Geochemistry of Miocene-Pliocene Epithermal Gold-hosting Volcanic Rocks in northeastern Borneo (Sabah and North Kalimantan)

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Miocene-Pliocene volcanic rocks are widely exposed in North Kalimantan (Indonesia) and the Semporna and Dent Peninsulas in Sabah (East Malaysia) [1-2]. These volcanic rocks are host to many high-/low-sulfidation epithermal gold-(silver-copper) and lead-zinc deposits, notably at Seruyung and Jelai (North Kalimantan) and Tawau (Sabah), which forms the northeastern part of the Kalimantan Gold Belt. Field geological and petrographic study suggest that these volcanic rocks are mainly basaltic to andesitic (minor dacitic), porphyritic (with plagioclase and pyroxene phenocrysts), and comprise mainly lavas and minor tectonic / volcanic / hydrothermal breccias. The breccias are best developed along the regional NE-trending structures, notably the Sembakung Lineament. Close to the structures, the volcanic rocks are strongly altered (silicic, phyllic and (advanced)-argillic), and spatially associated with the epithermal mineralization. The Miocene volcanic rocks are largely calc-alkaline, with chondrite-normalized LREE/HREE and LILE (large ion lithophile element) enrichments and distinct negative Nb and Eu anomalies. The samples fall mainly in the continental arc field in the Th/Yb vs. Nb/Yb diagram [3]. Comparatively, the Pliocene volcanic rocks are more OIB-like, and some basaltic samples contain especially high Nb contents. We propose that the Miocene volcanic rocks in northeastern Borneo may have formed in a subduction-related continental arc setting, whilst the Pliocene OIB-like magmatism was probably more related to mantle upwelling during the opening of the Sulu Sea [4].

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