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CORRESPONDENCE

Biogeography, ecology and tectonics in New Guinea

A comment on Novotny, V., Miller, S.E., Basset, Y., Cizek, L., Darrow, K., Kaupa, B., Kua, J. & Weiblen, G.D. (2005) An altitudinal comparison of caterpillar (Lepidoptera) assemblages on *Ficus* trees in Papua New Guinea. *Journal of Biogeography*, **32**, 1303–1314.

Research carried out at the New Guinea Binatang Research Centre in Madang continues to produce very significant results (e.g. Novotny *et al.*, 2002). A recent, intensive study examined altitudinal variation in communities of lepidopteran caterpillars feeding on species of *Ficus* (Moraceae) (Novotny *et al.*, 2005). Novotny *et al.* compared two communities, one lowland and one montane, and discovered large differences in the Lepidoptera species present that are not explained by differences in the host-plant species present. The authors wrote that 'Gradients in environmental variation can cause substantial species turnover with altitude…' and they discussed variables such as temperature. Current differences in temperature, rainfall, predators, etc. probably do account for many differences in gross aspects of the Lepidoptera fauna at lowland, montane and alpine sites. However, the New Guinea/Indonesia region represents a geological maelstrom in which historical factors have also been of great importance in determining community composition.

New Guinea is made up of the northern part of the Australian craton plus about 32 terranes that have accreted to it. The craton margin runs through the middle of New Guinea. There are major differences between the respective biotas of the component terranes, even in mobile taxa such as birds (Heads, 2001a,b,c, 2002a,b, 2003) and flies (Clarke *et al.*, 2004). This is hardly surprising, as the terranes originated far apart from each other and had quite different histories before eventually amalgamating. Novotny *et al.*'s (2005) study compares two sites 130 km apart, one at 100 m altitude near Madang, by the Finisterre terrane; the other at 1800 m near Kundiawa, on the northern margin of the Australian craton (Heads, 2001b: Fig. 29). Novotny *et al.* write that 'it is unlikely that species turnover is caused by geographic isolation. There are no obvious migration barriers separating the two study areas…', but this overlooks the very different tectonic history of the craton and the terranes accreted to it. This recalls Diamond's (1972) major transect study of birds between Okapa and Karimui. Diamond found many faunistic changes along the transect, but did not refer to the tectonics of the area. His transect, like that of Novotny *et al.*, crossed the major tectonic boundary in New Guinea, the craton margin.

Thus it could be predicted that many of the differences between the communities are due to tectonic history rather than altitudinal factors, and that different species would be present at the Madang and Kundiawa sites even if the sites occurred at the same altitude. But why do the two communities currently occur at these altitudes? Again, tectonic history is probably relevant. Rapid tectonic uplift and subsidence in the southwest Pacific have had major, direct effects on communities (Heads, 2001b, 2003, 2006). For example, the uplift rates in New Guinea will raise a community at sea level to alpine tree line (at 3000 m) in just 1 Myr. Some taxa will perish but others will survive, either by being preadapted or by developing new adaptations.

The phenomena reported by Novotny *et al.* (2005) represent further challenges for interpretations of the biogeography and ecology of this complex island. Whether or not tectonic effects have been important in every case, it seems unrealistic to discuss horizontal or altitudinal variation between biological communities in New Guinea without referring to terrane history and changes caused by uplift and subsidence.

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