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Short Paper

Cultivation and human impact at 6000 cal yr B.P. in tropical lowland forest at Niah, Sarawak, Malaysian Borneo

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Abstract

This paper describes palynological evidence for what appears to be comparatively large-scale human impact in the catchment of the Sungai Niah in the wet tropical lowland swamp forests of Sarawak, Malaysian Borneo close to the Great Cave of Niah. Pollen associated with cleared landscapes and rice cultivation is evident in the sedimentary record from before 6000 cal yr B.P. Human activity seems to have been associated with changes in sedimentary regime, with peat-dominated environments being replaced diachronously by clay-dominated deposition. This may reflect anthropogenic soil erosion in the catchment of the Sungai Niah.

Keywords: Holocene; Palynology; Wet tropical forest; Rice farming; Clearance; Sedimentation

Introduction

An emerging literature documents Holocene human impact on the wet tropical forest landscapes in Island Southeast Asia. Clearance was early (~7500 cal yr B.P.) in Sumatra (Maloney, 1985; Flenley, 1988). It was also early (~5000 cal yr B.P.) in Irian Jaya (Haberle et al., 1991). Significant human impact on Java extends only over the last few hundred years (van der Kaars and van den Bergh, 2004; van der Kaars et al., 2001). There is, as yet, little evidence from the Island of Borneo, although Anshari et al. (2004) tentatively suggest Holocene human impact ~3000 yr ago at Lake Sentarum, Kalimantan.

In this paper, we describe palynological and sedimentary evidence for comparatively early Holocene human impact in Sarawak, Malaysian Borneo, most probably linked to rice cultivation. This is the first evidence for mid-Holocene human impact in Borneo.

The study area

The study sites are located within the catchment of the Sungai Niah, close to the limestone massif of the Gunung Subis (N3° 48′ E113° 47′). The Gunung Subis contains the Great Cave of Niah, which has yielded the most comprehensive sequence of prehistoric archaeology in the region, including an important 'Neolithic' cemetery (Harrisson, 1958; Barker et al., 2002a,b) containing ~500 graves and the renowned 'Deep Skull'—still, at 42,000 yr, the oldest modern human remains in Southeast Asia. The cave was used intermittently through the Late Pleistocene, and then again during the 'Neolithic' to recent. There appears to have been a gap in use of the cave during the Early Holocene (Barker et al., 2002a).

Previous discussion of this site (summarised in Barker et al., 2002a; Doherty et al., 2000) suggests that the 'Neolithic' people who used the Great Cave as a cemetery were pursuing hunter–gatherer lifeways. On isotopic evidence, however, Krigbaum (cited in Barker et al., 2002b: 147) suggested that plant foods consumed by the 'Neolithic' people at Niah were grown in more open environments than those consumed by 'mesolithic' and 'upper palaeolithic' groups. Cereal pollen was recently noted in mid-Holocene cemetery sediments in the cave (Hunt and Rushworth, 2005: 469–470), but the significance of this observation is, as yet, unclear.

The Gunung Subis lies ~11 km SW from the present coast of the South China Sea. This is part of the Indo-Pacific Warm Pool—and thus part of the warmest seas on Earth, with temperatures averaging ~28°C (Yan et al., 1992). Tapper

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(2002) describes the regional climate. Typically, daily air temperatures are 22°C before dawn, rising to 32°C in the afternoon. Precipitation at Niah is ~2000 mm yr^{-1}. The coastal location of Niah enhances strong local seasonal variations in climate (Hazebroek and Morshidi, 2001). Climate is modulated by the distinctive seasonal reversal of winds associated with the East Asian and Australian monsoons. El Niño episodes can bring marked and sustained droughts and sometimes fire (Potter, 2002).

Closed rainforest of great biodiversity is still present in the lowland in the National Park around the Gunung Subis (Hazebroek and Morshidi, 2001; Pearce, 2004). This includes: seasonal wet swamp forest with abundant *Pandanus* spp., *Octomeles sumatrana* and *Pterospermum subpeltatum* on alluvial clay soils; dry Dipterocarp forest characterised by *Dryobalanops lanceolata*, *Shorea superba* and *Dipterocarpus caudiferus* on low siltstone–sandstone hills; and *Elaeocarpus–Lithocarpus*-dominated riverine woodland on natural levees beside the Sungai Niah. The limestone of the Gunung Subis carries an unusual and distinctive flora including *Gymnostoma nobile* (Casuarinaceae), *Schefflera* spp., *Ficus* spp. and *Podocarpus confertus* (Pearce, 2004). Closer to the coast are remnant mangrove forests dominated by *Bruguiera* (0.5–5 km from the coast) and then a Nypa-dominated zone immediately behind the sandy coastal barrier, which here is dominated by *Casuarina* (personal observation). Large areas outside the National Park have, however, been cleared in recent years for oil-palm plantation agriculture.

Methods

The work reported here was done to provide landscape context for the ongoing re-investigation of the archaeology of the Great Cave (Barker et al., 2002a,b). The lowland around the karst towers of the Gunung Subis is densely covered with alluvial and swamp forest (Pearce, 2004). Topography in these forests is difficult to resolve on the ground since visibility is rarely more than 20 m. It was thought, at the outset of this investigation, that perennially wet sites would give better conditions for pollen preservation than would be available on sites more prone to drying out. Local informants were, therefore, asked to suggest marshy areas for investigation. Two areas, one close to the cave of Gan Kira and the other near the longhouse at Kampong Irang, were chosen for initial investigation because they were reported by the informants to be exceptionally wet and flood-prone. Within these generally wet and flood-prone areas, drilling sites were chosen by the late B.K. Maloney because they had vegetation which he regarded as of ‘wetter’ aspect than that covering most of the alluvial lowland around the Gunung Subis. It was impossible to obtain GPS plots beneath the dense forest canopy, so the positions (Fig. 1) were approximated by tape and compass survey.

Initial coring was carried out in September 2001 and a second core was taken from the Gan Kira site in September 2002. A clay-cutting Edelmann head was used to break through superficial tough clays at Gan Kira, and a modified Livingstone corer of Aberystwyth pattern was then used to collect cores from depths below 1 m at that site. At Kampong Irang, the Livingstone corer was used to collect the entire profile. Cores were wrapped in aluminium foil and polythene and refrigerated within hours of collection.

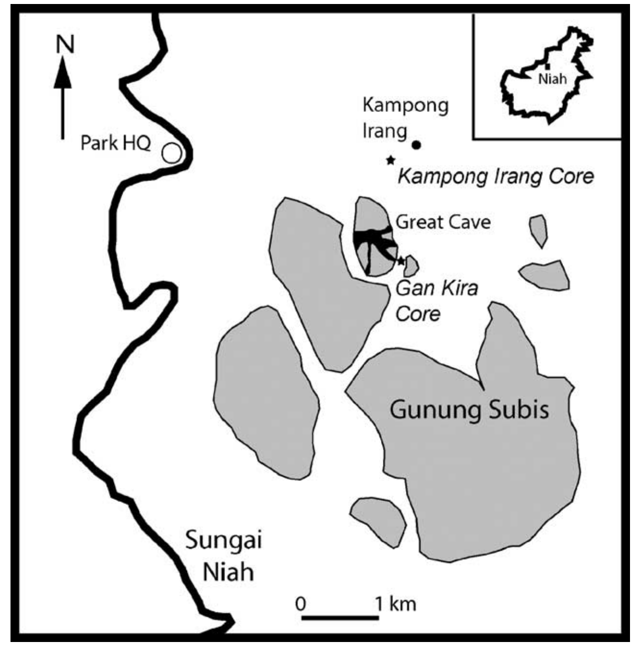

Figure 1. Location of the study sites and of the Great Cave of Niah. Limestone massifs are shaded.

Samples were prepared for palynology by the method of Hunt (1985)—disaggregation by boiling in 5% potassium hydroxide solution, sieving on 6-μm nylon mesh to remove solutes and fines, and swirling on a clock-glass to remove silt and sand. Counts of at least 500 pollen grains and spores per sample were made where possible, together with all other palynomorphs encountered during the pollen counts.

The palynofacies of the samples was also established, based on counts of 200 organic particulates classified into the usual groups (pollen and spores, algae, insect-derived material, plant cell walls and cuticle, fungally derived material, thermally mature material, spherules, inertinite) following Hunt and Coles (1988). Of these classes, counts for thermally mature material (microcharcoal: characteristically brown to dark brown in colour and showing traces of cellular organisation typical of wood), carbonaceous spherules and VAMs (vesicular arbuscular mycorrhyza: fungal symbiotes on the roots of plants and thus a useful indicator of eroded soils in water-laid sediments), were included in the pollen diagrams.

The data were handled and pollen diagrams constructed in TILIA, TILIAGraph and TGView. The diagrams (Figs. 2 and 3) show all pollen, spores, algae and palynofacies calculated as a percentage of total pollen and spores.

AMS and conventional radiocarbon dating with extended counting was carried out at Beta Analytical Inc., Florida, USA. Dates were calibrated using the CALIB programme and the INTCAL98 data set (Stuiver et al., 1998). Results are given in Table 1. In spite of the proximity of sample sites to limestone karst towers, the sediments were extremely acidic, with pH