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An Archeological Study to Identify the Ancient Settlement Pattern of Anuradhapura with Special Reference to the “Deegapasana” Rock Outcrop in Sri Lanka

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Abstract

Anuradhapura is a remarkable landscape with a continues history and human interactions from the Prehistoric periods. Natural settings of the landscape, directly and indirectly, influenced for the settlement pattern as well as the centrality of the area. Among them, the "Deegapasana" rock outcrop was a prominent feature which helped to make a favorable environment for the ancient inhabitants. The natural landscape greatly helped early migrants to form a well-planned fortified city and a hydraulic agriculture landscape in the vicinity. The main intention of this research was to identify the horizontal distribution of the material culture as well as the techno-cultural evolution of the area. Also, it was intended to analyze the horizontal connectivity with the Anuradhapura citadel stratification. Direct and indirect impacts from the rock outcrop to the evolution of entire cultural landscape was studied in related to the geospatial data. Further, the interrelationship between ancient irrigation landscape and the rock outcrop was studied. A desk-based assessment was carried out to collect information from published and unpublished materials. During this process, multiple sources of information were obtained. Primary data were collected through a field survey and recorded as photographs, plans and field notes. Different methods were used to collect and record data. Geographical Information System (GIS) database was created integrating the spatial data gathered through numerous methods including GPS point survey and field exploration. This research was able to identify the influence of Deegapasana rock-outcrop for the settlement pattern of the ancient Anuradhapura. It was a favorable factor for the settlement layout during different techno-cultural phases. Further interlinkages can distinguish from the ancient industrial activities, water management system, and the built environment of the area.

Key words: Ancient human settlement, Geospatial study, Hydraulic agriculture landscape, Urban planning

1. Introduction

Since the colonial period over two centuries, ancient Anuradhapura city in Sri Lanka was subjected to various archeological research. Series of stratified excavations and research which has conducted in the post-colonial context was able to locate the Anuradhapura in a broad context of time and space. Human interactions with the Anuradhapura landscape was evident from 3900 BCE with the commencement of prehistoric Mesolithic settlements in the area. Consequently, numerous settlement phases are visible from the stratified soil starting from the Early Iron Age about 950 BCE to the Middle Historic periods (Deraniyagala 1992; Coningham 2006).

Previous research was able to establish a clear cultural sequence to the Anuradhapura ancient city based on the historical sources and number of stratified excavations conducted in the area. However, rare efforts have been taken to study the microelements in the area in related to the settlement pattern and human interactions with the landscape.

The long rock outcrop "Deegapasana" could be identified as a prominent feature influenced to the centrality of the Anuradhapura as well as the behavior of the periphery. "Deegapasana" rock outcrop is located in a rich archeological and cultural hub in Anuradhapura. It is hypothesized here that the microenvironment formed by the rock outcrop was a prominent reason for the settlement pattern developed through the human activities from prehistoric period to present as well as the techno-cultural evolution of the area.

The main intention of this research was to identify the horizontal distribution of the material culture as well as the techno-cultural evolution of the area. Also, it was intended to analyze the horizontal connectivity with the Anuradhapura citadel stratification. Direct and indirect impacts from the rock outcrop to the evolution of entire cultural landscape was studied in related to the geospatial data. Further, the interrelationship between ancient irrigation landscape and the rock outcrop was studied.

2. Materials and Methods

2.1 Study site

Anuradhapura is a remarkable landscape with a continues history and human interactions from Prehistoric period to the Middle Historic period. Natural settings of the landscape, directly and indirectly, caused for the settlement pattern as well as the centrality of the area. Among them, the "Deegapasana" rock outcrop was a prominent feature which helped to make a favorable environment for the prehistoric inhabitants. Ancient chronicles like *Mahavamsa* described this rock outcrop as "Digupahana" or "Digugalvila" (Geiger 1908).

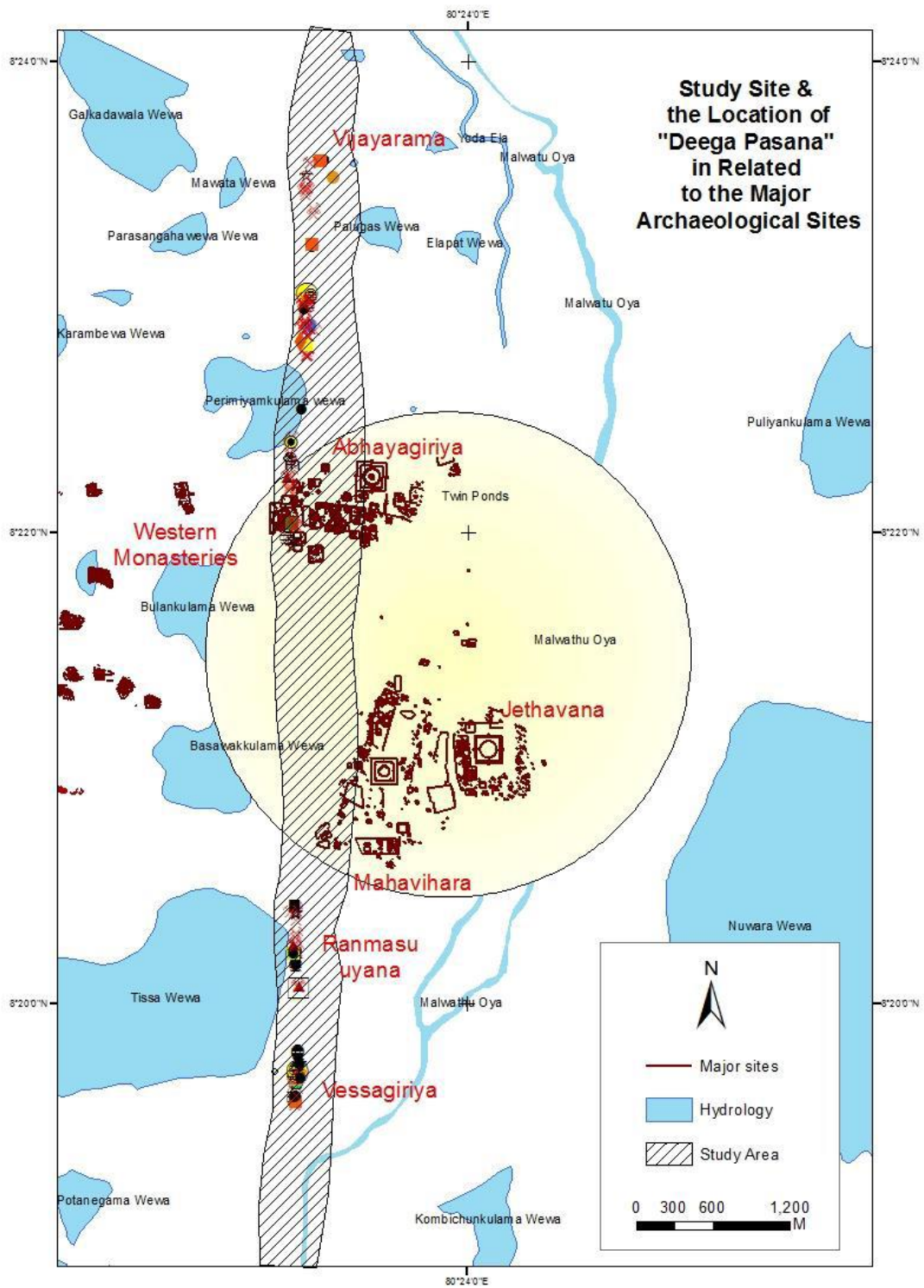


Figure 01: Location of "Deegapasana" rock outcrop in related to the archaeological sites

This rock outcrop is visible from certain locations in the ancient Anuradhapura city, starting from the present day "Vessagiriya" site (Isurumuniya in the ancient times) to North of the "Vijayarama" monastery site, through "Abayagiriya" monastery (Figure: 01). Deegapasana rock outcrop extends in north-south directions closer to the ancient citadel. The river Malvathu (Ancient *Kolomhoya*) is located one kilometer away from the outcrop to the eastern side. The fertile valley between the river Malavathu and Deegapasana is rich with archaeological and cultural sites such as Vessagiriya monastery, DhakshinaVihara monastery, Jethavana monastery, Anuradhapura Citadel, Abayagiriya monastery, Pankuliya monastery, Vijayarama monastery and Kiribathvehera monastery.

Study limits for this research extended from present day Vessagiriya monastery to the North of the Vijayarama monastery. Deegapasana rock outcrop was studied on the surface from South to North direction, covering Vessagiriya monastery, Isurumuniya monastery, Ranmasuuyana the royal pleasure garden, Basawakkulama tank, Abayagiriya monastery, Perimiyankulama tank and Vijayarama monastery.

2.2 Historical and Archaeological background

According to the earliest chronicles, Sri Lanka was inhabited by the migrants from India, namely princes Vijaya and his team from Lata country. They established settlements adjacent to several river valleys in the dry zone of Sri Lanka such as river Malavathu, Kala, and Mahaveli. Those earliest settlements were known as Manthota, Thambapanni, Udeni, Anuradhagama, Uruwela and Vijithagama. The settlement called Anuradhagama closer to the Kolomhoya or the present day Malvathuoya which has established by the minister called Anuradha gradually became the center of the civilization. (Geiger 1908; Oldenberg 1879).

According to the literature, by 4th century BCE, the Anuradhapura settlement was started to form a city. The King Pandukabaya was the pioneer who formed it as a city. He separated the city into different quarters for the well-functioning of the city. It is evident that in the King Pandukabayas period, Anuradhapura landscape consists of the city, central area for commercial activities, irrigation schemes in the outer ring of the city, agricultural lands, and different settlements (Silva 2000). He established an official bearer called "Nagara Guththika" for the administration of the city. Also, he built a tank, cemetery and few places for religious activities (Geiger 1908). Further, the Mahavamsa described the layout of the city. A wall protected it, and four gates were established from the four directions linked with the main roads. Villages were located closer to the main gates, and the main settlements were located to the South and the North of the city (Geiger 1908).

Next important phenomenon in the development of Anuradhapura landscape is the introduction of Buddhism in 3rd Century BCE in the reign of the King Devanampiyathissa. Thereafter, the city was organized with the guidance from chief monks and influence of Northern Indian architecture and town planning concepts. Many evidence can be gathered from the description in *Mahavamsa* on the acceptance of Mahavihara (Geiger 1908).

Also, it mentions about the "Deegapasana" rock outcrop. *Bodhiwansa Gatapada* described it as "Digugalvila" (Amaramoli 1957). Similarly, even today, rock outcrop is mention as

"Deegapasana." Abaya Wewa tank is located parallel to the rock outcrop. Gamini tank is located West to the Abaya Wewa tank. According to the *Mahavamsa*, the King Parakramabahu built the tank Jayawapi for the water requirement of the city. If the Jayawapi is hypothesized as the present day Abaya tank, Deegapasana rock outcrop would be the western limits for the boundary mentioned in the *Mahavamsa* story.

Anuradhapura landscape was developed throughout the centuries within the time and space, adding an inner city, ring of irrigation and agricultural landscape, settlement areas and several ring of monasteries. The monastic architecture in Anuradhapura corresponds with the development of the socio-economic and cultural institutions as a whole. There are several types of monasteries are preserved in the landscape such as cave monasteries, Maha Vihara or Organic monasteries, Pabbatha Vihara or Mountain monasteries and Patanagara or double platform monasteries(Silva 2000).

Anuradhapura was subjected to many archaeological excavations during last century. Particularly after 1969, stratified scientific excavations were carried out on numerous occasions. First human occupations in the soils of the Anuradhapura landscape is visible from the prehistoric periods. The Gedige excavation in 1969 reveals evidence on prehistoric Mesolithic settlement dated to 3900 BCE(Deraniyagala 1972). The basal gravel in Anuradhapura citadel comprised with Mesolithic stone tools such as cutters, scrapers, choppers, points, hammers and stone tool waste(Deraniyagala 1972; Deraniyagala 1992). Deraniyagala identified a Mesolithic culture from Anuradhapura citadel which is similar to the Mesolithic in the other parts of the country acronym as *BalangodaCulture*.

The prehistoric settlement in Anuradhapura was superimposed by Early Iron Age culture in 950 BCE by the Indian migrants, defining the commencement of the protohistoric period in the area(Deraniyagala 1972). The Early Iron Age was established in South India before 1200 BCE(Deraniyagala 1992). Initial Early Iron Age settlements in Anuradhapura was up to 10 hectares in 900 to 800 BCE. As stated by Coningham, in Anuradhapura, Early Iron Age culture was active from 840 to 460 BCE(Coningham 2006). The prevailing characteristics of the Early Iron Age settlements were the rice cultivation, animal domestication, use of horses, primary metal industry, Black and Red ware with symbols and megalithic burial practice(Deraniyagala 1992; Seneviratne 1996).

Anuradhapura Citadel was extended at least up to 50 hectares by 700 to 600 BCE, and it coincided with the second urbanization in the GangaticValley in India(Deraniyagala 1992). Basal Early Historic period from 600 to 500 BCE was an important era in the settlement history of the area. There were evidence of early Brahmi writing and imported pottery wares of this period(Deraniyagala 1992).

Lower Early Historic context is recorded from 500 to 250 BCE in Anuradhapura, and it corresponded with the King Pandukabaya story in Chronicles describing the beginning of the Anuradhapura city. Still, the extension of the city limited to 50 hectares based on the archaeological materials(Deraniyagala 1992). Anuradhapura developed rapidly in Middle Early Historic period (250 BCE to 100 CE) as the main hub for the dry zone agriculture civilization. During this time, the inner city extended up to 100 hectares and placed it within the five biggest cities in the South Asia(Deraniyagala 1992). This phase of development was

correlated with the establishment of Buddhist monastic complexes in Anuradhapura which has been described in the ancient literature (Bandaranayake 1974).

The last phase of the development of cultural landscape in Anuradhapura link with the Middle Historic context from 300 CE to 1250 CE, until the commencement of Polonnaruwa Kingdom. During this period, most of the elements which have remained up to now were added to the landscape including splendid monumental architecture and irrigation networks. Stratified archeological materials demonstrate the strong trade and cultural networks with the outside World.

2.3 Data collection and Sampling design

A desk-based assessment was carried out to collect information from published and unpublished materials. During this process, multiple sources of information were obtained. Primary data were collected through a field survey and recorded as photographs, plans and field notes. Different methods were used to collect and record data. Geographical Information System (GIS) database was created integrating the spatial data gathered through many methods including GPS point survey and field exploration. Data on following key parameters were obtained through the field exploration.

- Built Environment
- Ancient technology and resource use
- Ancient irrigation works
- Topography

3. Results

3.1 Evidence on Early Settlements

Stratified excavations conducted in Anuradhapura Citadel, Jethavana monastery, and Vessagiriya, revealed evidence on prehistoric settlements in the area (Deraniyagala 1992; Mendis 2014; Mendis 2008). Microenvironments in these three sites show slightly different characteristics. However, it is evident that the “Deegapasana” rock outcrop has played a significant role in forming favorable microenvironments in these sites. Mesolithic settlements in Sri Lanka was essentially a hunting and gathering society and established in different Eco zones, adopting to the local environmental conditions. Anuradhapura is located in the dry zone lowland area. Prominent data sources for the Mesolithic in Sri Lanka uncovered from the number of wet zone cave habitation sites. Similarly, in Vessagiriya site, microenvironment consists of many natural caves and rock shelters (Mendis 2008). Up to now 26 caves were identified from the sites (Figure: 06). However, most of these natural caves were transformed to monastic dwellings with a drip ledge to prevent water flow inside. It is hypothesized here that the natural caves in Deegapasana rock outcrop in Vessagiriya site made a favorable condition to establish prehistoric Mesolithic settlements in the area. Stratified artifacts such as stone tools and waste materials support that opinion (Figure:2-5).



Figure 02: Chert tool from *Vessagiriya*



Figure 03: Chert tool from *Vessagiriya*



Figure 04: Quarts tool from *Vessagiriya*



Figure 05: Quarts tool from *Vessagiriya*

Anuradhapura Citadel and Jethavana sites activated as open air Mesolithic habitation sites. Similar to the Vessagiriya site, these two locations were given with the favorable locational factors for a prehistoric hunter-gathering culture. Especially the rock shelters in “Deegapasana” rock outcrop situated closer to the Abayagiriya monastery could be used as dwelling places for the prehistoric people while they used the adjacent lands to the natural water holes rich with flora and fauna, in between the river Malvathu and present day Abaya Wewa tank for their hunting and gathering purposes. Further, topography of the Jethavana and Citadel sites made a comparatively hazard free safe environment for the prehistoric habitations (Table: 01)

Table 01: Average Bed Rock Elevation for major sites

Bed Rock Elevation – Vessagiriya	Bed Rock Elevation – Jethavana	Bed Rock Elevation – Anuradhapura Citadel	Bed Rock Elevation - Abayagiriya
83.5 M	72.55 M	78.96 M	87.32 M

Therefore, some favorable locational factors for a prehistoric Mesolithic settlement in Anuradhapura can be listed as follows.

- Dwelling places in natural rock shelters in “Deegapasana” rock outcrop
- Availability of water and mineral resources for stone tool industry from river Malavathu
- Elevated areas in the landscape
- Natural water holes in between the river Malvathu west bank and the present day Abaya Wewa tank provided suitable lands for game hunting and food gathering

Protohistoric Early Iron Age is the next dominant cultural phase in Anuradhapura. Many sites reveal material evidence on Early Iron Age in different time and space context (Table: 02).

Most of the sites located in the North, North Central, East, North Western, Northern hill country and the Western areas(Seneviratne 1984).There are two types of sites demonstrate evidence on Early Iron Age.

- Early Iron Age settlement sites
- Mortuary complexes

Table 02: Dating on Early Iron Age settlement and mortuary complexes in Sri Lanka

Site	Dating
Anuradhapura	900 BCE (Deraniyagala 1992)
Sigiriya	1000 BCE (Karunaratne et al. 1994)
Ibbankatuwa	500 BCE – 400 BCE (Deraniyagala 1992)
Ranchamadama	1359 BCE (De Silva et al. 2006)
Pinwewa Galsohon Kanatta	112 BCE (Deraniyagala 2007)
Kalatuwawa	130 BCE (Deraniyagala 2007)
Manthai	200 BCE (Carswell et al. 1984)
Kantharodei	500 BCE (Ragupathy 1987)
Lower Kirindhi Oya basin	900 BCE (Somadeva 2006)
Thissamaharama	360 BCE – 290 BCE (Weisshaar et al. 2001)
Polpithigama	520 BCE – 310 BCE

Study area reveals substantial evidence on Early Iron Age habitations. Stratified excavations conducted in the Vessagiriya monastery site were able to uncover Black and Red Ware (BRW) and crucibles used for iron smelting which is prominent characteristics of the Early Iron Age(Mendis 2008).By comparing the material evidence from the stratified excavations in Vessagiriya with the Anuradhapura Citadel, it is obvious that Early Iron Age settlement was established in the area nearly 800 BCE to 500 BCE.

Micro-environmental features designedthe nature of the Early Iron Age and Historical settlements in the Vessagiriya area. Due to the rock outcrop, natural depression was made to the western side later converted to the Thissa Wewa with an artificial bund. Sudharshan Seneviratne mentioned a similar natural depression named Idamoraluwa, used by the Early Iron Age settlers in Ibbankatuwa (Seneviratne 1996). The flat valley lands East to the outcrop allowed early inhabitants for agriculture and animal husbandry. Further, fertile Reddish Brown Earth (RBW) made a favorable microenvironment for the agriculture settlements.

A demographic expansion happened in Protohistoric Early Iron Age from the center to the periphery, extended from Anuradhapura Citadel to the Southern Anuradhapura(Deraniyagala 1992). Further, settlements were spread to the sites like Ibbankatuwa and river Kala Oya valley. Spatial patterning of the sequence of Iron Age mortuary complexes such as Galewela, Anekotawa, and Kandalama supports this hypothesis(Seneviratne et al. 2006).Seneviratne identified this process as a centrifugal phenomenon resulted from the multi-resources subsistence pattern in the Early Iron Age(Seneviratne 1996).

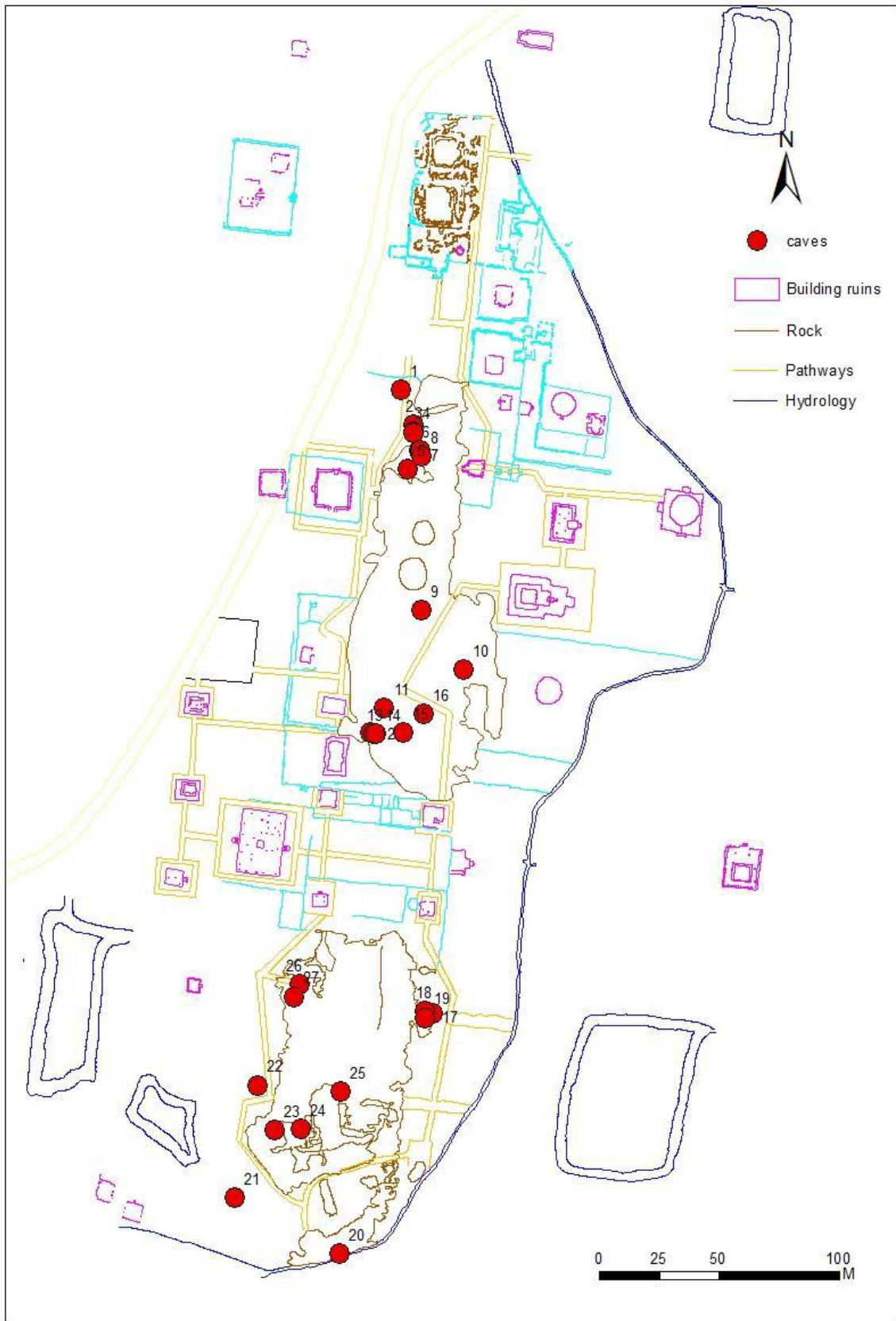


Figure 06: Location of natural caves in Vessagiriya site

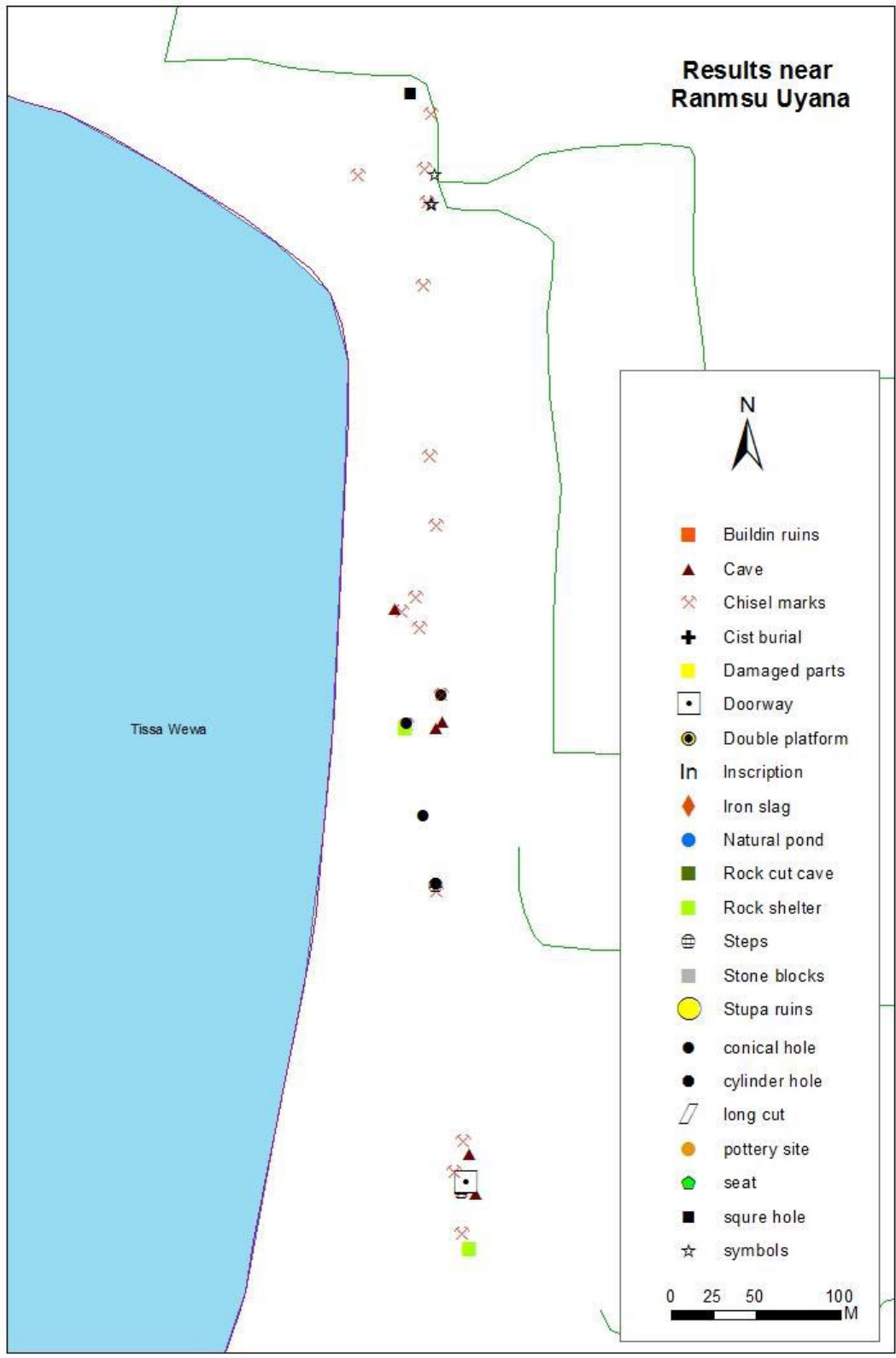


Figure 07: Recorded evidence in Ranmasu Uyana area

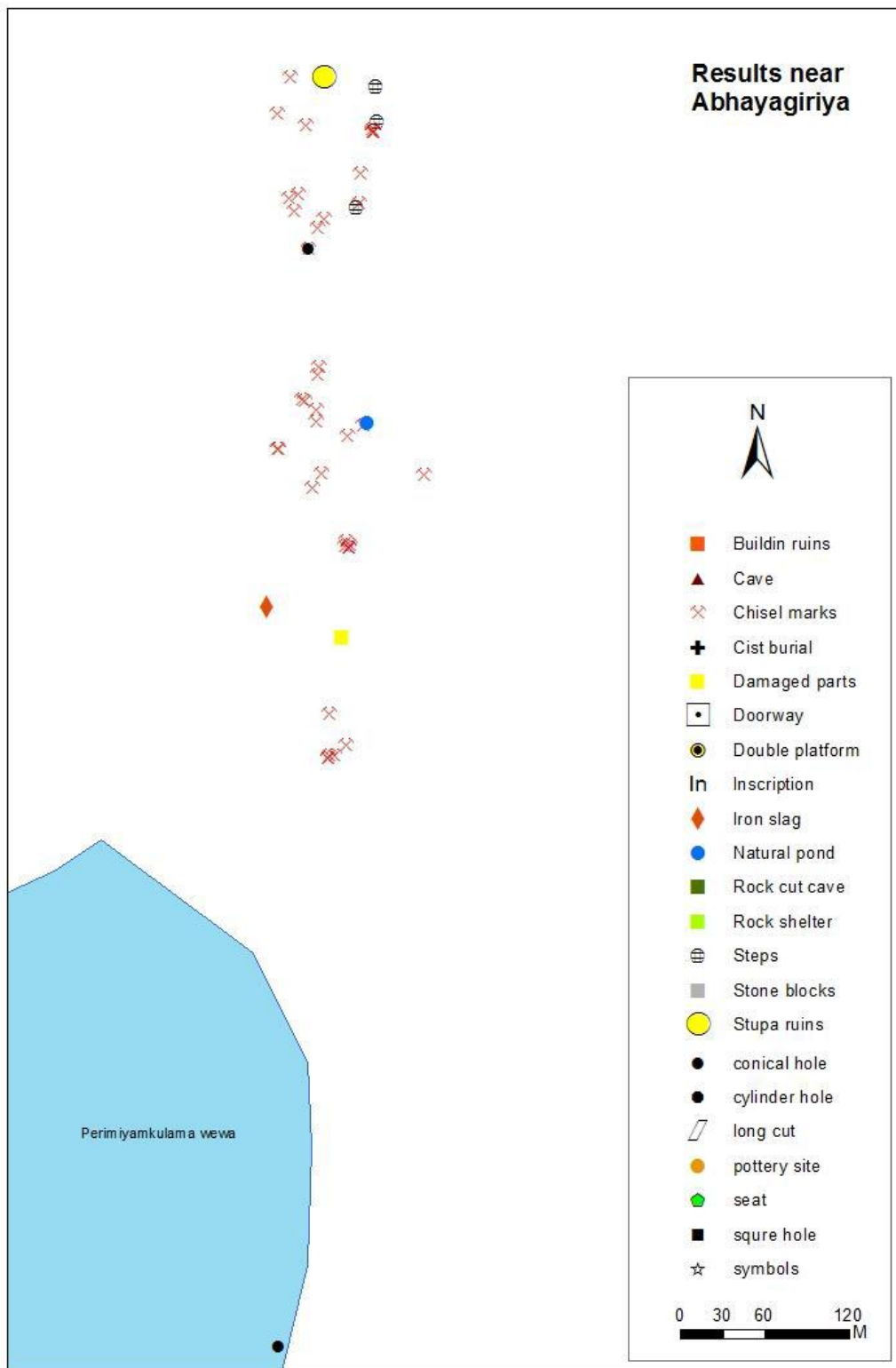


Figure 08: Recorded evidence in Abhayagiriya Monastery area

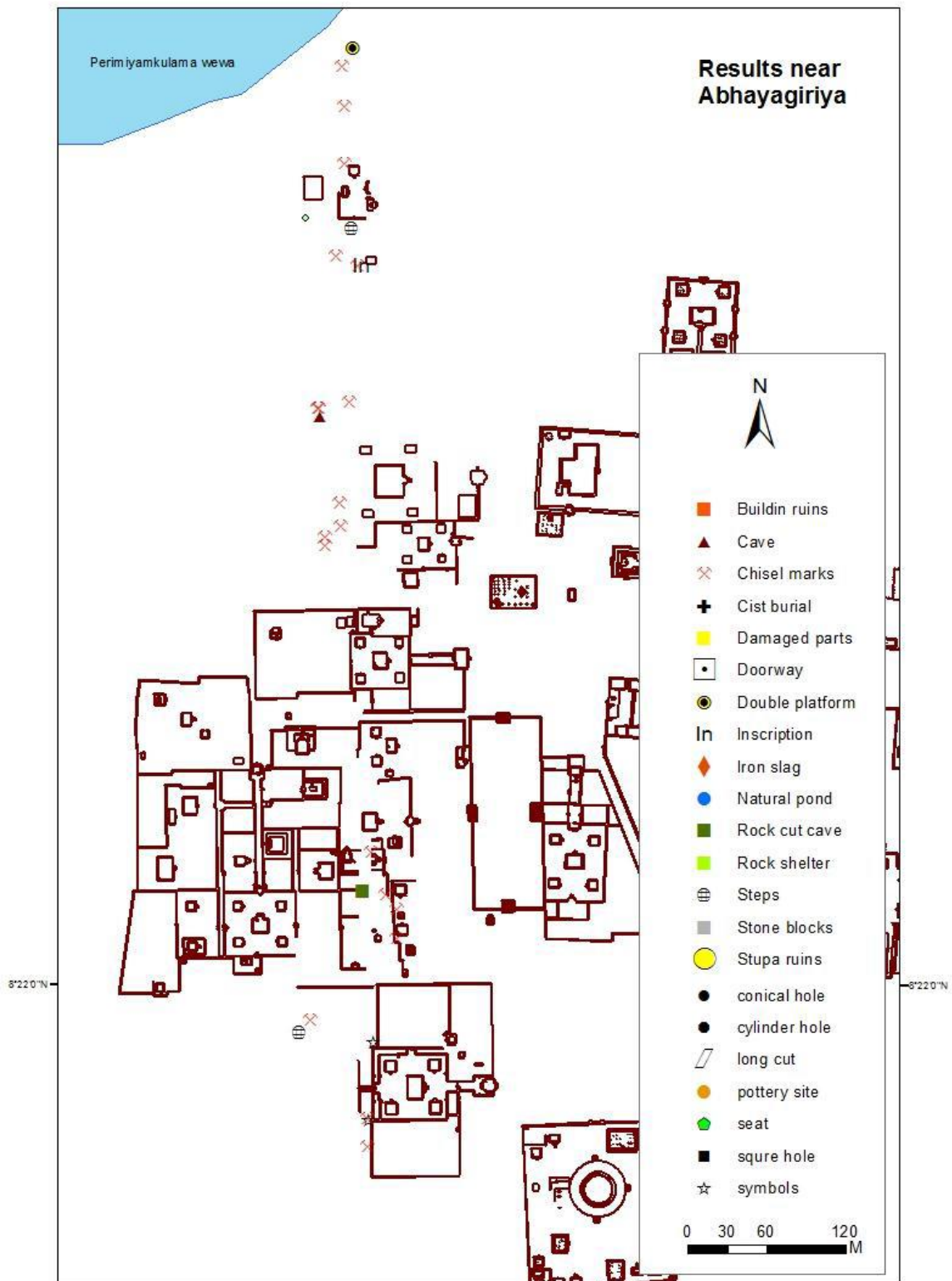


Figure 09: Recorded evidence in Abayagiriya Monastery area

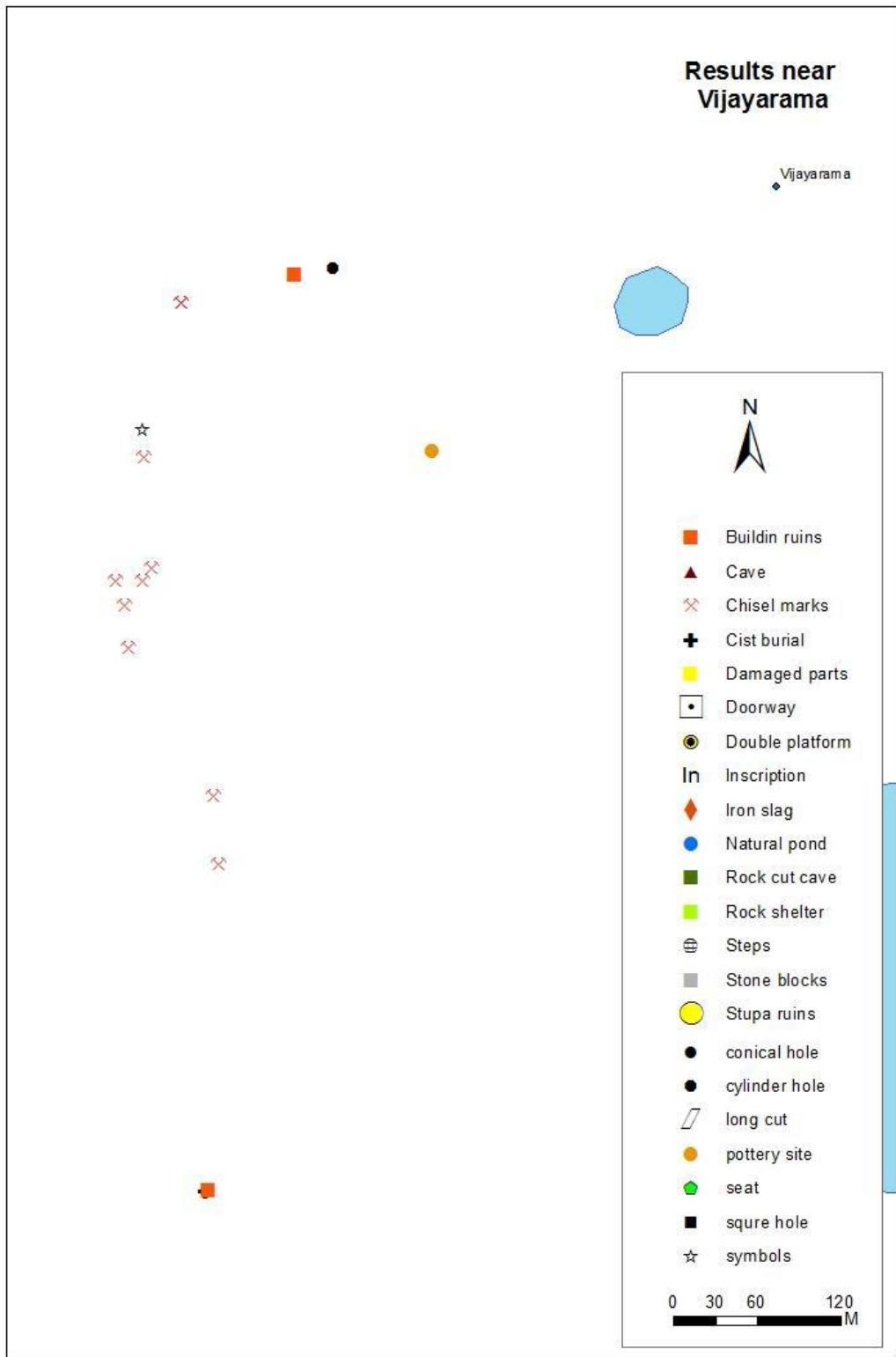


Figure 10: Recorded evidence in Vijayarama Monastery area

A promising discovery was made during the Deegapasana rock outcrop survey which gives new evidence on Early Iron Age mortuary practices in Anuradhapura. A cist burial was uncovered for the first time adjacent to the Anuradhapura ancient settlement, from a private land closer to the Perimiyanikulama tank (Figure: 11).



Figure 11: *Palugaswewa Cist Burial*

Deegapasana rock-outcrop revealed evidence on Early Iron Age context in Anuradhapura by many Early Brahmi Inscriptions and symbols. The study area consists 47 Early Brahmi Inscriptions out of 402 inscriptions recorded in the North Central province. Among them, Vessagiriya site in Deegapasana rock-outcrop consists majority of the inscriptions, 27 in number. Besides, 4 Early Brahmi inscriptions recorded in Abayagiriya monastery area (Paranavithana 1970). Further, 11 symbols which demonstrate Early Historic context, were identified during the survey from Vessagiriya, Ranmasu Uyana, Abayagiriya and Vijayarama area (Figure:12-21).

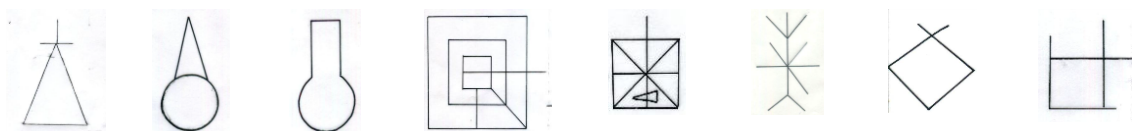


Figure 12-19: Symbols on *Deegapasana*



Figure 20 & 21: Symbols on *Deegapasana*

3.2 Ancient Industrial Activities in “Deegapasana” Area

The “Deegapasana” rock outcrop revealed much evidence of metal and stone industry conducted in Early and Middle historic periods. Main results can be categorized as follows.

- Drip ledge on natural caves and rock shelters
- Stone query sites with chisel marks
- Conical holes and stone canoe used to sharpen the tools
- Structural evidence on rock surface
- Symbols on the rock

Natural caves were converted into dwelling places in Early Historic period with a 90° drip ledge carved on to the rock surface to prevent water flowing inside. During the survey twenty-six caves in Vessagiriya, two caves in Isurumuniya and four caves in Abayagitiya were recorded (Figure: 22 & 23)



Figure 22 & 23: Drip ledge caves in Vessagiriya

"Deegapasana" rock outcrop revealed much evidence on the extraction of rock materials for the construction purposes as stone slabs and pillars in historical times. A number of oval shaped holes dig into the rock surface visible in many places of the outcrop. Ancient craftsmen had the ability to identify the natural mineral line to extract rock materials easily. These holes or so-called cut-marks were recorded ranging 2cm to 3cm in radius and 7cm to 11 cm in depth. Chisels were used to make oval shaped holes on the natural mineral line of the rock (Figure:33). During the survey, 125 quarries with chisel marks were recorded (Table: 03).

Table 03: Number of Queries in different sites along the “Deegapasana”

Site	Number of Queries
Vessagiriya	12
Abayagiriya	25
Isurumuniya	04
Perimiyankulama	52
Ranmasu Uyana	32

Deegapasana was used to extract materials for the construction and development processes in Anuradhapura ancient landscape as well as the extraction process of rocks were caused to shape the landscape of the area (Wagalawatta et al. 2017).



Figure 24-32: Stone quarries in “Deegapasana” Rock Outcrop

Metal production was another important component of the industrial processes happened related to the Deegapasana rock outcrop. Ancient craftsmen used metal tools to extract stones boulders from the outcrop as well as shape up the stone structures. During the survey number of places uncovered with evidence on metal production such as remains of iron slags (Figure:34). Further, a significant number of conical holes which used to sharpen the metal

tools were studied. The majority of the conical holes out of studied fifteen, demonstrate similar characteristics with approximately 12cm in diameter and 8cm to 10cm in depth (Figure 36-38). Ancient times, stone canoe were used as mobile devices for sharpening the tools. Present research uncovered some stone canoe from the area between Perimiyankulam tank and Vijayarama monastery (Figure:35).



Figure 33: Stone Chisels



Figure 34: Iron Slags



Figure 35: Stone Canoe



Figure 36 - 38: Conical holes in "Deegapasana"

3.3 Evidence on Built Environment

Architectural remains combined with Deegapasana indicate a significant stage of the settlement history of the area. The majority of the structural remains demonstrate a Buddhist religious context despite few other secular structures remain. Base on the materials, architectural remains in Deegapasana can be categorized in to two major types.

- Stone made architectural structures
- Brick made architectural structures

Stone steps, pillars, and post holes are prominent among the architectural stone remains and stick into the rock outcrop itself (Figure:39-41). The majority of the architectural features studied and recorded during the survey were identified from the Vessagiriya and the Isurumuniya archaeological sites. Further, the Royal pleasure garden "Ranmasu Uyana" consist of significant stone architectural structures in a varied nature and demonstrate a secular context in contrast to the monastic architectural features find in elsewhere.

Besides the stone structures, there are many brick made structures visible in Deegapasana area. Among them few stupas and different kinds of building ruins are prominent. Three rock boulders in Vessagiriya monastery site consist remains of five stupas. Also, two other stupas were erected on Deegapasana in Isurumuniya monastery and Perimiyankulama. All six stupas were constructed on the rock outcrop with stone basements (Figure:42 & 43).

The next constructional element in Deegapasana is the stone carved postholes which used as a support for the wooden pillars(Figure:45-47). Postholes were in different dimensions, and the majority were examined approximately 15cm in diameter.



Figure 39: Stone steps - Isurumuniya



Figure 40: Stone steps - Perimiyankulama



Figure 41: Stone steps - Vessagiriya



Figure 42: Stupa ruins - Vessagiriya



Figure 43: Stupa ruins - Perimiyankulama

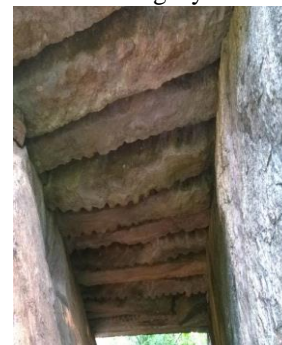


Figure 44: Stone slab - Isurumuniya

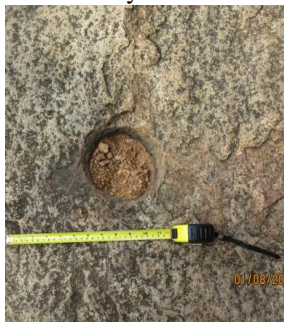


Figure 45 - 47: Postholes in Deegapasana rock-outcrop

3.3 Ancient Water Management Activities

Anuradhapura considered as the center of the ancient dry zone hydraulic civilization. The ancient water management system started in a primitive society base context in Anuradhapura and developed to a sophisticated system in Middle historic periods. Deegapasana rock-outcrop played a significant role in shaping up this water management system since prehistoric times. Anuradhapura ancient settlement located in a lowland dry zone ecosystem. Prehistoric Mesolithic evidence uncovered from some sites in Anuradhapura. Availability of water played a prominent role in the establishment of prehistoric hunter-gathering societies in the area. Deggapasana rock-outcrop consist with some natural rock shelters away from the floodplain of the river Malvathu provide considerably hazard free dwelling for the prehistoric hunter-gathers. Meanwhile, in some places high elevated rock-outcrop disturb the gently

rolling flat terrain and block valleys to make natural water holes. Two cross-sections made from Basawakkulama tank and Thissa Wewa tank to the river Malvathu through Deegapasana rock-outcrop, clearly demonstrate the conversion of natural water holes into the tanks in ancient times (Figure:48).

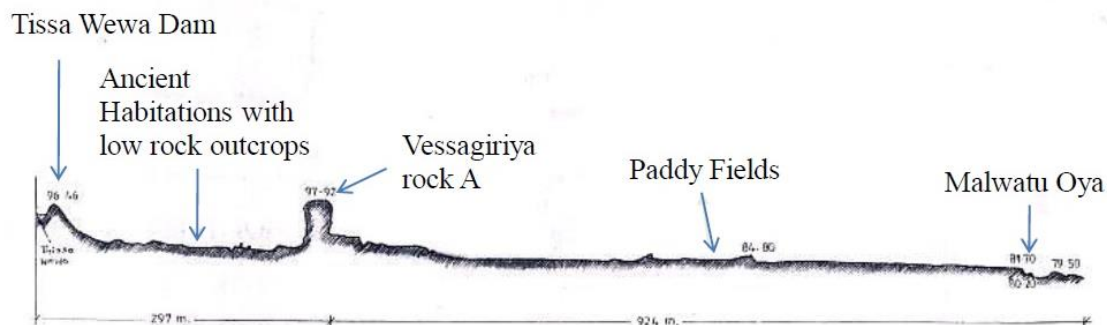


Figure 48: Cross Section from West to East (Thissa Wewa tank to River Malavathu)

The Ranmasu Uyana royal pleasure garden gives evidence on sophisticated landscape and water management system in the middle historic period. This water garden is located East to the Thissa Wewa tank and extends a land nearly 35 acres. According to the Bandaranayke, Ranmasu Uyana was constructed in 9th or 10th century CE (Bandaranayake 1993). 70 feet long channel from Thissa Wewa tank is used to provide water to the rectangular ponds. Complex water flowing network in a navel system manifests the water management skills practiced in Anuradhapura during Middle Historic times.

4. Conclusion

Anuradhapura considered as the first city of the Sri Lanka as well as the starting point of the ancient dry zone hydraulic civilization. Early migrants from India and elsewhere established settlements in lowland dry zone area since Early Iron Age. However, in Historical periods, Anuradhapura became the capital of the country and the center point of the civilization. The natural landscape including the Deegapasana rock-outcrop greatly helped early migrants to form a well-planned city and a hydraulic agriculture landscape in the area. This research was able to identify the influence of Deegapasana rock-outcrop for the settlement pattern of the ancient Anuradhapura city. Rock-outcrop was a favorable factor for the layout of the settlement during different techno-cultural phases. Further interlinkages can distinguish from the ancient industrial activities, water management system, and the built environment of the area.

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