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Ancient Rock Quarries in Anuradhapura, Sri Lanka

The ancient city of Anuradhapura (4th century BCE to 10th century CE), established on the banks of the river Malwathu Oya in north-central Sri Lanka, is one of that country's most important archaeological sites. Numerous ancient buildings and monuments occur throughout the entire settlement. The preserved parts of the Anuradhapura ancient built environment are mostly solid masonry constructions. However, foundations, floor areas, pillars, and entrance units of the buildings provide evidence that rock materials were prominently used in constructions. This study focuses on the investigation of former rock quarry locations in the surroundings of Anuradhapura, their distributional pattern and their classification according to their morphological and archaeological significance. The majority of quarrying traces detected in the survey are distributed along a central rock outcrop line which runs across the city area. Altogether, 65 ancient rock quarries were identified in the area and classified into six categories. Moreover, numerous of historic stone buildings in the monasteries are also situated along the exposed rock outcrops line.

Ancient quarrying; historic built environment; cultural landscape; natural resources; landscape evolution.

1 Introduction

The city of Anuradhapura, today the provincial capital of the North Central Province in Sri Lanka (Fig. 1), served the ancient Sinhala kings as a capital between the 3rd century BCE and the 10th century CE.[1] Thus, it is one of the oldest continuously inhabited cities in the world. The earliest written sources began to appear in the 5th century BCE,[2] and Anuradhapura's remarkable architectural remains make it one of the most important archaeological sites in the cultural landscape of Sri Lanka. Even today, the ruins of numerous monasteries, palaces, stupas and temples bear testimony to the impressive construction works, documenting the outstanding architectural and artistic culture of the Anuradhapura period.[3] Both bricks and stones were used in the construction of most of the buildings. However, the majority of foundations, floor areas, pillars, and entrance units of the buildings consist of stone blocks and provide evidence that rocks were the primary building material used in construction during the Anuradhapura period.

Quarry sites as the source area for building material have made up a largely neglected category of archaeological sites; however, they allow constructions on exploitation strate-

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1 Bandaranayake 1974, 7.
2 Deraniyagala 2004, 709; Deraniyagala and Aberathna 1997, 2.
3 Bandaranayake 1974, 7.

gies and techniques of ancient cultures.[4] This study aims to present an inventory and classification of ancient quarry sites in the hinterland of Anuradhapura. In this context, the spatial distribution of the quarries is assessed, different quarrying techniques are described and the bedrock that was exploited for construction purposes is determined.

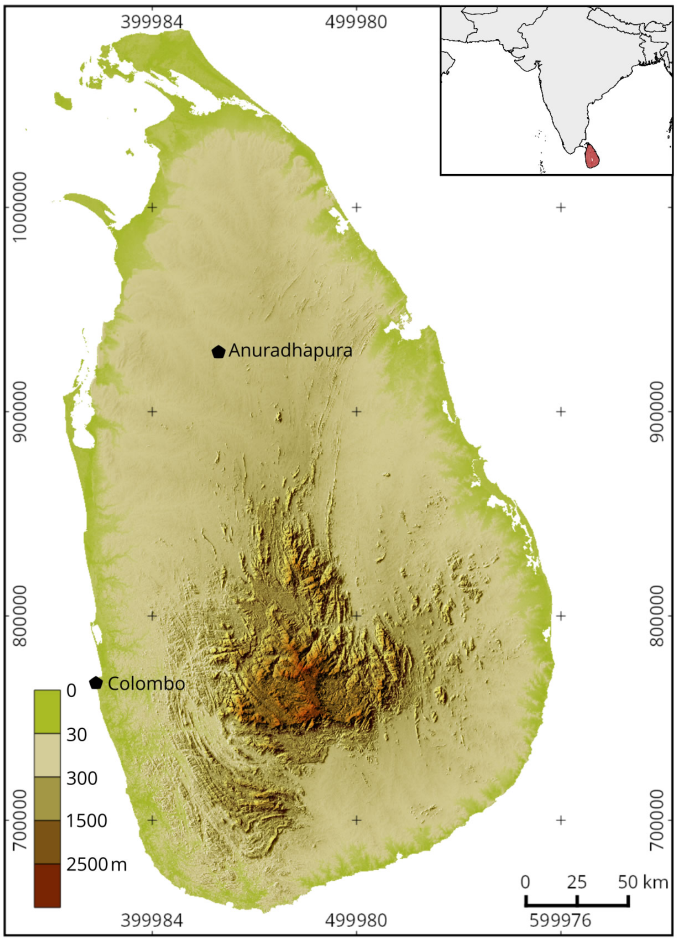

Fig. 1 | Topography of Sri Lanka and location of the ancient capital Anuradhapura Jarvis et al. 2008.

2 Research background

Only limited attention has been drawn to ancient quarries as archaeological sites, despite the fact that their study is promising in multiple respects. Ancient quarries provide information on i) strategies for the exploitation natural resources by ancient cultures, ii) technological knowledge, iii) social organization, trade and communication.[5] While numerous studies have been conducted on the quarries of the Mediterranean dating to the Roman period and the quarries of ancient Egypt[6] comparable studies for ancient South Asia are scarce, and lacking completely with respect to Sri Lanka.

4 Heldal 2009, 126.
5 Heldal 2009, 127.
6 R. Klemm and D. D. Klemm 2008, 334.

3 Ancient quarrying techniques and identification of quarries

Ancient craftsmen could choose among multiple techniques for separating stone blocks from parent rocks depending on the petrographic characteristics of the bedrock and the morphological situation. Bedrock outcrops with bedded layers, natural foliations or mechanical weathering fractures were preferred starting points for stone quarrying, because these structures ease the workflow of stone splitting.[7] Levers were used to widen natural cracks, joints, in the bedrock.[8] In cases where such joints did not occur naturally, they were generated by a) chiseling holes and inserting wedges, b) removing bedrock material by channeling or c) heating the bedrock surface by fire and then subjecting the rock to pressure through percussion.[9]

Stones found during fieldwork in the hinterland of Anuradhapura document that quarrying was predominantly performed using the chisel-hole and wedge method. The workflow of the chisel-hole and wedge method is made up of the following tasks: (i) a series of holes is chiseled, following the edging of the block to be extracted, then (ii) wedges are inserted into each hole, and (iii) a hammer is used to push the wedges further into the holes. The wedges create an internal pressure inside each hole and that pressure generates a fracture line linking all the holes and separating the block from the parent rock.[10] Sawing stone blocks with a blade saw is another known method, observed e. g. at quarries in Egypt from the Old Kingdom period[11] and also at Roman quarries;[12] there is no field evidence attesting to the practice of sawing stone blocks for Sri Lanka.

The identification of quarry sites is based on marks providing evidence of the quarrying process.[13] Depending on the technique used, tool marks appear as chiseled holes, shallow channels or sawed rock profiles.[14] It is possible for spoil produced as a residue of the quarrying process to accumulate in considerable quantities throughout a quarry site.[15] However, mining residues were frequently re-used in the quarries of the Roman empire, e. g. (i) to build loading ramps (ii) by burning limestone mining residue to make lime mortar or (iii) to re-fill the quarry pit.[16] Furthermore remains of tools and unfinished stone blocks also provide evidence of ancient quarrying activities.[17]

4 Classification of quarries

Varieties of approaches have been taken to the classification of ancient rock quarries. The parameters most frequently used to classify ancient quarries are the type of rock separated[18] and the morphology of the quarry site.[19] Additionally, numerous authors have classified ancient quarries according to their layout: as, for instance, boulder quarries, slope, flat ground, narrow plot, open, pit, trench, gallery, bedrock outcrop, boulder quarries.[20] Degryse, Bloxam, and Heldal (2006) listed some parameters such as location (local

7 Dworakowska 1975, 97; Heldal 2009, 129; Kelany et al. 2009, 89; Schierhold 2009, 38.
8 Heldal 2009, 89.
9 Dworakowska 1983, 61; Heldal 2009, 129; Kelany et al. 2009, 90; Rockwell 1993, 161.
10 M. Gage and J. Gage 2005, 36.
11 Moores 1991, 143.
12 Harrell and Brown 2002, 52–57.
13 Heldal 2009, 127.
14 Heldal 2009, 127; Rockwell 1993, 163.
15 Dworakowska 1975, 98.
16 Dworakowska 1983, 120.
17 Heldal 2009, 127.
18 Abu Jaber, Al Saad, and Smadi 2009, 9; Kelany et al. 2009, 92–95.
19 Dworakowska 1975, 119 and 134; Kelany et al. 2009, 89; Vanhove et al. 1996, 28.
20 Dworakowska 1975, 119 and 134; Kelany et al. 2009, 89; Vanhove et al. 1996, 28.

or regional), geology, morphology and production evidence as they classify rock quarries in the territory of Sagalassos in southwestern Turkey.[21]

5 Study site

5.1 Physical settings of Anuradhapura

The city of Anuradhapura is located in the northern lowlands of Sri Lanka (8°21' N, 80°23' E; 89 meters above sea level) and is the present-day capital of the North Central Province. Notwithstanding an average annual precipitation of 1198 mm,[22] Anuradhapura is located in what is known as the low country dry zone of Sri Lanka and is characterized by distinct summer aridity. Due to its location northwest of the Central Highlands, Anuradhapura is not directly exposed to either the southwest monsoon (May to September) or the northeast monsoon (December to February); accordingly, there is no strong correlation between the area's spatial and temporal rainfall pattern and the monsoonal periods. Rather, most of the precipitation appears in the inter-monsoonal periods from March to May (minor rainy season) and October to November (major rainy season).[23] Due to the long settlement history of Sri Lanka, potential natural vegetation is scarce and some secondary forests have developed on the slopes of the isolated hills. In the region of Anuradhapura, wet rice is the main crop under permanent cultivation, mostly in the valley bottoms, spatially alternating with *chena* agriculture, the traditionally practiced shifting cultivation, which is found mainly along the plateau divides.[24]

The topography of the area is generally flat, with some gently rolling plains with some isolated hills. To the east of Anuradhapura, the river Malwathu Oya flows in a northerly direction. The geology of the study area is dominated by plutonic rocks, mostly granitic, migmatitic and chanockitic gneisses of the Precambrian age. The Anuradhapura area belongs to the geological formation known as the *Wanni* complex.[25] Intensive chemical weathering under tropical environmental conditions caused the development of a saprolithic layer up to several meters thick, which covers the bedrock.[26] Outcropping bedrock is therefore a rare phenomenon.

A linear rock outcrop 75 to 100 m in width and 4 km in length transects the area of the ancient city from south to north, due to its elevation, it is the region's most prominent geomorphological feature (Fig. 2). The outcropping bedrock appears in the form of i) plain rocky surfaces exposed only a few decimeters above the present day surface, ii) rock boulders up to 10 m in height and 8 m in diameter, iii) some of which appear as small-scale basal knobs,[27] or inselbergs, with their basal section buried in the subsurface.[28] Occasionally these outcrops have formed natural rock shelters.

5.2 Settlement history and structure of the city

The settlement history of Anuradhapura can be traced back to the Early Iron Age, which is dated to 1000 to 800 BCE approximately.[29] Wattle and daub constructions comprised

21 Degryse, Bloxam, and Heldal 2006, 7.
22 FAOCLIM 2001.
23 Domroes and Ranatunge 1993, 741.
24 Schütt et al. 2013, 52.
25 Department of Survey 1988, 24.
26 Bremer et al. 1981.
27 In German: *Grundhöcker* as defined in Büdel 1982.
28 Büdel 1982, 123.
29 Deraniyagala 2004, 709.

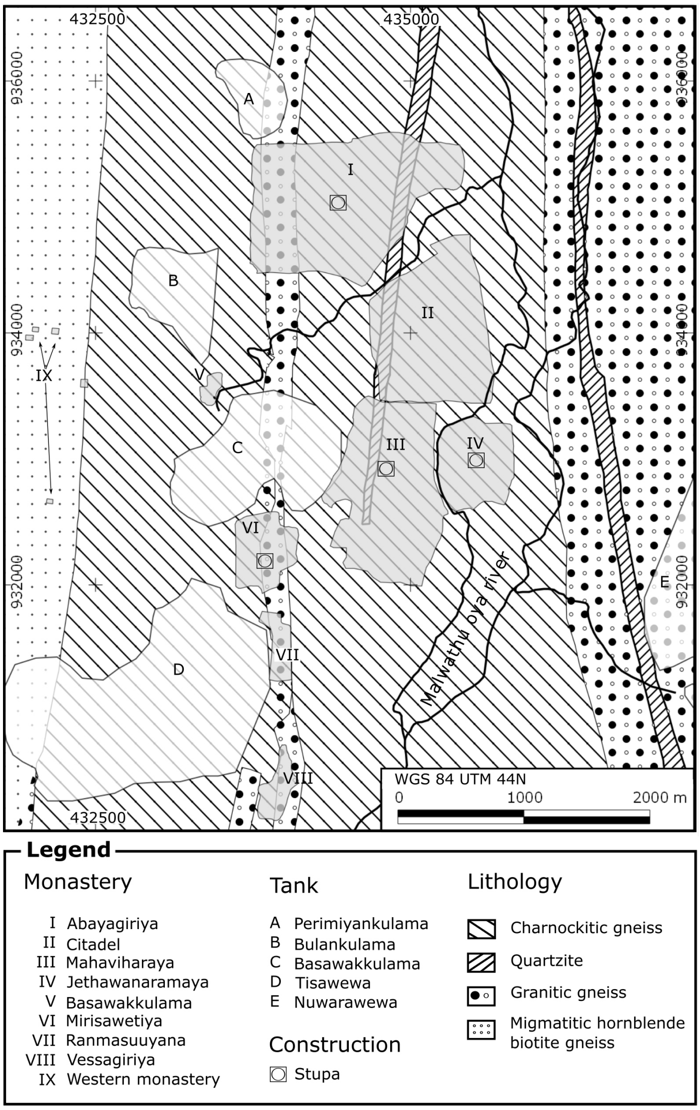

Fig. 2 | Structure of ancient Anuradhapura city and geology of the study area.

the architecture of that period.[30] However, peoples who lived in the Early Iron Age did use stone materials to construct tombs for the burial of their ancestors.[31] The historical written sources and findings of archaeological excavations offer little evidence of stone architecture before the 200 BCE to 100 CE period.[32]

King Pandukabaya (437–367 BCE) developed the settlement at Anuradhapura as the capital of the Anuradhapura Kingdom (3rd century BCE to 10th century CE).[33] During this period, the urban structure of the city developed different functional units.[34] The area of the citadel, which was surrounded by a rampart and a moat, represents the fortified center of the city.[35] The major monastic complexes are located immediately adjacent to the citadel to the north and south, with smaller monasteries found along the central rock outcrop line, as well as west of this geological feature. Reservoirs, called tanks (Sinhala, *wewa*), which were constructed cascade-style along the river courses to store run-off for

30 Coningham 1999, 128.
31 S. Seneviratne 1984, 246.
32 Coningham 1999, 125–131.
33 Mahavamsa X, 75.
34 A. Seneviratne 1994, 82.
35 A. Seneviratne 1994, 19.

irrigation purposes, built the third functional unit of the ancient city.[36] According to archaeological evidence[37] and written chronicles (especially Sinhala *Mahavamsa*), use of stone blocks and burnt bricks in the construction of buildings did not start before 200 BCE.[38] Although it is possible to identify the initial construction of major monasteries and tanks with the reign of certain kings (Tab. 2), the identification of specific building phases and a precise dating of the preserved ruins is difficult. Nevertheless, Bandaranayke states that these remains were probably constructed during late Anuradhapura period (Tab. 1).[39]

Phase	Period	Reign of kings
Phase I	3rd Century BCE to 1st Century CE	Devanampiyathiss (250 BCE–210 BCE) to Vasabha (65–109 CE)
Phase II	1st Century CE to 5th Century	Vasabha to Mahanama (410–432 CE)
Phase III	5th Century to 7th Century CE	Datusena (459–477 CE) to Manawamma (684–718 CE)
Phase IV	7th Century to the end of the 10th Century CE	Manawamma to Chola conquest (993 CE)

Tab. 1 | Phases of the Anuradhapura period (according to Bandaranayake 1974).

Type	Constructions	Reign of kings
Monastery	Abayagiriya	King Valagamba (89–77 BCE)
	Jathawanaramaya	King Mahasena (273–301 CE)
	Mahaviharaya	King Dutugemunu (161–137 BCE)
	Mirisavetiya	King Dutugamunu (161–137 BCE)
Tanks	Basawakkulama	Pandukabhaya (437–367 BCE)
	Tisawewa	Devanampiya (307–267 BCE)

Tab. 2 | Age of major construction works in Anuradhapura (according to the *Mahawamsa*).

5.3 Methods

Fieldwork was conducted in March to April in 2013 and 2014, bedrock outcrops lying within an approximately 4 km radius from the center of the Citadel were systematically surveyed in order to identify and map sites of quarrying activities. The definition of the research area was based on the density of the historic monasteries surrounding the Citadel. Maps were generated using satellite images.

Classification of the rock quarries was carried out qualitatively, based on the at least one of the following characteristics, which could be ascertained at the site, i. e. (i) mor-

36 A. Seneviratne 1994, 82.
37 Coningham 1999, 126–129; Coningham 2006, 5; Deraniyagala 2004, 719.
38 Coningham 2006, 5.
39 Bandaranayake 1974, 7.

phology, (ii) quarry position with respect to the outcrop, (iii) subsequent usage of the quarry sites (Tab. 3).

Quarry type	classified based on the		
	morphology	location*	post usage
Boulder	+		
Pit	+		+
Boulder top terrace		+	+
Surface	+		
Rock shelter		+	+
Tank bottom		+	
* Quarry location in respect to the outcrop			

Tab. 3 | Accessible classification parameters of ancient quarry sites in the Anuradhapura.

6 Results

6.1 Identification of quarries

Quarry identification is based primarily on the documentation of quarry marks, specifically, drilled quarry holes. Two types of quarry marks were observed: i) drilled, but not fractured holes in the bedrock (Fig. 3d), and ii) half-hole structures which remained after the successful splitting of stones blocks (Fig. 3f). The quarry holes are mostly oval in shape and vary in size from 2 cm to 5 cm in diameter and 5 cm to 9 cm in depth. Depending on the size of the stone selected for splitting, the individual quarry holes are spaced at intervals of between 1 cm and 14 cm.

Quarry features indicate that the stones extracted by the ancient craftsmen were predominantly geometrical in shape (such as cubes, cuboids and rectangular prisms of differing sizes). In some cases, split but unfinished stone blocks, e. g. pillars, were found in the area of quarries. No tools belonging to the ancient stonecutters were found at any of the quarry locations investigated; an assessment of a chronological frame of the quarrying activities is not possible. Consequently, the techniques used to split the stones provide the basis for distinguishing between ancient and a more modern quarries; any quarry exhibiting the chiseled quarry holes described above has been interpreted as an ancient quarry. In modern times, quarrying activities in Sri Lanka have been conducted with the use of an explosive substance and modern machines.

6.2 Classification and distribution of quarries

A total of 65 ancient quarry sites were recorded and classified according to the developed parameters (Tab. 3). The classification into six types is based on quarry site morphology, the location of the quarry in the outcrop (quarry position with respect to the outcrop) and incidence subsequent use of the quarries. The majority of the ancient quarries, 59 of the 65 identified, are situated along the central rock outcrop line; the remaining six lie west of the rock outcrop line. None of the quarries identified lie east of the rock outcrop line (Fig. 4).

Thus, it was primarily the granitic gneiss of the central rock outcrop line that was exploited in ancient times, while the migmatite hornblende gneiss occurring near the surface west of Anuradhapura was also exploited to a minor extent.

The six quarry types can be characterized as follows (Fig. 3, Fig. 4, Tab. 3):

Fig. 3 | Different types of quarries in the region of Anuradhapura: (a) boulder quarry, (b) boulder top terrace quarry, (c) rock shelter quarry, (d) surface quarry, (e) pit quarry, (f) tank bottom quarry.

Quarry type	Location* and number		
	On the outcrop line	outside	total
Boulder	38	–	38
Pit	1	3	4
Boulder top terrace	15	–	15
Surface	1	2	3
Rock shelter	3	–	3
Tank bottom	1	1	2
Total	59	6	65
* Location in the landscape			

Tab. 4 | Type and locations of 65 ancient quarry sites in the surrounding of the Anuradhapura Citadel.

a) **Boulder quarries.** Boulders, resulting from weathering of the parent bedrock along the rock line and exposed by erosion, were frequently used for exploitation of stone for building material. There were 38 boulder quarry locations identified in the research area. The natural shape of the boulders was lost as a result of the quarrying.

b) **Boulder-top terrace quarries.** At some locations, ancient craftsmen extracted small amounts of rock materials from the top of boulders to obtain building material and to level the boulder surface. The material was extracted without destroying the boulder as a whole. Frequently, architectural remains, like small stupas or brick structures, can be found in these terrace-like settings. Altogether, 15 boulder-top terrace quarry locations were identified in the research area.

c) **Rock-shelter quarry.** Rock shelters which ancient craftsmen mined limited amounts of rock materials without causing the shelter's destruction are classified as rock-shelter quarries. Three quarries of this type were identified in the study area.

d) **Surface quarries.** Sites where material was mined directly from the surface level. Three surface quarries were identified in the research area.

e) **Pit quarries.** At some locations, surface-near bedrock was mined by creating pits. The pit quarry locations found are four in number. In general, pit quarries were later transformed into ponds.

f) **Tank-bottom quarries.** The quarries currently located at the bottoms of tanks have been classified as tank-bottom quarries. The numerous pieces of cut stone, ranging in size between 50 cm and 500 cm, constitute the most notable feature of this quarry type.

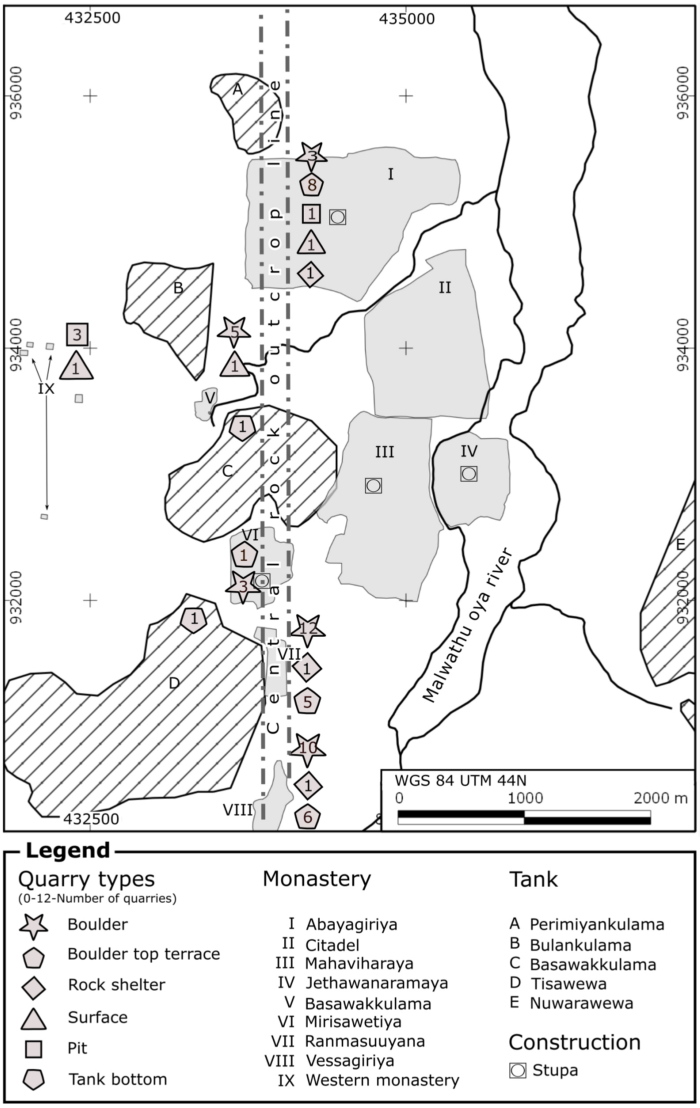

Fig. 4 | Classification and distribution of ancient rock quarries in the city area of Anuradhapura.

Two quarries of this type were identified, one at the bottom of the Basawakkulama tank and one at the bottom of the Tisawewa tank. These quarries are visible only during the drought season when the water level is low.

7 Discussion

7.1 Identification of ancient rock quarries in Anuradhapura

Drilled quarry holes on rock outcrops and unfinished stone blocks were identified during the survey as the most marked evidence of quarrying activities in the area around Anuradhapura. We found no other traces of the quarrying process, such as the presence of spoil and tools found at ancient quarries in the Mediterranean and Egypt.[40]

For the most part, the rock quarries in the region of Anuradhapura are small in scale. Accordingly, one could not expect any major accumulation of excavation material, and indeed, such an accumulation was detected only at tank bottom quarries (Fig. 5). In

40 Dworakowska 1975, 98; Heldal 2009, 127; D. D. Klemm and R. Klemm 2001, 634.

addition, because hard rock is a scarce resource in Sri Lanka, it is highly probable that the rural population reused the quarry dumps. Moreover, one should also bear in mind that archaeological excavations conducted at the beginning of the 20th century must have resulted in the destruction of the evidence of quarrying activities.

7.2 Classification and distribution of the quarries

While ancient quarries in the Mediterranean[41] are frequently categorized in terms of their location within the landscape and petrography,[42] rock quarries found in the hinterland of Anuradhapura are relatively uniform with respect to these characteristics. We therefore used morphology, subsequent usage and quarry position at the outcrop to classify the quarries in the vicinity of Anuradhapura. 'Subsequent usage of the quarry' refers to how people used the quarry site after initial quarrying activities had ceased. There is evidence that ancient people quarried limited amounts of material from the outcrops in order to convert the quarry location for another purpose; boulder-top terrace, pit and rock-shelter quarries are examples of this (Tab. 3). 'Quarry position at the outcrop' refers to the section of the outcrop that was utilized for quarrying activities; for instance the top section of a boulder, the section inside a rock shelter or the area at bottom of a tank (Tab. 3).

a) *Boulder quarries*: Rock boulders appear frequently along the rock outcrop line. The high frequency of this type testifies to the intensive exploitation of these boulders in ancient times.

b) *Boulder-top terrace quarries*: Buddhist monasteries played a pivotal role in defining the structure of the ancient city of Anuradhapura.[43] In ancient Sri Lanka, elevated locations were preferred for the construction of smaller Buddhist monasteries and other sacred buildings, such as stupas, as height had a protective function.[44] Within the study area, such buildings are frequently found on top of basal knobs and inselbergs. Mining of rock materials on boulder-top locations may therefore have been performed with the intent of preparing platforms to serve as sites for the construction of sacred buildings, also the structural stability of the buildings benefit from the rocky surface in the underground.

c) *Rock-shelter quarries*: Utilization of natural rock shelters for habitation or as sacral chambers is clearly documented as far back as the beginning of the Buddhist civilization in Sri Lanka.[45] The *Mahavamsa* tells of King *Devanampiyatissa* converting natural rock shelters to dwelling places for *Arhath Mahinda* as earliest historical use.[46] Occasionally, Buddhists used to prepare natural rock shelters, constructing a drip ledge above the roof portal,[47] and donate them to Buddhist monks. In some cases, the entrances to the rock shelter were properly covered by masonry brick walls. Thus, the main objective of quarrying activity in natural rock shelters seems to have been an expansion of living space.

d) *Surface quarries* were used to mine construction material that was exposed to the surface. This was a highly efficient type of quarry, entailing relatively low labor intensity compared to mining from pit quarries, for example. The surface could easily be restored after stone exploitation activities, which is one reason why surface quarries are now difficult to detect in the densely vegetated landscape, and hence why only three quarries of this type were identified in the survey.

41 Dworakowska 1975, 96–97; Kelany et al. 2009, 31–41.
42 Abu Jaber, Al Saad, and Smadi 2009, 71; Kelany et al. 2009, 92.
43 S. Seneviratne 1984, 80 and 83.
44 Wijesuriya 1998, 15.
45 Bandaranayake 1974, 46; Wijesuriya 1998, 46.
46 Mahavamsa XVI, 12.
47 Bandaranayake 1974, 46.

e) *Pit quarries* are found exclusively at a distance from 500 to 1000 m west of the rock outcrop line, where outcropping bedrock and boulders are scarce. Areas featuring near-surface bedrock were preferable for use as basements of sacred buildings or monasteries. This meant that the availability of stones as building material either depended on transport from the rock outcrop line or required pitting. Pit quarries therefore suggest that the exploitation of the raw material near the relevant construction area was more cost effective than arranging the transportation of heavy rocks across a nearly impassable terrain of wetlands and ridges covered by dense tropical forests.[48] Once mining was finished, the pits could easily be converted into ponds to use for storing surface runoff in the rainy season.[49]

f) *Tank-bottom quarries* constitute a special type of quarry, as their classification as such is based solely on their present-day location in ancient tanks. This location means that they can only be examined when water level in the tank is low. Both of the tank-bottom quarry sites in the study are located along the bedrock outcrop line (Fig. 4). In the center of the *Basawakkulama* tank, boulders of the bedrock line protrude out of the water throughout the year, so access to these parts of the tank bed was not possible within the framework of our investigation. Only the margins of these two quarry sites were mapped (*Tisawewa* and *Basawakkulama*). Consequently, recording of data on tank bottom quarries entailed a systematic uncertainty, as their accessibility is limited to times of low water levels in the ancient tanks. comparison to the quarries of other types, both tank bottom quarries are characterized by remarkable remains of extensive stone cutting activities, such as an assemblage of stone blocks with quarry marks and slabs, pointing to the exploitation of the vast amount of rock material that was removed from the tank bottom (Fig. 5).

The tank-bottom quarries differ from the other quarry types classified in one other important respect: Written chronicles date the construction of the tanks *Basawakkulama* and *Tissawewa* to 400 BCE.[50] Assuming that the quarrying activities preceded the construction and flooding of the tanks, tank ages provide a tentative minimum age for the beginning of quarrying activities.

Fig. 5 | (a) view from the banks of Basawakkulama tank to the South during rainy season (December 2012). (b) assemblage of stone blocks and slabs on the bottom of Basawakkulama tank during visible during low lake level in August 2014 with some of them showing quarry marks (c).

8 Conclusions

The development of Anuradhapura city as the capital of the ancient kingdom of Anuradhapura and the attendant demographic expansion concomitantly increased the demand

48 Coningham 1999, 10.
49 Coningham 1999, 9.
50 Mahavamsa XXI, 66.

for natural resources. Arable and grazing land water, fuel and building material are the five basic natural resources which determine the suitability of the natural environment for settlement.[51] In a tropical county like Sri Lanka, where mighty saprolites, several meters in thickness, overlie the bedrock, rocks are a scarce resource. Hence, the accessibility of stone resources for use as building material might have been a decisive factor favoring the establishment and development of the ancient Anuradhapura settlement. This hypothesis applies especially with respect to Anuradhapura's function as a capital, which entailed the construction of representative buildings. Anuradhapura's position between the rock outcrop line to the west, offering the natural resource of rocks for use as construction material, and the Malwathu Oya to the east, providing the natural resource water as well as fertile floodplain soils, offers impressive testimony to the location's advantages for this purpose (Fig. 4).

All of the quarries in Anuradhapura recorded in this study are located within a small, geologically uniform area, which makes classification on the basis of petrological and lithological characteristics difficult and of little relevance. Morphology, subsequent usage of the quarry and the quarry position at the outcrop are more applicable classification parameters, since the quarries investigated have more pronounced differences in those respects.

Extensive exploitation of building material, especially along the rock outcrop line, resulted in considerable transformations of the natural landscape. Several outcrop types were recognized as suitable for quarrying activities in the surroundings of Anuradhapura, including boulders and natural rock shelters situated along the central rock outcrop line as well as surface-near bedrock outcrops (Fig. 6a). Depending on the size of the block to be extracted, ancient stoneworkers would have assessed the outcrop's quarrying potential and removed either parts of the outcrop or entire boulders were removed (Fig. 6b). After exploitation of stone blocks, quarried areas were integrated into the built environment as basins for water storage, as enlarged rock shelters for living space or as platforms on which to build stupas or other religious buildings (Fig. 6c). Hence, the historic built environment that we see in Anuradhapura today is a product of a natural environment transformed through historic quarrying activities (Fig. 6).

51 Chisholm 2007 [1970], 115.

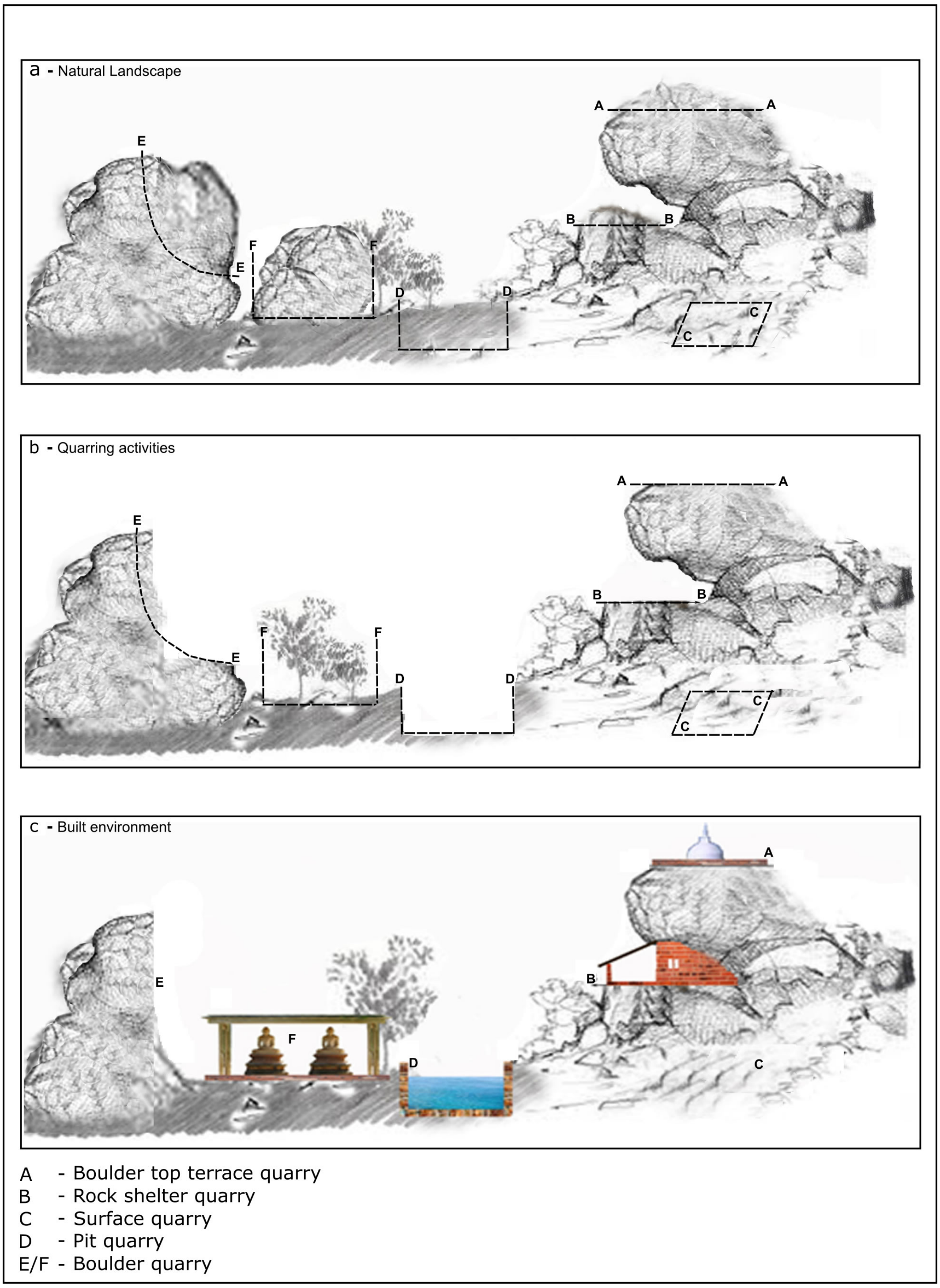

Fig. 6 | Evolution of the quarry landscape in the surrounding of Anuradhapura: a) Natural landscape along the rock outcrop line before quarrying activities had started (boulders, natural caves and surface rock exposes), b) descendant landscape after potential quarrying activities (either of parts of the outcrop or of whole boulders were removed), (c) integration of the built environment with quarry locations.

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