Drastic changes in subduction flux following subduction inception

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Volcanism following the initiation of subduction is vital to our understanding of this specific magma-generation environment. This period is represented by the first development of the Izu-Bonin-Mariana (IBM) arc system as subdcution commenced along the Western Pacific margin in the Eocene. A new collection of volcanics recovered from the islands and exposed crustal sections of the Bonin Ridge span the age range of the early arc. An elemental and radiogenic isotope dataset from this material is presented in conjuction with new $^{40}Ar/^{39}Ar$ ages and a stratigraphic framework develped by a detailed mapping campaign through the volcanic sections of the Bonin Islands.

The dating results revealed that both the locus and type of magmatism systematically changed with time in response to the progressive sinking of the slab until the establishment of steady-state subduction at around 7-8 My. Following the initial MORB-like spreading-related basalt magmatism, volcanic centres migrated away from trench and changed from high-Si boninite to low-Si boninite/high-Mg andesite, then finally tholeiitic/calcalkaline arc magma.

Subducting pelagic sediment combined with Pacific-type igneous ocean crust dominate the slab input to the shallow source of high-Si boninites at 49 Ma, but high-precision Pb isotope data shows this sediment varies in composition along the subducting plate. At around 45 Ma the pelagic component was almost entirely replaced by volcanic or volcaniclastic material originating from a HIMU ocean island source. Following this sharp isotopic switch, the slab component simply varies in terms of the proportions of igneous ocean crust and seamount material through the following 5 My. However, this same post-switch slab input is imparted on the boninite, high-Mg andesite, tholeiite and calcalkaline mantle sources.

Fluctuations in the slab-derived geochemical signature were superimposed on a change in the mantle wedge source from highly-depleted harzburgite to a DMM-type source. In turn, this may correspond to the increasing depth of the leading edge of the slab through this 5 My period.