Geophysical Research Abstracts
Vol. 16, EGU2014-1098-1, 2014
EGU General Assembly 2014

Petrogenesis of Malaysian tin granites: geochemistry, fractional crystallization, U-Pb zircon geochronology and tectonic setting

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The Malaysian tin granites forming the backbone of the Thai-Malay Peninsula has been long recognized with two distinct granitic provinces:-
1. Early Permian to Late Triassic Eastern Province with mainly “I-type” (Hbl)-Bt granites with associated Cu-Au deposits, with subordinate Bt granites hosting limited Sn-W deposits, and
2. Late Triassic Main Range Province with mainly “S-type” Bt granites with associated Sn-W deposits, and subordinate (Hbl)-Bt granites.

New geochemical data show that Chappell and White’s (1974) I-S granite classification adopted in the existing model does not adequately distinguish the granites from one another as previously implied. Trace element geochemistry and Sr-Nd isotopic compositions show that the Malaysian tin granites in both provinces have transitional I-S characteristics. In addition, they inherited within-plate signature from Cambro-Ordovician Gondwana-related source rocks. Previous ages were obtained by whole rock Rb-Sr and biotite K-Ar geochronology in the 70s and 80s, dating methods that may not accurately represent the crystallization age of granites. We re-sampled the entire Malaysian Peninsula and 40 samples were collected for high-precision U-Pb SIMS dating on extracted zircon grains in order to better constrain the magmatic and tectonic evolution of Southeast Asia. The crystallization ages of the Eastern Province granitoids have been constrained ranging from 220 to 290 Ma, while the Main Range (Western) Province granitoids have ages ranging from 200 to 230 Ma. A progressive westward younging trend is apparent across the Eastern Province, but becomes less obvious in the Main Range Province. Our model suggests two east dipping subduction zones. We suggest that subduction roll-back along the Bentong-Raub suture might account for the westward younging trend, in the Eastern province. A second Late Triassic east-dipping subduction zone beneath western Malaysia is proposed in order to explain the “I-type” components to the Main Range Province granitoids.

Reference:
Chappell, B.W., and White, A.J.R., 1974, Two contrasting granite types: Pacific Geology, v. 8, p. 173-174