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Geochemical evolution of Mesozoic oceanic plate recorded in the New Zealand accretionary prism

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Westward subduction of the Izanagi oceanic plate beneath the southeastern margin of Gondwana is recorded by occurrences of allochthonous low-grade metabasite (zeolite–prehnite-pumpellyite facies) in Mesozoic accretionary prism greywacke. Analysed metabasite samples were collected from three fault-bounded sub-terranes of the greywacke: Rakaia (western; Late Triassic), Esk Head (central; Late Jurassic–Early Cretaceous) and Pahau (eastern; Early Cretaceous). Based on whole-rock XRF and solution ICP-MS analyses the metabsite protoliths are identified as: Rakaia sub-terrane — MORB; Esk Head sub-terrane — MORB, intraplate tholeiite, alkaline basalt; Pahau sub-terrane — alkaline basalt, type-2 boninite. The eruptive ages of the basalt are indirectly determined by radiolaria in associated chert and range from Late Permian (Rakaia), Late Triassic–Early Jurassic (Esk Head) to Early Cretaceous (Pahau). The relation between inferred basalt eruption age and emplacement in the Gondwana margin sediments indicates a decreasing age gap with time, largest in the Late Triassic when Permian basalt was tectonically incorporated, and smallest when Early Cretaceous boninite was erupted into Early Cretaceous sediments. The basalts record time-dependent compositional variation within the subducting Izanagi Plate. Late Permian MORB was produced at the Phoenix Ridge of the Izanagi-Phoenix plate-boundary. Late Triassic MORB, intraplate tholeiite and alkali basalt were erupted at the Phoenix Ridge and from Izanagi Plate seamounts. Early Cretaceous boninite indicates unusual thermal and petrological conditions for formation (high water-flux, shallow melting, elevated geothermal gradient). Basalt composition and basalt and greywacke age data provide constraints for tectonic-reconstructions of the southeastern Gondwana margin from ~250–140 Ma in that they indicate decreasing distance from basalt eruption sites, such as the Phoenix Ridge, to the convergent margin over this period. It is possible that the Phoenix Ridge was subducted in the Early Cretaceous. This is supported by the lack of a discernable age-gap between basalt eruption and emplacement in the accretionary-prism, as well as providing the necessary conditions for boninite generation.

Acknowledgement

This research was partly funded by support from the European Community, Access to Research Infrastructure action of the Improving Human Potential Programme and the University of Bristol.