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A Comparative Study of the Geochemistry and Tectonic Setting of Cenozoic Igneous Rocks from East Kalimantan and Sabah, Borneo

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Detailed geochemistry of Cenozoic igneous rocks in central eastern and northeastern Borneo provide insights to its tectonic history. Samples from Upper Sungei Mahakam, the Telen river and the Kelian area of the Kutei Basin in east Kalimantan are compared with data for rocks from the Semporna and Dent peninsulas and the Kinabalu pluton in Sabah. K-Ar dating of Telen River samples yields late Oligocene to early Miocene ages (18.9 ±0.6 to 23.8 ±0.7Ma, Moss et al. 1997). Similar early Miocene ages (19.6 ±0.2 to 20.7 ±0.5Ma, Abidin, 1998) have also been measured in the Kelian area while the samples from Sabah yield middle to late Miocene ages (10 to 18.2 ±1.2Ma, Swauger et al. and Bergman et al., in press). At Kelian and in southeast Sabah younger basalts and dacites (0.97 ±0.02 to 3.11 ±0.93 Ma, Swauger et al., in press) have also been identified. The late Oligocene to early Miocene rocks found in the Kutei Basin appear to belong to an east-west trend of intrusive rocks belonging to the Sintang suite that extend right across Kalimantan. The youngest stages of the Sintang episode overlap with eruptive volcanism in southeast Sabah and precede the intrusion of the Kinabalu pluton in the middle Miocene. This period of igneous activity in northwest Borneo is coeval with the opening of the Sulu Sea. The spatial distribution of late Plio-Pleistocene volcanics of Borneo reveals a prominent northeast-southwest trend. Large volcanic deposits that can be traced over a distance of 400km form a series of sub-parallel fields that cap the topography and are tentatively correlated with the youngest magmatism identified at Kelian and in southeast Sabah.

Hypabyssal Miocene rocks of basaltic and intermediate compositions are found in Upper Sungei Mahakam whilst basaltic and andesitic lavas and tuffs are found in the Telen river. Miocene porphyritic andesites, andesitic tuffs and stocks of diorite are found in southeast Sabah and hornblende monazites in the Kinabalu pluton. The Plio-Pleistocene basalts at Kelian and the Semporna peninsula are mildly alkaline.

Major element variations in the Sintang rocks of east Kalimantan suggests crystallisation of the assemblage plagioclase + clinopyroxene + Fe-Ti oxides + apatite ±olivine. The large ion lithophile elements (LILEs), such as Rb, Th and Pb, and the light rare earth elements (LREEs) are enriched relative to the high field strength elements (HFSEs). On MORB-normalised plots the HFSEs plot slightly above unity suggesting that the mantle source of these lavas was not depleted with respect to the source of mid-ocean ridge basalt. Both the LILEs and LREEs are enriched by 20 - 100 times with respect to MORB. There are only minor differences between the trace element patterns of rocks from the three locations in east Kalimantan. Preliminary Sr isotope data for east Kalimantan reveal that $^{87}Sr/^{86}Sr$ in the Telen samples change little with increasing differentiation indicating that assimilation with fractional crystallisation has had a negligible influence on this suite. However, in the Mahakam samples $^{87}Sr/^{86}Sr$ ratios increase with differentiation, indicating that magma mixing or crustal assimilation has occurred as these rocks were emplaced. The lowest $^{87}Sr/^{86}Sr$ ratios in these two locations are significantly higher than MORB. MORB-normalised trace element patterns of magmatic rocks from Sabah display only slight differences from the Kalimantan suites, however, samples from Mt. Kinabalu contain higher overall abundances of the most incompatible elements.

Basaltic Plio-Pleistocene lavas from Kelian and Sabah display relatively smooth trace element patterns without the high LILE/HFSE ratios of the older magmatism. The smooth trace element patterns and alkaline nature of these lavas are similar to lavas found in continental rifts and indicates that subduction may play a minimal role in their petrogenesis. In conjunction with the sub-parallel alignment of the elongate Plio-Pleistocene lava fields this suggests that large extensional basement structures may influence the distribution of the youngest magmatism in Borneo.

Abidin HZ, *PhD Thesis, University of Adelaide*, (1998).
Bergman SC, Hutchison CS, Swauger DA & Graves JE, *Bull. Geol. Soc. Malaysia*, (in press).
Moss SJ, Carter A, Hurford A & Baker S, *J. Geol. Soc. London*, **155**, 177-192, (1998).
Swauger DA, Hutchison CS, Bergman SC & Graves JE, *Bull. Geol. Soc. Malaysia*, **(in press)**.