

Evolution from subduction initiation to mature island arc volcanism in the Upper Eocene to Middle Miocene Vitiaz Arc, SW Pacific: Evidence from Malekula Island (Vanuatu)

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The oldest volcanic rocks exposed on Malekula Island, now belonging to the New Hebrides Island Arc, formed in the Upper Eocene to Middle Miocene Vitiaz Island Arc, Southwest Pacific. They are thought to have formed contemporaneously with Fiji and the Izu-Bonin-Mariana (IBM) arc during westward subduction initiation along the same plate boundary [e.g., 1]. To test this hypothesis with regard to the mantle source compositions and contributions from the subducting slab, we provide major- and trace element data combined with Hf, Nd, and Pb isotopes for twenty-seven volcanic rocks of Malekula Island. Our results show that Malekula lavas display similar magma types, i.e., boninite-series rocks, island arc basalts, and MORB-type tholeiites, to the earliest volcanic rocks of Fiji and the IBM system. However, Malekula MORB-like tholeiites formed after island arc volcanism and are more consistent in composition with South Fiji back-arc basin basalts [c.f., 2] rather than with forearc basalts or early arc basalts as found in the IBM subduction zone and on Fiji, respectively. Yet, the stratigraphy of Malekula with boninite-series rocks followed by island arc basalts resembles the sequential stratigraphy of the IBM system [3], rather than the interlayered stratigraphy of early arc rocks on Fiji [4]. Moreover, a special feature of Malekula lavas is their unique Hf-Nd isotope composition, changing from isotopically ‘Indian’ similar to the IBM arc [5, 6], to mainly ‘Pacific’, like on Fiji [4]. We interpret this progressive change in mantle source composition to reflect the propagation of ‘Pacific’ South Fiji Basin spreading into the Vitiaz Arc near Malekula Island. Hence, the Malekula lava succession provides a link between the IBM subduction initiation in the Northwest Pacific and the onset of subduction on Fiji in the Southwest Pacific.

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