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Geochemistry of adakites from the Philippines: constraints on their origins

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We have identified in the Philippine Archipelago 230 samples of Late Miocene to Quaternary intermediate and evolved magmatic rocks or glasses, the compositions of which plot within the adakitic field defined by Defant and Drummond (1990) using Sr/Y ratios versus Y contents. These rocks belong to four different subductions, along the Manila Trench (Batan, Northern Luzon, Central Luzon), the Negros and Sulu Trenches (Negros and Western Mindano), the Cotobato Trench (Southern Mindanao) and the Philippines Trench (Eastern Mindanao), respectively. Lavas from Central Mindanao overlie the deep remnants of the Molucca Sea Plate, and were emplaced in a post-collision setting.

All these samples show a significant depletion in Y and HREE with respect to their "normal" calc-alkaline equivalents, suggesting that garnet was either a residual phase during partial melting or a fractionating mineral during differentiation or assimilation coupled with fractional crystallisation (AFC). However, only 19 samples out of our set (i.e., 8%) display very high Sr/Y ratios (100-250). Our preferred model for the genesis of these "typical adakites" is ca. 20% partial melting of subducted altered oceanic metabasalts converted to eclogite. This melting process could have been triggered by water from the underlying serpentinites. Most of the samples, termed "intermediate adakites", display major and trace element chemical features intermediate between those of the former group and those of normal calc-alkaline lavas. We show

that magma mixing between slab-derived adakitic magmas and mafic mantle-derived melts accounts for most of the trends linking typical and intermediate adakites, although an additional contribution of mantle is required in some cases.