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Review of Palaeobotany and Palynology 143 (2007) 83–105
Review of Palaeobotany & Palynology
www.elsevier.com/locate/revpalbo

Holocene volcanic activity, vegetation succession, and ancient human land use: Unraveling the interactions on Garua Island, Papua New Guinea

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Received 30 June 2005; received in revised form 2 June 2006; accepted 8 June 2006
Available online 1 September 2006

Abstract

An integrated approach to the reconstruction of vegetation history and human land use during the Holocene on Garua Island, Papua New Guinea analysed sediments and plant microfossils (phytoliths and starch granules) together with archaeological data. The long-term record is punctuated by a series of volcanic disasters, where repeated cycles of massive destruction were followed by differing cycles of forest regeneration. The plant microfossil record shows that instead of long-term forest recovery, the overall pattern of regeneration was progressively more disrupted. Through time regeneration was halted earlier in the sequence and then reverted to increasingly open plant communities dominated by grasses. The temporal patterns of burning, stone artefact discard, and plant introductions demonstrate that the increased impact of human systems of land management was primarily responsible for the temporal patterning. Most notably, the study shows that human interference begins much earlier than expected given previous archaeological research and relatively intensive burning and landscape modification, possibly indicating cultivation, predates the introduction of Lapita pottery.
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Keywords: volcanic impact; vegetation recovery; land use intensification; Lapita; phytoliths and starch; Papua New Guinea

1. Introduction

A series of major Holocene eruptions from the Dakataua and Witori volcanoes deposited thick layers of airfall tephra over vast areas of the island of New Britain in Papua New Guinea (Machida et al., 1996; Boyd et al., 1999; Torrence et al., 2000). Not surprisingly, these environmental disasters had major impacts on the human history of settlement in this region. Archaeological research has revealed that periods of abandonment in the order of several hundred to one thousand years followed the largest events (Torrence et al., 2000; Torrence, 2002a,b). The effects of these disasters on human cultures, however, particularly in terms of changes in land use, are surprisingly difficult to discern when the volcanic history is examined over the long term, i.e. the Holocene as a whole. Instead of a punctuated pattern tracking the

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doi:10.1016/j.revpalbo.2006.06.007

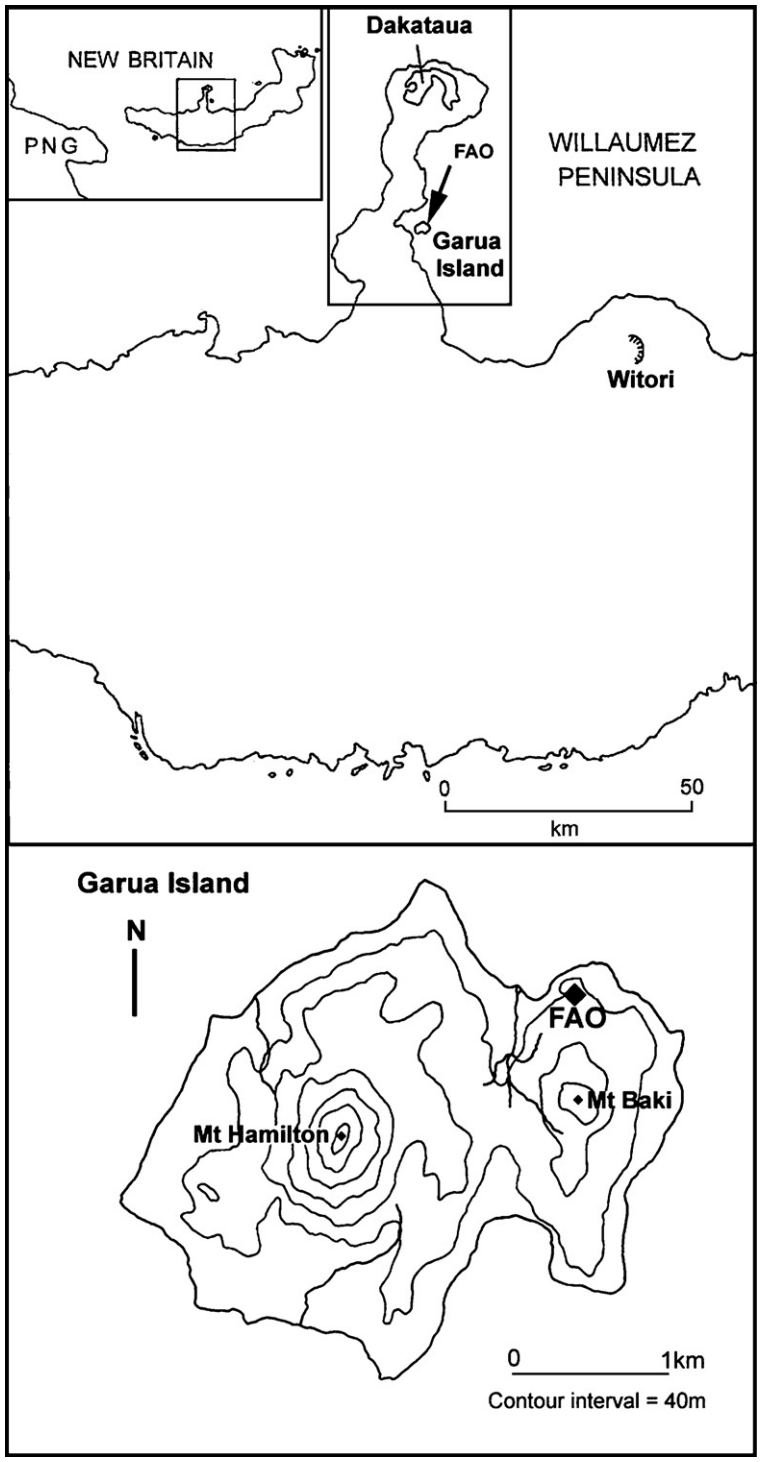

Fig. 1. Location map of Garua Island showing the FAO site and Dakataua and Witori volcanoes.

volcanic history, changes in the nature and distribution of stone artefact assemblages – almost the only archaeological data – are slow and directional. This pattern has been interpreted as the consequence of an increasingly intensified system of land use (Torrence et al., 2000; Torrence, 2002a,b). To date, the reconstruction of

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