Petrogenesis of fertile abyssal peridotites of the Pujada Ophiolite, SE Mindanao, Philippines

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Fresh mantle peridotites of the Pujada Ophiolite are extensively exposed in southeast Mindanao, Philippines. Despite its good preservation, its origin and formation is not constrained due to lacking geologic data. In this study, petrographic and geochemical characteristics of the mantle section of the Pujada Ophiolite are investigated to determine its tectonic setting and the magmatic processes operating during its formation.

The mantle section of the Pujada Ophiolite is composed of massive and pyroxene-rich lherzolites and harzburgites and interlayers of variably serpentinized lherzolites, harzburgites and dunites. Mineral chemistry of the spinel peridotites reveal spinel Cr# =0.10-0.50 and olivine Fo =89-91 typical of abyssal peridotites. The mantle peridotites are classified into three based on their field occurrence and spinel Cr#: Group I - massive lherzolites and harzburgites with Cr# =0.10-0.40, Group II - interlayered lherzolites and harzburgites with Cr# =0.10-0.40, and Group III - interlayered harzburgites and dunites with Cr# >0.4. The Group I peridotites are protogranular with minor vermicular spinel. The Group II peridotites are highly serpentinized. Preserved portions show porphyroclastic texture with vermicular to subhedral spinel. The Group III peridotites are also highly serpentinized but porphyroclastic texture in the harzburgites can be observed. Clinopyroxene and orthopyroxene compositions of the peridotites reveal an increasing depletion in Al_2O_3 from Group I to Group II and III with increasing Mg#. Groups I and II show lower Mg# =0.90-0.93 and 0.92-0.93, respectively. The Group III peridotites have the highest Mg# =0.925-0.935. The clinopyroxene Na_2O and TiO_2 of the three groups are within the same range of 0.10-0.40 and 0.10-0.25, respectively. The orthopyroxenes also show the same range of Na_2O and TiO_2 of 0.01-0.10 and 0.01-0.20, respectively. In general, rare earth element composition shows depletion of light rare earth element (LREE) and relatively flat heavy rare earth element (HREE) which further suggest an abyssal origin. Trace element compositions of the peridotites are indicative of low degrees of partial melting within 6%-14%. A few peridotite samples also show LREE enrichment suggesting that metasomatism may have affected these rocks.

Keywords: Pujada Ophiolite, peridotites, mid-oceanic ridge, LREE enrichment

