Significance of the Indian Ocean-type isotopic signature in Western Pacific marginal basin basalts

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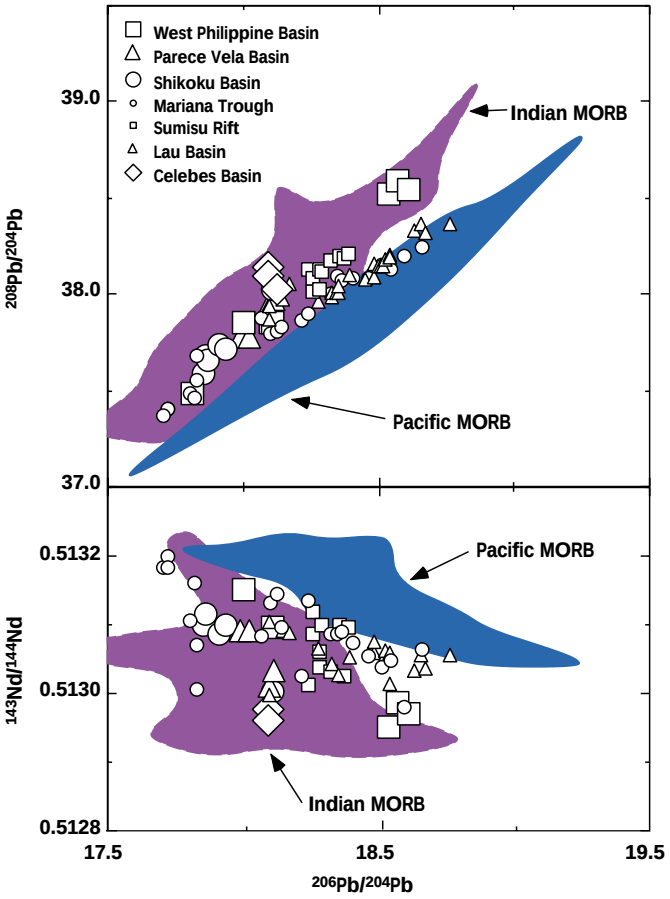

Pb and Nd isotope ratios in Western Pacific marginal basin basalts compared with fields for basalts from Indian Ocean and Pacific Ocean spreading ridges. References are in Hickey-Vargas et al. [1995].

One exciting result of ocean drilling in Western Pacific marginal basins is the discovery that basin floor basalts have the Sr, Nd and Pb isotopic characteristics of basalts from Indian Ocean ridges. Samples from DSDP Leg 31, 58 and 59 sites and ODP Leg 124 and 135 sites in the West Philippine, Shikoku, Parece Vela, Celebes and Lau Basins and the Mariana Trough were included in the study [*Hickey-Vargas et al.,* 1995]. It is now well established that the earth's major spreading ridges tap geochemically distinct upper mantle domains (Indian Ocean and Atlantic/Pacific Ocean types) with present day boundaries located along the Southeast and Southwest Indian Ridges. That basalts from actively spreading and extinct Western Pacific marginal basins share Indian Ocean-type isotopic characteristics implies that the Indian Ocean-type domain currently extends at least to the eastern edge of the Philippine Sea plate (Mariana Trough) and Indo-Australian plate (Lau Basin), and that it extended beneath the West Philippine Basin (60 Ma) and Celebes Basin (55 Ma) at the time of their opening.

An alternative hypothesis, that the same isotopic characteristics were generated independently in each basin, is not well supported by geochemical tests. For example, the possibility that subducted material introduced the Indian Ocean-type signature conflicts with the observed Sr, Nd and Pb isotopic compositions of Mariana island arc volcanic rocks, which are the same as, or form trends toward, Pacific Ocean-type basalt. The probable juxtaposition of Indian Ocean-type mantle wedge and Pacific Ocean-type subducted basalt in this region may now enable geochemists to distinguish and quantify elemental contributions from these two sources in island arc magmas.

References:

Hickey-Vargas, R., J.M. Hergt, and P. Spadea, The Indian Ocean-type isotopic signature in Western Pacific marginal basins: Origin and significance, In: B. Taylor and J. Natland, Active Margins and Marginal Basins of the Western Pacific, *AGU Geophysical Monograph, 88,* 175-197, 1995.