CONTENTS

PREFACE

F.R. Allchin

THE origins of the cities of Greece and Rome have long been the subject of scholarly attention, together with the social evolution that accompanied the formation of their states. In the mid-nineteenth century ancient historians, and particularly Fustel de Coulanges, achieved a striking depth of understanding of these themes, almost wholly on the basis of textual data (Coulanges 1864). This was long before archaeologists developed an active interest in such things.

Historians of South Asia were slow to follow in their footsteps. Only in the past half century have such scholars as D.D. Kosambi, Debriprasad Chattopadhyaya, Romila Thapar and Ram Sharan Sharma begun to focus attention on what was involved in the rise of cities in South Asia and in its social and economic implications. With the notable exception of Marshall's excavations at Bhita (1912) and Taxila (1951), South Asian archaeologists for the most part have neglected to use their discipline to contribute to the study of Early Historic cities. A. Ghosh in his small book *The City in Early Historical India* (1973) and D.K. Chakrabarti in his PhD thesis on *Early Urban Centres in India* (1972) were each in their own way pioneers. Nevertheless, up to the present time, archaeological fieldwork at Early Historic cities in India has been largely limited to cutting sections through city ramparts with a view to establishing their chronology, and the unique opportunities offered – for example by the Nagarjunasagar dam project – have to a large extent been wasted.

My introduction to the early cities of the Ganges valley goes back to the early 1950s. At that time my wife and I were inspired by a number of site visits. These included Hastinapur in the company of B.B. Lal and B.K. Thapar; Kausambi under the guidance of Professor G.R. Sharma, then excavating there; and Kumrahar, where we were happy to meet Vijayakanta Mishra, a brilliant young archaeologist whose early death robbed Indian archaeology of a most promising career. These visits gave me the beginnings of a new perspective which was far removed from the text-centred history I had hitherto learned. I remember giving a lecture in London around that time in which I argued that the society which gave rise both to the early Upanisads and to Buddhism should be seen in the context of the life and culture of the new cities. With regard to the former philosophical texts, forest hermitages may have been their setting, but they must also have been near enough to cities to permit the meetings and discussions with local kings (such as Ajatasatru of Kasi and Janaka of Videha) and the bestowal of royal gifts of great herds of cattle. Moreover, the proximity of their ashrams to major settlements seemed to be a requisite for the sages to enjoy the material support of the local population. Surely, I argued, this indicated that the sages and disputants in the *Brihadaranyaka Upanisad* and the *Chandogya Upanisad* were not the forerunners of the early cities, but rather among their products. Regarding the rise of Buddhism the case was even clearer, since it was generally agreed that this took place in the context of the emergence of a powerful merchant class in the cities. Moreover, the Suttas themselves gave ample support for the close links between early Buddhism and the cities. In those days I was unaware of Max Weber's *Hinduismus und Buddhismus* (1920, English translation 1958), where this view had been expressed with great clarity some forty years earlier.

My attention was drawn to early city formation in Sri Lanka during several visits to that country in the late 1980s. On one of these I read a paper, later published in 1989 in *South Asian Studies* (Allchin 1989), arguing that city formation appeared to have taken place more or less contemporaneously throughout South Asia. If this were the case, it should be treated as a South Asia-wide process and not thought of in isolation in any one part of the subcontinent. These occasions also offered an opportunity to visit the Citadel mound at Anuradhapura and witness at first hand the excavation of the carefully planned and sited sondages which Dr Siran Deraniyagala of the Department of Archaeology was at that time directing. I was struck by his bold and original plan, which coincided with my belief in the importance of purposefully designed research projects. I was particularly impressed by his systematic use of radiocarbon dates to provide a proper archaeological chronology (something which was surprisingly rare in most South Asian excavations before this). If this were combined with his carefully excavated stratigraphic sequence, a solid basis for chronology must emerge. This matter became even more important when early Brahmi inscriptions, scratched on pottery, were reported from the sondages. At first I was frankly sceptical and expressed the view that the inscriptions must be much younger than the radiocarbon dates suggested. All these things highlighted the need for such problem-oriented projects concerning the Early Historic period throughout South Asia. Until this wish becomes a reality our knowledge of the early cities and states of India, Pakistan, Afghanistan and Nepal must remain fragmentary and lack the balanced perspective that archaeology can provide.

While appreciating the originality of the concept of Dr Deraniyagala's project, I also became aware of its

limitations. The accumulated deposits of the Citadel mound at Anuradhapura are around ten metres in depth, and the excavation of sondages of only three metres square to such a depth was something of a *tour de force*. To begin with, working in so small an area makes the task of accurately recording the stratigraphy very difficult to achieve, not to say hazardous. For example, how accurate a picture can be obtained of features such as pits, or portions of pits? Moreover, the excavation of single sondages of such dimensions more or less completely rules out the possibility of discovering identifiable rooms or other structural features, let alone complete houses. Again, the opportunities for recording the positional contexts of finds in relation to other objects or features must be reduced by the small area available, and many other aspects of cultural data are likely to be inaccessible. To me it appeared that a logical next step would be to undertake the excavation of a larger area, making possible the observation of areas of actual occupation large enough to reveal such evidence.

Dr Deraniyagala told me that he would welcome collaboration from foreign excavators. I suggested that we would like to field a British team and he expressed a positive interest. I added that, on account of my age and imminent retirement, I should want to entrust the field direction to a younger person. Further discussions of this plan were held with Dr Roland Silva, then Director of Archaeology, Professor Senaka Bandaranayake and others. The outcome was that Dr Deraniyagala very kindly invited our team to work under the aegis of his major Anuradhapura project and generously offered us the ASW2 site, alongside his own ASW sondage. The outcome was the six seasons of excavation and post-excavation fieldwork carried out between 1989 and 1994. I would like, at this point, to express my gratitude and that of the rest of our team to Dr Deraniyagala and his colleagues in the Sri Lankan Archaeological Department for their continuing support and encouragement. Without this our project would have been difficult, if not impossible to achieve.

I am happy therefore to be invited to write the Preface to the report of the excavations at ASW2. I was present at the first conception of the project, and so it is a matter of great satisfaction to see it reach its conclusion. The completion of the final report and its publication marks the fulfilment of the obligation we accepted from the start. To reach this point within a decade of the inception of the project is quite an achievement, bearing in mind the number of field seasons involved and the other preoccupations of several of the chief actors. No sooner was a field season completed than normal duties recommended, including – not least – the earning of their livings. The successful completion of the several specialist reports from authors who were also heavily committed in other areas deserves recognition!

Perhaps this is a good point at which to make a small digression and express the personal view that all too often these days over-much emphasis is placed upon the need for prompt, almost instantaneous, publication of excavation results. No one will dispute that preliminary reports should be published as early as possible. But the preparation of a final report, particularly when it has involved several seasons' work, must demand sufficient time for adequate research and study, for technical and scientific analyses to be made, and for the report itself to be written and edited. A few years' delay is a small price to pay for getting a comprehensive and maturely produced report. Surely this is to be preferred to a hastily written report, lacking in both depth of research and scholarship? Clearly there is a happy mean between too much haste, on the one hand, and too much perfectionism or delay on the other. One regrets that some grant-giving bodies seem to regard it as their duty to harass recipients of grants, particularly when the latter happen to be relatively junior, even threatening them, to produce final reports with unreasonable speed, as though speed were the overriding consideration. This it should never be.

The Sri Lankan–British excavations at Anuradhapura, site ASW2, constitute a further contribution to the growing body of data regarding the early history of the site. The present publication is in two parts, that is, two volumes, the first dealing with the site, the excavations and stratification, and the second with the various categories of objects and materials discovered. The chronology of the early occupation emerges with considerable clarity and, in spite of minor differences between our dating and that obtained from Deraniyagala's sondages, the impressive number of radiocarbon samples deriving from both must make Anuradhapura archaeologically one of the most firmly dated Early Historic cities of the subcontinent. The radiocarbon chronology can be applied with confidence to the remarkable series of structural periods discovered in the site and discussed in chapters 5 and 6 of the present volume.

The earliest structures, in periods K and J, were circular huts with timber posts and wattle and daub walls, and buildings of this type continued to be made through a series of eight or more reconstructions. Structural period I witnessed a major change with the introduction of rectangular buildings of timber and wattle and daub, apparently carefully oriented. This was evidently the time when Anuradhapura was refounded as a city planned on traditional South Asian lines. Once again in this period there were around eight further reconstructions. A substantial change in building construction and materials took place in structural period G, when solid buildings of burnt brick and occasional limestone blocks, and terracotta roof tiles, appeared for the first time. This period too witnessed a further five reconstructions. From structural period F forwards one more major change in building materials was introduced, with structural stonework, including columns and beams, used to a quite unprecedented extent. This period heralded the beginning of the largely stone architecture which was to remain a feature of the 'Anuradhapura period', throughout its life as a capital city. Thus in the course of the excavations at ASW2 well over a millennium of structural history has been identified and dated.

Our work was also able to throw new light on the nature and history of the fortifications surrounding the city. We were fortunate to be able to study the section excavated in 1992 by the Sri Lankan–Japanese team, near the southern gate. We made a fresh study of the ditch and ramparts from the surface of the mound by remote sensing, using a proton magnetometer, a resistivity meter and a soil auger. By these means it was possible to obtain both a preliminary chronology for the city ramparts and a much wider perspective of the fortifications than could be had from the customary excavation of a single cross-section, used on many Early Historic ramparts in northern India.

In the second volume of the report the finds are studied. These reveal much interesting and exciting material, of which one or two categories may suffice as examples. The pottery is dealt with in Chapter 5: Glazed Ceramics and Chapter 6: Unglazed Ceramics. The predominant pottery, from period K forwards, was a black and red burnished ware, made by a craft tradition and producing a range of forms strikingly similar to those reported in early Iron Age settlements throughout peninsular India. By structural period I the pottery range was augmented by two imported fabrics, a grey ware of a finely sorted clay and Rouletted ware of equally finely sorted clay. Along with these wares came other categories of finds providing evidence of importation and of growing foreign trade – pieces of glass, varieties of beads etc. From period I onwards small numbers of coins begin to appear in the excavations. These are studied in Chapter 2: Coins and, incidentally, provide an opportunity for a critical comparison of the chronologically determined stratification in relation to the various coin types. It may be remarked that in early South Asia coins are for the most part imprecisely dated by their find spots, while at the same time the chronology of many coin types has remained ill-defined. Hence there is a real need for this kind of analysis. The inscriptions and graffiti found in ASW2 are studied in Chapter 9: Epigraphy. Graffiti appear on pottery throughout structural period J and onwards, only disappearing around the start of the Christian era. The first examples of crudely scratched Brahmi letters occur before the end of period J, and from period I onwards more regular use of script is found. The short inscriptions on pottery appear to have served as a means of denoting ownership, either of the vessel or of its contents. The graffiti appear first in period K, while the inscriptions occur first at the end of period J. Thereafter both systems run parallel to one another. We may infer that both were used for the same purpose, to identify ownership, either of an individual or of a family or clan. The script shows only slight developments during the following two or three centuries, but virtually none of the changes of script which occurred in Sri Lanka in the early centuries AD are present, suggesting that the custom of inscribing pottery with owners' marks or inscriptions ended before that time. By *c.* 200 BC some of our inscriptions bear the names and titles of several royal ladies and an official, all of whose names are already known from early Buddhist cave inscriptions.

In sum, the excavations at Anuradhapura provide a wonderful database of evidence relating to the early history of Sri Lanka before, at and after the time when it became a capital city. From it we can study the stages of the emergence of a city and its subsequent growth. The record presented in this publication and its companion volume is, as far as can be, honest and objective. A point is now being reached at which one may confront the early textual tradition of Sri Lanka with the archaeological data. The study of the evidence for trade and foreign imports takes us far beyond the island; while the inscriptions and graffiti take us into the very centre of the state, maybe even into the residence of the ruling family. The excavations leave many questions unanswered and raise many new and difficult problems of interpretation. But they do, we believe, point to the way in which archaeology can contribute to advancing knowledge of the processes of early city and state formation in South Asia.

ACKNOWLEDGEMENTS

I am most grateful to the three Directors-General of Archaeology, Dr Roland Silva, the late Mr M. Sirisoma and Dr Siran Deraniyagala, who held office during our fieldwork at Anuradhapura between 1989 and 1994. Together, and singularly, they provided excellent support and collaboration for the team. I am also extremely grateful to Dr Roland Silva for his continued assistance as Director-General of the Cultural Triangle. Special thanks are, however, reserved for Dr Siran Deraniyagala, first as Director of the Anuradhapura Citadel Archaeological Project, and later as Director-General of Archaeology. The pioneer of scientific investigation at the Citadel of Anuradhapura, he acted as a mentor to the field team and was an exceptional source of knowledge about the archaeology of the Citadel and the island itself. Indeed, without Dr Deraniyagala's generous invitation to Raymond Allchin to mount an archaeological expedition to the Citadel of Anuradhapura, none of the fieldwork published here would have been undertaken. Dr Deraniyagala is internationally recognized as an expert on Sri Lankan prehistory, and the value of his contributions to the archaeology of Early Historic South Asia through his work at Anuradhapura cannot be over-estimated. The present volume builds on his pioneering work. Thanks must also go to the directors, officers and staff of the Cultural Triangle Jetavana and Abhayagiri projects in Anuradhapura, especially Dr Hema Ratnayake and Professor Hetterachchi. In addition, great assistance was provided by Dr Bridget Allchin, Dr Raymond Allchin, Dr Janet Ambers, Mr Robert Janaway, the late President J.R. Jayewardene, Mr Rukshan Jayewardene, Dr N. Kemp, Mr Nimal Perera, Dr Martha Prickett, Dr Sudashan Seneviratne, Dr Colin Shell, Professor van Andel and Mr Wijepala. In particular, I should like to warmly thank Rukshan and Viji Jayewardene for their hospitality, support and friendship over the years.

A great debt of gratitude is owed to the members of the field teams of officers, students and staff from the Archaeological Survey Department, the Cultural Triangle and the universities of Bradford, Cambridge, Keleniya, Peradeniya, the Post-Graduate Institute of Archaeological Research and Sri Jayewadenapura who worked at the site. Whilst there are too many to name individually, in particular I would like to thank the following: Dr Bridget Allchin; Mr Kalum Nalinda Manamendra Arachchi; Claudia Beukmann, MA; Steve Cheshire, BSc; Masaki Choya, BA; Paula Coningham, MA; Gary Dooney, MA; Luxman Chandra, MA; Antonia Douthewaite, MA; Rukshan Jayewardene, MPhil; Dr Carl Knappett; Mr Alfred de Mel; Mr P.D. Mendis; Halawthage Jude Perera, BA; Mr P.R. Premachandre; Simon Weston, MA; and Sarah Wilde, BA. The Anuradhapura Citadel Archaeological Project lab teams provided excellent back-up and support, for which I am very grateful. I would also like to acknowledge the efforts of the lab teams and experts who have helped prepare the field data in the UK for publication: Dr Cathy Batt; Paul Cheetham, MPhil; Steve Cheshire, BSc; Dr Randolph Haggerty; Jon Sygrave, BSc; Ruth Young, MPhil; and Alistair Wilson, BSc. Finally, I should like to acknowledge the work of Jenny Marsh as copy editor and for seeing this volume through to press.

The financial support of the following bodies is also gratefully acknowledged: the Archaeological Survey Department of Sri Lanka; the Ancient India and Iran Trust, Cambridge; the British Academy; the British Council, Colombo; Churchill College, Cambridge; King's College, Cambridge; the McDonald Institute for Archaeological Research, Cambridge University; the Overseas Development Administration; the Society of Antiquaries of London; and the Society for South Asian Studies (British Academy). I would also to thank the following institutions for temporary loan of their equipment for fieldwork: the Archaeological Survey Department of Sri Lanka; the Department of Archaeological Sciences, Bradford University; and the McDonald Institute for Archaeological Research and Department of Earth Sciences, Cambridge University.

This research was carried out while the author held a college studentship at King's College, Cambridge, between 1989 and 1993; a research fellowship at the Ancient India and Iran Trust in Cambridge between 1993 and 1994; and a lectureship and senior lectureship in South Asian Archaeology at the Department of Archaeological Sciences, University of Bradford, from 1994.

LIST OF ILLUSTRATIONS

Alistair Wilson kindly prepared Figures 33, 37, 41, 45 and 53. The remaining plans were prepared by John Sigrave, the maps by Steve Cheshire, and the photographs were taken by Robin Coningham.

Colour Plates

Figures

Table

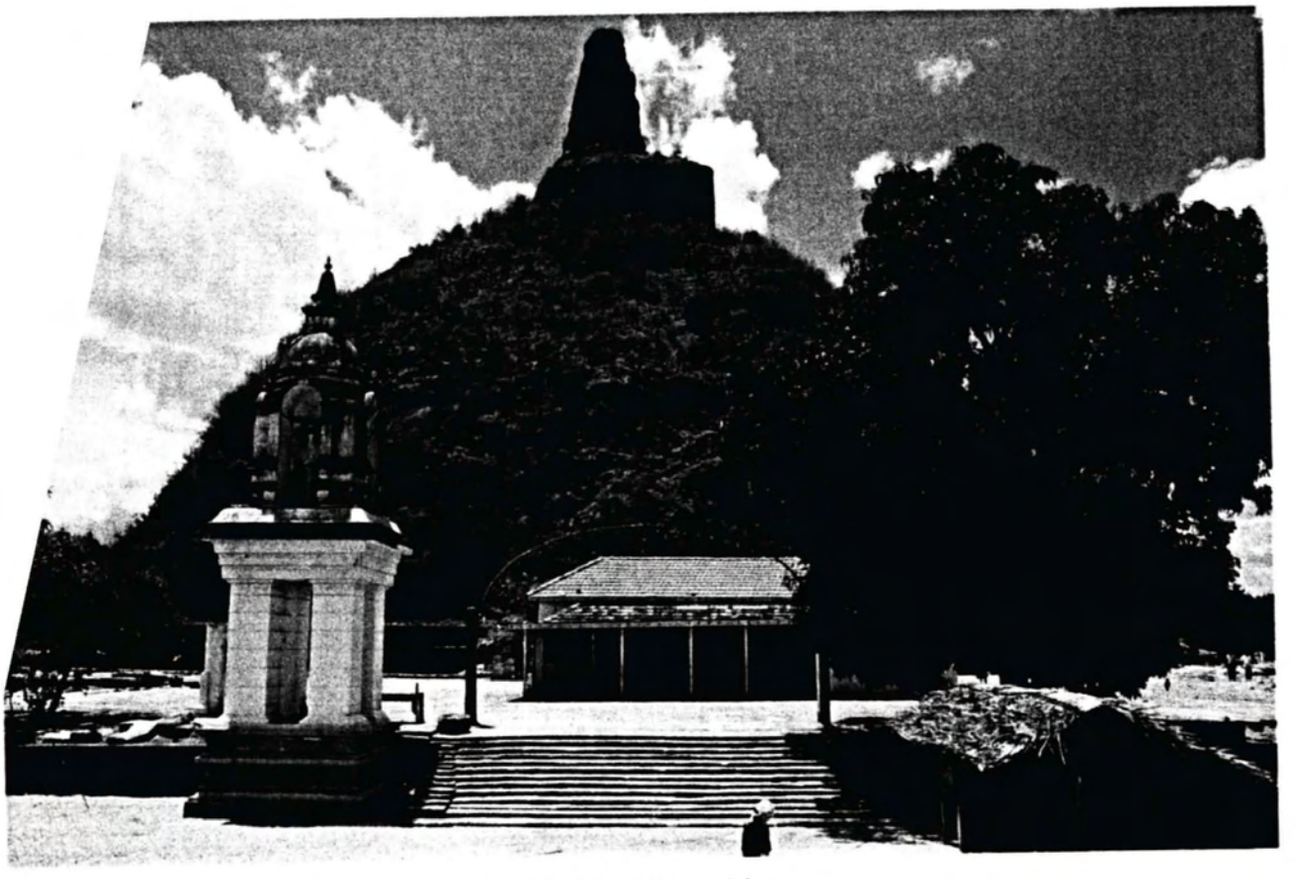
Table 1: Chronological summary from the sequence at ASW2 (earliest appearance)		
Structural phases		
A	Enameled sign (1918) and George VI coin (1943 AD)	
B5		
B4		
B3		
B2		{ c. 600 AD - 1100 AD
B1		
C, D & E	Pandyan coin, Lustre ware, Lead Glazed ware, White, tin glazed ware, Buff ware, Sassanian-Islamic	
	Blue glazed ware, Changsha painted stoneware, Yue green ware and Xing and Ding wares.	
F	Granite and Late Roman Imperial Third Brass	{ c. 200 - 600 AD
G5	Maneless lion coin, copper alloy kohl stick, Eastern Mediterranean glass and blue glazed ceramics	
G4	Caitya & Fish coin	
G3	Lakshmi plaque and copper alloy mirror	
G2	Limestone & pillar foundations, Arikamedu type 10, Nandipada & Swastika coin, Tree & Swastika	{ c. 200 cal BC - 130 cal AD
	coin, Tree & Caitya coin and iron saw	
G1	Elephant & Swastika coin	
H2		
H1		
I8	Punch-marked coin and copper alloy vessel with laurel leaf design	
I7		
I6	Flap-shell turtle and palm fibre	
I5		
I4	Mangrove wood species	{ c. 360 cal BC - 190 cal BC
I3	Lapis lazulin and Rouletted ware	
I2	Bamboo	
I1	Square structures, roof tiles & horse	
J5	Marine shell	
J4	Carnelian, marine turtle and early Brahmi scriptural graffiti	
J3	Rice	{ c. 340 cal BC - 510 cal BC
J2	Burial pit?, quartz and Grey ware	
J1		
K3		
K2		{ c. 460 cal BC - 840 cal BC
K1	Round structures? and iron objects	

Pl. Ia: Conducting a geophysical survey of the Citadel's fortifications

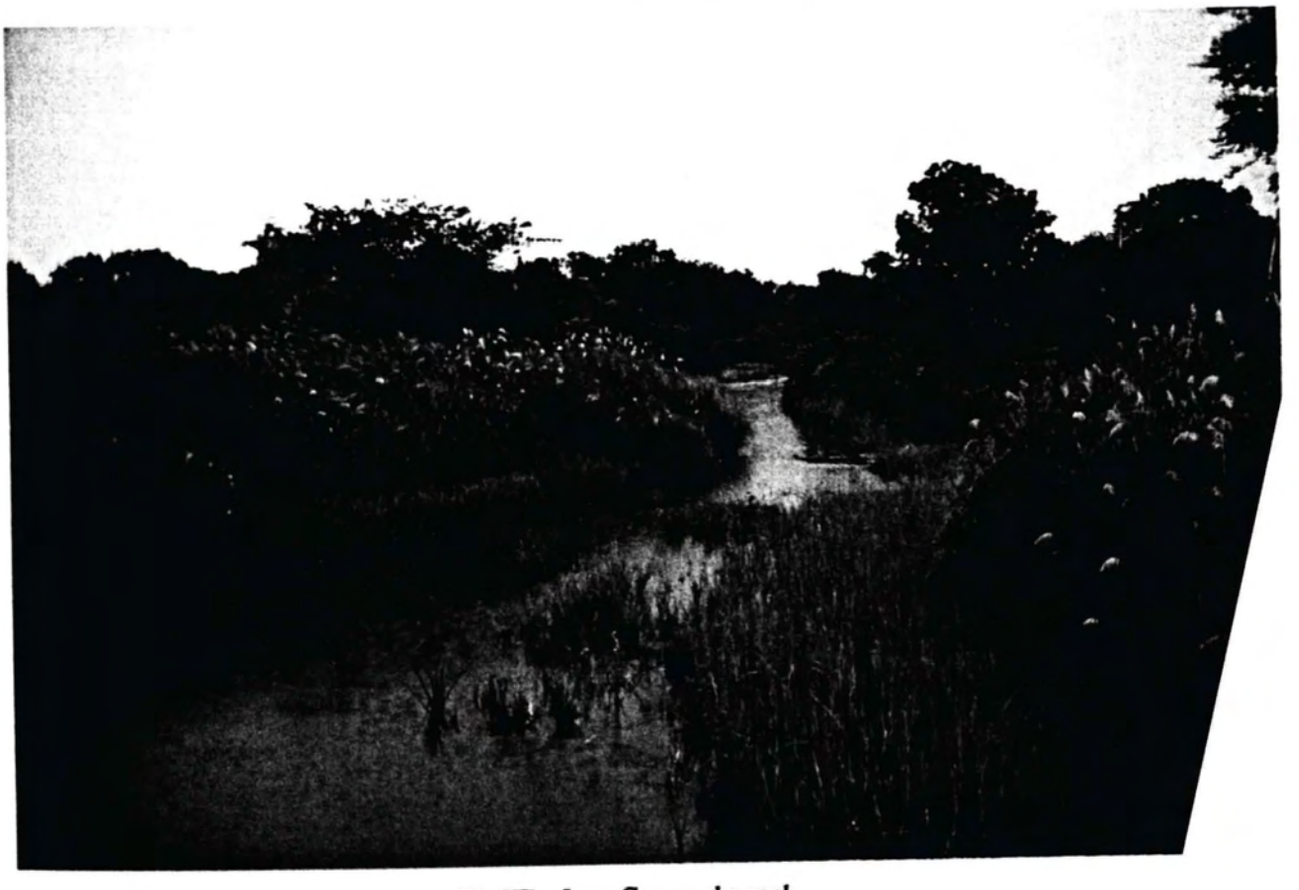
Pl. Ib: Trench ASW2

Pl. IIa: Buildings A and C with Daladage and Mahapali in background

Pl. IIb: The Mahathupa



Pl. IIIa: The Abhayagiri stupa

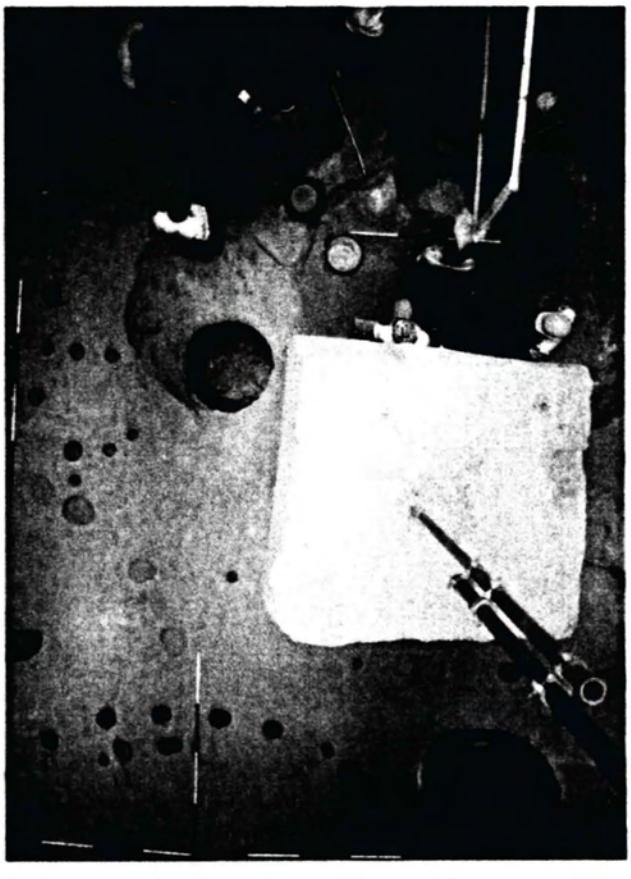


Pl. IIIb: Jaya Ganga channel

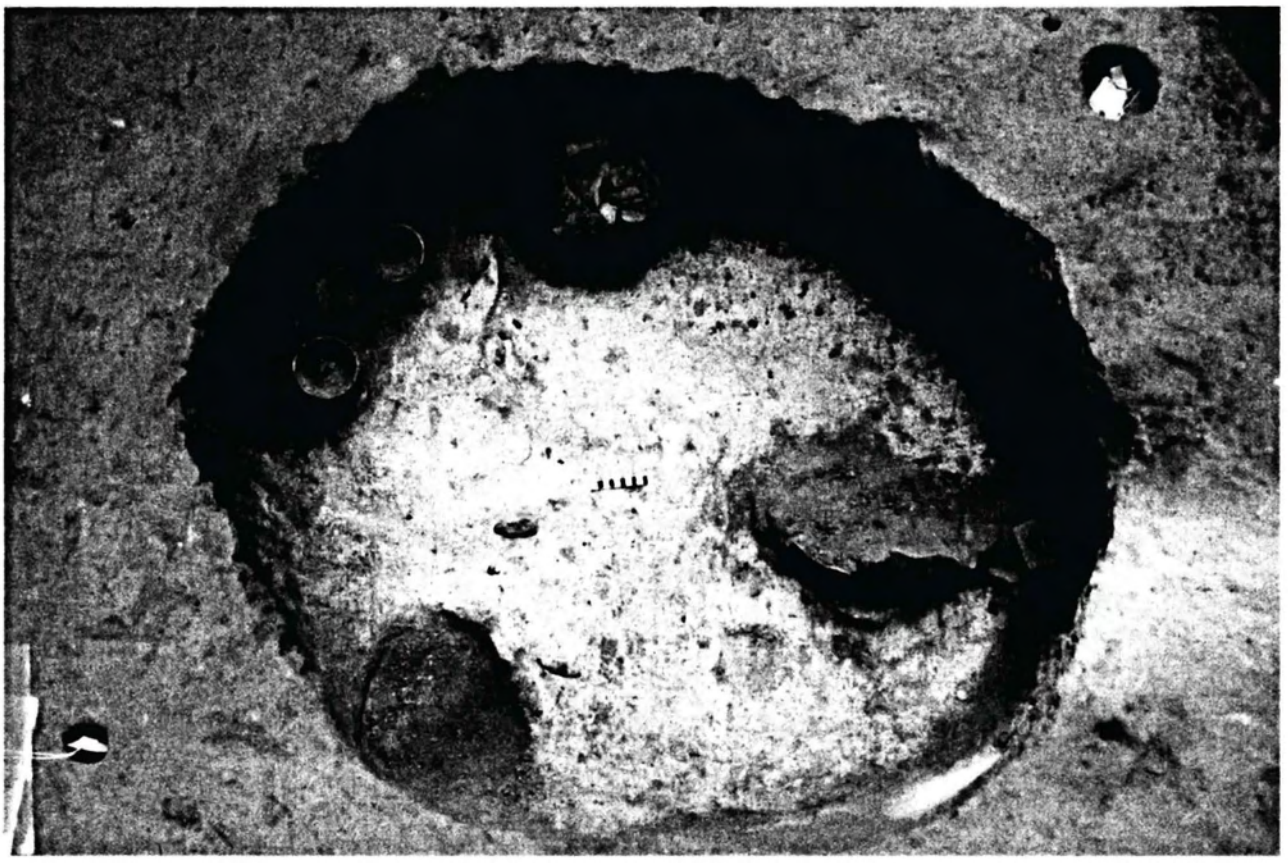
Pl. IVa: The Kiribat vihara stone bridge

Pl. IVb: Exposed wall close to eastern gate

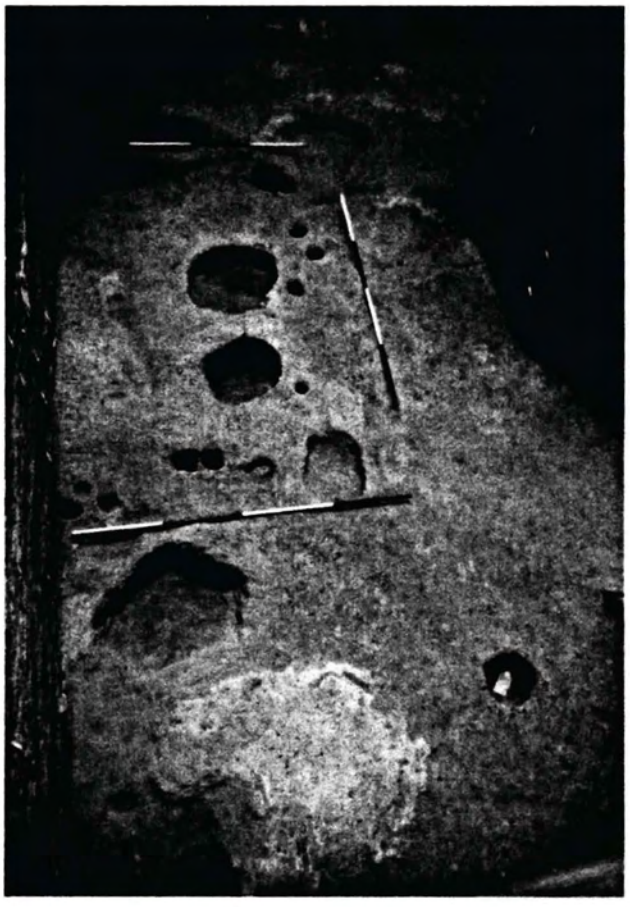
Pl. Va: Trench ASW2



Pl. Vb: Structural phase J2

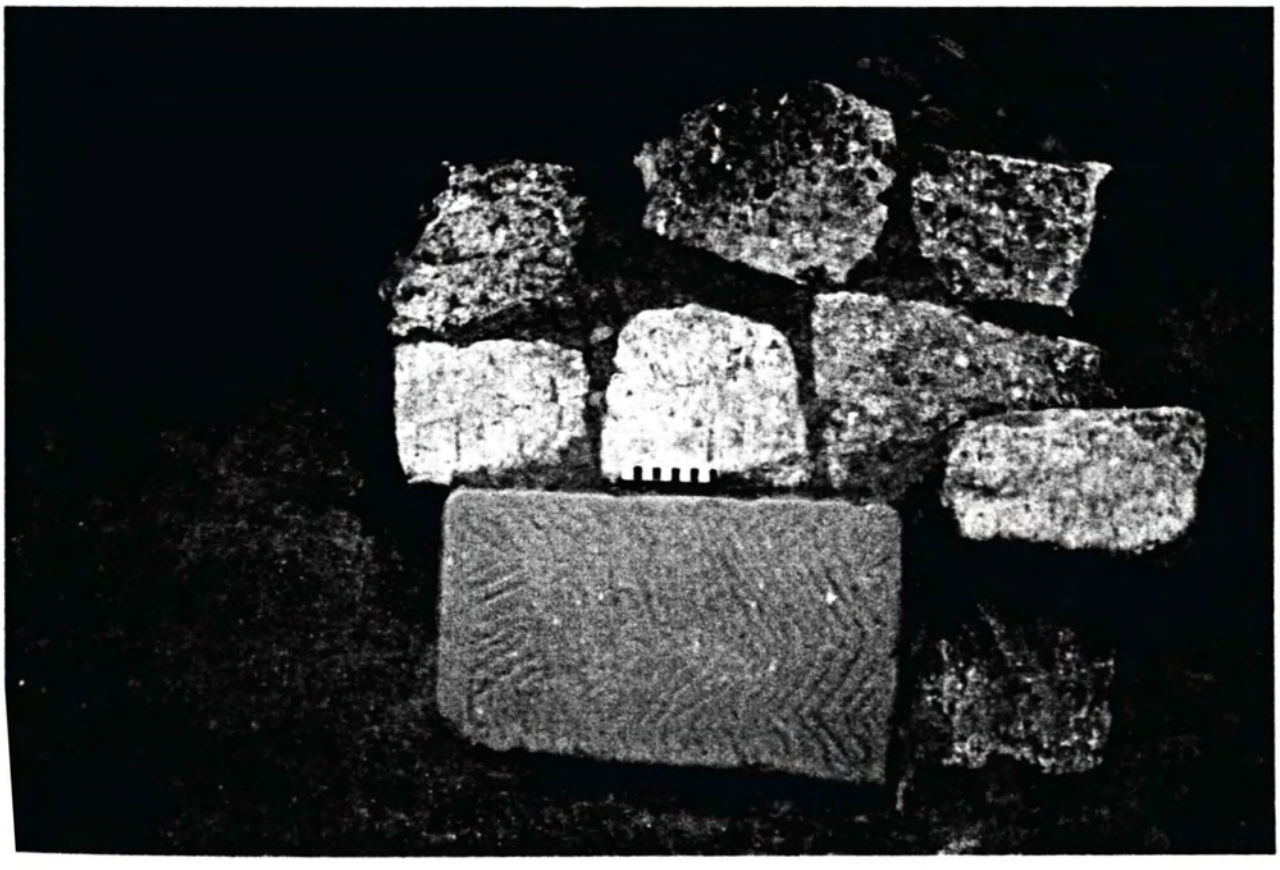


Pl. VIa: Pit 1371 (structural phase J3)



Pl. VIb: Structural phase I1

Pl. VIIa: Furnace or oven 1109 and 1111 (structural phase I2)

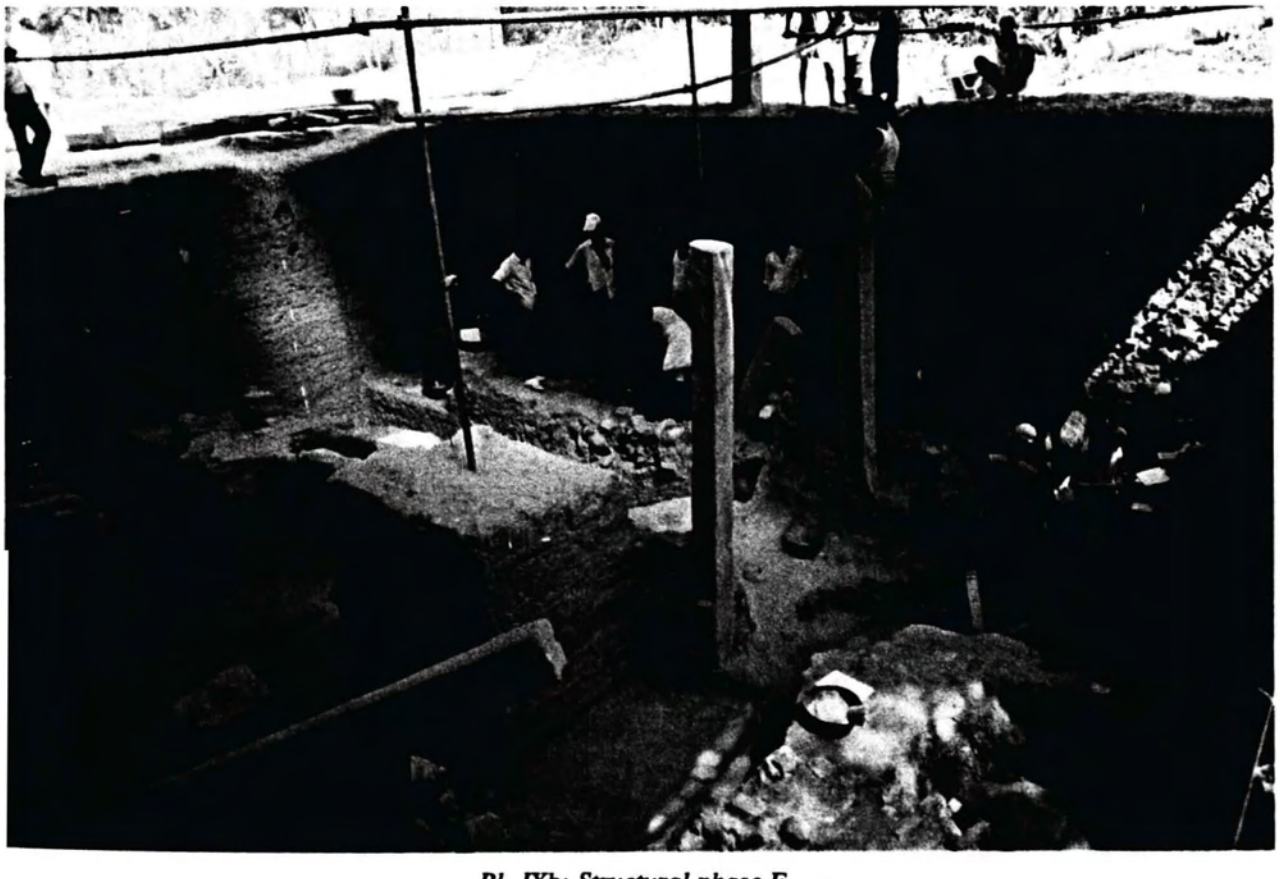


Pl. VIIb: Floor 613 and sf 10186 (structural phase G3)

Pl. VIIIa: Floor 408 (structural phase G4)

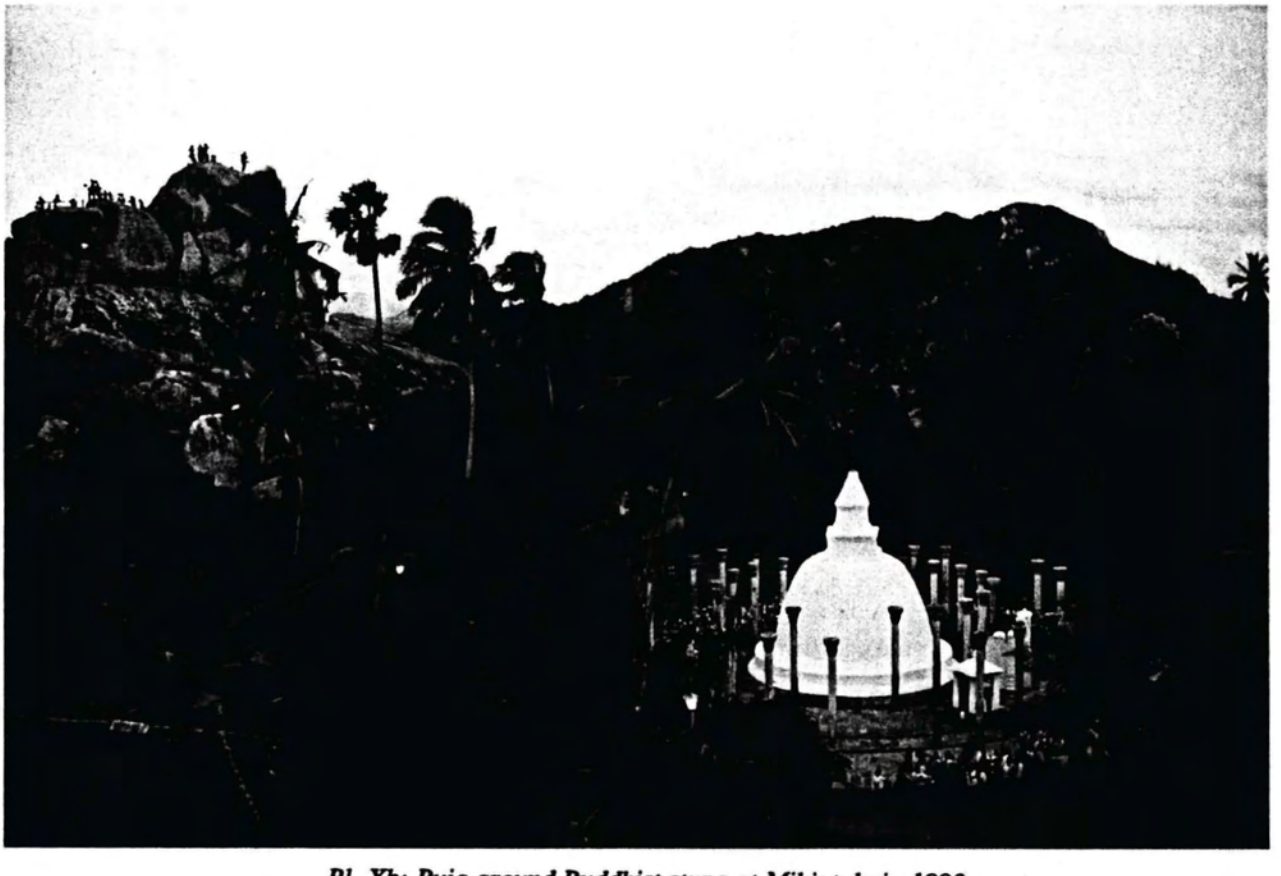
Pl. VIIIb: Floor 405 (structural phase G5)

Pl. IXa: Walls 339, 437, 442, 444, 453, 455 and 471 (structural phase G5)



Pl. IXb: Structural phase F

Pl. Xa: The megalithic cemetery at Ibbankatuva



Pl. Xb: Puja around Buddhist stupa at Mihintale in 1990

CHAPTER 1

INTRODUCTION

Robin Coningham

THE modern settlement of Anuradhapura is the capital of Sri Lanka's North Central Province and has a population of some fifty thousand. However, in the nineteenth century, it was little more than 'a small mean village, in the midst of a desert' (Davy 1821: 225) (Fig. 1). Anuradhapura's recent genesis owes much to the colonial restoration of the ancient irrigation system of the area (Parker 1909; Brohier 1934), but a great deal more to its role in the hearts and minds of many Sri Lankans as the royal capital of the island for over one and a half millennia. To some it is a symbol of the island's magnificent pre-colonial past, echoed on modern Sri Lankan banknotes and stamps; to others it is a holy city to be visited on pilgrimage; while to others still it is a reminder of Asia's rich cultural heritage, a heritage which has been barely exposed. It is a city which, through the pressures of modern politics, has been politicized from the massacres of 1986 to the restoration of the Mirisavatiya stupa by the late President Ranasinghe Premadasa in 1993. It is also a city which has kept the same name from its initial foundation in the first millennium BC to its selection in AD 1873 as the administrative centre of colonial Ceylon's North Central Province, despite abandonment from the eleventh century AD.

It also represents, as noted by Anuradha Seneviratna, one of the world's major archaeological sites, covering over 40 square kilometres (Seneviratna 1994: 13). Although recognized and protected as a UNESCO World Heritage Site, the process of curation of these monuments and their environs was begun in the nineteenth century by colonial officials prior to the development and establishment of an Archaeological Survey in 1890. This process was greatly strengthened in the late 1950s when the Prime Minister, S.W.R.D. Bandaranaike, ordered the destruction of the structures of the administrative centre which had been established by the British in the heart of the ancient ruins of the capital of Anuradhapura and thus separated the city into two – a sacred city and a new town. While archaeological investigations continued at Anuradhapura under the auspices of the Archaeological Survey and the Anuradhapura Preservation Board, the scale and speed of research altered radically with the creation of the UNESCO – Sri Lanka Project of the Cultural Triangle by President J.R. Jayewardene in 1980. In Anuradhapura, the programme undertook to safeguard the Abhayagiri and Jetavana monastic complexes by excavating, conserving and presenting them to both pilgrims and tourists. At the same time the Archaeological Survey continued to carry out research and in 1984 set up the Anuradhapura Citadel Archaeological Project (ACAP), under the direction of Dr Siran Deraniyagala, specifically to investigate the ancient urban core of the complex. This volume presents the results of a single trench, Anuradhapura Salgaha Watta 2 (ASW2), and associated fieldwork that was carried out under the auspices of the ACAP by a collaborative Sri Lankan–British team between 1989 and 1994 (Pl. Ia, Figs 2, 3).

Archaeologically, Anuradhapura is an extremely important site as it fills a lacuna in the chronological and artefactual sequences for the island. Whilst major excavations have been conducted over the last thirty years at the major sites of Mantai, Kantarodai, Pomparipu and Ibbankatuva, the associated reports are still only at a preliminary stage. This state of affairs has led to a reliance upon textual sources for much of the early history of the island and a subsequent relegation of archaeological research to support such sources. Such a process has not been without its problems (Coningham 1994a, 1995a), and it is hoped that this volume and its companion volume will illustrate some of the opportunities that archaeology can offer the historian. This process, combined with a general absence of chronometric dating, has led also to the lack of a classic type site for the island's chronologies. It is hoped that these two volumes, augmented by the future publication of the ACAP's sondages excavated between 1984 and 1990, will allow Anuradhapura to provide a typological artefactual and structural sequence with which to date other sites within the island.

Anuradhapura also fills a lacuna in the chronological and artefactual sequences for the southern part of South Asia. It can undoubtedly be classified as an Early Historic fortified city and, as the most southerly example of its type, helps us to understand the test models for this, the second urbanization of South Asia. Indeed, the nearest known examples of similar cities are at Dhanyakataka in Andhra Pradesh and Banavasi in Karnataka, some 900 km to the north. The presence of a fortified urban centre in the interior of the island in the fourth century BC surely recommends re-examination of earlier hypotheses that the urbanization of the peripheries of South Asia occurred as a direct result of Mauryan expansion and contact in the third century BC. Indeed, the excellent sequence of structures and artefacts at Anuradhapura allows us to study an aspect of the urbanization of South Asia in some detail, with development from a small Iron Age settlement to

a medieval metropolis. Unlike many of the great Early Historic cities in the north of the subcontinent, Anuradhapura is protected to ensure that it is relatively free of the pressures of increasing urbanism and agriculture.

Another aspect of this importance is illustrated by Anuradhapura's pivotal role in Indian Ocean trade. Although rather better known sites such as Mantai (Carswell and Prickett 1984) or Arikamedu (Wheeler 1946; Casal 1949; Begley 1996) are frequently cited as providing clear evidence of the early and late stages of this trade, Anuradhapura, with its sequence from the beginning of the first millennium BC to the beginning of the first millennium AD, straddles its growth and development for almost two millennia. All the more surprising, then, that Anuradhapura is situated over 60 km from the coast, with no navigable river connecting the city to the sea. The second volume of the present report will provide ample evidence of this trade and contact with the coast in the form of early Islamic glass and glazed ceramics, Greco-Roman glass, metalwork and derived ceramic forms, Chinese glazed ceramics, imported semi-precious stones, as well as the presence of marine species at the site. Such studies have also allowed us to understand more about the position of Anuradhapura as a primate city within the island and its role as a centralized manufacturing centre. We have been able to study internal trade developments through analysis of metal-working, stone-working and shell-working debris at the site, allowing us to identify the stages at which different raw and semi-processed materials were processed within the site.

A further, connected aspect is the evidence at Anuradhapura for the development of writing systems within South Asia. The earlier prophetic work of Deraniyagala at Anuradhapura suggested for the first time that Brahmi, the ancestor of many of South Asia's vernacular scripts, occurred a number of centuries earlier than had previously been thought (Deraniyagala 1990a). It had been generally accepted that this script derived from a Semitic script developed in northern India under the Buddhist emperor, Asoka, in the third century BC and had spread southwards through the peninsula until it reached Sri Lanka (Bühler 1896; Winternitz 1927; Dani 1963; von Hinüber 1990). Our own work now supports Deraniyagala's earlier hypothesis, and evidence of Brahmi script dating to the beginning of the fourth century BC is presented in Volume II. This discovery, the earliest example of its kind in South Asia, has enabled us to reassess the traditionally accepted theories and suggest fresh hypotheses for its development and spread through trade (Coningham *et al.* 1996).

These combined archaeological factors help to overturn the cultural stereotype of Sri Lanka, which suggests that as it is situated at the southern tip of the peninsula it was the latest recipient of any innovation. As this theoretical paradigm appears to have been widely accepted, all resultant formulations of relative chronologies have naturally followed its directive. The growing use of chronometric dating within Sri Lanka is helping to establish its position, not as a cultural cul-de-sac but as the pivotal point of South Asia. This is not to suggest, of course, that ritually Anuradhapura is not a site of more significance as a result of its association with Buddhism. This association has taken two forms, one in a physical sense of relics, the other in a more mystical sense, both of which are recorded in the *Mahavamsa* and *Culavamsa*, Pali texts which relate the history of the island.

The first type of significance is given by the presence of relics associated with the Buddha, or Buddhism, within the monastic establishments in the city. The *Mahavamsa* records that many of these relics were taken to the island during the reign of King Devanampiya Tissa (*r.* 250–210 BC), shortly after his conversion to Buddhism by Asoka's son, the devout Mahinda. The relics taken to Anuradhapura included the Buddha's right collar-bone, which was enshrined in the Mahavihara's Thuparama stupa (*Mvs*.xvii.55–57); a branch of the Bodhi tree under which the Buddha had obtained enlightenment, which was enshrined in the Mahavihara's Bodhighara (*Mvs*.xix.35–46); the bowl relic, which was enshrined in the Cetiyapabbata close by at Mihintale (*Mvs*.xvii.22–24); and one of the original eight shares of the Buddha's remains from the stupa of the Koliyas of Ramagrama, which was then enshrined in the Mahathupa or Ruvanvalisaya (*Mvs*.xxxi.1–126). These relics of the Buddha were later supplemented by the arrival of the tooth relic from Kalinga during the reign of King Sirimeghavanna (*r.* AD 301–28). The latter was first housed in a building called the Dhammacakka within the Citadel itself (*Cvs*.xxxviii.92–98) before being installed in the Tooth Relic temple, or Daladage, during the reign of King Dhatusena (*r.* AD 455–73) (*Cvs*.xxxviii.70–72). This relic, a relative late-comer to Anuradhapura, was to become the symbol of kingship of the island and, when Anuradhapura became untenable, it was moved from capital to capital until in 1815 it was captured by the British.

While Anuradhapura was thus associated with the Buddha through his relics, it was also associated with him in a more mystical way. The *Mahavamsa* records that Anuradhapura was founded as a village by Anuradha (*Mvs*.vii.43), a minister of King Vijaya, who colonized the otherwise unoccupied island on the day of the Buddha's nirvana (*Mvs*.vii.1–4). The site was later settled by Prince Anuradha, brother-in-law of King Panduvasudeva, who built a tank and palace there (*Mvs*.ix.9–10). It was then selected by Prince Anuradha's great-nephew, King Pandukabhaya, as his new capital – Anuradhapura (*Mvs*.x.73–102). The association of the city with the Buddha is only later made in the *Mahavamsa* when it describes the reign of Pandukabhaya's grandson, King Devanampiya Tissa, in the third century BC. Following the latter's conversion to Buddhism by Mahinda, he presented the royal garden known as the Mahameghavana, situated to the south of Anuradhapura, to the *Sangha*, or Buddhist order, and

with Mahinda proceeded to mark out the future location of the various monastic monuments and structures. At each site Mahinda marked there was an earthquake and, on inquiring from the monk, Devanampiya Tissa was informed that similar establishments had been located in the same places during the lifetimes of the three Buddhas who had preceded the historical Buddha in the present era – Kakusandha, Konagamana and Kassapa. They had all visited the site in the past, when the city, the royal garden and even the island were known by different names. Thus the Buddha Kakusandha was given the garden Mahatittha by King Abhaya, when the city was known as Abhaya and the island as Ojadipa (*Mvs*.xv.56–59); the Buddha Konagamana was given the garden Mahanoma by King Samiddha, when the city was known as Vaddhamana and the island as Varadipa (*Mvs*.xv.91–93); and the Buddha Kassapa was given the garden Mahasagara by King Jayanta, when the city was known as Visala and the island as Mandadipa (*Mvs*.xv.125–127). The sanctity of Anuradhapura was further enhanced by a record in the *Mahavamsa* that Gautama Buddha himself, even before Vijaya's arrival, had visited the future site of the monastery and meditated at the future sites of the Bodhi tree, the Mahathupa and the Thuparama (*Mvs*.i.80–83). That these traditions were widely held is supported by the report of the fifth-century AD Chinese monk Faxian (or Fa Hsien), who visited Anuradhapura on a pilgrimage to the holy Buddhist sites and stated that the Abhayagiri stupa had been built over one of the footsteps of the Buddha, made when he visited the site (Beal 1869: 150). These factors, when combined with the series of monumental constructions erected by successive kings at the city, continued to add to the ritual significance of the site to Buddhists. Indeed, Anuradhapura contains seven of the island's sixteen holiest places of Buddhist pilgrimage: the Bodhi tree, the Maricavatticetiya or Mirisavati stupa, the Mahathupa or Ruvanvalisaya stupa, the Thuparama, the Abhayagiri vihara, the Jetavana vihara and the Selacetiya (Geiger 1960: 207). Even in the late eighteenth century AD this factor still caused Sri Lankan monarchs, by then confined by the European maritime powers to kingdoms in the hill country, to undertake pilgrimages to the ruins of the holy city (Coningham 1994a: 92). Anuradhapura is therefore not merely a ruined city, but a living cultural entity which intertwines identity, ritual, tradition and archaeology.

The report of the Sri Lankan–British excavations at trench ASW2 has been divided into two volumes – Volume I: *The Site* and Volume II: *The Artefacts*. It is felt that the preparation of this report, six years after the final excavation season and four years after the last field study season, is not unduly excessive. The present volume – Volume I – contains a further six chapters which discuss the site, its location and chronology, and the excavations at trench ASW2. Volume II contains the artefactual chapters and has been divided largely according to the physical material (see p. 147 for a summary of Volume II's contents). In addition to the discussion of general aspects of each of these artefact categories, the actual catalogue data are also presented. While this block clearly makes up the largest section of Volume II, its position is key to the importance of the site. The publication of the artefacts from the excavations at trench ASW2 allows presentation of the data, enabling the conclusions presented here to be refuted or supported. It is hoped that their presence within Volume II will act as a catalyst. Our reasons for so doing are adequately summed up in Cunliffe's words (Cunliffe 1984: viii):

> ... no excavation report, however detailed, can hope to be more than an interim summary of a site. To suggest more would be naive or arrogant. A data-set of this kind . . . will continue to be reworked by students for the foreseeable future asking new and increasingly sophisticated questions. These reports merely advertise what is available and offer some general approximations to the truth which may help those interested in these matters to design new and more penetrating analyses.

Before commencing, certain conventions adopted in the text should be explained. Firstly, De Silva's list of Sri Lanka's rulers (see Appendix A) has been accepted as an initial framework for the island's chronology (De Silva 1981). We understand fully, however, that as this was based upon a combination of sources, including the *Mahavamsa*, the *Culavamsa* and various inscriptions, it is not necessarily free from error or omission (Coningham 1994a, 1995a). Secondly, for the sake of consistency, Bandaranayake's terminology and names for the monuments within Anuradhapura have been adopted within the text and illustrations (Bandaranayake 1974). Finally, it should be noted that all diacritical marks have been dispensed with, following the convention used in the *Cambridge Encyclopedia of India, Pakistan, Bangladesh and Sri Lanka* (Robinson 1989).

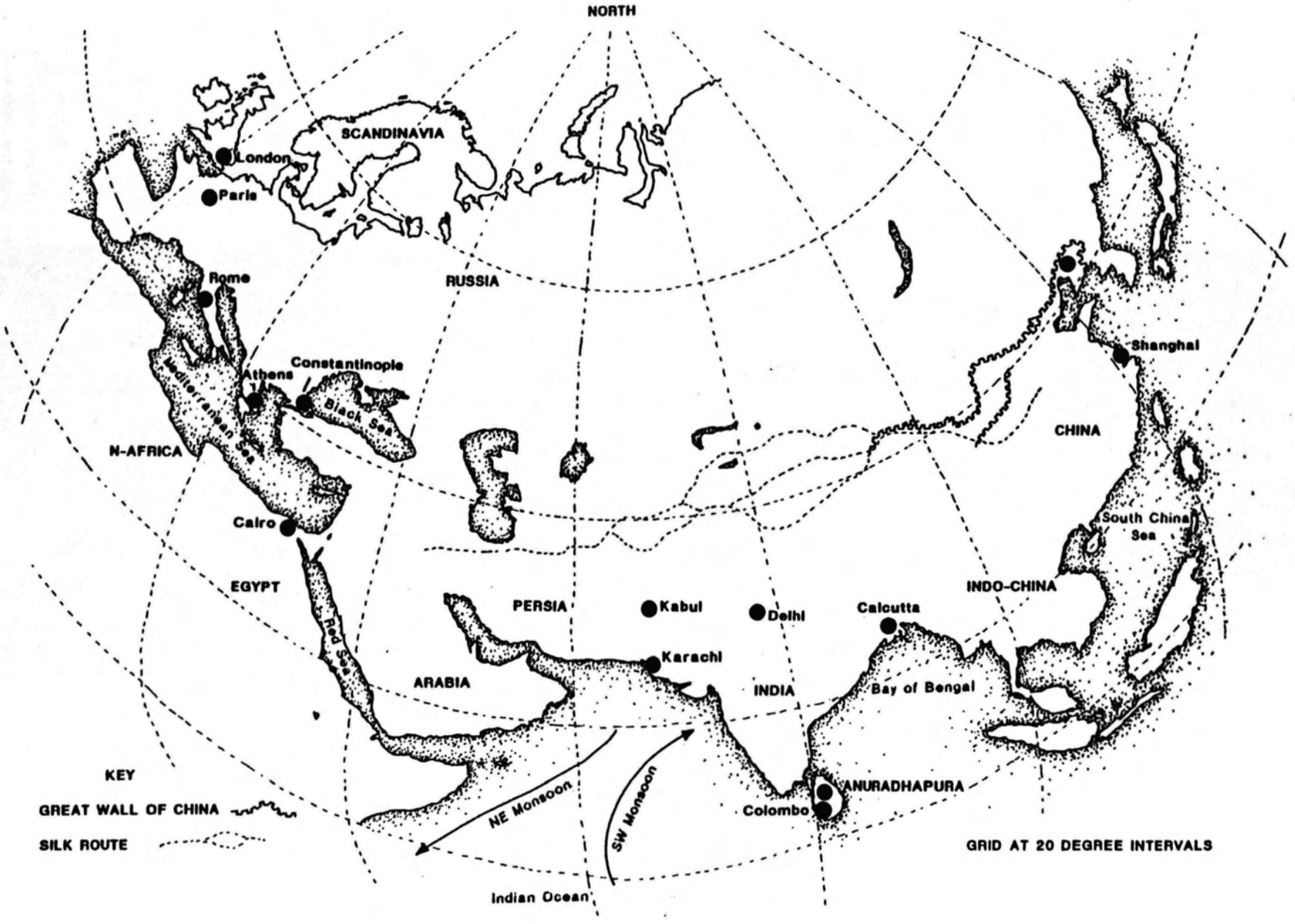


Fig. 1: Map showing location of Sri Lanka and Anuradhapura

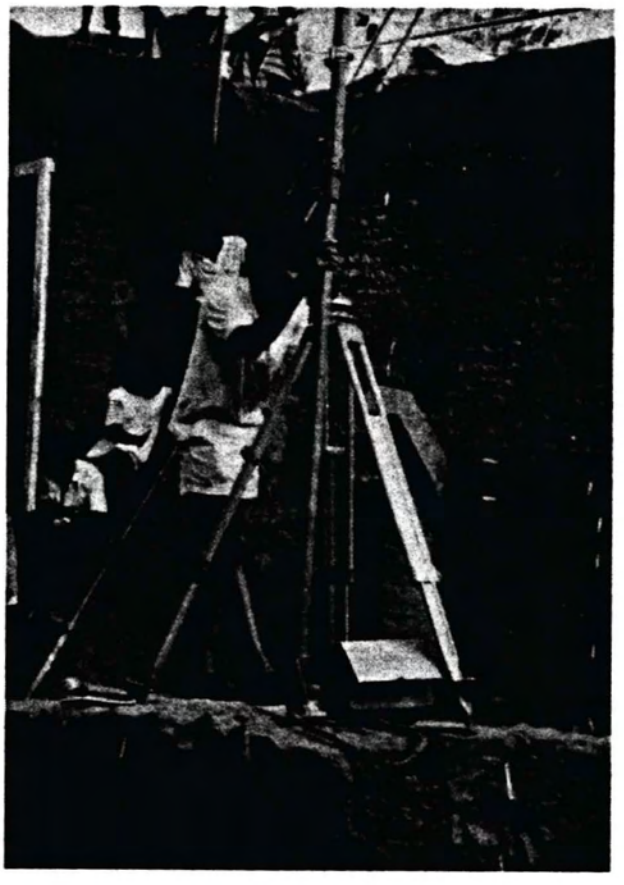


Fig. 2: Surveying structures in trench ASW2

Fig. 3: Taking an auger core through the Citadel's archaeological deposits

CHAPTER 2

THE PHYSICAL ENVIRONMENT

Randolph Haggerty and Robin Coningham

2.1 Introduction

The modern administrative centre of Anuradhapura is situated in the north–central lowlands of the island of Sri Lanka (Fig. 4). Part of the island that is frequently referred to as the 'Dry Zone', it sits astride the division which Deraniyagala makes between ecozone A, semi-arid lowlands, and ecozone B, dry lowlands (Deraniyagala 1992: 2). These lowlands, which form part of the island's lowest peneplain, are less than 30 m above sea level and stretch down to the coast (Cooray 1984: 49). Mainly flat, but at times gently undulating, they are transversed by a series of rivers which rise in the foothills of the hill country in the centre of the island. In places isolated granitic erosion remnants or inselbergs form dramatic hills or ridges, while smaller, low rock mounds or turtle backs also scatter the plain (ibid.). The sites of Mihintale and Ritigala are well-known local examples of the former which reach heights of 309 m and 766 m above sea level, respectively.

Anuradhapura itself consists of a series of shallow valleys within the catchment of the 120 km long river known as the Malvatu Oya and its tributary, the Maminiya. The Malvatu rises from higher ground to the northwest of Sigiriya and, flowing in a northwestern direction, feeds into the lagoons to the south of Mantai, where it is known as the Aruvi Aru. The urban core of the archaeological site, the Citadel, covers approximately 100 hectares and is situated on a low ridge of raised ground on the western bank of the Malvatu Oya. The highest point of the Citadel is some 87 m above sea level and it stands 10 m above the surrounding land. In this chapter we will describe the physical environment surrounding the city, introducing the study area's geology, mineral resources, water resources, vegetation and climate.

2.2 Geology

In geological terms Sri Lanka is essentially an extension of the Indian peninsula (Cooray 1984). The island has neither been fully submerged by the sea nor suffered extensive crustal upheavals during mountain building. It became an island 12 million years ago when the land subsided, allowing the sea to inundate the land connection with southern India. The original island was smaller than it is today, with the northwest coast and the Jaffna Peninsula being submerged below a shallow coral sea. At the end of the Miocene period, seven million years ago, the sea retreated and left the island with its general present-day outline (ibid.). Over the last two million years there have been minor fluctuations in the relative levels of sea and land, resulting in the formation of raised beaches, gravel terraces, buried river channels and lagoonal deposits. The island contains predominantly Precambrian rocks, with Tertiary (Miocene) limestones deposited in the Jaffna Peninsula (ibid.: 77–9). In the Anuradhapura region the geology consists of Precambrian high-grade metamorphic rocks of the Highland Series and Western Vijayan Complex. The Highland Series, which outcrops around Anuradhapura and in the east of the area, is comprised of quartzites, quartz schists, garnetiferous granulates, quartz–feldspar–garnet granulites, biotite–hornblende gneisses, graphite schist and carbonitite, invariably interbanded with charnockites (ibid.: 80–99). These metasedimentary rocks give ages of between 2000 and 3000 million years, with the main phase of metamorphism at 2000 million years. The Western Vijayan Complex outcrops in the west of the region and contains granitic gneiss, quartzite, biotite gneiss and granite (ibid.: 108–11). This succession of rocks post-dates the Highland Series with an age of 1150+/-60 million years. Both the Highland Series and the Western Vijayan Complex rocks have undergone extensive structural deformation with the formation of folds, faults and shear-zones.

Mineral resources in the Anuradhapura region are limited to small deposits of graphite, apatite, mica, clay and stone suitable for building (Fig. 5). Graphite, black lead or plumbago, as it is commonly called, is a pure crystalline form of carbon which occurs as minute flakes and nodules in many of the Precambrian crystalline rocks of Sri Lanka, especially the Highland Series (Cooray 1984: 232–8). It is also found as rosettes, veins, pods and lenses, and it is these concentrations that are commercially mined. The graphite veins range from a few centimetres to over a metre thick, with variable length and depth. The key graphite resource in the Anuradhapura region is at Talawa (ibid.). Although there is no evidence to suggest that graphite was mined during the Iron Age or early historic periods, Paranavitana recorded finding crucibles with graphite residues during his excavations

at the Daladage in the Citadel of Anuradhapura (Paranavitana 1936: 3). Mica is found in association with marbles, gneisses and schists and is present in large quantities at Kebitigollewa to the northeast of Anuradhapura (Cooray 1984: 238). A relatively large deposit of apatite, a calcium phosphate mineral, occurs at Eppawala in the south of the study area associated with the weathered surface of a Precambrian carbonitite intrusion (ibid.: 227). It is probable that this mineral was not exploited in earlier times. Clay is widely extracted around the town of Anuradhapura as a building material (ibid.: 221). These montmorillonite–kaolinite clays are coloured with a high proportion of iron minerals and have a low refractoriness. The clays are soft, highly plastic and easily worked, being used today to make bricks, tiles, stoneware and pipes. Such clays are also very suitable for the construction of wattle and daub structures (Coningham 1994b). At ASW2 the earliest finds of tiles occur in stratigraphic phase XXXI, the first bricks rather later in phase LXXIII, while finds of accidentally fired wattle and daub lumps in structural periods I and G suggest that such clays were also being utilized in an unaltered nature as early as the fourth century BC. Suitable clay deposits occur within alluvium, or as residual soils, the former being associated with the main river valleys, flood plains and tank beds (Cooray 1984: 219, 224).

The crystalline rocks of Sri Lanka are eminently suitable for use in construction as they possess both durability and strength (ibid.: 231–2). Marbles, especially the dolomite marbles of the Western Vijayan Complex and the Highland Series, have been extensively worked in the area owing to their attractive appearance and easy working. Granite, quartzite and garnetiferous gneiss have also been utilized. There are many partially worked outcrops within the vicinity of the city at the Abhayagiri, Isurumuniya and Vessagiriya viharas as well as at the Royal Baths and the Western monasteries; indeed, at the very base of the ASW2 sequence we located an outcrop of gneiss boulders oriented north–south (for further details see Chapter 5 below). Generally, it is accepted by archaeologists, art historians and architects that dolomite limestones were in use prior to granite and garnetiferous gneiss. Thus, at Sigiriya, limestone was in early use while semi-dressed and dressed gneiss only appears during the sixth century AD (Bandaranayake 1984: 15). Similarly, many of the earlier monuments and sculptures at Anuradhapura were of limestone, while scholars suggest that granite could only have been used once specific tools and techniques had been introduced during the Anuradhapura period (Wijesekera 1962: 179). The evidence from ASW2 suggests that limestones were indeed utilized for constructional purposes earlier than granite and garnetiferous gneiss. Limestone paving slabs were identified in stratigraphic phases LXXIX and LXXXV, dating to between the first century BC and the first century AD. Limestone saddlestones were also identified in three pillar foundation pits belonging to stratigraphic phase LXIX, dating to the first century BC. The first use of dressed gneiss occurs in structural period F. This period's stone pillared hall was erected utilizing pillars of gneiss measuring 4.6 x 0.25 x 0.2 m and dates to between the third and seventh centuries AD. A smaller, but earlier utilization, a four-footed grinding stone of this material, was identified in a secondary role as a paving slab in stratigraphic phase LXXXV, which can be dated to the first century BC. This is, however, not the earliest working of such stones as substantial drip ledges were cut to prevent water flowing down the roof of caves for monastic use during the last centuries BC (Coningham 1995a), as well as being utilized as hammerstones, mullers and grindstones by prehistoric hunter–gatherer groups (Deraniyagala 1992: 271).

The island of Sri Lanka is renowned as one of the major producers of gemstones, and most of the gemfields are located in the southwest of the island in Ratnapura District and Sabaragamuwa Province (Cooray 1984: 241–9). The gemstones present are corundum (ruby, sapphire), beryl (aquamarine), chrysoberyl (alexandrite, cat's eye), spinel, topaz, tourmaline, garnet, zircon, quartz (amethyst, citrine) and feldspar (moonstone) (ibid.). Most gem material is recovered from gravels associated with old river deposits. These gems have been eroded and washed down from areas of crystalline metamorphic rock, surviving this process as a result of their superior hardness, their resistance to abrasion and their inert chemical nature. Examples of almost all these stones have been found in the ASW2 sequence, as detailed in Volume II (Chapter 8: Stone Objects). They are found in the form of unworked nodules, worked blanks and debitage as well as finished products. Finished products vary in form between beads and bangles to intaglios and ring stones. Other examples of semi-precious stones found in the sequence, but not endemic to the island, are lapis lazuli and carnelian. Much of the lapis lazuli found in South Asian archaeological sites was mined in Afghanistan, while the region of Gujarat in western India was one of the most productive sources for carnelian. The earliest examples of the former, two beads (special finds [sf] 17281 and 17474), were recovered from structural period J and date to between the sixth and fourth centuries BC. The earliest examples of the latter, again two beads (sf 10629 and 16821), from structural period I, date approximately to between the fourth and second centuries BC.

The island also has adequate resources of iron ores. Concentrations of slag in sizeable amounts in much of the Kandyan Highlands are indicative of the antiquity of iron-smelting and steel-making in the island (ibid.: 211–12). While there are large reserves of high-grade iron ore at depths of between 20 and 152 metres below the surface, several million tons of ore are easily available on the surface. These low-grade ores, either aggregates of hydrated ores such as limonite or ores of hematite, are found as lenses, pockets and irregular distributions close to the surface in weathered deposits

(ibid.). Hydrated iron ores are mainly found in Sabaragamuwa Province in the southwest of the island. More recently, in 1971, copper–magnetite ores covering an area of some ten square kilometres were found at Seruwila in the east of the island, close to Trincomalee (ibid.). It is unclear at present which sources were being utilized in antiquity, however recent excavations at Samanala-wewa have identified a potential third- to fourth-century BC smelting locus in the southwest of the island (Deraniyagala 1992: 733). Evidence of smithing has been recovered from the ASW2 sequence and is assessed in Volume II (Chapter 4: Metal-working Residues), although smelting must have occurred elsewhere, presumably outside the urban core.

2.3 Climate

The position of Sri Lanka as an island at the southern tip of India means that it has an oceanic climate which is still heavily influenced by the monsoons. There are no great fluctuations in temperature in the area around Anuradhapura, with a mean monthly minimum of 21–23 degrees C and a monthly maximum of 30 degrees C (Somasekaram 1988). Anuradhapura is located in the Dry Zone, where annual rainfall is under 2000 mm (ibid.). In general, rainfall increases to the south and east and decreases to the north and west, with strong local variations in precipitation. The coastal strip between Puttalam and Mannar is the driest in the country with an annual rainfall of 750 mm (ibid.). The north–central plains have strongly seasonal rainfall related to the monsoons. There are two dry seasons and two wet seasons at Anuradhapura. Between January and mid-February there is a short, mild dry period followed by a short wet period between mid-February and April related to the southwest monsoons being weakened by the Central Highlands. The main dry season between April and July is accompanied by strong, dry southwesterly winds known as the Kachchan. The main wet season is between August and December and is related to the northeast monsoons.

2.4 Drainage and relief

The area surrounding Anuradhapura is part of the northern lowlands and has a moderate relief, typically between 50 and 400 m above sea level. The land surface rises from west to east, with the region surrounding Anuradhapura and to the west being under 100 m and the eastern area being 100 to 500 m. The highest point in the area is Ritigala, which has an elevation of 766 m. Drainage in the region is dominated by the key river systems, the Kala Oya, the Modaragam Aru and the Malvatu Oya, all of which discharge westwards into the Gulf of Mannar. The annual rainfall in the region is between 1000 and 1500 mm (Somasekaram 1988). As the underlying crystalline rocks have a low porosity of between 0.2 and 0.8 percent, heavy run-off is promoted at an estimated 38 percent of all the water falling in the Dry Zone (Cooray 1984: 256). In addition, most of the rivers of the Dry Zone are non-perennial; only the Mahaweli Ganga river, which drains a large area of the Central Highlands, has a continuous flow. In 1994 we carried out a series of auger cores across the site and have now constructed a macro-stratigraphy suggesting that the settlement was founded on a rise of bedrock and gravel standing above the Malvatu Oya's flood plain, ensuring an element of defensiveness combined with a location above seasonal flood waters.

In such a region, where rainfall is limited to between October and February and where there is a water deficit for much of the rest of the year, the natural and artificial storage of water is of great importance. Natural water storage is in a variety of forms from aquifers and rock 'cisterns' to natural pools known as *villus*. The natural storage of water in aquifers and other favourable geological structures is limited throughout Sri Lanka, with the laterites, Pleistocene gravels, alluvium, regosols and Miocene limestones being the key exceptions (ibid.). Around the Anuradhapura region discrete bands of fractured rock act as localized aquifers. Approximately ten percent of the rainfall in the Dry Zone seeps into the ground to be stored in aquifers, where it can be reached by wells. These wells are sunk, usually in weathered rock, to tap shallow aquifers at depths ranging from 3 to 12 metres. However, such wells are seldom found in the Dry Zone, where shallow aquifers dry up during the long dry season. For this reason, even today, many wells are located below the bunds of village tanks and reservoirs or by the sides of irrigation canals to benefit from the stored waters there (ibid.: 257). In the extreme south of the study area there are a handful of cold springs, with water emerging from the fissured quartzites, with rates of 225,000 to 900,000 litres per day. Additional supplies can be found in natural 'cisterns' within outcrops of gneiss boulders, but these are usually very limited in nature (Coningham and Allchin 1995), or in the natural clay-lined pools or *villus* in the western part of the study region (Deraniyagala 1992: 372). The latter, however, are small in size, the largest covering only some two acres (Parker 1909: 360).

The artificial storage of water, therefore, is necessary for any substantial domestic and agricultural use. Such storage has occurred in the Anuradhapura region in two forms: firstly, the storage of water by damming river valleys; and secondly, diversion of water from one area to another by the use of annicuts and channels (ibid.). The Citadel and monastic complex at the heart of the region is also the location of four major reservoirs or tanks: the Bulankulam, the Basavakkulam, the Tissavava and the Nuvaravava (see Figs 21–23 below). All are formed by dams or bunds across undulating land and contain unequal bodies of water. The Bulankulam covers some 32 hectares, the Basavakkulam 91 hectares, the Tissavava 160 hectares and the Nuvaravava 1288 hectares (Parker 1909: 360–400). These tanks were in turn fed by the Malvatu Oya, itself dammed and regulated by the Nachchaduva

tank, and the Jaya Ganga, a channel cut running from the Kalavava tank (Brohier 1934: II, 16). The latter, formed by a bund thrown across the Dambulla and Mirisgoni Oyas, is one of the largest tanks in the province, covering some seven square miles, and includes run-off from the Matale Hills in the south in its watershed (ibid.: 4).

In terms of the chronological development of this system of water management, most reliance – in the absence of excavations – has had to be placed on textual sources and inscriptions. The *Mahavamsa* states that, when Anuradhapura was first founded by the minister Anuradha, it was located close to the banks of the river (*Mvs*.vii.43–44), evidently the main source of water. The earliest reference to the artificial storage of water occurs when Prince Anuradha, King Pandukabhaya's great-uncle, built a tank (*Mvs*.ix.11). Pandukabhaya, the founder of the city of Anuradhapura, is recorded to have further developed this system by deepening a natural pond – the Jayavapi – and by constructing a new tank to the west of the city – the Abhayavapi (*Mvs*.ix.10, 59–60). While the Abhayavapi has been identified as the Basavakkulam, the Jayavapi's identity is still uncertain, although it may perhaps be the Tissavava (Parker 1909: 361). Parker has also suggested that the Tissavava was enlarged in the third century BC by King Devanampiya Tissa (ibid.: 364), while Brohier has argued that the Nuvaravava was constructed in the first century BC (Brohier 1934: vol. II, map 8). The next stage was the construction of channels and bunds upstream to further manipulate the water resources. The Jaya Ganga channel was cut *c*. AD 459–79 to divert water from the Kalavava, also constructed at this time, to the Tissavava and Basavakkulam (ibid.). The last phase was the construction of the Nachchaduva tank in *c*. AD 866–901, which was fed by both the Jaya Ganga, via the Yoda Ela, and the Malvatu Oya itself. This tank regulated the flow of the Malvatu Oya and also fed directly into the Nuvaravava (ibid.).

In addition to these more major works there are just under 3000 village tanks within the province (Brohier 1934: vol. II, 2), underlining the inescapable importance of artificial water storage in the study area. Partial drought, absolute drought and dry spells are common, with any failure of the northeast monsoon seriously affecting the availability of surface water in the Dry Zone. The unpredictable nature of the rainfall has greatly affected local agricultural practices. The intense management of water resources has been a priority for the last 2000 years, creating an elaborate irrigation system – the use of village tanks being a key part. Flooding resulting from unpredictable rainfall is another problem in the Dry Zone, with flash flooding occurring after short periods of intense precipitation. In December 1887, 805 mm of rain fell in 24 hours at Nedunkerni near Vavuniya, while in three days over Christmas 1957 a total of 1240 mm of rainfall was recorded at Habarana, 50 km southeast of Anuradhapura (ibid.). The floods that followed the 1978 cyclone caused serious damage to the island, affecting a million people, including those of the Anuradhapura area. Historically, therefore, embankments and bunds have been constructed to control floods in populated areas as well as to store water for domestic, livestock and agricultural uses.

2.5 Flora

Sri Lanka has a wide range of natural vegetation types with 11 key flora types recognized, containing 4000 species. Each of these, except tropical savannah, grassland and mangrove, are true forests peculiar to a particular climatic zone (dry, intermediate and wet zones): tropical thorn forest, dry evergreen forest, moist deciduous forest, moist semi-evergreen forest, wet semi-evergreen forest, tropical savannah, tropical wet evergreen forest, sub-montane evergreen forest, montane temperate forest, grassland and mangrove (Somasekaram 1988).

To the west of Anuradhapura the vegetation becomes dry evergreen forest, which merges into tropical thorn forest along the coast north of Puttalam. The dry evergreen forest occurs in the Dry Zone, where annual precipitation varies between 1250 and 1900 mm, with rainfall concentrated in October to January, and with a long dry period from June to September. This vegetation type is restricted to the drier areas of the Dry Zone, and trees are usually under 12 m tall but may reach 20 m in favourable areas. The main tree type is *Manilkara hexandra* (Palu). Along the coast between Puttalam and Mannar, in the driest part of the island, tropical thorn forest has developed. The precipitation in this area is below 1250 mm per annum and is mainly associated with the northeast monsoon. Hence the area experiences four to seven months of partial drought from March to September. The vegetation comprises open thorny scrub with isolated trees and small woods. The main species forming the scrub are *Carissa spinarum* (Heen Karamba), *Zizphus spp.* (Eraminiya), *Acacia chundra*, *A. Leucophloea*, *A. planiformis* (Maha Andara) and *Dichrostachys cinera* (Andara). *Salvadora persica* (Maliththan) and *Manilkara hexandra* (Palu) form the woods and isolated trees. Mangrove swamps are found in certain areas along this coastal stretch. The natural vegetation of the Anuradhapura region is moist deciduous forest, of which 60 percent has been removed to provide agricultural land. This is the most widespread natural plant community in the Dry Zone. A characteristic feature of this forest type is the presence of emergent dominants, which rise up to 3 m above the general canopy level. Most of the emergents are such deciduous species as *Chloroxylon swietenia* (Burutha), *Vitex dinnata* (Milla), *Sapium insigne* (Thel Kaduru), *Grewia polygama* (Bora Deminiya), *Berrya cordifolia* (Hal Milla), *Adina cordifolia* (Kon) and *Pterospernum canescens* (Velang). Common evergreen emergents are *Manilkara hexandra* (Palu), *Alseodaphne semicarpifolia* (Wewarana) and *Diospyros ebenum* (Kaluwara). The main canopy has a height of 20–25 m and consists of evergreen species of which *Drypetes*

seplaria (Weera) is the most common. It is this species, more than any other, that gives the forest its evergreen appearance. The moist deciduous forest is basically of very mixed composition, locally reflecting the different soils, geology, geomorphology and human interference.

These forests are essentially secondary forests that developed in the last 400 to 500 years after the collapse of the extensive agricultural societies that existed in the region from the fourth century BC to the twelfth century AD, as indicated by the proliferation of irrigation tanks in the area. The botanical samples from the ASW2 sequence have allowed us to partially reconstruct the natural and cultivated vegetation in the vicinity of the city prior to this collapse (see also Volume II, Chapter 12: Botanical Remains). Although our evidence of cultivated crops is restricted to finds of rice and finger millet, we have identified the presence of bamboo and coconut as well as both hardwoods and softwoods. It is interesting to note that there is no apparent restriction in the use of these latter two, which were found in contexts suggesting functions as both a structural element and as fuel. In carrying out our analysis we have also been able to identify at least one species, *Lumnitzera racemosa*, which is not endemic to the Anuradhapura study area. The presence of this mangrove wood in stratigraphic phases XXIV and LXV, dating to between the second and fourth centuries BC, suggests that conscious decisions were made to select and transport this wood over 60 km into the interior of the island. The reasons for such a selection are not altogether clear but may be connected with the apparent immunity to termites that this wood possesses, making it a very suitable structural timber.

2.6 Fauna

Sri Lanka has a very rich and diverse fauna with 625 species of land vertebrates, including 400 species of bird, while 1000 species of fish swim around the coasts, in rivers and lakes. The main exploitable fauna of the region comprises the following: monkey, pig, chevrotain, muntjac, spotted deer, sambhur, water buffalo, elephant, scaly ant-eater, giant squirrel, porcupine, bandicoot rat, black-naped hare, jackal, sloth bear, leopard, land monitor lizard, water monitor lizard, soft-shelled terrapin, hard-shelled terrapin, star tortoise, Ceylon python and crocodile (Deraniyagala 1992: 508). Although many of the above now only occur in restricted reserves and sanctuaries, it is expected that they enjoyed a wide distribution within the study region in the past. With the exception of the scaly ant-eater, giant squirrel, sloth bear and leopard, all of them were present within ASW2's faunal assemblage (see Volume II, Chapter 10: Faunal Remains). They were, of course, augmented by the presence of such domesticated species as cattle, horse and goat. The horse is not endemic within the island, and its presence in stratigraphic phase XXIII indicates its importation to Sri Lanka as early as the fourth century BC. One might have expected that the majority of the faunal assemblage from this urban site would have been domesticated, helping to ensure supply, however only one of the four most highly represented species, which collectively accounted for 90 percent of the entire faunal assemblage, can be clearly attributed to such a category. This species is cattle, which accounts for 31 percent of the four species, while pig, which may include both domestic and wild variants, accounts for a further 21 percent. It is interesting to note that the highest percentage, 33 percent, is attributed to the Ceylon spotted deer, while a further 17 percent is attributed to the freshwater corrugated clam. The former is noted by Deraniyagala (1992: 376) as

> . . . the most abundant game animal in the entirety of the Dry Zone . . . Prominent among the factors that makes the hunting of spotted deer relatively productive is their pattern of grouping: the animals tend to be gregarious.

The presence of the freshwater clam illustrates the flexibility of the exploitable biomass in the study area. The provision of artificial water reserves, both tanks and flooded paddy land, creates ideal habitats for freshwater species such as fish, reptiles, snails and bivalves which, if not domesticated, can to an extent be farmed! This biomass is augmented by that of neighbouring areas or zones, as indicated by the presence of marine species such as whale, sea cow, turtle and shellfish. Evidently many of the latter cannot have been brought inland to the site for meat but rather proved an additional raw resource. It is interesting to note that a number of this marine group were found within the lower part of the sequence in stratigraphic phase XVIII, suggesting close links between the coast and this inland site between the sixth and fifth centuries BC. However, the presence of any of these species within the sequence at ASW2 does not necessarily indicate that they formed part of the subsistence strategy, rather it shows that such species were part of a very broad-based exploitative strategy.

2.7 Soils

In the Anuradhapura region the main soil types are reddish-brown earths, low humic gley soils and various alluvial soils, with localized areas of exposed rock and erosional remnants (Cooray 1984: 291; Deraniyagala 1992: 449–503). The reddish-brown earths are found throughout the region and are moderately fine-textured soils with good to imperfect drainage (Epitawatte 1990: 44). Typically they occupy the crests, upper and mid slopes of the undulating topography. These soils are suitable for subsidiary food crops, with irrigation in the dry season or without irrigation in the wet season. Low humic gley soils are also found throughout the region but are poorly drained, moderately fine to fine-textured soils developing at the base of slopes and in valley bottoms (ibid.: 43). They are used extensively for rice cultivation, with or without irrigation. Alluvial soils are normally associated with the Makvaru Oya and Aruvi Aru valleys and come in a variety of colours from

white to reddish-brown, grey and black. They vary widely in nature from coarse river gravels to very fine clays, with excellent to poor drainage. They are associated with river systems, forming adjacent to rivers and streams, and over flood plains. The clay-rich alluvium is suitable for rice cultivation and the lighter sand-rich alluvium for subsidiary food crops (ibid.). Along the west coast between Puttalam and Mannar and extending up to 20 km inland, the main soil type is red-yellow latosols which form a flat, undulating land surface. These latosols occur on crests and mid-slopes, forming a layer 5 to 7 m deep. They are well drained, with a moderate to fine texture and a neutral to acidic nature. At the slope bottom yellow latosols develop. These are poorly drained and provide good agricultural land for intensive farming if irrigation can be provided. Around Mannar and extending up the Modaragam Aı and Aruvi Aru valleys, solodized solonetz soils aı developed. These are coarse dark grey to brown soi associated with recent calcareous marine sediments an flat-lying land. The subsoil is a fine-grained, gre alkaline soil which makes agriculture difficult witho reclamation. Rock knobs, eroded land, erosion remnants, steep rocklands and lithosols cover localize areas of several square kilometres and are more or le infertile. As is demonstrated in Volume II (Chapter 1 Botanical Remains), other than charting the localities paddy land and using modern soil exploitation pattern it is still unclear which of the above soils were partiall or fully exploited in antiquity.

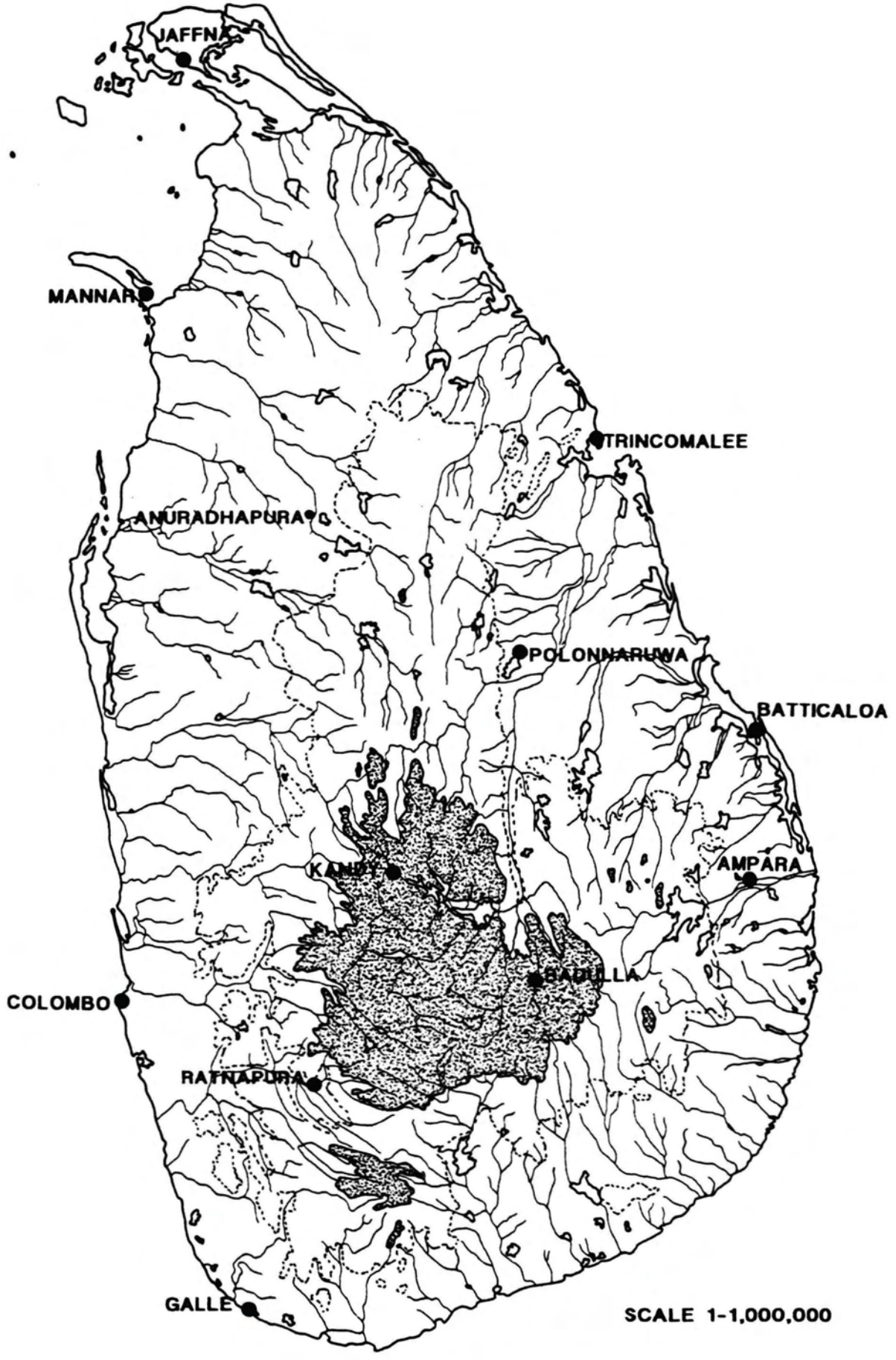


Fig. 4: Map showing Sri Lanka's topography and rainfall

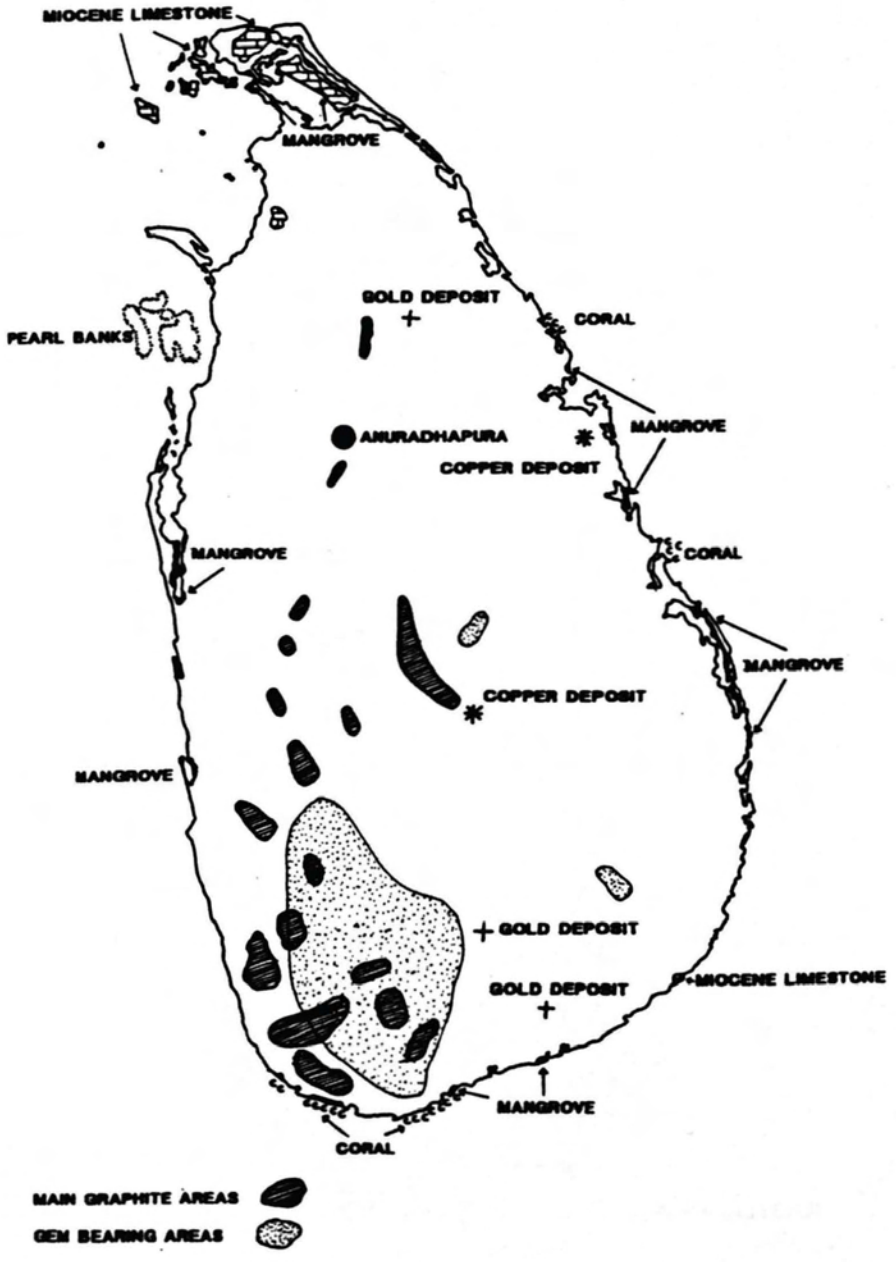


Fig. 5: Map showing Sri Lanka's raw materials