Reviewing the Paleo- Biological Remains of Rajagala Mahalena Cave in The Eastern Province of Sri Lanka.

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ABSTRACT

The Rajagala is the dry lowland of the island, which lies at or below 900m asl, is confined to the north-central and southeastern parts of Sri Lanka. The zone comprises a plain rarely rising above c.40 m asl, but which contains isolated eroded remnants or monadnocks. The site of Rajagala is spread over 1025 acres consisting of more than 700 archaeological remains of prehistoric and historic periods. Preliminary investigations revealed that prehistoric human activity took place in the natural cave of the area before the third century BC. Accordingly, from 2016 to 2019, a selected cave called Maha Lena (ML) was excavated for further investigation. This cave was excavated jointly by Deccan College and the University of Sri Jayawardanepura. Excavations in 2018 and 2019 revealed a large number of prehistoric evidences. Among them are stone tools, bone tools, animal bones, and botanical remains. The main focus of this research paper is to analyze the biological remains found during the excavation of the ML Cave and to assess what the past environment was like through it. We have very limited knowledge of prehistoric research and information in the Eastern Province compared to the Low land Wet Zone of Sri Lanka. Accordingly, the focus was on research questions on the subsistence of prehistoric humans living in the caves of the Eastern Province and how environmental conditions have changed concerning the wet zone. Faunal and botanical remains have been recorded from ML, denoting the prevalence of climatic conditions similar to those of the present.

***Keywords**: Rajagala, Faunal, Botanical, Prehistory, Environment*

Introduction

The present paper is attempted to synthesize the paleo-environment on faunal and botanical remains found during excavations carried out at Rajagala in Ampara District, Eastern Province of Sri Lanka (fig.2). Rajagalatenna, Ampara is famous for being a Buddhist temple complex from the 3rd century BCE. Rajagala monastic complex had been initially named *Girikumhiila Tissa* Pabbatha Viharaya (Paranavithana 1983). The setting of this study spans an area of 4.1 km^2 square kilometres. Rajagala is located at an elevation of 346 m above sea level in the middle part of the mountain. The area in which the site is located in a remarkable zone according to its geological evolution complexity and geomorphologic variability. Rajagala archaeological site could be approached through Ampara - Mahaoya highway near the Rajagalathanne village (Fig.1). The area lies within "N 070 29'42'' and E 810 36'54''. Ampara in the dry zone is surrounded by agricultural province holds. The mean temperature is the 300C. The Highest temperature is 36oC. The lowest temperature is 240C during December and January periods. Annual rainfall is 1400mm and it rains during monsoon time. The dry season from March to September. The rainy period falls from October to February.

This research deals with the study of palaeo- biological remains (faunal and botanical) from excavations at ML season 2018-19. The botanical remains discussed here are segregated from two trenches (Trench No. S8E0 and S8E1) and three pits (Pit No. 1, Pit No. 2, and Pit No. 3). And studied in detail concerning the morphological and anatomical investigation of seeds, fruits, and nuts. These plant remains are likely to have been incorporated in the deposits from certain human activities. However, it is difficult to mention with certainty how and through what sort of activity the material got carbonized and came into the deposits. To define the taxonomic diversity of faunal remains the excavations. To relate these to the environmental setting of the site at various times in the past and to spatial and temporal patterns of past exploitation of animals to integrate zooarchaeological analyses both with other bio archaeological studies and with the archaeology to reconstruct past subsistence systems and paleoenvironment at the site.

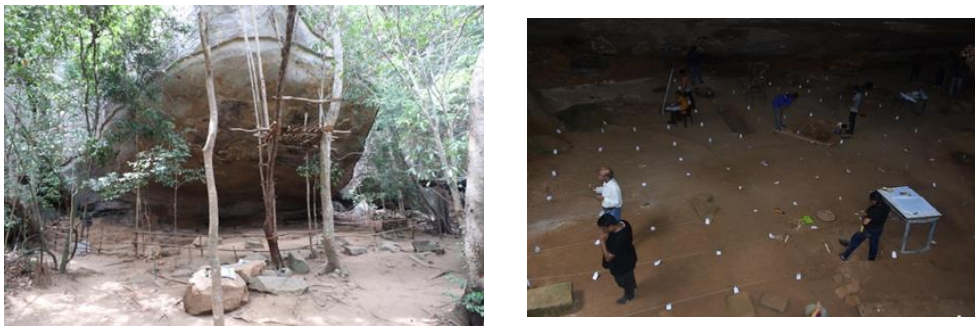

Figure 01: *General overview of the Mahalena cave site*

Materials and Methods

Testing at ML in 2019 was limited to the excavation of test units in the Northeastern corner (Fig.1). Excavation of the Pleistocene rock shelter of ML has yielded a well-sealed and major cultural sequence covering the Mesolithic phase of Sri Lanka (bones, shells, shell fragments, and microliths) (fig. 5).

Biogeographically, the Rajagala area lies within the low country Dry Zone. It supports tropical natural vegetation with grassland, rocky plains, plains, water streams, rough gradients, and man-made tanks. A brief phytogeographical survey of the site in the context of different ecological formations occurring in the Rajagala project area is given herewith for improving understanding of modern and ancient environmental conditions around the site. Botanical remains were segregated from the soil samples by sieving, visual inspection, and classified in Palaeobotany laboratory under low power Stereo-binocular (LEITZ WETZLAR) microscope. It has been found that the plant remains did not actually catch fire during conflagration but burnt slowly, retained their shape and fine morphological details. In most of the remains, the surface is partly eroded and the artefacts of carbonization could be seen. These were critically studied and identified based on external morphological features also, photographed satisfactorily under a research trinocular stereo macroscope (WILD PHOTOMAKROSKOP-M 400 1,25x). The features were then compared with wild and cultivated materials to aid the identification. The measurements were noted with the help of an eyepiece micrometre. To devise sampling strategies for the recovery of various categories of animal remains bones of mammals, reptiles, birds,

fishes, shells crustaceous. ets. The assemblage included faunal remains from Rajagala careful labelling of specimens with exact context data the lifting and packaging of specimens washing and drying of material labelling of all elements recovered storage of material awaiting analysis and card index end catalogue of all samples with full context details. This material was brought from the Rajagala to the University of Jayewardenepura. The identification was made by comparing the reference collection they lived in wet on day zone forest of Sir Lank end also the wild animal lived deer, sambur, buffalos, monkey, mongoose, wild cat, Leopard for which mainly considered in sir lank. The Department of Archeology has a good collection of skeletons of modern animals for comparative studies.

Results and Discussion

The archaeobotanical analysis is exclusively based on twenty samples of well-preserved carbonized plant remains. All the samples were represented by the fragments of wild fruit nuts with charcoal bits (Table 2). These nuts are of Aleurites moluccana (L.) Willd. commonly called candlenut/Indian walnut/Kekuna belong to the family of Euphorbiaceae. Nuts are drupe, subspherical, somewhat laterally compressed, measuring 2.3 cm long and 1.07 cm broad, ovoid, smooth in surface (Fig. 3). These candlenuts are often used cooked called kemiri in Indonesian and buah keras in Malaysian cuisine (Orwa et al. 2009). Nowadays candlenuts are used as food and candlenut oil is in use in South East Asia and the Pacific. By removing the outer hard coat the seeds are pounded and eaten as a thick sauce. 100 gram of seed contains 626 calories energy, 63 gm fat, 19 gm protein, 8 gm total carbohydrate, 7 gm water, 3 gm ash, 200 mg phosphorus, 80 mg calcium, 2 mg iron, and 0.06 mg thiamine. The seed oil is used as a substitute for diesel suitable with its modification and the residue is used for conversion to alcohol or pyrolysis. The Mesolithic habitation at Batadomba Lena (28000 – 11500BP), Belilena Athula (8000BP.), Pothgul Lena Alawala (16000BP.) in the wet zone has yielded large quantities of the edible nut *Canarium Zeylanica* (Kekuna). Remains of *Canarium Zeylanica* were found in prehistoric levels of Rajagala ML excavation. This tree is not found in the dry zone.

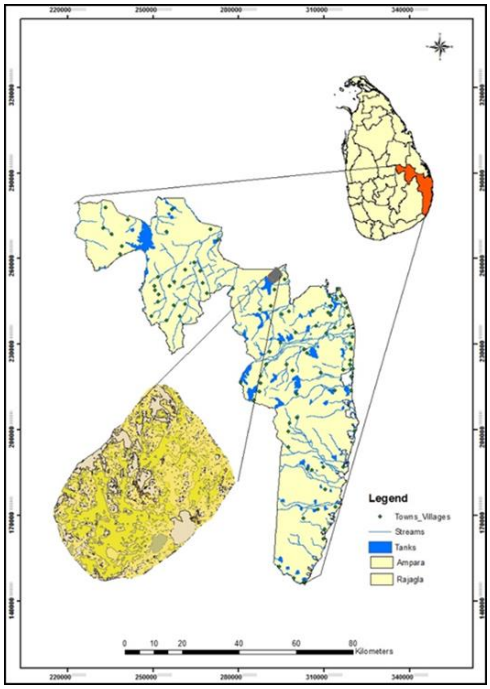

Figure 2: *Rajagala Archaeological Site in Ampara District*

The nut stone was used for cracking nuts of Canarium *Zeylanica*, and the absence of this lithic types in the prehistoric deposits of the dry zone, as opposed to those of the wet zone where it is common, could signify that this tree did not at any time, during the Mesolithic phase of Sri Lanka, grow in the dry zone, which in turn could mean that a wet zone type of rain forest never existed during this period in what is today the dry zone (Deraniyagala 1992).

Faunal assemblages are collected from the Ampara Rajagla ML archaeological research project and have been dealt with separately in the following discussions. More than 32 species of animal belonging to mammals, reptiles, birds, mollusks, crustaceous, and fish were identified from the excavation. The total number of animal bones and shells found out from the Rajagala ML archaeological excavation site is 4935 comprising seven excavation layers. For the analysis maximum number of bones found are 404, shells 197 respectively (fig.4). The identifiable bones element

the considerable number of unidentifiable bones high degree of very small fragmentation of bones this may be due to human and taphonomy activities.

Figure 3: *Nuts of Aleurites moluccanus (L.) Willd. (Candlenut/Indian walnut/Kekuna)*

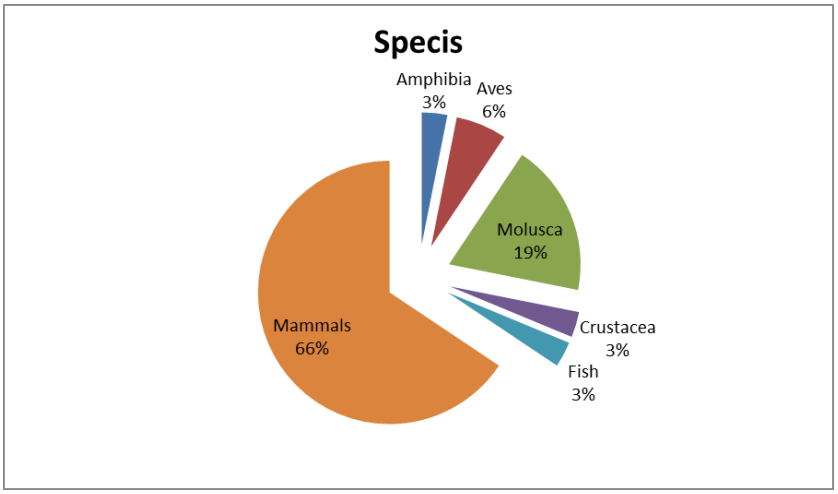

Figure 4: *A chart showing the relative proportion of faunal species*

The excavation in Rajagala habitation yielded a very large quantity of faunal remains from the Mesolithic horizon and the following forms have been identified (Perea 2019): **MAMMALIA**- *Canis aureus lanka*, Ceylon Jackal, *Felis Sp*, Wild Cat, *Panthera Pardus*, Leopard, *Viverricula indika*, Ceylon Small civet – cat, *Pardoxurus*

sp:, Common Indian palm – cat, *Herpestes sp*: , Mongoose , *Lutara lutra,* Otter: **ARTIDACTYLA-** *Bubalus Budalis* Water buffalo, *Axis axis ceylonensis,* Spotted deer, *Cervus unicolor,* Sambur, *Sus Scrofa,* Wild Pig, *Moschiola Meminna,* Mouse Deer: **PRIMATE-** *Semmopithecus Priam,* Tufted Gray Languor, *Trachypithecus vetulu vetlus,* Purple –faced Leaf Monkey, *Macaca sinica sinica,* Toque Monkey: **RODENTIA-** Mouse Rat, *Rattus Sp*:, Rat, *Hystix indica,* Porcupine, *Petinomys fuscocapillus,* Small Cleon Flying –Squirrel, **REPTILES-***Serpentoid Sp*:, Snake, *Varanus Bengalensis,* - Land Monitor, *Melanochelys Triiuga,* Terpin - Hard Shelled, *Lissemys Punctata,* Terpin - Soft Shelled.

Among the molluscs at Rajagala were numerous specimens of the arboreal forms Acavus *sp., bddomea sp. Cyclophorus sp. Tortulosa sp*. and *Lamellidens sp*. (Table 1). The excavation in the caves of Beli Lena, Batadomba Lena, Alu Lena, Kabara galge, Beli galage, Beli Lena, Alawala Potgul Lena has yielded numerous specimens of the arboreal forms *Acavus Prosperus* and *Acavus reseolabiatus* (Deraniyagala 1992; Wejepala 1997; Perera 2010; Adikari 2009). Batadomba Lena has radiocarbon dating from 28500 to 12000BP. have yielded numerous specimens of A. Prosperus and A. Phoenix, which are the same as the species occurring in the vicinity of the cave today (Draniyagala 1992). Acavus has been found in numerous Mesolithic cave habitations in the dry zone, notable instance is Bellan-bandipalassa, Udupiyan galge, Alugalge Telulla, Nilgala cave. Acavus is not live in the dry zone of Sri Lanka. Above snail faunal data suggests that Acavus was brought into the dry zone by a prehistoric man perhaps as an ornament or as an item of exchange.

Class	**Layer**	***Species***	
GATOPODE	3	*Acavus sp*	3
,,	3	*Cyclophorus sp:*	2
,,	3	*Pila sp:*	10
,,	6	*Pila sp:*	3
,,	7	*Acavus sp*	1
,,	7	*Pila sp:*	1
,,	7	*Paludomus sp:*	1
,,	8	*Acavus sp*	6
,,	8	*Cyclophorus sp:*	4
,,	8	*Paludomus sp:*	17
,,	8	*Pila sp:*	34
BIVALIVIA	8	*Lamelliden sp:*	2
,,	8A	*Lamelliden sp:*	2
GATOPODE	8A	*Acavus sp*	4
,,	8A	*Cyclophorus sp:*	3
,,	8A	*Paludomus sp:*	26
,,	8A	*Pila sp:*	66

Table 1: *Detailed Analysis of Major Taxonomy Class Mollusks*

Sr. No.	Trench	Lot	Layer	Depth	Sample
1	S8E0	003			42 fragments of wild fruit nuts with a lot of Charcoal bits Coprolites of some small modern wild animals
2	S8E1	002	4		7 fragments of wild fruit nuts with a lot of Charcoal bits and Coprolites of some small modern wild animals
3	Pit 01		03	80.69 cm	4 small fragments of wild fruit nuts with Charcoal bits
4	Pit 01		16	59.19 cm	13 small fragments of wild fruit nuts with Charcoal bits
5	Pit 01		18	55.99 cm	6 small fragments of wild fruit nuts with Charcoal bits
6	Pit 01		21	57.59 cm	3 small fragments of wild fruit nuts with Charcoal bits
7	Pit 01		22	59.19 cm	13 small fragments of wild fruit nuts with Charcoal bits
8	Pit 01		23	59.69 cm	12 small fragments of wild fruit nuts with Charcoal bits
9	Pit 01	001	24	64.49 cm	22 small fragments of wild fruit nuts with Charcoal bits
10	Pit 01	002	24		Fragments of wild fruit nuts with lot of Charcoal bits
11	Pit 01	002		97.42 cm	11 small fragments of wild fruit nuts with Charcoal bits
12	Pit 01	003	24		27 fragments of wild fruit nuts with lot of Charcoal bits
13	Pit 01	003		S.D.: 97.42 cm E.D.: 97.35 cm	35 fragments of wild fruit nuts with lot of Charcoal bits
14	Pit 01	004	25		2 fragments of wild fruit nuts with Charcoal bits

15	Pit 01	004		80.49 cm	4 fragments of wild fruit nuts with Charcoal bits
16	Pit 01		25	86.69 cm	27 small fragments of wild fruit nuts with Charcoal bits
17	Pit 02	003			5 fragments of wild fruit nuts with Charcoal bits
18	Pit 03	004	03		12 fragments of wild fruit nuts with Charcoal bits
19	Pit 03	004	25		5 fragments of fruit nuts of *Aleurites moluccana* (L.) Willd. (Kekuna) and 6 fragments of wild fruit nuts with Charcoal bits
20	Pit 03	005		98.08 cm	12 fragments of wild fruit nuts with Charcoal bits

Table 2: *Archaeobotanical findings at Rajagala*

Figure 5: *Extent of the Ash pit in Pit 3 and Pit 4*

Conclusion

The 2019 first phase of excavation at ML was very limited but provided quantitative data available are sufficient to understand the Paleoenvironment condition in the prehistoric context. Faunal and botanical remains endemic to the wet zone found among the Rajagala deposits correspond to the ecological pattern of the late Pleistocene wetland. *Canarium Zeylanica* and Acavus sp. endemic to the wetlands may have been brought in by prehistoric man. This implies that there was an exchange between the ecological zones. Palynological evidence gathered from the caves at Beli-lena Kitulgala, Batadomba-lena, and Bellan Bandi Palassa suggests that early Mesolithic groups in the interior and hinterlands exploited a wide range of food plants which included canarium nuts, wild breadfruit, wild bananas, and Dioscorea yams. Faunal evidence from Rajagala suggests a range of animals were eaten that included small vertebrates such as porcupine, mouse-deer, giant squirrel, flying squirrel, civets, pangolin, monkeys, and rats, several species of birds, snakes, molluscs, and several various types of fresh have been documented. There has been no drastic environmental change in the analysis of the present ecological formations around the Rajagala and the botanical remains found during the excavations. palyno-stratigraphic study of two peat swamps in the wet highlands of Sri Lanka's Horton Plains, Premathilake and Risberg (2003) presents a useful summary of generalized climatic trends on the island over the last 25 kya (Premathilake and Risberg 2003). The pollen spectra suggest semi- arid conditions and relatively species-poor plant community 20000- 15500BP. The snail fauna at Batadomba lena , Beli lena from 28500- 11000BP. indicates that moisture conditions during this period of late Pleistocene to early Holocene were scarcely drier than those prevailing today. The above data suggest that the temperature in Sri Lanka had not dropped by more than 6^0C between 28000 and 13000BP. and not over 3^0C between 13000 and 11200BP. (Deraniyagala 1992).

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