# *Magmatism*

**Arc-like andesites from the ocean floor: a key to Archaean continental crust? (*December 2005*)**

To most geologists ‘andesite’ spells subduction beneath island arcs and continental margins. Geochemically they share a universal signature: their depletion in the elements niobium and tantalum. Both find the aqueous fluids that rise from subducting slabs repellent and so they stay in the source of arc magmas, almost certainly in amphibole minerals. Negative Nb and Ta anomalies pervade the continental crust, suggesting that it owes its origin to subduction processes of some kind; maybe over the whole of recorded geological time. The other dominant means of expelling magmas is through the adiabatic melting of drier upper mantle as it rises along oceanic rift zones. Theoretically and also in innumerable analyses of ocean-floor rocks Nb and Ta behave like other elements that favour melts over the minerals of mantle residues. That there are ocean-floor rocks that show evidence of incompatible behaviour of the two elements comes as quite a surprise. More surprising still is that they are of bulk andesitic to more silica-rich dacitic composition (Haase, K.M. *et al*., 2005. Nb-depleted andesites from the Pacific-Antarctic Rise as an analogue for early continental crust. *Geology*, v. **33**, p. 921-924; DOI: 10.1130/G21899.1). The rocks analysed by the team from the Christian-Albrechts University of Kiel, Germany, occur close to a hotspot in the South Pacific and span about 130 km of the ridge system, along with basalts.

Modelling the geochemistry of the silicic lavas suggests a dominant role for fractional crystallization of magnetite and ilmenite from a basaltic parent magma that itself is enriched in iron and titanium. Yet, associated basalts do not show depleted Nb and Ta, so some other mechanism must be responsible for their occurrence in the andesites. One possibility is production of silicic magma by partial melting of amphibole-rich mafic oceanic crust, and then its mixing with fractionated basalt to form low-density magma that rises. Silicic lavas in Archaean greenstone belts are often associated with basalts that have chemical affinities to those in modern oceanic settings. It is therefore possible that a substantial proportion of Archaean continental crust originated in ocean hotspot settings, rather than by some form of subduction process.