

Zircon U-Pb ages and geochemical characteristics of post-Miocene volcanic rocks from Southeast Sabah (Borneo), East Malaysia

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Borneo is situated in South East Asia characterized by the occurrence of a suite of marginal basins that are located at the junction of three converging major plates (Eurasia, Philippine Sea and Australia). Sabah that exists in northeastern Borneo has a basement of the Mesozoic ophiolitic complex, overlain by Cenozoic sedimentary formations associated with post-Miocene volcanic rocks in Southeast Sabah and late Miocene (~7-8 Ma) granitic intrusions in Mt Kinabalu. This study reports new zircon U-Pb ages and Hf isotopes together with whole-rock geochemical data of the Sabah volcanic rocks, which remain poorly studied, to better understand their petrogenesis and tectonic significance.

Our data allow us to divide the volcanic rocks into two stages, a predominant Middle Miocene (12~9 Ma) stage and a subordinate Pleistocene (~0.5 Ma) stage. The Miocene stage consists of calc-alkaline rocks, which vary from basaltic to rhyolitic composition and show subduction-related geochemical features such as depletion in high field strength elements (HFSE, e.g., Ta, Nb and Ti) and enrichment in large ion lithophile elements. Their magmatic zircons display generally high despite various $\epsilon\text{Hf}(T)$ values from +17 to +3. The Pleistocene stage consists exclusively of high-Nb basaltic rocks that show no or insignificant HFSE depletion. Zircons from an evolved sample ($\text{SiO}_2=53.5$ wt.%) gave a $^{206}\text{Pb}/^{238}\text{U}$ age of ~0.5 Ma coupled with significantly lower $\epsilon\text{Hf}(T)$ values from +5 to -2. This is the youngest volcanic product identified so far in entire Borneo.

The Miocene volcanism in Southeast Sabah is interpreted as the westernmost part of the Sulu arc system that initiated in the Middle Miocene. The Pleistocene basaltic rocks, which show intraplate geochemical characteristics, may have resulted from small degree melting of the convecting upper mantle and later being contaminated by crustal materials during magma ascent.