Volcanic geology, petrology and geochemistry of a juvenile oceanic arc in northern Zambales Ophiolite

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Zambales Ophiolite, located in west-central Luzon, the Philippines, is the type supra-subduction ophiolite of the Western Pacific. Thus, it is an ideal place to test the "subduction initiation" rule [1]. Studies have shown that it is composed of two distinct mantle-crust sequences – the 45 Ma Coto Block with transitional MORB affinity and 44-43 Ma Acoje Block with island arc characteristics [2,3,4,5].

Based on observations in the vicinity of Barlo Mine, two volcanic lithofacies are recognized in the Acoje Block upper crustal section. A lower bulbous boninitic pillow lava unit is overlain by an andesitic upper unit consisting of submarine explosive eruptives including scoria and spatter deposits marginal to a fissure vent, moderately welded agglutinates interbedded with pahoehoe lava flows, breccias and feeder dikes. Transitional boninites (after Beccaluva and Serri, 1988) from the Zambales Ophiolite are hypohyaline and highly phyric. Phenocryst assemblage include olivine usually replaced by calcite, zeolite and clay minerals, subhedral-euhedral augite (Mg#=81-91) with oscillatory and sector zoning, and rare corroded enstatite (Mg#=84-89) with reverse zoning. Spinel (X_{Cr}=0.6-0.7) with melt inclusions occurs near phenocryst/microphenocryst margins. Crystallization order is sp+ol+cpx+opx. Groundmass consists of <0.3mm long plagioclase microlites with swallow-tail terminations and spherulitic clinopyroxene. With MgO = 11-14 wt%, TiO_2 = 0.2 wt% and SiO_2 = 48-50 wt%, transitional boninites from the Zambales Ophiolite are characterized as high-Ca, low-Si subtype. In contrast, the upper explosive volcanic unit consists of aphyric arc tholeiites with sparse pyroxene microphenocrysts in a trachytic groundmass consisting of plagioclase microlites and magnetite.

Coupled with intense petrological studies of the IBM forearc, geophysical studies of the West Philippine Basin and Luzon, the presence of a transitional boninite-tholeiite suite in the Acoje Block vis-à-vis the transitional MORB of the Coto Block [3,4] calls for a re-evaluation of the backarc-arc pair [2] and backarc [5] models for the Zambales Ophiolite.

[1] Whattam and Stern (2012) *Contrib Miner Petrol* **162** 1031-1045. [2] Hawkins and Evans (1983) *AGU Geophysical Monograph* **27** 124-138. [3] Geary et al., (1989) *Tectonophysics* 168 43-63. [4] Yumul et al., (1990) *J. Geol. Soc. Phil.* **45** 69-100. [5] Encarnacion et al., (1993) *J. Geophys. Res.* **98** 19991-20004.