Characterization of Soils at the Vessagiriya Archaeological Site in Relation to Past Settlement Sites

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Introduction

The study of archaeology is based on artifacts and ecofacts retrieved from explorations and excavations. In the past two decades environmental archaeology has come to play a crucial role in data collection and interpretation. The application of archaeological sciences has introduced the use of multidisciplinary studies in archaeology. It is in this context we wish to argue that information from soil, insects and pollen could be integrated with investigative and interpretive archaeology. When a particular human activity related to land use is carried out on the earth's surface for a sufficient time span, it produces certain imprints on the soil. Therefore, information on past cultural activities can be complemented by analyzing soil characters that are mainly influenced by human interventions.

This paper describes a preliminary soil characterization carried out at the Vessagiriya archaeological site. The objective was to characterize soils at the Vessagiriya excavation site to relate them with past cultural events in the site.

Methodology

Soil samples were collected from one of the excavation sites in Vessagiriya located at Anuradhapura. Soil samples were obtained from five layers at depths of 0 – 25 cm (D1), 25 – 37 cm (D2), 37 – 55 cm (D3), 55 – 89 cm (D4), and 89 – 170 cm (D5). Sand (diameter, 0.05-2 mm), silt (diameter, 0.002-0.05 mm) and clay (diameter, less than 0.002 mm) proportions in each layer were determined by the pipette method (Gee and Baurder, 1986). The sand fractions were oven dried and fractionated into five groups by mechanical sieving. The five groups were the particles having diameter of 1-2 mm, 0.5-1 mm, 0.5-0.3 mm (medium sand), 0.3-0.1 mm (fine sand) and 0.1-0.05mm. Fine sand / silt and medium sand / silt ratios were derived. Soils were digested with aqua regia and hydrofluoric acid in a closed vessel to determine total P content (Hossner, 1996). Available P, occluded P in Fe, Al oxides and hydroxide and Calcium Phosphate were extracted by using standard fractionation schemes as described by Kuo (1996). Extracted P fractions were determined by the Ascorbic acid method (Kuo, 1996). Organic matter content was determined using the Walkley & Black method (Nelson and Sommers, 1996). These results were used to complement information on archeological findings.

Results

The texture of soils in all five layers was sandy. Fine sand / silt and medium sand / silt ratios were different among the layers. The organic matter percentage of soil gradually reduced with depth. The maximum organic matter content was 1.2% in the D1 layer.

As shown in Figure 1, layers of D1 and D2 showed the highest total P concentration which were five times higher than the minimum in the D4 layer. In D3 and D5 there was no significant difference in total P concentrations, which were two times higher than the minimum. Table 1 shows that the D5 layer has comparatively extreme proportions of soil inorganic P fractions. Layers of D3 and D4 expressed similar signature in inorganic P fractions. The D1 and D2 layers showed similar inorganic P fractions.

Discussion

Different fine sand / silt and medium sand / silt ratios indicted that the soil profile was disturbed by external factors. When the landscape evolution of the site is considered, siltation could be the most possible natural external factor. The sandy texture and the organic matter variation along the profile showed that there has been no siltation process in the past. Therefore, human influences could be the major reason for the disturbance of soil at the Vessagiriya site.

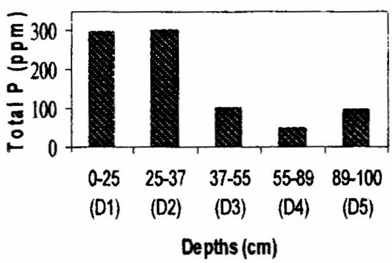

Figure 1. Total Phosphorus concentrations in soil layers

Table 1. Percentage of different fractions of inorganic P in soil layers

Depths (cm)	F 1 % *	F 2 % **	F 3 % ***
0 - 25 (D1)	2	74	24
25 - 37 (D2)	2	74	24
37 - 55 (D3)	7	24	69
55 - 89 (D4)	9	22	69
89 - 100 (D5)	4	83	13

* Easily extractable P
** Tightly bound or occluded P
*** Calcium phosphate and apatite

Different levels of total P among the layers confirmed that diverse cultural phases existed in the site as interpreted by archaeologists. Varying proportions of P fractions demarcate the soil layers, which were subjected to various land use systems. Similar proportions of P fractions in D1 and D2 layers indicated that these layers were subjected to the influence of the same land use system. Similar proportions of P fractions and different total P concentrations in D3 and D4 layers indicated that they were under the same land use system but in different intensities and durations. According to the archaeological findings D3 and D4 layers belong to the Early Iron Age dating to 1000 BC – 400 BC. The deepest layer (D5) showed remarkably different proportions of P fractions, expressing that this soil layer was subjected to different cultural phase. According to archaeologists D5 represents the Prehistoric culture that had a hunting and gathering economy. As P fixed in Fe, Al oxides and hydroxide content increases with time of soil development, this fraction of soil P can be used to determine the relative age of soils. This theory was correlated with chronological sequences developed by archaeologists using artifacts at the Vessagiriya excavation site.

In the above context, it can be shown that results of soil analysis complemented archaeological interpretations. The soil P fractionation result was a valuable tool to demarcate past cultural phases to show that the Vessagiriya archaeological site was under different human settlements at different eras.

References

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