such ancient coins in the island.

However compared to the large quantities of early Imperial Roman coins found in India, the ones attested in Sri Lanka are so far limited to fourteen. Although already catalogued by Codrington, we have added three more tetradrachms of this series, recently found in Sri Lanka (cf. O. Boparsachchi, 1990: 132-3). All three of them were struck in the mint of Alexandria of Egypt

- The first is in the name of Agrippina of the 4th year of Nero (= 57/58 A.D).
- The second tetradrachm is of Lucius Verus of the year 7 (= A.D. 168/7).
- The third is of Aurelian of the year 5 (= A.D. 274/5).

With these three tetradrachms in a private collection, a number of early Imperial Roman coins found in Sri Lanka will be increased up to seventeen. It should be underlined here that we could examine rapidly in many other private collections more than ten coins of this series. During our investigations in late Roman Imperial coins, we observed that other than the ordinary 'blind brass' with the following coin types: *Secvritus rei publicae type*, *Salva Republicae 2 type*, *Victoria Exercitus 2 type*, *Gloria Romanorum 2 type*, *Gloria Romanorum 23 type*, and the cross within wreath type, found in thousands all over the island, only a few folles are known in Sri Lanka context. Three folles of Constantine I, from the mint of Rome dated A. D. 317, from Antioch dated A. D. 330/3, and from Constantinople dated A. D. 337-340, were found in the excavations of Sigiriya conducted under the Cultural Triangle Project during the 1982 and 1983 campaigns (cf. See O. Boparsachchi, 1990: 21). A certain number of folles were acquired by private collectors, and we mention two of them

- the first is a follis of Valentinus I from the mint of Alexandria (A. D. 367).
 - the second is a follis of empress Helena from the mint of Antioch (A. D. 326/3).
- (cf. O. Boparsachchi, 1995: 133-4).

Five Roman coins were identified at ASW 2, two from structural period F

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and three from period C, D & E. The earliest example was found in structural period F. Although we have no chronometric dates for F, we may assume that it dates to c. the third and the fourth centuries AD. One of them is the type GLORIA ROMANORUM: emperor advancing dragging the captive, int: Antioch.

Among the coins collected on the surface during the explorations conducted by the French Mission of Archaeological Co-operation in Sri Lanka, the large majority represent Roman "third brass" and their imitations. Among the most spectacular objects collected by us thanks to the courtesy of a villager is a small terra cotta pitcher converted into a money box. According to the information we could gather from the villager who found it, the pot was filled with Roman coins. When we recovered it, there were about eighteen Roman Third Brass stuck to the inner surface of the pitcher. Besides, the pierced whole is large enough to insert Roman Third Brass alone.

It has been suggested by many numismatists that Roman coins disappeared from circulation all over the country by the mid 7th century. The fall of Alexandria in Egypt in 638 may have put an end to the direct trade with Rome and the western world.

We have however added to the list of coins from the West, a very interesting anonymous bronze coin of the XIth century found very recently in Sri Lanka.

Obv. Bust of bearded Christ facing. Gospels in the field, to l. IC, to r. XC.

Rev. Patriarchal cross. A twig at the foot of the Cross.

This exceptional coin may have been brought to the island by the Muhammadan Arabs who were actively involved in trade in the Indian Ocean from the Xth century onwards.

Apart from Roman third brass found in thousands belonging to late Imperial period, a certain number of Sasanian coins are now attested in the island. Cosmas Indicopleustes, the Egyptian Greek of the sixth century of our era bears witness to the presence of Persian traders in Sri Lanka. According to a description in his *Christian*

Topography Sri Lanka was playing an important role in transmitting merchandise between East and West, a role once played by Western India. Cosmas (XI, 15.) demonstrating the central position that the island held in international commerce says: "... the island is a great resort of ships from all parts of India and from Persia and Ethiopia, and in like manner it dispatches many of its own to foreign ports. And from the inner countries, I mean China and other parts in that direction, it receives silk, aloes, clove-wood, sandalwood, and their products, and there it again passes on to the outer ports, I mean to Male, where pepper grows, and to Kalliana, where copper is produced, and sesame-wood, and material for dress; for it is also a great mart of trade; and to Sindu also, where musk or coster is got, as well as Androstanchus, and to Persia and the Homerite country, and to Adole. Receiving in return the traffic of these parts and transmitting to the inner ports, the island exports to each of these at the same time its own products" (J. W. McCrindle, 1901: 160-1).

By publishing three coins of the Sasanian king Yazdigerd I (A.D. 397-417), Codrington put forward the hypothesis according to which occasional finds of small copper coins among the "third brass" show the dealing of Persians in the island. We have added three more Sasanian coins hitherto unknown in Sri Lankan context. All of them bear the same obverse and reverse types: bust to r. surmounted by crescent / Fire altar with flames and two attendants.

- the first coin is of Xusro I (A. D. 531-579) of the year 16, mint AYR,
- the second is of Hormized IV (A. D. 579-590), of the year 10, mint BBA,
- the third is of Xusro II (A.D. 591-628), of the year 6.

It would seem that with the decadence of the Sasanian empire, the Muhammadan Arabs began to reach the Malabar coasts and Sri Lanka. Almost at the same period Chinese traders developed their commercial activities with the island. It seems that the Sri Lankan contacts with China as early as the second century were purely religious. By the eighth century the first trade links begin to take form. It was with the sudden burst of trade

activities between China and Middle East from the seventh century onwards that Sri Lanka began to play a decisive role in the maritime trade between east and west. The main reason for this active trade relations between east and west was the unification of Arabian countries under the Islam putting an end to the Sasanian power in A. D. 650 on one hand and on the other hand the establishment of power by the Tang dynasty in China. As Axelle Rougeulle (1996: 159-60) correctly observed that during this period, "silk, a perishable material, lost the preeminent part it played in the Chinese exports to pottery, the famous porcelain and stoneware, the best examples of which started to be produced in China during the 8th century and were soon exported in quantity". As P.Y. Manguin (1993) clearly shows that these ceramics appear in the archaeological sites varying from Southeast Asia to East Africa, along most shores of South China sea and the Indian Ocean. After the unification of China in A. D. 960 under the Song dynasty, ceramics became the major export product of China.

The imported Chinese ceramics constitute the most characteristics sign of the trade contacts that Sri Lanka had established with China from the eighth century. The first transactions are revealed by the presence of three heavy Chinese storage-jar fragments found in archaeological context. The earliest wares from Manthai are products of the Tang dynasty (618-907). It was only from the eleventh century that China developed extensively its commercial activities with Sri Lanka.

The south Indian conquests of the island which brought the existence of Anuradhapura as the capital of the island to a conclusion, diverted the trade centres. By this time Gokanna in the eastern coast and all the port in the western wet zone became more important.

E. H. Schafer, (1963: 13) is of the opinion that in the 9th and 10th centuries the Chinese ships did not reach the Persian Gulf, and the largest ships engaged in the rich trade came from Ceylon. Sri Lanka seems to have furnished the Chinese markets with ivory, gems and cotton. According to Hasan (1928: 9), the monk Vajrabodhi found

thirty-five Persian vessels in a port of Ceylon early in the 8th century, there for the purpose of trading in gems. E. H. Schreier (1963) shows how the Chinese of Tang obtained ivory from their own province of Lingnan and from more remote source like the Lion Country - Ceylon. cf. T'FYK, 971, 17H, (T'ao fu yuan kuei, 1642 ed.) and fine cotton from Ceylon. cf. TS, 221b, 476ah - T'ang shu (KM) T'FYK, 971, 17b - (T'ao fu yuan kuei 1642 ed.).

Hundreds of coins belonging to the Song and Southern Song dynasties found at Anuradhapura and Polonnaruwa, and especially in the short-lived capitals of the thirteenth and fourteenth centuries, such as Yappawa, Karunegala and Demadeniya and many other places in the country, preclude commercial exchanges of China with ancient Sri Lanka.

The absence of Chinese coins for the period prior to the tenth century - and the abundance of coins dating from the Zhenzong period in the island, can be explained by two factors. Firstly in 1075, the prohibition to make payments for imports with cash was cancelled, and secondly from the time of Emperor Shenzong (1078-1086) the annual production of coins was raised up to six

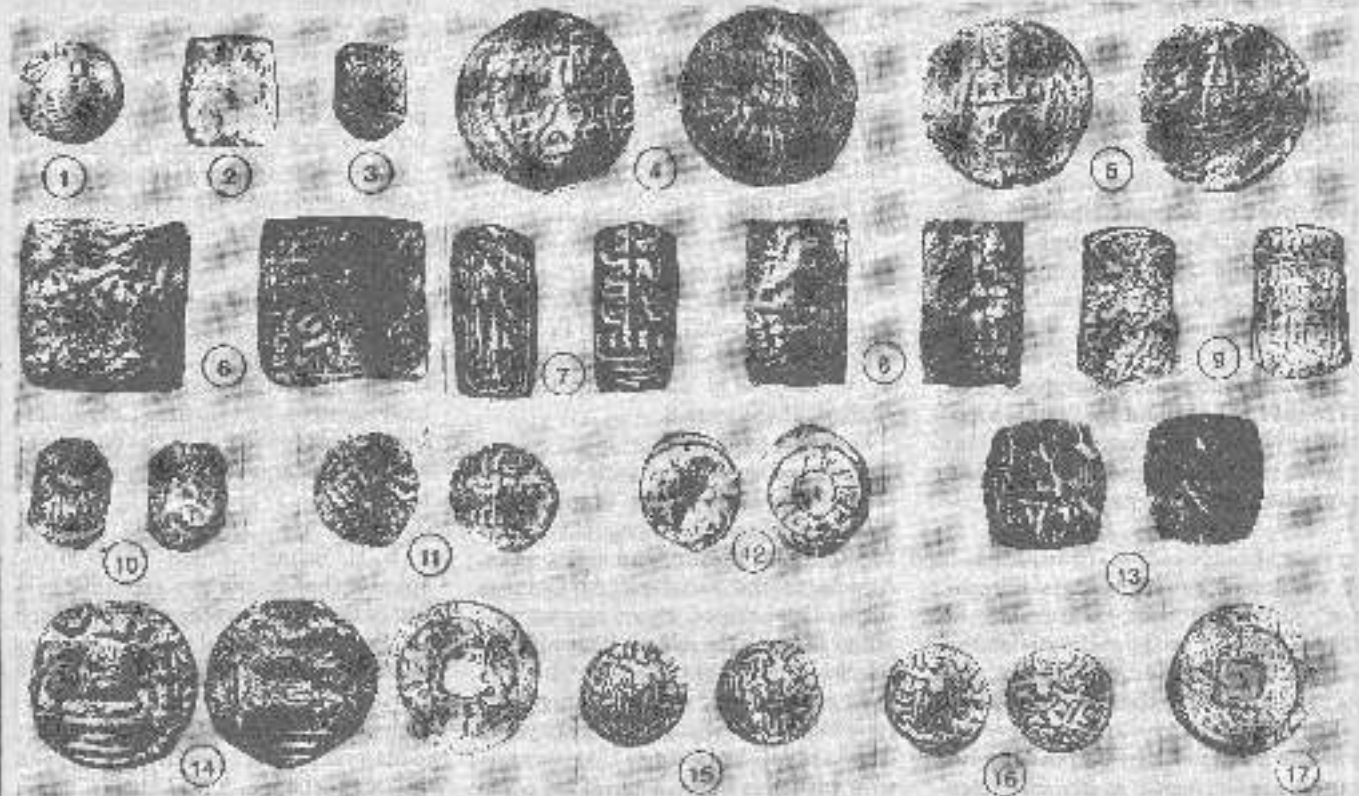
millions of strings, each containing thousand cash. The discovery and exploitation of mines in the centre and south of China, enabled to produce such enormous quantities of coins. These Chinese mines were found everywhere in Asia and Africa along the maritime route, especially in Japan, Vietnam, Java, Sumatra, India, Sri Lanka, Zanzibar, Mozambique and Middle East (see no. 17). The exploitation of copper mines was so intensive that the Southern Song dynasty began to feel a serious shortage. In 1219, it was ordered to pay the imports only with silk and porcelain. As Joe Cribb

(1986 A : 256) clearly explains: "In the period after the fall of the Song dynasty coin production continued to fall and it is clear that long periods of the Yuan dynasty (AD 1271-1368) there was no production at all". Only very few coins are attested in Sri Lanka belonging to the period that follows. The first voyages of Portuguese and Spaniards to the Indian Ocean and the diminution of trade activities of China with Sri Lanka take place almost at the same period. The last delegation from Sri Lanka was sent to China in 1439.

Illustrations

- No. 1-3. Punch marked coin from the Trincomalee based. British Museum.
- No. 4 & 5. Multi-type Elephant and Swastika. British Museum (enlargement).
- No. 6. Lakshmi plaque (standing Gaja Lakshmi/Swastika). Bibliothèque Nationale, Paris (enlargement).
- No. 7. Lakshmi plaque (standing Gaja Lakshmi/Swastika). British Museum.
- No. 8. Lakshmi plaque overstruck on "Elephant and Swastika" type coin. Private collection.
- No. 9. Aqueduct - lion type coin from the ASW 2 (Anuradhapura) Excavations.
- No. 10. "Tree and Swastika" coin from the ASW 2 (Anuradhapura) Excavations.
- No. 11. Imitation of a Late Roman Imperial coin. British Museum.
- No. 12. Cat's and fish Pandya multi-type coin from the ASW 3 (Anuradhapura) Excavations.
- No. 13. Pandya coin. Goshart's humped bull and two-fishes. Bibliothèque Nationale, Paris (enlargement).
- No. 14 & 15. Gold coins. Sri Raja Raja. British Museum.
- No. 16. Chinese coin. Yuan Feng period (1078-1085). Yuan Feng, long hao, currency script. Colombo National Museum.

We wish to thank the authorities of the British Museum; the Bibliothèque Nationale, the Colombo National Museum and Dr. Robin Coningham for authorising us to publish these coins.



A R C H A E O L O G Y

Ancient Iron Smelting in Sigiriya Dambulla Region

by

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Studies in the pattern of ancient settlement proved that they had characteristic technological systems which were connected to their environmental resources. Iron was one of the critical technological and economic resources in all ancient societies. Iron making provides many illustrations of the way in which technological innovations change the lives of people in the community into which they are introduced. It not only affected those actually engaged in production but also had a more general social, economical and political significance in its influence on trade, urban growth and patterns of consumption.

There are numerous references in ancient chronicles like the Mahavamsa, Thupavamsa, Pujavaliya and inscriptions, to the use of gold, silver, lead, copper and iron in Sri Lanka from Early Historic times. Archaeological explorations and excavations carried out in various parts of the island confirm such written evidence and records of the metallurgical knowledge of our ancestors. The earliest known date of iron smelting, viz. 9th century BC was established through C14 dating of an archaeological context from Aligala, Sigiriya.¹ It is thought likely that this technology was adopted at some point in time during or before the 9th century BC. The results yielded from the excavations in the Anuradhapura Citadel area have confirmed this evidence further.²

It is important to ascertain whether Sri Lanka had an indigenous metal technology and if so, what the characteristics of such a technology could have been. The study on pre-modern iron production in Sri Lanka seems to have started in the 19th century. Early descriptions and investigations such as those of John Davy,³ Ondaatje,⁴

Coomaraswamy⁵ and Hadfield,⁶ have indicated that Sri Lankan iron and steel technology occupied a significant place in the South Asian iron technology complex.

In the late 1980's important breakthroughs in the archaeological investigation of this subject were made by the Postgraduate Institute of Archaeology (PGIAR) - in collaboration with the Swedish Board of National Antiquities, under the Settlement Archaeology Research Collaboration Project (SARCP) in the Sigiriya-Dambulla region⁷ and by the Archaeological Department working in collaboration with a British team at Samanalavava on the bank of the upper Valave river.⁸ However, in addition to these two sites, the remains of iron smelting furnaces unearthed at Ridiyagama (under the Department of Archaeology and the French Mission of Archaeological Cooperation) in 1995,⁹ and explorations conducted in Alahara in 1992,¹⁰ Tunnana, Yabaraluwa and many sites which area located in the lower Kelani valley region in 1996¹¹ and the existence of iron slag mounds throughout the island, bear evidence that this technology was widespread.

Excavation, furnace construction and technological evaluation

Research and scientific activities presented in this paper, were principally focused on this major 'factory' site at *Dehigaha-ala kanda* near *Alakolavava village* in Sigiriya, identified in 1988 and excavated in 1990 and 1991. This site is situated 8 1/2km south-east of the Sigiriya rock. This iron production site which is hidden in deep jungle 1 1/2km from Alakolavava village is demarcated on the north and the west by *chena* cultivation and on the east by the Kiri Oya which is one of the major waterways feeding the

Sigiriya area. In the Kiri Oya valley alone, there are more than 20 iron production sites. Excavations revealed a series of furnaces and a massive slag heap covering the site of nearly 3,750 m². Archaeological research enabled the identification of large scale iron production using an advanced bloomery process with magnetite ore (Fe₃O₄) at the site. Pieces of iron slag of various sizes and shapes, slag mounds covered with soil layers and the research carried out bear testimony to the extent of production and the stage of development of the technology.

Figure 1 : The study region with iron production sites

Systematic excavations conducted over two years in two stages and spread all over the site have led to the discovery of several furnaces used in iron production. These furnaces were made by carving the bedrock into an oval shaped pit. In every excavated furnace the front wall was missing. The reason for this may be that the wall had to be broken to enable the spongy iron bloom - which was the final product of furnaces of this type - to be taken out.

The height and shape of the construction had the capability to control the temperature and ensure the strength of the furnace. The height of a furnace when reconstructed with the remaining fragments seems to be about 2m. The width at the bottom of a furnace was 80-95cm and the depth (east to west) was 40-60cm. Taking the above as well as the height of the furnace into consideration it is evident that the furnaces at Alakolavava were relatively broad. This construction feature also had the capability to control the temperature at a suitable point to obtain a high production activity from the production process.

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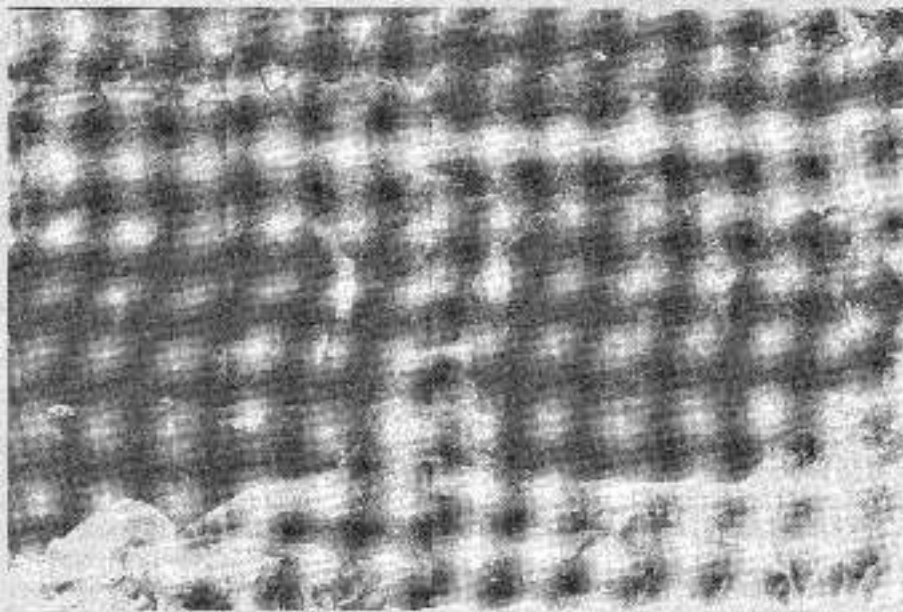


Figure 2: Two furnaces seen from the west

Production activities

The maximum production which can be obtained from raw material used, generally depended on the ability to control the reduction conditions in the furnace. Heat is the most important factor of the iron smelting process. The heat generated by an ordinary charcoal fire may reach up to 700°C. The furnace, therefore, should have facilities either of natural draught or forced draught to raise the required high temperature for the smelting process. A natural draught of air through a furnace is induced by a high chimney. A forced draught furnace will have provision for an air blast blown in by bellows through a tuyere.¹⁴ In the furnaces excavated at Alakolavaya pressure marks on the lower parts of the back walls, indicate the use of a forced draught which must have been blown by bellows. It must be mentioned here that it is believed that unlike at Alakolavaya the smelters at Samanalavaya used the monsoon winds that lashed across the region at a velocity of 70 miles per hour from April to August as a natural draught.¹⁵ There was evidence that the iron masters of Alakolavaya on some occasions used eight tuyeres at a time for one furnace. This was a very special arrangement used for controlling the heat which was essential for the success of the production process. And they also had the ability to avoid cold zones and

distribute the air equally to all parts of the furnace

Generally, iron smelters used haematite and limonite for primitive bloomery furnaces. This was due to the difficulty of reducing very dense iron oxide in a bloomery furnace. In India, the Dhatwa iron smelters used the locally available limonite ore. They roasted iron ore in vertical kilns haematite and to remove much of the water content together with carbon dioxide and other volatile components like sulphur in the ore.¹⁶ The Samanalavaya iron smelters in Sri Lanka also used limonite and haematite iron ores in the production process. The Anuradhapura Gedige site yielded pieces of iron slag and limonite nodules indicating that these iron smelters also used limonite ores.¹⁷ The use of magnetite in bloomery furnaces has so far been identified only in a few exceptional cases. Modern archaeometallurgists assume that it would be difficult to reduce the dense magnetite ore by this technique. However, in view of the iron ore fragments found around the boulders at the site and from around the furnaces and attached to the iron slags at the Alakolavaya excavation site, it seems that magnetite had been used for this bloomery process. Chemical analyses have shown that the average percentage of iron oxide content in these magnetite grains is 98. According to chemical analysis the slag samples from Alakolavaya consisted of a fayalite (Fe₂SiO₄) compound and a lower iron oxide content when com-

pared with slag samples from other production sites which were situated around the river. These factors indicate that the yield at that site has been very high and the iron masters of the site had an ability to select the ore for the production which was most suitable economically.

Dating of the production site

C₁₄ dates¹⁸ indicate that the factory was in operation from about the 1st century BC to the 4th century AD, a particularly early period for iron production of this scale and quality. The pottery types found at the site indicate that production was carried out during the Early Historic period (continuing at the site until the 4th century AD). Thus it seems that there had been a well organized iron production system prior to the 5th century AD Kshyapana period which was the main construction phase in Sigiriya city.

However, excavations carried out in the area make it clear that iron production in the Sigiriya - Dambulla area was in existence before the Alakolavaya production site and subsequent to the Sigiriya kingdom. Evidence of iron production sites belonging to the post-Kshyapana phase has been found in excavations carried out recently in the outer moat of Sigiriya¹⁹ while evidence has also been found of protohistoric iron production sites in excavations carried out at Aligala prehistoric cave within the citadel of Sigiriya²⁰ and at Ilbankatava in the Dambulla area.²¹ It is important to note that the protohistoric layer in which evidence of iron production was found at Aligala, was dated to the 6th century BC. This is the oldest dating obtained so far for the iron smelting in the island.

Agriculture helped the expansion of the protohistoric settlements in Sigiriya which flourished around the waterways in the area. The emergence of minor irrigation networks which gave rise to large irrigation systems and the food surplus which was the result of that system may have created a favorable background for the adoption of new technological methods. These factors may have contributed to the emergence of Sigiriya as a suitable location for urbanization. Therefore, in the light of this and the various excavations conducted around

Sigiriya, it becomes clear that even long before the 5th century urbanization, there were iron production and related socio-economic activities in the Sigiriya area. Similarly, a thorough study of ancient economic patterns show that the economic structure of the Raja Rata, i.e. the irrigation and agricultural society, was based on iron use.

In the 1920s, the archaeologist Hocart observed that the transition from limestone to granite as a building material took place in the 5th century AD. He draws special attention to the use of "square hammered stones" in the constructions of the Sigiriya fortress wall and the cyclopean style stone walls at Mapagala.^{20,21} The ability to cut massive blocks of granite of the types mentioned above probably depended on major developments in the production of iron and steel in the Sigiriya hinterland. This finds further support in the quality of the granite carving of the stone thrones in the assembly hall and in the palace on the summit of the Sigiriya rock.

Iron production and communities

In the study of socio-economical system which was relevant to the iron production activities in ancient time, we have formulated some general themes to discuss:

What demands have the various methods of ironmaking made on the supply of raw materials and labour and its organization?

How has iron been distributed and used?

What kinds of community or organization have developed to supply the needs of the industry?

Production facilities might be built and operated by a social group and transport, trade and distribution might be arranged on a large scale, involving a more complex social organization. In more recent times the different stages of the iron production process have been associated with particular castes. Those who extracted the iron from the ore were called the *yammanno* caste, while the producers of 'steel' or iron tools belonged to the *navandanna* or *aachari* caste. The Brahmi inscriptions

of Pre-Christian times, speak of the existence of craftsman in different kinds of metal. They are referred to as *kabara* (ironsmith), *tabakara* (coppersmith) and *topasa* (tinsmith). The word *kabara* derives from the Pali word *kammara*.²² The ancient texts of Sri Lanka also recorded implements used in the iron production process such as bellows, blow pipe, anvil, tongs.²³

In folk songs or *jana kavi*, handed down from generation to generation which refer to iron producers, a clear distinction is shown between the *yamanno* and the *aachari* or *navandanna* caste. In ancient times the caste system was mainly occupation based. As a result, technology was preserved by being handed down from generation to generation. The caste system in ancient Sri Lanka was evolved to maintain the socio-economic systems of the day. This social pattern changed with the advent of foreign rule and as a result the traditional technological know-how was lost under colonialism. Another reason for this decline was the import of cheap steel and iron implements from Europe and the inability of the indigenous iron producers to adopt new advances in technology.

Frequency of production

The approximate volume of iron production can generally be estimated from the amount of slag remaining on the site. However, most of the slags remain buried under soil layers. According to rough calculations, more than 10,000 tons of iron had been produced at the Alakolavava site.

A study of the high technological knowledge possessed by these iron masters, the highly developed furnaces used in the process, the high iron content of the iron ore used, the iron content of slag etc. makes it clear that they were capable of producing very high quality iron relative to the amount of raw material used. The high quality of iron produced, the quantity of output and the nature of the organization of production suggest industrial level production for use beyond the Sigiriya - Dambulla region, for local purposes such as agriculture and war, and even possibly for export. There was written evidence of that blacksmith of Kandyan period used to supply certain quantity of steel for the royal treasury

as their service rent or *rajakariya* annually.²⁴

A total of 35 iron production sites including about 5 of similar magnitude have been found in the area. There are some records in neighboring India about the Early Historic site of Kamrej, situated on the banks of the river Tapi which was dated to the same period as the Alakolavava production site. This site was mentioned in a Greek maritime guide *Periplus Maris Erythraei* as a coastal trading station engaged in the export of iron to the Red Sea littoral and the Mediterranean region.²⁵

In considering ancient production systems, there is evidence to suggest that the distribution of Sri Lanka's natural vegetation and natural resources played an important role in its socio-economic patterns in ancient period. The industry of iron might be influenced the economic and political development of the island during the pre industrial era.

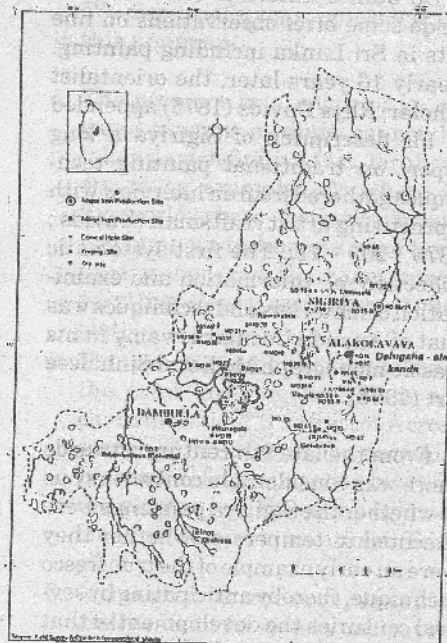


Figure 1: The study region with iron production sites

FOOTNOTES:

1. Kurunaratne, P. and Adikari, G. 1994, Excavations at Aligala Prehistoric Site, *Further Studies in the Settlement Archaeology of the Sigiriya-Dambulla Region*, Bandaranayake, S. and M. Mogren (eds.), PGIAR, Colombo.
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Cont'd on page 35

Material and Techniques of Sri Lankan Paintings

by
Jagath Weerasinghe.

Interest in the material and techniques of the historic and traditional paintings of Sri Lanka goes at least to the 19th century. The first scientific description of the pigments and techniques of Sri Lankan paintings was published by John Davy in his *Account of Ceylon* (1821: 134-85). Like other Europeans of his time, Davy had no eye for the stylistic modalities of Kandyan art.

Sir James Emerson Tennant (1859) made some brief observations on fine arts in Sri Lanka including painting. Nearly 16 years later, the orientalist scholar, Rhys Davids (1875) appended to his description of Sigiriya a long report on traditional painting techniques gathered from an interview with a practising artist craftsman (Davids: 1875: 200-11). The first systematic collection of information and examination of materials and techniques was that of Ananda Coomaraswamy in his classic monograph *Medieval Sinhalese Art* (1908).

From the late 19th century onwards there was considerable controversy as to whether the Sigiriya paintings were executed in tempera or whether they were an early example of the *true fresco* technique, thereby anticipating by several centuries the development of that technique in Europe in the 13th century. The discussion of whether the paintings of Sigiriya were *fresco* or *tempera* began with Bell (1897, 1905), Havell (1908) and Coomaraswamy (1927). It is sufficient to say that, Bell (1905), Havell (1908), Coomaraswamy (1927), Wind (1962), Dharmapala (1957) and Wijesekera (1951) were of the opinion that they represented some form of *fresco* or *true fresco* technique, while Sans Villa (1943) and de Silva (1971) questioned this view. The matter seems to have been finally settled

by Silva's (1962) pioneering study of the technology of the Sri Lankan paintings, presented as his doctoral dissertation to the University of Oxford in 1962.

This work remains as yet the only systematic and analytical investigation of our present subject.

The basic technique of Sri Lankan paintings, as described by many of the writers listed and also confirmed by my own, as yet limited, experience, can be summarized as follows:

1. The application of mud or lime plaster, which in technical terms is called a ground or rendering layer, to the rock or brick support. The rendering is prepared by the addition of an organic binding medium and a fibrous admixture. Where there are multiple layers, up to a maximum of three, each successive layer had a more refined matrix;
2. The application of the paint receiving layer or the final white coating, which was trowelled in such a way that it became a key layer to support the pigment layer;
3. Making the preparatory drawing on the wall in red or black lines;
4. The application of the pigment to complete the main body of the painting;
5. The final modeling and detailing of the painting; and
6. The application of an oil varnish layer or burnishing with a soft pad to seal the surface.

The exception to the general sequence was the omission of this instance rendering the paint receiving

layer was directly applied on the supplied on the support, as in rare examples at Vessagiriya (5th A. D.) and Gonagalla (ca. 8th A. D.)

The materials used in these successive stages in the production of a painting can be summarized in the following way:

1. The rendering or the ground:
Mud, and hill clay, lime, vegetable materials such as straw, paddy husks, leaves, etc., an organic binding medium such as a plant gum;
2. The paint receiving layer (PRL):
Lime or 'Makul' a kind of a clay containing a high percentage of magnesium carbonate and an organic binding medium;
3. The paint layer:
Earth pigments such as, cinnabar (Hg₂), Orpiment (As₂S₃), vermilion, Lapis Lazuli, carbon black and organic pigments such as: 'Gokatu' - sap of the *Cereus* *scabellii*, 'Nil Avuriya' plant, lime and 'makulu' (a white clay or kaolin, containing a high percentage of magnesium carbonate).

The principal palette used in the Sri Lankan paintings was as follows.

- a. White
- b. Black
- c. Yellow
- d. Red
- e. Blue and Green sparingly.

The most common palette of the Sri Lankan painter consisted of the yellow-red spectrum along with black and white.

Some of the most important aspects of the study of materials and techniques or the chronological variations in the painting technology. A major

contribution to this field was made by Dr de Silva (1962) who provided a clear periodization.

It is seen from de Silva's (1962) unpublished dissertation and his important article in *Ancient Ceylon* (No. 1, Jan. 1971) that his chronological studies were based on a total of 26 samples from 23 sites. It is a part of a projected programme to continue this pioneering work further. Further investigation will enable us to test and develop de Silva's (1971) hypothesis, grounded in cross-sectional studies and physical and chemical analysis, and to use it as a basis for evolving what will undoubtedly one day be a more complex chronological model. The elaboration and 'finalization' of that model would then provide an excellent calibration for the technological dating of extant paintings without recourse to spectroscopic analytical techniques. This may also help us to confront that vexed question, to what extent those Kandyan period paintings, which are found in early temples, contain sections of paintings from the lost art of the previous 13th-17th century period.

My own work in this area began in 1983, and for the time being I have only three important observations to make, all of which need further investigation.

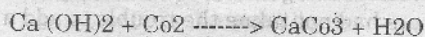
Two of these relate to the technique of the Early (EHP) and the Middle Historical Period (MHP) paintings, i.e. the period extending from about the 3rd century B.C. to the 13th century. These two observations are interconnected, one supports the other. Following de Silva (1962 and 1971), there is general agreement that the technique of Sri Lankan painting is essentially a tempera technique. However we must recognize that there is a possibility that the exposure to the elements, especially exposure to excessive humidity of tempera paintings executed on lime renderings and lime based paint receiving layers, could produce a natural fresco effect after a certain period of time (Moriens 1972).

This phenomenon can be elaborated as follows:

When a wet, lime-containing rendering with a thin coating of lime on its surface begins to dry, calcium hydroxide from within the rendering migrates towards the surface and on the



surface begins to react with carbon dioxide in the environment to form calcium carbonate. The chemical reaction here is:



Since carbonization starts on the surface and due to the creation of water, the pores of the rendering get blocked with time. With this development, the migration of calcium hydroxide to the surface and also the induction of carbon dioxide gas into the rendering gradually slow down. Thus, the calcium hydroxide in the rendering remains there without coming into contact with carbon dioxide gas, preventing the conversion to calcium carbonate. However, this trapped calcium hydroxide can migrate to the surface at a later date due to the effect of moisture or increasing dampness, to carbonize on the surface. If this phenomenon took place in the paintings at sites such as the Thivanka Temple at Polonnaruwa, at the remaining red stripes at the Royal Palace of Parakrama bahu, also at Polonnaruwa, and at Sigiriya those paintings might have been naturally 'frescoed' giving them extra strength to withstand exposure to the elements, especially to high levels of humidity (Mora and Mora: 1984:12). The definitive test for this is the examination of the surface layer with an electron scanning microscope.

In the context of such observations it would be pertinent to re-discuss the technique at Sigiri and of Early and

Middle Historical Period paintings in general. De Silva (1971) rejects the possibility of the existence of the fresco technique completely and his arguments leave little room for doubt. The basic arguments he puts forward in support of his view (as deduced from his unpublished thesis) are these:

1. An organic binding medium can be detected with the pigments at Sigiri and in other Early and Middle Historical Period paintings in general. In the 'true fresco' technique no organic binding medium is required.
2. Cross-section studies of these paintings do not show a paint layer that has diffused into the surface of the ground, instead a distinctly separate layer can be seen.
3. Visual examination of the Sigiriya or other paintings does not reveal joints or 'giornate' mark which are present in 'true fresco' paintings.

We may briefly consider each point in this argument:

1. The presence or absence of an organic binding medium cannot be taken as a definitive test, for there are many examples elsewhere in the world where both the 'fresco' and tempera techniques have been used in one and the same mural painting (Mora and Mora 1984: plate v.)
2. The penetration of pigments from the paint layer to the PRL is not characteristic of 'true fresco'. A cross section of 'true fresco' too normally presents a clear separation between the plaster and the paint layer as found in tempera paintings (ibid.: plate v.)
3. Although it is true that joints generally cannot be seen in ancient Sri Lanka paintings, but this is not entirely so at Sigiriya. Here it is possible to see that the immediate area around the figures is marked out from the surrounding area. However, this aspect requires further investigation.

Thus it can be seen that the data and arguments put forward by de Silva to support his contention may need re-investigation and reconsideration. I must stress, that it is not my intention to suggest that the Sigiriya and other

Early and Middle Historical Period paintings in Sri Lanka are executed in the 'true fresco' technique. It seems that we still have to study the material extensively before coming to a conclusion. However, it is likely that the ancient painters had some knowledge, perhaps by trial and error, of the 'natural fresco reaction' and that in doing so that they had anticipated the conscious invention of 'true fresco.'

If we consider the fact, that the Sigiri painters used an organic binding medium also in the lime renderings (de Silva, 1971), one can suggest that the addition of the organic binding medium was a mere contribution of the tradition. It is important to remember that before the 5th century A.D. lime was not used in rendering (Silva 1971) and thus it was a necessity in the pre-Sigiriya technique to ensure the secure adhesion of the components of the ground and the ground to the support, a practice which was then continued during subsequent periods, even after the adoption of lime.

My third observation is related to the fragility of the yellow pigment of the Kandyan period (Late Historical Period - II) and renderings of the early 19th century paintings executed in the Kandyan technique. The main reason for this undue fragility may be attributed to the non-mixing of a drying oil. Our experience at Dambulla is that, the ceiling paintings of the latest cave,

completed in 1915, have lost adhesion to the rock ceiling in many places, while the older, 18th century ceiling paintings in these caves, under similar and worse climatic conditions, are still well adhered to the rock ceiling. The descendants of the traditional artist-craftsman who executed the paintings of vihara No. 5 at Dambulla maintain that they do not use any oil, such as 'dorana oil' to their rendering mixtures or pigment mixtures (Naide, pers. com. 1986, June). This probably could be the reason for the extraordinary weakness of these renderings. The long term consolidation effect given by a drying oil is that it can create a lattice-like structure within the rendering by cross-linking between the oil molecules (Macshlein-Kleiner, 1985). The fragility of the yellow pigment at Dambulla which is the sap of the *Gercenia morella* tree is such, that satisfactory cleaning of these paintings was not achieved either with aqueous media or with organic. Since this yellow pigment was a gum, the traditional painters had not taken the trouble to add a further drying oil, thus rendering these pigments extremely sensitive to both cleaning media.

Future studies with regard to the materials and technique of Sri Lankan paintings are planned on three specific aspects:

1. Carrying out stratigraphical studies of wall paintings in connection with a substantial cross section of

Middle Historical Period sites. (5th-13th century).

2. Examining the Later Historical Period paintings (LHP - II) for the possible existence of renderings and paint layers from the LHP - I, in order to determine their technology.

3. Studying the aging patterns and degradation products of materials currently used by traditional painters under artificial aging.

In the important area of the study of the pigments themselves, we have not yet planned any substantial research programme and would welcome information or collaboration in this regard. My paper is merely an overview of the existing situation in the study of materials and techniques, presented here for the benefit of advice and suggestions from colleagues from the neighbouring SAARC countries.

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3. The third stage of the metallurgical transition in Sri Lankan coinage was the emerged of gold coins in the late 7 or early 8 c. AD. It remarked the east Indian influence to the indigenous monetary system. In the same period very few amount of silver also used for the coins but not sustained in a long duration. However again, in the early 9c. AD it had been adopted to the copper coins, because of the debasement in gold.

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Management of Large Archaeological Sites

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It is widely accepted that the archaeological heritage is a fragile and non-renewable cultural resource. This demands a high level of management skills to deal with these resources. The management of the archaeological heritage comprises one or more of the following aspects: Inventorization of monuments and sites and other movable objects; Adoption of integrated protection policies; Preparation of adequate legislation to cover all types of matters such as protection, to prohibit destruction of different forms, to allow all types of investigation; Finding required funding; Scientific investigations range from non-destructive techniques through sampling to total excavation; Conservation, restoration and maintenance; Presentation, information, interpretation; Public participation of different sorts; Professional development; International cooperation; Institution building.

Archaeological Heritage

The Antiquities Ordinance of 1940 (revised in 1956) is the principle legislation governing the management of the archaeological heritage of Sri Lanka. Under this ordinance there are two types of properties. They are as follows:

1. Ancient Monuments; According to the Antiquities Ordinance an Ancient Monument means

any monument lying or being or being found in Sri Lanka which dates or may reasonably be believed to date from a period prior to the second day of March, 1845 and includes

(a) any other monument which has been declared to be an ancient monument by an order published in the gazette under Section 16. Under Section 16, the Minister can declare any building built before

1850 as an ancient monument.

(b) any tree in respect of which an order under Section 17 has been published in the gazette.

Such monuments can be situated in state or private lands and those in private lands are designated as 'protected monuments'.

2. Archaeological reserves

These are large areas with more than one monument as against individual buildings mentioned above but limited only to the state lands.

Procedures and power required to manage the above are given in the Antiquities Ordinance.

Large Archaeological Sites

There is a major shortcoming in identifying monuments and sites in this manner. In particular, such identification has led to the fragmentation of large archaeological sites which need to be considered as one whole to understand the proper meaning and also for the maintenance and presentation. For instance, the ancient city of Anuradhapura consists of an area of about 40 sq. km where there are elements interconnected such as the citadel, numerous monasteries, other settlements and infrastructure around them. With the above identification system, only isolated monuments or sites have been grouped and listed for protection. There is no power in the Ordinance to incorporate the entire area and prepare an integrated plan for protection and to provide facilities for the public who visit these places.

In Galle, only the ramparts of the ancient Fort belong to the state while all the historic buildings inside belong to private individuals or institutions. Its located in the heart of a developing

city as such the management strategies suitable to an archaeological site with ruins cannot be adopted to such a place. It is important that such situations are handled by integrating the archaeological sites into the overall planning of the city and to have new institutions to handle them.

Today, some of these large sites have been recognized as World Heritage Sites by the UNESCO which requires the government to maintain a high level of management in these places. Ancient city of Anuradhapura, Polonnaruwa, Sigiriya, Kandy, Galle and the Temple of Dambulla are in the World Heritage list.

It is proposed in this paper to outline some of the management strategies adopted for large archaeological sites of this nature. Since, Antiquities Ordinance do not have sufficient provisions to handle such situations, these strategies have been formulated with the help of other institutions and legislation. The characteristics of the individual sites always tend to determine or dominate major management strategies. It is therefore important to adopt a different set of rules for individual sites.

Although individual characteristics of the sites have determined major strategies, the following common objectives constitute the key features of any management plan.

- Conduct research based on a set agenda and carry out conservation on a set programme. (Conservation priorities are determined by a variety of factors, not only the condition of the monuments).
- Conserve and control peripheral areas around monuments and sites.

- Provide infrastructure facilities for pilgrims and visitors.
- Control tourist hotels and other peripheral service areas required for tourism.
- Prepare rules and regulations to facilitate the above objectives.
- Show that conservation and development can join hands in certain cases.

Legislation and Institutions

In the process of preparing management plans for large archaeological sites, the following legislation and institutions handling them have played the major role. The legislation and institutions are as follows:

1. Town and Country Planning Ordinance

Under the powers of this ordinance, the Department of Town and Country Planning can declare an area a 'sacred area' or 'sacred city' and prepare a planning scheme. The important pre-requisite for such a planning scheme is the presence of a sacred site. The Department also has the power to implement such a scheme, under which it is possible to provide infrastructure facilities if necessary, relocate people living in and around monuments, pay compensation and also control the character of new buildings.

2. Urban Development Law

This is one of the most powerful laws of the country for development planning. Under this law, the Urban Development Authority can declare any area an urban development area and prepare a planning scheme. This can be applied to any area, whether or not that area contains an archaeological area. It also has the power to implement such a scheme and has wider powers than the Town and Planning Ordinance, in that it can act faster on matters of land acquisition etc...

3. Central Cultural Fund Act

The fund is chaired by the Prime Minister of the country and several key ministers are members of the board. It has archaeologists the chance to converse closely with im-

portant political leaders on matters related to heritage management. This was established for implementation of the Cultural Triangle Project, and it has provided new opportunities in the country for the professionals of different sorts to join the heritage management process which otherwise would have been limited to the conventional government departments, such as the Department of Archaeology.

4. Galle Heritage Foundation Act

This was specially prepared for the development and conservation of the World Heritage City of Galle. This provides for public-private partnership to conserve and develop the World Heritage Site of Galle.



Sacred City of Anuradhapura

Sacred Area Planning Scheme can be considered as one of the major attempts in this regard which was first aimed at the Anuradhapura Sacred City. Anuradhapura constitutes one of the most extensive archaeological sites in the world covering an area of about 40 sq km, of surface and immediate sub-surface monuments, as well as stratified remains to a depth of over 10 meters. These remains represent 1500 years of continuous construction activities.

It is also the most important religious city of the country since the 3rd century BC. Most of its centuries old monuments are still being worshipped by the majority of the country's people, as well as pilgrims from other Buddhist countries of the region. On important religious days, thousands of pilgrims gather at these sites. The archaeological sites themselves comprise important religious buildings.

The major monuments in Anuradhapura belong to the monks, but they have been declared 'protected monuments' under the Antiquities Ordinance. All the other sites are ar-

chaeological reserves, declared under the same ordinance. But neither the law nor archaeological activities for the past hundred years in Anuradhapura had thought beyond the conservation of individual monuments, or smaller sites. No proper demarcation of the boundaries of archaeological sites, leaving them free of various encroachments, or providing infrastructure facilities, or controlling the environment around such monuments etc. was not possible.

Nevertheless, the government had recognised the significance of Anuradhapura for a considerable time. The Anuradhapura preservation board for the planning and protection of the sacred city was established around the 60's. This was abolished later and the ordinary Town and Country Planning came into force. A 'sacred area' planning scheme was prepared mainly to provide facilities for the pilgrims and develop the city according to a plan. Although it was the main objective, the archaeological aspect was not overlooked. Archaeological areas, religious sites and utility areas were identified.

Beginning with the identification of a site for a sacred area scheme, the Department of Town and Country Planning works closely with the Department of Archaeology, as well as other relevant authorities such as religious communities, local governments, local administrations, and institutions dealing with the infrastructure. Right throughout implementation too, the Department of Archaeology works as principal partner of the scheme.

Within this scheme, archaeological activities can take place in individual identified areas assisted by the provision of infrastructure facilities. At present, the excavation and conservation of two major sites in Anuradhapura are in operation under the Cultural Triangle Project. Two more projects are under the Department of Archaeology.

The religious factor caught the attention of the government and brought in a large sum of money to fund implementation. For the first five years, a sum of Rs. 150 million was approved, which is considerable compared to the annual allocation of the Department of

Archaeology. This has helped to manage a large archaeological area now on the World Heritage List. This principle has been adopted for a large number of major Archaeological sites.

Ancient City of Sigiriya

Unlike many archaeological sites in Sri Lanka, Sigiriya can be considered a secular site. The main archaeological area is an 'archaeological reserve' and the Department of Archaeology can exercise its authority to an extent of 400 yards around the site but not to the larger landscape. Apart from being one of the most important archaeological sites, its palace on top of the rock, its elaborate gardens, with moats and ramparts, make Sigiriya a site of considerable natural beauty. Thus, the Sigiriya archaeological site with its rural setting and large forest cover has become part of a larger landscape. This has to be considered in any management plan. The economic potential of Sigiriya is also a factor of reckoning.

About 12,000 acres of land containing natural forests, agricultural areas, several traditional villages and a number of other archaeological sites were considered for a development plan. In this case, the urban development law was utilized and the plan was prepared by a multi-disciplinary team of experts from Sri Lanka. The development plan summarised its objectives as follows: "Sigiriya has been acknowledged as one of the World Heritage Cities because of its

Outstanding archaeological and artistic value. It is not only essential that this heritage be protected and preserved for posterity, but also develop and promote the economic potential of Sigiriya as a cultural and tourist centre. It requires that the area in and around Sigiriya be comprehensively planned to provide for its conservation as well as future growth and also to maintain its socio-cultural value and to preserve the natural environment"

The plan prepared includes the following aspects: A Structure Plan; Conservation, preservation and environmental protection; Human Settlements and Land Resources; Minor Irrigation and Agricultural development; Alternative Employment; Tourism; Research.

Within the overall plan, the Cultural Triangle Project has formulated its own research and conservation strategies for the archaeological epicentre of Sigiriya.

It was the Cultural Triangle Project of Sigiriya which initiated the programme and got the urban Development Authority involved in the planning process. All the relevant authorities gathered at the initial planning process and are being consulted at the implementation stages as well.

The environmental factor required the entire region to be considered as a whole which meant new problems were encountered. Under the Urban development law and a multi-disciplinary approach, solutions were sought to these problems while considering the conservation of the entire region. In this case, conservation and development were integrated elements.

Sacred City of Kandy

The major feature of the sacred city of Kandy is the Sacred Tooth Relic Temple which is the most revered religious center of the country. This is situated in the midst of a growing urban sprawl. Similarly its annual pagent is one of Sri Lanka's most colourful cultural events. The natural setting of Kandy, with its forest, hills, and lake is its other vital aspects. The palace complex around the Tooth Relic Temple comes under the purview of the Department of Archaeology. In the close vicinity is the city centre with its ancient layout and architectural fabric which belong to private owners. The infrastructure of the city is controlled by the municipality. The Urban Development Authority and the municipality are involved in the planning of the city.

The 'sacred area' concept was adopted for the development of the major centre, but it was understood that the greatest threat to the monuments came from the expansion of the city which had resulted in changing of the environment. Therefore regulations were made under the Urban Development Law to control this growth. These regulations can control the height, density and character of buildings in and around the city.

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A R C H A E O L O G Y

The Measurement of Unemployment

Statistics on unemployment are important for several reasons. They indicate the number of persons who are not employed during a specified period and hence, the analysis of unemployment statistics presents a better insight into the economic and social health of a country. Governments, research and academic institutions, aid donors, financial institutions, politicians and many others make extensive use of these statistics, but due to differences in terminology, definitions, measurements and methods of data collection, the interpretation of these statistics should be done cautiously.

In Sri Lanka, the definition of the unemployed tends to follow the internationally agreed definition of unemployed reflected in the International Labour Organisation's (ILO) Resolution on Statistics of the Economically Active Population, Employment, Unemployment and Underemployment adopted by the 13th International Conference of Labour Statistics in 1982. According to this definition, a person of working age is classified as unemployed if during a specified reference period he or she was,

"Without Work", i.e. not even for one hour in paid employment or self employment or working for family gain;

"Currently available for work" whether for paid employment or self employment or for family gain;

"Seeking work" by taking active steps in a specified recent period to seek paid employment or self employment;

The primary sources of data on unemployment in Sri Lanka are the population censuses carried out by the Department of Census and Statistics (DCS), household sample surveys conducted by the DCS and the Central Bank of Sri Lanka (CBSL) and administrative records such as the registration of unemployed persons. The census of population conducted before 1946 did not provide any information on unemployment. For the first time, the census of population in 1946 collected information on unemployed persons. Here, the unemployed were classified as those who had previous employment, but were without work at the time of enumeration. In the 1953 census, unemployed persons were considered to be those who had previous employment, but were temporarily unemployed at the time of data collection. Persons who were seeking employment for the first time were treated as dependents rather than unemployed. In the next census, in 1963, the number unemployed

was underenumerated. The 1971 census used a wider definition for the unemployed, including discouraged workers, while in the 1981 census, the number of unemployed persons was derived as a residual category.

Thus the unemployment statistics in the population censuses cannot be compared over time as they use different definitions. In addition, due to non-availability of a census after 1981, data for inter census periods will have to be found from other sources.

Therefore, household surveys are used as the most popular source of data on unemployment in Sri Lanka. The Quarterly Labour Force Surveys carried out by the DCS are based on both direct interviews with households and information obtained through survey questionnaires. This data series is available from the first quarter of 1990. The survey covers a total sample of 10,000 households across the country, except the North and the East, the sample, which is designed to represent the economically active population, including self-employed casual workers and unpaid family workers, as well as first time job seekers, is fairly comprehensive.

The Consumer Finance and Socio Economic Surveys (CFS) conducted by the CBSL are available for the years 1953, 1963, 1973, 1978/79, 1981/82 and 1986/87. There are differences in the rate of unemployment as measured by the DCS and the CBSL, mainly because of the differences in the definition and the lower age limit of the labour force. According to the DCS the lower age limit is 10 years. The Central Bank considers it to be 14 years.

Apart from household surveys, unemployment statistics can be drawn from administrative records. In Sri Lanka, a job bank system was introduced for the registration of unemployed persons in the late 1970's, but due to malpractices the scheme was abandoned in the late 1980's.

Unemployment statistics obtained from administrative records generally indicate low levels of unemployment than those derived from household surveys. However, the data from administrative records are not subject to sampling errors, are relatively inexpensive and can be released more frequently, compared with survey data. However, they cover only the segment of the population which uses employment insurance, and hence leaves out a

significant portion of the population. Therefore, unemployment statistics derived from these two sources are complementary, but not substitutes.

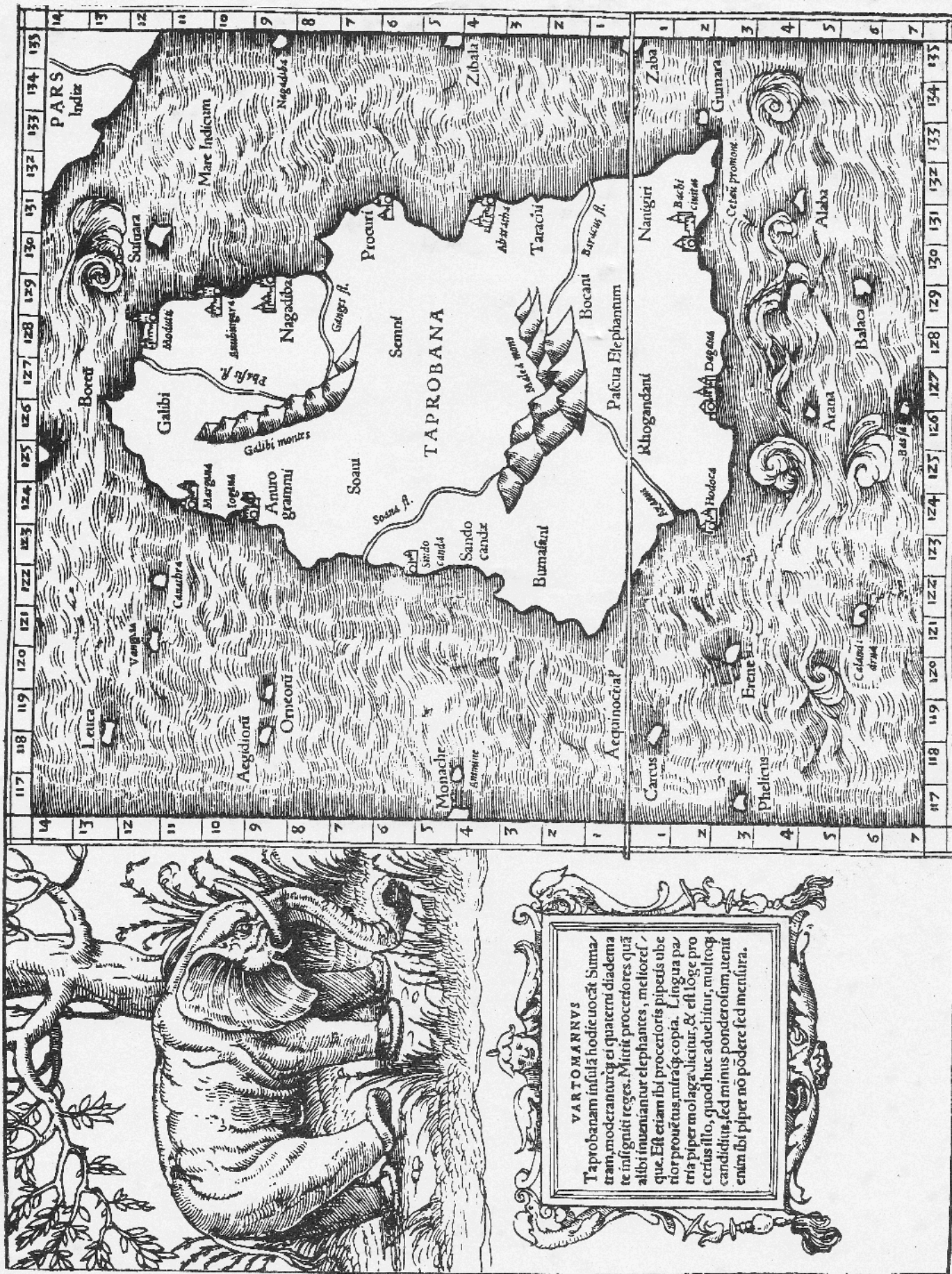
The definition of unemployment and its actual measurement should be closely examined. Conceptually, unemployment statistics cover only those who are actively seeking and available for work during a specified reference period. This leaves out persons who may want to work, but for work during the reference period. Further, unemployment data may indicate only a part of the unemployment problems in a country, i.e. the total lack of work. This leaves out under utilisation of skills, partial lack of work and underpaid categories.

Further, the classification of unemployment data in Sri Lanka does not include underemployed in rural and urban areas. In Sri Lanka, where around 73 per cent of the population live in rural areas, the unemployed often tend to enter informal sector activities since most of them cannot afford to be unemployed. There could be high underutilisation of their actual and potential skills although they may be engaged in some form of economic activity. While some of them maybe waiting for other employment or additional work, they are considered as employed. For example, although unpaid family workers are considered as employed, their contribution to the economy is marginal.

Sometimes, problems arise in a situation where a person works in a very temporary, lowly paid job while also looking for more substantial work. Such persons are categorised as employed. In a situation where a student who is attending school is also looking for work, he would not be included in the labour force. Often, in these situation, as light alteration or misinterpretation of one or more features of the definition of one or more features of the definition can entail a major change in the statistical classification. In reality, border cases are inevitable in any economy and these cases should be examined carefully in the light of the relevant statistical criteria.

Inconsistencies in definitions and concepts of the unemployed hinder comparison of unemployment data over time.

(CBSL)



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