

Sediment and archaeology along the southern coast of Sri Lanka

Gamini Adikari¹, Jan Risberg²

Postgraduate Institute of Archaeology, University of Kelaniya, Sri Lanka

Introduction

This report constitute the results from inventory corings in southern Sri Lanka between February 19-26, 2000, in relation to the PhD prorates of Gamini Adikari and Raj Somadeva, of the Postgraduate Institute of Archaeology (PGIAR), Colombo. The purpose was to study the environmental settings of shell-beds in the coastal zone and the sediment types accumulated in the flood plain of Kirindi Oya. An attempt to classify the shell beds in relation to natural and anthropogenic interferences have been made. The second purpose was to discuss what methods could be used for further studies and also to design a minor project for two Swedish students.

Typical features of the area under investigation are extensive dune formation and large lagoons. The ones not fed by rivers are very saline and used as salt pans. The Kalpitiya lagoon was formed by complex spit growth, while the Hambantota lagoons were formed due to drowning and barrier development. Since c.6000 BP, sea levels have fluctuated reaching at the most ca. 2.5 m higher than today (Katuphota 1995). The sediments carried by the Kirindi Oya have caused fertile soils which now are used for paddy cultivation (Swan 1983).

The bedrock in the area is made up from biotite rich gneisses and granites of the Vijayan Series. The soils are characterised as reddish brown earths and low humic gley soils north of the sand dune complexes. Regosols are developed on the recent beach and sand dunes (National Atlas of Sri Lanka 1988, cf. also Deraniyagala 1992).

Methods

The soils and sedimentary layers were investigated in open sections using jackhammer technique adapted with a flow through sampler. Minor studies were undertaken with a Russian peat corer and a soil auger.

Key Words: Coaster Geomorphology, Environment, Prehistory

Results and interpretation

Arabokka area (6° 08'15"N, 81° 05'49"E)

Below an open section of 2 m height in the north - western part of the lagoon, corings were undertaken using jackhammer techniques. A general stratigraphic description is as follows (all depths in cm from the ground surface, i.e. including the open section):

- 000-040 Site with a high organic content. Probably wind transported and/or the result from surface runoff (alluvium).
- 040-200 Shell beds. There is a downward increase in the shell concentration and the number of complete shells. The mixed in material in the upper part appeared to be similar to that in the overlying unit. These layers also contain a varying degree of artefacts (human and animal bones, quartz, pottery, charcoal, grinding stones, burnt clay).
- 200-540 Brown to grey coarse to medium sand mixed with complete and fragmented shells and pebbles. Interbedded are 5-10 cm layers consisting of sandy silt/ silty sand. The latter are free of shells. Piece of cemented beach rock at 295 cm. Some of the fine grained sequences might be repeated.
- 540-580 Dark grey to black silt and sand with occasional shells of a different type compared to the sequence 40-200 cm

Corings at Indivinna on the northern flank of the sand dune that closes Karagan Lewaya revealed the following strigraphy:

- 000-110 Fine sand, brown
- 110-130 Fine sand, dark brown (high in organic matter?)
- 130-140 Medium sand with occasional shells, light grey
- 140-160 Missing
- 160-190 Sand with pebbles (iron nodules), Fe precipitation, light brown
- 190-220 Sandy silt with abundant shells, grey
- 220-240 Sand with Fe-precipitation, light brown
- 240-260 Sand with occasional shell fragments
- 260-280 Silty sand, blusih
- 280-290 Sand with abundant shells, dark grey
- 290-310 Sand, light brown

310-320 Silty sand, bluish

All layers from 160 cm downwards reacted with HCL, indicating the presence of shell, shell fragments and/or carbonates.

Investigations with the soil auger in the marsh land in the north western part of Karagan Lewaya indicated varying size distribution to a depth of c. 2.5m.

Interpretation

We concluded that first sequence is the result from lagoon formation and sea level changes. The lagoon was trapped behind a prograding spit consisting of sand, now appearing as dunes (second coring). The investigated site is never reached by floods, i.e. it is located at a higher elevation than the present lagoon. Probably it represented near shore conditions during a high sea level stand that were turned into dry land when sea level sunk. It seems to be relatively easy to explain the sequence as the result from natural environmental changes. The problem which remains to be answered is when and how the artefacts were enclosed in the shell-beds. Levelling should be carried out to investigate the relation between the shell beds and the present day lagoon. The uppermost 110 cm in the sand dune corings represent an eolian sediment. It is possible that the underlying dark brown unit is a buried soil horizon. The remaining sequence represent shore accumulations in various environments, all with precipitated carbonates and/or shells.

Kalamatiye (6°05'02"N, 80°56'33"E)

This site display large excavation of shells in a relatively small lagoon. Artefacts (grinding stones, burnt bones, bones, charcoal) from unknown stratigraphical positions, indicate that stone age people were present. Stratigraphy as follows (upper 200 cm from an open section, the rest by Russian corer):

- 000-123 Silt-gyttja with occasional shells in the lower 20 cm. Dark brown colour.
 - 123-350 Silty sand with abundant horizontal stratified shell-beds (this sequence is being excavated).
 - 350-390 Gyttja silt with shells.
 - 390-507 Silty sand with occasional shells.
- Jackhammer indicate a depth >10m.

We interpret these shell beds to have been formed in the lagoon under natural conditions. Proper archaeological excavations are needed in order to understand Stone Age activities at the site.

Malikolaniye Vāligatte

The site is connected to the lagoon further to the south, i.e. closer to the ocean. Jackhammer corings as follows (from a non-excavated area in the eastern part):

- 000-040 Sandy silt, brown
- 040-055 Sandy silt, grey
- 055-080 Silty sand, light grey with Fe-precipitation
- 080-200 Silty sand with occasional pebbles, light grey with Fe-precipitation

We interpret this sequence to represent lagoonal sediments (the upper 55cm) overlying weathered bedrock. Artefacts (pottery, bone, grinding stones, quartz debitage) have been found within shell-beds by miners. Shell beds occur in patches, i.e. we investigated an area in between the shell-beds.

Hamagodana (6°09'43"N,81° 10'38"E)

Corings west and east of a small water hole to the west of the large lagoon Malala Lewaya. The water hole is connected to the Malala Lewaya. Since water fluctuates in the water hole in the same way as in the lagoon they seem to be located at about the same elevation. Artefacts (burnt clay, quartz, grinding stone, pottery, stone tool (chert), charcoal) have been found in shell-beds east of the water-hole. The shell-beds have so far only been identified north and south of the connection to Malala Lewaya. They appear in mound like shapes. Coring revealed the following:

Site 1 (west of the water-hole)

- 000-070 Sandy silt, brown
- 070-160 Weathered bedrock

Site 2 (on the shore of the water hole)

- 000-005 Silty sand, oxidised
- 005-120 Weathered bedrock

Site 3 (In the Water hole with Russian corer)

- 000-007 Water
- 007-120 Clayey silt

Site 4 (On top of mound south of the connection)

- 000-030 Silt, rich in organic matter
- 030-115 Shells with silt and sand, grey. Complete shells with sand inside were observed
- 115-140 Sand with occasional shells and fragments (Fe- precipitation)
- 140-160 Silty sand with pebbles
- 160-170 Sand with occasional shells and fragments (Fe- precipitation)
- 170-185 Sand with shell fragments
- 185-190 Silty sand with pebbles
- 190-200 Sand with pebbles
- 200-210 Sand with shells, grey
- 210-230 Sand with shells, brown
- 230-240 Sand
- 240-350 Sand with occasional shells and fragments

Site 5 (on the eastern shore)

- 000-020 Silty sand with minor shell fragments
- 020-040 Silty sand
- 040-080 Clayey silt

Site 6 (on the southern side of the connection to Malala Lewaya)

- 000-010 Sand
- 010-040 Silty sand

Site 7 (on top of a mound Ø 30 m, north of the connection to Malala Lewaya)

- 000-030 Silt, high in organic matter, shells and fragments, dark brown
- 030-090 Highly fragmented shells, organic matter, light grey
- 090-130 Organic matter, shells, dark grey
- 130-200 Sand with shell and fragments, light brown

Site 8 (south of site 7, close to the connection)

- 000-030 Site, rich in organic matter, shell fragments, dark brown
- 030-120 Silty sand with abundant shell fragments
- 120-160 Sand with shells (beach)

Site 9 (east of site 7, in between two mounds)

- 000-005 Silt, rich in organic matter, dark brown

- 005-090 Sand, coarsening downwards
090-160 Silty sand

Site 10 (open section close to site 7)

- 000-060 Silt, high in organic matter, shells and fragments, dark brown
060-067 Silt, high in organic matter, shells and fragments, abundant charcoal with
a lateral extension of 80 cm, dark brown
067-115 Sand with abundant shell, light grey
> 115 Sand with occasional shells (beach sand)

Interpretation

Shell beds occur only east of the water hole, north and south of the oya connecting the water hole and Malala Lewaya. They display more or less circular concentrations. When shells occur, the minerogenic sediment consists of beach sand which has been accumulated from long shore currents, probably prior to the closing of Malala Lewaya. From the airphoto it is clear that sand was transported from east to west.

The overlying layers, extremely rich in shells and fragments are interpreted as being the result of anthropogenic activities. This is supported by finds of various artefacts, both as loose finds on the ground surface and stratigraphically well defined strata. We believe that humans did not arrive to the site until the large lagoon had been formed. The observed charcoal at site 10, 60-67 cm depth, is interpreted to represent human activities.

The flood plain of Kirindi Oya

The area is mainly utilised for paddy cultivation. Slightly elevated areas serve as settlement sites. One question with regard to the construction of these is whether they are related to an undulating bedrock surface or are they constructed by man? Another question is regarding the possibility of using the flood plain sediments for stratigraphic studies on climate etc.

Site 1 (Diyasyaya, on an elevated settlement site; east of Kirindi Oya)

- 000-003 Site sand with pebbles, Fe-precipitation, brownish
003-010 Sandy silt, grey
010-015 Sandy silt with brick fragments, dark brown

- 015-030 Sandy silt with brick fragments, grey
- 030-080 Silty sand, Fe-nodules (?), light grey
- 080-110 Sand silt, light brown
- 110-280 Silty clay, light grey

Site 2 (north of the settlement site, at the edge of the paddy field)

- 000-130 Sand silt
- 130-160 Silty clay with thin lenses of sand

Interpretation

It is concluded that the sediments underlying the settlement are similar to those in paddy field. Therefore we interpret both to be the result from river flooding.

Site 3 (*Pustolamulla*, on a mound littered with pieces of pottery and slag; east of Kirindi Oya)

- 000-100 Silty sand, brownish, pottery at 45 and 70 cm
- 100>140 Weathered bedrock

Site 4 (Parallel to site 3)

- 000-080 Silty sand, brownish, with pottery and slag
- 080>120 Weathered bedrock

Site 5 (*Koonvalana*, a large mound cut through a recently constructed canal; west of Kirindi Oya). The site revealed about three metres of sandy silt with abundant pottery, burnt and unburnt bones, slag, beads. No detailed investigation was carried out.

Interpretation

Pustolamulla and *Koonvalana* are both settlements sites resting on bedrock on the eastern and western side of the Kirindi Oya flood plain respectively. None of these have been reached by fine grained flood sediments.

Conclusion

Altogether, ca. 32 m have been cored by the jackhammer technique. The technique applied is considered reliable. The only exception is Arabokka, Site 1, where the

layers of sandy silt and sand might be repeated. This could happen when compact material (sandy silt) is supposed to be pushed out by less compacted material (sand).

Lagoonal sites

The investigated lagoonal sites can be divided into three types. At Kalametiya, shells are accumulated in a natural way and until otherwise proven there are no artefacts incorporated in the shell beds themselves. At Arabokka, it is likely that shells and artefacts were accumulated simultaneously. This means that humans were active in the area during the formation of the shell beds. At Hamagodana, it is clear that Stone Age humans are responsible for the construction of mounds. Probably, they arrived to an area with abundant shells deposited at a time when the sea level was about 2 m higher than today (cf. Katuphota 1995). The mounds may have functioned as a protection from extreme high sea level sands. An alternative reason for deeper water could be a period with increased precipitation on the southern slopes of the elevated highlands of central Sri Lanka. If the lagoon was already cut off from the ocean, this would result in a higher water discharge in the rivers and thus deeper water in the lagoon. All these possibilities are important to investigate, since they also affected the food intake by humans. Access to the ocean would lead to a different water chemistry than a closed lagoon and a higher discharge of water. Perhaps, measurements of $^{18}\text{O}/^{16}\text{O}$ in the shells could indicate variations in salinity and temperature.

Kirindi flood plain

Prior to regulation, Kirindi Oya was allowed to spread its sediment over a large area, mainly east of its present day location. The lower part serves as paddy fields in the present day, whilst the elevated areas serve as settlements. The latter may be remnants of ancient levees, which on the air photos display a dendritic and elongated pattern making it unlikely that they are human constructions. Probably, the dendritic pattern is a remnant from the time before river regulation, when its course varied over time. It is possible that people have utilised these ancient levees for settlement construction. In some cases the levees might have been enforced in order to protect the settlement sites at the boundaries of the flood plain. They both rest on bedrock and were never reached by the floods of the river. The cultural layers at Pustolamulla are considerably thinner compared to those at Koonvalana. This could depend on differences in e.g. time period in use, type of activities, population density etc.

Future suggestions

In order to prove these speculations, archaeological excavations, levellings, radiocarbon datings, and Palaeoenvironmental studies, are needed in both areas. Palaeoenvironmental studies may involve stratigraphical studies of diatoms, phytoliths, pollen, molluscs, grain size distributions, organic carbon content, oxygen isotopes. We have selected the Arabokka site as suitable to be further investigated by the Swedish students. Gamini Adikari will perform proper archaeological excavations at the site during August 2000. Therefore, Palaeoecological studies in sediments in the surroundings and from the excavated area will improve the interpretations on environmental changes prior to, during and after the settlement period.

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References

- Daraniyagala, S. U. 1992 *The prehistory of Sri Lanka*. Part I & II. Colombo: Department of Archaeological Survey. Memoir Vol. 8, 813 pp.
- Katuphota, J. 1995 *Evolution and the geological significance on Late Pleistocene fossil shell beds of the southern coastal zone of Sri Lanka*. Natural Resources, Energy and Science Authority of Sri Lanka. 64 pp.
- National Atlas of Sri Lanka*. 1988 Survey Department of Sri Lanka. 142 pp.
- Swan, B. 1983 *An introduction to the coastal geomorphology of Sri Lanka*. A publication of Nation Museums of Sri Lanka. 182 pp.

Samples brought to Stockholm for preliminary studies:

Arabokka 580cm (silty sand with occasional shells)

Kalamatiye 407cm (silty sand with occasional shells)

Kalamatiye 507cm (silty sand with occasional shells)

Hamagodana, Site 3, 120cm (clayey silt)