Tectonomagmatic evolution of the Main Range Granite of Peninsular Malaysia

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The voluminous Triassic Main Range Granite (MRG) is a spectacular and a fundamentally important geologic feature. Its tectonomagmatic evolution is a contentious issue, and must be understood before the problems related to the geological evolution of the region can properly be resolved.

The MRG is a composite batholith emplaced into lower green schist facies environment. It is in general mildly peraluminous; and it has petrographic, geochemical and isotopic characteristics of S-type granites. The crystallization of the MRG occurred at relatively low pressure (< 4 Kb) from water undersaturated melts (< 4% H_2O). Pl-Q-Bi-Kf or Pl-Bi-Q-Kf are common paragenetic sequence. The MRG includes many textural varieties due primarily to variations in growth rates, physical conditions and H_2O-activity. Effects of fluid relocation, deformation of crystal-melt mush, subsolidus alterations and recrystallization, and post-crystallization deformation. Influx of water caused partial re-melting of already crystallized hot and relatively dry granite and gave rise to primary composite textured granites (two-phase granite).

The MRG comprises several chemical suites which have evolved along broadly parallel paths from different batches of magmas representing different crustal melt fractions. The

suites have evolved to varying degrees through crystallization-differentiation. Mixing of magmas at various stages of evolution has occurred to a certain extent. Restite-controlled differentiation or lage scale assimilation did not play any significant role in the evolution of the MRG magmas.

There is no regular spatial variation in the chemical characteristics of the suites; and compositionally similar suites are found to occur in geographically separated areas. Also the parental magmas of the least evolved suites do not reveal any significant chemical differences. Evidently the source rocks involved in the crustal anatectic processes were compositionally very similar. The source rocks were relatively K_2O poor and weakly to moderately peraluminous. Psammopelitic or immature quartzofeldspathic sediments are likely candidates.

The thermotectonic models of the MRG are poorly constrained. Currently available geological and geophysical evidence does not support the idea that crustal anatexis was caused by collisional thickening. The absence of coeval basic magmatism also precludes the possibility of significant heat supply from the mantle. High heat production and heat retention in radioelement enriched old basement have probably played an important role in inducing crustal anatexis in intra-plate tectonic environment.
