A PRELIMINARY POLLEN SEQUENCE FROM ANEITYUM ISLAND, SOUTHERN VANUATU

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The dates for first occupation of an area are traditionally based on the oldest ages directly associated with human presence. Such dates are always minimum ages because the site of first settlement may have been missed. Where human occupation has been associated with clearance and other environmental disturbance, ages on the clearance events will provide independent evidence which can provide a check on archaeological sequences. This paper describes a preliminary study of a sedimentary sequence spanning the period when settlement is thought to have begun in a region of the western Pacific.

While carrying out archaeological research on Aneityum, the southern-most of the islands of Vanuatu (Spriggs, this volume), an opportunity for palaeoenvironmental reconstruction through sediment analysis and vegetation history was found in Anawau Swamp, adjacent to the village of Anelcauhat. In particular, the discovery of coconut (Cocos nucifera) macrofossils below the swamp sediments, and dated around 5000 BP, required that possible environmental evidence for human presence be sought, since the oldest direct dates for human settlement in the Vanuatu region are less than 3500 BP (White and Allen 1980). The archaeological work and the significance of the early dates on coconut are discussed elsewhere (Spriggs, this volume and n.d.).

Anawau Swamp lies on the south coast of Aneityum, and is separated from the sea by a consolidated sandbar some 80 m across on which much of the present village of Anelcauhat is situated. The swamp is designated site number AT556 in the Aneityum site survey. Until the early years of this century the 15 hectare swamp carried swamp grasses and shrubs and had no outflow except by seepage through the sandbar. It was unsuitable for taro cultivation because the water level fluctuated too much, although some taro may have been planted at springs around its edges. In the 1920s an outflow channel was cut through the sandbar and channels dug within the swamp in an attempt to drain it and so reduce the mosquito population. This partial draining of the swamp significantly lowered the water table and much of the fibrous peat built up in it appears either to have been eroded and washed away into the bay or to have oxidized.

Trenches were dug 4 m and 50 m in from the edge of the swamp to determine when it was created and whether a pollen sequence could be obtained which might be able to show changes in the vegetation as a result of human interference with the landscape. The near-margin trench (Trench 1) was dug to a depth of 175 cm, at which point fine white sand with no noticeable coral fragments or shell

Layer	Depth from Surface (cm)	Description
1	0-15	Black fibrous peat containing roots and plant debris.
2	15-35	Black and brown mottled silty clay with many roots. A date on the organic material in the fine mud fraction from 20-30 cm depth gave an age of 2940±80 BP (ANU-2421b).
3	35-70	Brown peaty silty sands containing numerous roots and abundant preserved material including *Cocos nucifera* endocarp fragments. A C14 sample of coconut endocarp found at 90-100 cm gave a date of 5410±100 BP (ANU-2419).
4	100-145	Grey peaty sands with abundant preserved plant debris including *in situ* *Cocos nucifera* roots as well as endocarp fragments. Coconut endocarp at 115 cm gave a date of 5420±90 BP (ANU-2418).
5	145-175	White sand with some hard beachrock fragments and occasional *in situ* coconut roots. A C14 sample of coconut roots from 160-170 cm gave a date of 5050±370 (ANU-2417). No shell or coral fragments were encountered.

Table 1: AT556, Anawau Swamp, Anelcauhat, layer description.

within it grades into more consolidated beach rock (Table 1). The second inner trench has a similar stratigraphy to Trench 1 but lacks the clay-rich Horizon 2. Sediment samples for dating and pollen analysis and carbonised particle counts were collected from 5 cm thick sections near the centre of each horizon in Trench 1. Additional dates were obtained from plant remains in the lower levels.

The lack of shell or coral fragments in the basal sands contrasts with modern beach and lagoon sands around the island. Dates from in situ coconut roots in Trench 1 in the bottom layer (layer 6), and coconut endocarp from layers 4 and 5, gave ages of 5040±370 BP (layer 6), 5420±90 BP (layer 5) and 5410±100 BP (layer 4).[1] The in situ coconut roots suggest that Trench 1 is located at the edge of a former lagoon. During gardening operations elsewhere at the swamp edge mangrove stumps have been recovered and the presence of sulphates in the test trench deposits is also an indication of their presence as part of the lagoon-edge vegetation. The lagoon entrance was evidently blocked by the sandbar about 5500-5000 BP, allowing vegetative debris to accumulate in the former lagoon, burying and preserving the coconuts at its edge. The base of Trench 1 is at about present sea level, so the shallow lagoon was probably created by the post-glacial rise of the sea to about its present level. The stabilisation occurred between 6000 and 5000 years ago in the region (Chappell and Thom 1977; McLean 1980). The lagoon was thus only open to the sea for a short period before the sandbar was thrown up.

A date on wood and leaves in Trench 1 layer 3 of 3740±170 BP shows that the organic debris built up slowly, averaging 25 mm/100 years based on an age of 2940±80 for the middle of the layer. This layer is apparently material washed in from the slopes, as shown by its absence from Trench 2 nearer the centre of the swamp. The upper layers are no longer present as a result of the recent drainage of the swamp.

Samples for pollen and carbon particle analysis contain abundant well-preserved pollen from a wide range of pollen types, many of which could not be identified. Preliminary counts of the slides have been made, to provide an indication of gross vegetation change, for comparison with more accurate estimates of carbonised particle concentrations. The samples are not suitable for detailed work because they were collected from 5 cm thick sections near the centre of each layer rather than as a continuous column or at regularly spaced depths.

Pollen percentages are based on total pollen and spore counts, which exceed 80 in all samples. The small totals, large sampling intervals, and problems with identification mean that the results are not statistically very precise but probably indicate general trends. Carbonised particles larger than 5 m were counted and presented as approximate frequencies per ml of sediment. Changes in the pollen sum are unlikely to cause large or systematic changes in the carbonised particle curve. Figure 1 presents a summary of the data, with identified tree pollen being separated from shrubs and other dicotyledonous types (tricolporate and tricolpate), which may be shrubs or herbs.

The results indicate a vegetation dominated by dicotyledonous trees and some shrubs below 35 cm (>2900 BP). These include Eugenia, Podocarpus, Celtis, Acacia and Casuarina, and some possible Euphorbiaceae. Ferns and sedges are present in small amounts, but grass is almost absent. A few grains possibly attributable to palms (including Cocos) and Pandanus are present but their identification is uncertain. Carbonised particles are virtually absent.

The two samples representing the upper 30 cm (levels 2 and 1) are completely different in character. The pollen of a few dicotyledonous trees, including Eugenia, Celtis and Trema are present but sparse. Dicotyledonous herbs are present, e.g. Malvaceae and Asteraceae, while sedges are quite common. The major elements are ferns including Lycopodium, Gleichenia, and smooth trilete and monolete types, together with a range of grass types, including possibly bamboo. In the level 2 sample, carbonised particles increase by more than 100 times above the concentration of the lower levels. A further increase of 25 times occurs in the surface sample, where the particles form about 5% of the sediment.

These results are unequivocal; a massive vegetation change took place above 30 cm (about 2900 BP) from swampy forest to open grass-fernland with scattered shrubs and trees. The massive increase in carbonised particles coincident with this change demonstrates that the present vegetation is pyrophytic whereas that formerly occupying the site catchment was effectively fire free.

More detailed sampling would allow the process of change to be established; given the sampling method it is impossible to say whether an abrupt transition took place or not. However, the topmost sample indicates more open vegetation and contains higher concentrations of carbonised particles than that between 15-30 cm. Further palynological work would provide more details of the taxa present pre- and post-disturbance but this would require a botanical survey of the site.

CONCLUSION

The sequence from the Anawau swamp shows a landscape unaffected by human presence prior to 2900 BP, and the subsequent dramatic effects of human impact through burning of the vegetation and on the geomorphology of the island. It demonstrates the fragility of the pristine ecosystems of Pacific Islands and how rapidly and perhaps inevitably human colonization affected them. Similar widespread change following burning has been found on Lakeba Island, Fiji (Hughes et al 1979).

Previous research in Melanesia has failed to turn up convincing evidence for human occupation south-east of the Bismarck Archipelago of Papua New Guinea before the Lapita expansion of 3500-2500 BP (White and Allen 1980). The Aneityum sequence provides the first positive evidence that people were unlikely to have been in southern Melanesia before that date. A Lapita site on Malo Island in northern Vanuatu dates to 3150$\pm$70 BP,[2] and other Lapita sites in Fiji, the South-East Solomons and New Caledonia date to the same general time period (Green 1979). Occupation of the Banks Islands between the Solomons and the main islands of Vanuatu also begins at this time (Ward 1979). The date of about 2900 BP for human impact on the environment of Aneityum fits very well with the idea of the colonization of this island as part of the Lapita expansion. For reasons discussed elsewhere (Spriggs 1981; this volume), however, no early settlement sites have yet been located here.

FOOTNOTES

1 All radiocarbon dates (half-life 5570$\pm$30 years) are reported unrecalibrated.

2 This is reported in Green (1979). The date, and another of 2980$\pm$70 BP from the same site of MH-Ma-8 are taken from marine shell and may need correction because of the ocean reservoir environment effect.

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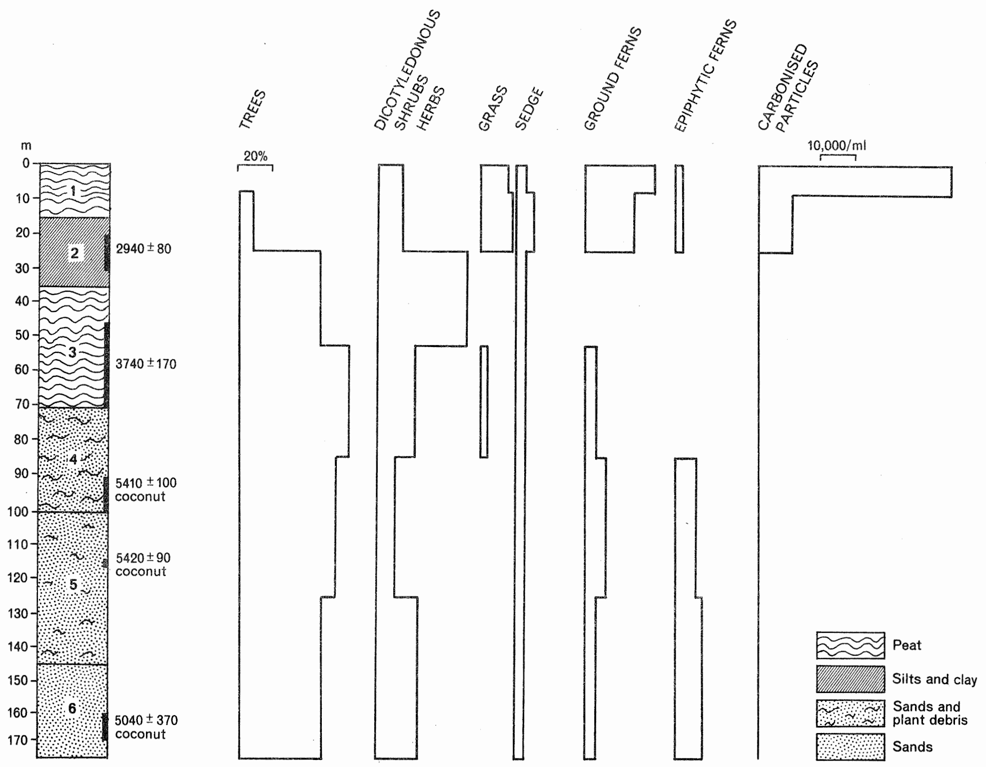

Figure 1. Summary pollen diagram from Anawau Swamp, Trench 1.

Pollen sum is all pollen and spores. Carbonised particle concentrations are given in numbers per ml of fresh sediment.

REFERENCES

Chappell, J. and B.G. Thom, 1977. Sea levels and coasts. In Sunda and Sahul: prehistoric studies in Southeast Asia, Melanesia and Australia (J. Allen, J. Golson and R. Jones eds), pp.275-291. Academic Press, London.

Green, R.C. 1979. Lapita. In The prehistory of Polynesia (J.D. Jennings ed.), pp.27-60. Australian National University Press, Canberra.

Hughes, P.J., G.S. Hope, M. Latham and M. Brookfield. 1979. Prehistoric man-induced degradation of the Lakeba landscape: evidence from two inland swamps. In Lakeba: environmental change, population dynamics and resource use (H.C. Brookfield et al.), pp.95-110. UNESCO/UNFPA Island Reports 5.

McLean, R.F. 1980. Spatial and temporal variability of external physical controls on small island ecosystems. In Population-environment relations in tropical islands: the case of Eastern Fiji (H.C. Brookfield ed.), pp.149-75. MAB Technical Notes 13, Paris.

Spriggs, M.J.T. 1981. Vegetable kingdoms: taro irrigation and Pacific prehistory. Unpublished Ph.D. thesis. Australian National University, Canberra.

______________ n.d. 1982. Early coconut remains from Aneityum Island, Vanuatu, and their significance for Oceanic prehistory.

Ward, G.K. 1979. Prehistoric settlement and economy in a tropical small island environment: the Banks Islands, Insular Melanesia. Unpublished Ph.D. thesis. Australian National University, Canberra.

White, J.P. & J. Allen. 1980. Melanesian prehistory: some recent advances. Science. 207:728-734.