

Dos Hermanos Mélange reveals presence of Eurasia-derived crustal fragments accreted in the Philippine Mobile Belt

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Mélanges are among the most diagnostic indicators of plate tectonics and ancient plate interactions because they often record subduction, accretionary and collisional processes. Here, we present an integrated study of zircon U-Pb-Hf isotopic and geochemical data to constrain the exact origin, character and nature of the continental fragments beneath northern Luzon. The Dos Hermanos Mélange (DHM) contains various clasts composed of basalts, cherts, gabbros, peridotites and schists. The presence of both magmatic and inherited zircons from this unit poses essential questions concerning their origin and provenance. Igneous zircons (n=34) from DHM gabbro gave a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 114.85 ± 0.85 Ma interpreted as the crystallization age of the gabbro. The $\varepsilon\text{Hf}(t)$ values between -25.4 to -3.5 suggests a crustally contaminated mantle-derived magma formed in a continental setting. Older zircons from the same sample show inherited ages clustering at ca. 235 Ma (n=3), 760 Ma (n=2), 1860 Ma (n=8), and 2460 Ma (n=3). These older zircons have heterogeneous $\varepsilon\text{Hf}(t)$ values from -25.2 to +2.0 suggesting a strong crustal contribution and show the involvement of ancient crustal material with Yanshanian, Indosinian and Paleoproterozoic age populations, consistent with a provenance comparable to the detrital zircons from the Cathaysian Block in SE China. Conversely, the detrital zircon ages of DHM schist range from 185-250 Ma with no older components. This sample shows uniformly high and positive $\varepsilon\text{Hf}(t)$ values from + 24.2 to +11.1 suggesting that juvenile parental magmas are added to the crust in the Late Triassic. These results allow us to identify old continental zircons suggesting the existence of Cathaysian-derived crustal fragments beneath northern Luzon and compare the results with the isotopic data from western Luzon and eastern Taiwan. We propose that the Mesozoic rocks from the DHM represents an old piece of continent formed adjacent to the Proto-South China Sea (PSCS) that rifted off the Eurasian continental margin during the opening of the SCS/closure of the PSCS and collided with the PSP in the