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RADIOCARBON DATING OF SOME PLANT REMAINS IN WEUDA SEDIMENTS FROM SRI LANKA

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ABSTRACT

Two plant remains preserved in a clay sedimentary bed located in the Weuda area, where the sediments are considered to be glacial in origin were dated using 14C method. 14 C were measured using the Accelerator-Mass-Spectrometry. The samples yielded the ages of 435±75 and 176±71 years and $\delta^{13}C$ values of -28.4, indicating relatively young ages for the plant remains. This indicate that the plant remains deposited in a lacustrine environment and then sediments were subjected to several cycles of erosion and deposition.

Key Words: Clayey sedimentary beds located in the Wauda area, Accelerator-Mass-Spectrometry, ^{14}C dating.

1. INTRODUCTION

The rhythmic varve like sediments in Weuda[1,2,] of the Kurunegala district in the northwest Sri Lanka is considered to be Paleozoic age which was argued on the basis of pollen. Based on the sedimentological analysis of these sediments it had been stated that they had either glacial or a glaciofluvial origin[1,3,4]. However, some geoscientists are skeptical about the pure glacial origin for these sediments and suggested a local lacustrine origin[5]. The granulometric and statis1ical analyses as well as field observations have indicated that sand and peaty clay layers in Weuda have a glacio-fluvial origin[1]. Pitawala and Dahanayake. (1992) analyzed the clay minerals in the peaty clay layers of Weuda sediments using a X- ray diffraction technique and concluded that the clay minerals in this area are more or less similar to characteristic clay minerals in typical glacial sediments found elsewhere in the World. After palynological study or well preserved but highly decomposed pollen embedded in peaty clay and sandy clay layers from Matibokka and Pussalla in Weuda area, Dahanayake et al. (1988) suggested that these sediment could be of Permo-Triassic age (?). Premarathne[5] (2001) has also discussed the geolog1cal processes and climatic conditions that might be subject to the Weuda sediments. He suggested that there could have been several episodes of reworking before these sediments were laid to rest within the present colluvial and lacustrine environments. This paper discusses the age of decomposed plant remains found within the clayey beds of Weuda sediments, as determined by the means of ^{14}C Accelerator-Mass-Spectrometry. This is the first time that decomposed plant materials embedded within the sediments of Weuda valley have been dated using the radiocarbon method.

2. REGIONAL SETTING

Geologically nine tenths' of Sri Lanka is composed of high grade metamorphic rocks of Precambrian age. Precambrian solid rocks of Sri Lanka have been subdivided into four lithological units (Fig 1) namely the Highland Complex, the Wanni Complex, the Vijayan Complex and Kadugannawa Complex[6]. Remaining one tenths of the island are composed of sedimentary beds and igneous bodies. Among these sedimentary rocks are Jurassic sediments deposited in faulted basins exposed at Tabbowa and Aandigama, Miocene limestone and sandstones, unconformably overlying the Precambrian basement in the North, Northwestern, and Southeastern coastal belts of Sri Lanka[7,8,]. Sediments belonging to Quaternary age such

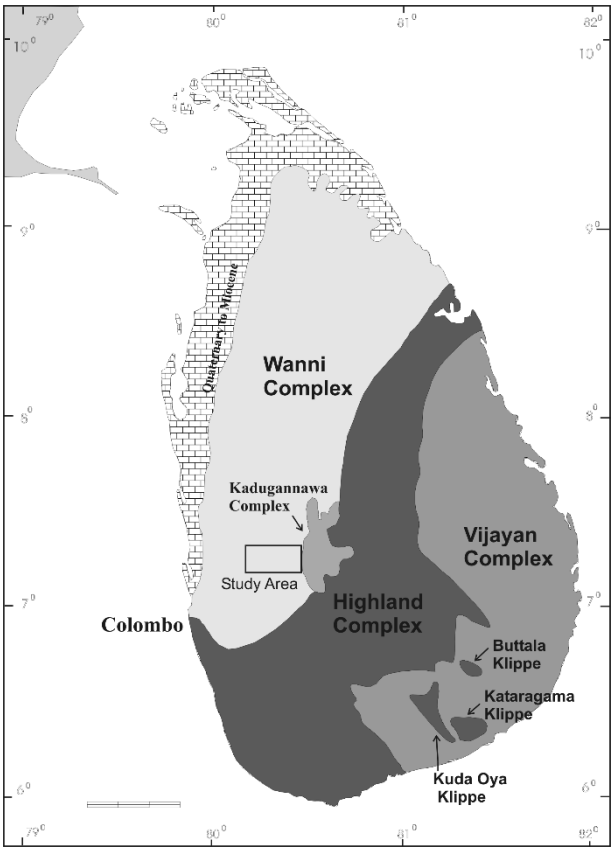

Figure. 1. General geology of Sri Lanka

as red beds, unconsolidated beach sand, alluvium, lagoonal and estuarine deposits, basal ferruginous gravels and terrace gravels are deposited in a wide range of scattered locations [9,10,11]. The Weuda area is located in the northwestern province of Sri Lanka and which is underlain by high grade rocks of the Highland Complex and is confined to latitudes 7° 20'N to 7° 29'N and longitudes 80° 28'E to 80° 50'E (Fig. 1). Rhythmic varve like sedimentary beds are widespread in this area overlying the Precambrian crystalline rocks. Representative stratigraphic sections collected from at Akade and Matibokka villages are shown in figure 2; however, the thickness of the profile varies from place to place[3].

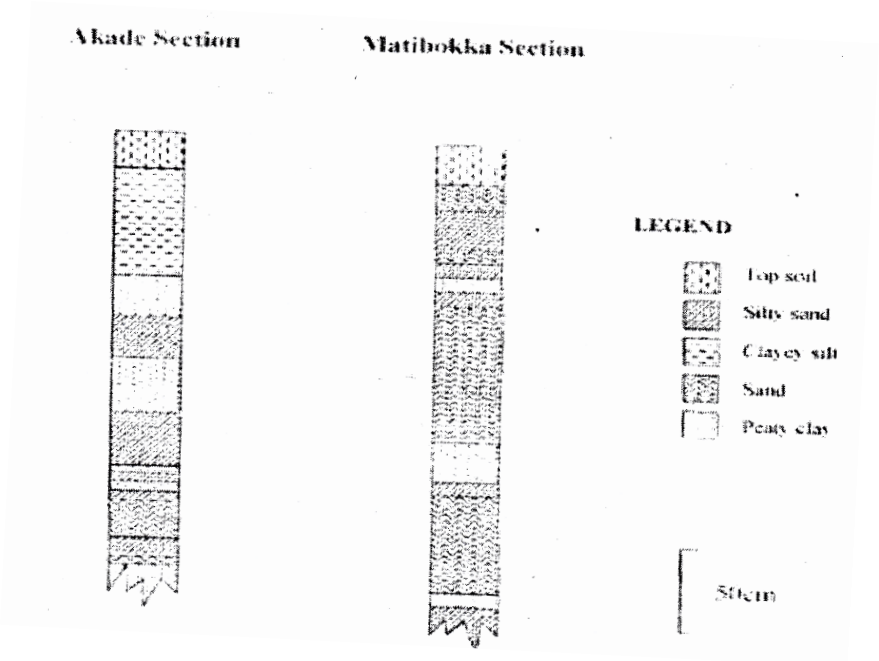

Figure. 2. Stratigraphic sections collected at Akade and Matibokka

3. MATERIAL AND METHODS

Two Kumbuk *(Terminalia arjuna)* seeds were collected at a depth of approximately 2 m below the surface from recently excavated dug well site in Akade village, located at 7° 24' 47.6" N and 80° 29' 59.9"E (Fig. 3). People of the area stated that they had found such decomposed plant material within these clayey sediments at a depth as deep as 2-3 meters while digging wells for drinking water. The collected samples were highly decomposed, except for the parts containing lignin (Fig. 4).

The age of the samples was determined with the ^{14}C Accelerator-Mass-Spectrometry (AMS) at the Department of Physics, University of Erlangen-Nürnberg in Germany. Unlike the conventional beta-counting method, AMS facility uses the radiocarbon method, which measures the $^{14}C/^{13}C$ ratio, to determine the age of samples. Before the sample was dated, it had to be chemically treated. The content of carbon of the samples to be dated was isolated while foreign carbon that would have resulted in a false aging of the sample was filtered out. Small sample sizes and the shorter measurement times are the main advantages of the AMS method. This method can be used for age determination of samples as old as 50000-60000 years.

4. DISCUSSION AND CONCLUSIONS

The Kumbuk Seed samples collected at Weuda yielded ages of 435±71 and 176±71 years and $\delta^{13}C$ values of -28.4. The seed samples yielded relatively recent ages and the calculated sedimentation rate with respect to tine present stratigraphic thickness could range from approximately 5.0 mm to 3.6mm per year. Such a high rate of sedimentation could be attained in a lake environment. Folklore says that there had been a "lake" in Weuda and the name "Weuda" (meaning upper periphery of a lake) itself gives a hint for the presence of such a lake in the recent past. The flat morphology of the Weuda valley in-between Weuda-Kanda and

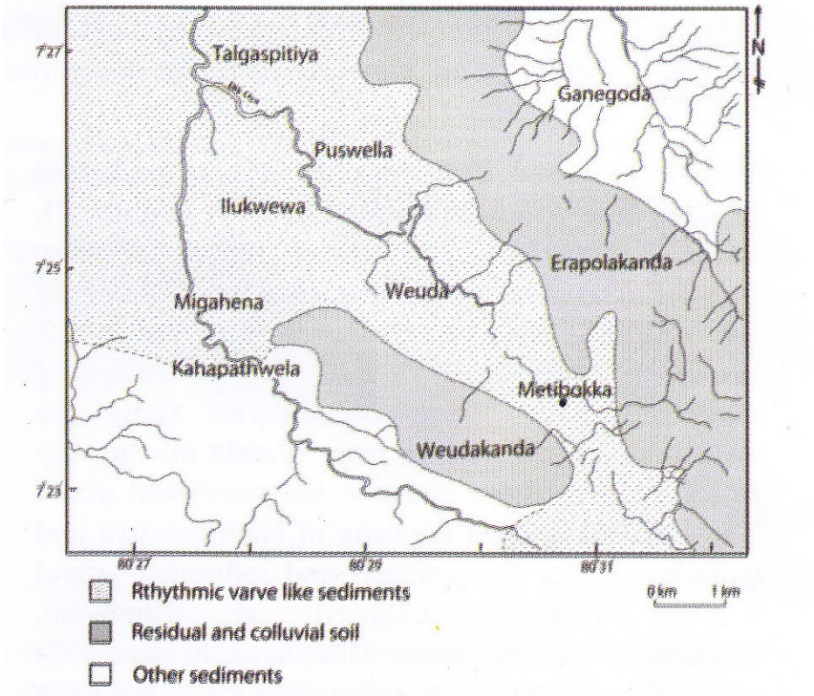

Figure. 3. Superficial geology of the Weuda area

Erapolakanda hills also bear out for the existence of a "lake" in the past. *Kumbuk is a* common tree, which grows around the periphery of lakes.

Field observations in the study area indicate displacement of sedimentary beds that probably had been subjected to neo-tectonic movements, which are commonly observed in the Central highlands[12].

Figure. 4. Decomposed plant remains

Although the earlier age dating of pollen from sediments in Weuda had indicated that they are Permo-Triassic[2], this study indicates that the sedimentary layers of the area have been deposited recently. The sediments of the area have been therefore subjected to several cycles of erosion, deposition, re-erosion and re-deposition. It is likely that the pollens could have been eroded top soils deposited in a lacustrine environment along with recent plant remnants.

5. CONCLUSIONS

The so called glacial sediments of the Weuda region had been subjected to several cycles of erosion and deposition. More facts regarding the geological history of the Weuda sediments should be obtained by properly planned sampling and more such radiocarbon dating of plant remnants which very commonly found within the deeper lay of the Weuda strata. The recent knowledge as acquired by this study indicates that interpretations of Weuda sediments require careful analysis of available field and laboratory data.

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REFERENCES

1. Dahanayake, K., and Dassanayake, D.M.S.M., *Sedimentary Geology*, 30. 1 (1981).
2. Dahanayake, K., Jayasena, H. A. H., Sign, B. K., Triwari , R. S. and Tripathi., *Review of Palaeobotany and Palynology*, 58, 197 (1989).
3. Jayasena, H. A.H., Singh, B.K., and Dahanayake, K., *Proceedings of the Symposium of the Geology of Sri Lanka*, Peradeniya. pp.20 (1983).
4. Pitawala, A., and Dahanayake, K., *Proceedings of the Sri Lankan Association of Advancement of science*, pp. 90 (1992).
5. Premarathne D.M.U.A.K., B.Sc. thesis, Department of Geology, University of Peradeniya. (Unpublished) (2001).
6. Cooray, P. G., Precambrian *Research*, 66, 3-18 (1994)
7. Cooray, P. G., An Introduction to the Geology of Sri Lanka, 2nd Ed., National Museum of Sri Lanka Publication, Colombo (1984).
8. Katupotha, K. N. J. and Dias, P., Journal *of Indian Association of Sedimentologist*, 20 (1), 21 (2001).
9. Cooray. P.G., *Ceylon Geographer*, 17, 39 (1963).
10. Cooray, P.G., Annales de Geomorphologie Neue Folge, Supplement band, 7, 95 (1968).
11. Seneviratne, L. K., Kwnarapeli, P.S., and Cooray, P.G., Proceedings of the 20th Annual Session. *Ceylon Association for the Advancement of science*. 1 (1964)
12. Vitanage, P. W., Proceedings of the 24th International Geology Congress, Montreal 3, 642 (1972).