

Episodes of Barren to Fertile Porphyry Copper Deposit Magmatism on a Complex Island Arc System: Insights from the Igneous Host Rocks of the Suyoc Epithermal Prospect, Northern Luzon, Philippines

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Based on new U-Pb zircon ages coupled with whole-rock and in-situ geochemical analyses of igneous host rocks in the Suyoc epithermal prospect, chronologic barren to fertile episodes were identified for the Baguio-Mankayan Mineral District in northern Luzon, Philippines: 1) Late Eocene (36.93 ± 0.62 Ma) barren magmatism associated with a thin, nascent Luzon arc. ; 2) fertile Pliocene (2.87 ± 0.23 Ma and 3.18 ± 0.77 Ma) magmatic event associated with subduction of the Scarborough ridge along the Manila Trench (MT) and 3) Pleistocene (<1 Ma) fertile magmatism associated with slab melting triggered by buoying of the MT subduction angle. The barren Eocene magmatic event, characterized by negative Eu anomalies and lower Sr/Y and V/Sc ratios, is considered as a significant factor in enhancing source and intra-crustal conditions for the onset of younger fertile magmatic events via sub arc modification and crustal addition/thickening. Furthermore, we consider the fertile (high Sr/Y and V/Sc ratios) Pliocene and Pleistocene magmatism in the Baguio-Mankayan area as two separate events with different petrogenesis. Mafic-silicic interaction in the Pliocene, which is characterized by positive FeO, Al₂O₃ and negative SiO₂ spikes up to 2 wt%, was documented on core-rim analysis of amphiboles from hornblende quartz diorite porphyry samples. On the other hand, slab melt signature in the Pleistocene represented by dacite porphyry samples is characterized by hybrid crust-mantle signature, listric REE pattern, higher Dy/Yb ratios, and a relatively high magmatic H₂O content ranging from 6.3-7.8wt%. Based on the assessment, the shift from barren to fertile signatures in the Baguio-Mankayan Mineral District is intimately linked with arc development and subduction dynamics leading to formation of fertile magmas.