

EVIDENCE FOR CHANGES IN HOLOCENE VEGETATION AND LAKE  
SEDIMENTATION IN THE MARKHAM VALLEY, PAPUA NEW GUINEA

by

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## DECLARATION

Except where otherwise acknowledged  
in the text, this thesis represents  
the original research of the author.

S. E. Garrett-Jones



*FRONTISPIECE.* Lake Wanum, Morobe Province, Papua New Guinea.

Oblique aerial view from the north-west, 8 October 1974.

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## ABSTRACT

The past stability of vegetation patterns in the Markham Valley (6°30'S, 146°30'E), a lowland grassland area of Papua New Guinea, is investigated by pollen analysis of lake deposits and related palaeoecological techniques.

The predominantly organic sediments of Lake Wanum (alt. 35 m) span the last 9600 years. A  $^{14}\text{C}$  chronology supports the calculation of annual pollen deposition, sediment accumulation, and carbonised particle influx rates. At Yanamugi lake (alt. 170 m),  $^{14}\text{C}$  assays of the calcareous muds are influenced by variable 'hard-water error'. A tentative chronology is based on palaeomagnetic and tephra correlations.

Pollen trapping reveals very high contemporary annual deposition rates within forest, but low values over the central lake area. Surface pollen assemblages from different habitats indicate the localised nature of pollen dispersal, although a relatively 'long-distance component' from higher altitudes is also recognised.

Analysis of floristic data from the herbaceous swamp vegetation of Lake Wanum suggests the existence of two free floating root-mat associations and two or three rooted associations. Water depth appears the primary control on their distribution.

Holocene swamp communities analogous with extant associations may be identified in the palynological record of Lake Wanum. Swamp marginal conditions prevail from 9500 BP until 8200 BP when permanent shallow water becomes established. Rooted vegetation associations then predominate until about 5000 BP. Floating vegetation associations first become important at this time, and

subsequently (3000 BP to 2000 BP) come to dominate the site. A general trend towards increased water depth is indicated throughout the sequence.

Increased representation of dry-land non-forest pollen occurs from 8550 BP, and grassland taxa become more frequent from about 5350 BP. Synchronous trends in carbonised particle influx identify fire as a probable agent of vegetation change.

Little change in dry-land vegetation is recorded in the pollen sequence from Yanamugi, although recent encroachment by swamp vegetation occurs. The large proportion of 'montane' pollen and spore taxa in the earlier sediments is attributed to variable fluvial influx.

Conditions at Lake Wanum until 8200 BP may reflect the early Holocene aridity widespread in equatorial areas, although the indirect hydrologic effects of rising sea level cannot be discounted. Human impact appears the main determinant of dry-land vegetation change during much of the Holocene.

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