RECENT ADVANCES AND EMERGENT PROBLEMS IN THE TECTONOMAGMATIC EVOLUTION OF THE GRANITOIDS OF THE MAIN RANGE PROVINCE, PENINSULAR MALAYSIA.

K.R. CHAKRABORTY
Department of Geology, University of Malaya, 59100 Kuala Lumpur

The N-S trending belt of Triassic granitoid batholiths of the Main Range Province is a most important and striking geologic feature in the western part of Peninsular Malaysia. Acquisition and accumulation

of petrographic, geochemical and geochronological data over the last two decades have significantly advanced our understanding of these batholiths, but at the same time new questions and conflicting ideas have also emerged. This paper aims to address some of the new ideas and emergent problems, particularly with reference to generation, emplacement and evolution of the magmas as well as their probable tectonic environment.

Granites of the Main Range Province are mainly peraluminous, although mildly metaluminous rocks are also present. They are alumino-cafemic to aluminous. They possess features of typical S-type granite and are undoubtedly products of crustal anatexis, the source probably being a 1500-1700 Ma old Precambrian crust as evidenced by the presence of inherited zircon.

There are some differences in opinion regarding the processes responsible for the chemical evolution of the magmas of this Province. An analysis of all available geochemical data reveals distinct chemical suites which seem to have evolved along broadly parallel paths through mainly crystallization- differentiation, the extent of which varies from suite to suite. Parental magmas of different suites represent differing degrees of crustal partial melts. Mixing of magmas at different stages of evolution has probably occurred to some extent. Coherent inter-element relationships of relatively immobile and high field strength elements and their regular variation patterns testify against assimilation playing any significant role. If "anomalously old Rb-Sr isochron" is an acceptable evidence in favour of appreciable assimilation, then it must have occurred at deeper levels since the plutons do not bear any distinctive chemical signatures reflecting the types of country rocks into which they have intruded. Restite-controlled differentiation can be discounted due to the lack of xenoliths with appropriate petrographic features or compositions. An important point that emerges from the chemical patterns is that compositionally similar suites occur in geographically separated areas. There is also no significant systematic chemical differences in the granitic suites across or along the Main Range Province. Evidently compositionally similar rocks were involved in magma genesis.

The early crystallizing phases in the granites are plagioclase-quartz-biotite or plagioclase-biotite-quartz. K-feldspar, despite its frequent occurrence as megacrysts, is a late crystallizing phase. Such a paragenetic sequence suggests a melt water content less than 4%, and hence crystallization probably occurred at pressures not exceeding 3 kb. Otherwise, plagioclase could not have crystallized before quartz and biotite. Such a low pressure of crystallization does not conflict with the presence of texturally inferred primary muscovite in some evolved granites. The intersection point of wet solidus and muscovite (+quartz) stability curve would shift towards lower pressure in presence of boron and other volatiles. Also, various lines of evidence such as emplacement in lower green schist facies environment, roof pendants of similarly low metamorphic grades, occurrence of miarolitic cavities, indicate rather a shallow level emplacement of the magmas consistent with the inferred pressure of crystallization.

Late saturation of K-feldspar would imply that source rocks for granite magmas were relatively poor in K_2O, and hence typical metapelites are unlikely to be the source rocks. If orthopyroxene bearing peraluminous granodiorite porphyry of Genting Sempah is genetically related to the granites, which seems very likely, then orthopyroxene can be assumed to be a liquidus phase leading to the suggestion that source rocks were orthopyroxene bearing. If this is correct, then quartz-plagioclase-biotite-orthopyroxene-garnet granulites or similar rocks appear to be likely candidates. This aspect of granite magmatism in the Main Range Province warrants more serious and in-depth studies.

Main Range granites display a variety of textures. Complex textural development is due to an interplay of a number of factors including fluctuations in physical conditions, fluid relocation, deformation of crystal-melt system, subsolidus alteration and recrystallization, and post-crystallization deformation. A composite porphyry-type texture or a variety sometimes referred to as "two phase granite" are quite common in many plutons. Influx of water into relatively dry rocks at solidus would cause partial fusion and remobilization. Subsequent crystallization of this remobilized mass could give rise to such textures. Invasion of early crystallized rocks by residual magmas may also produce similar textures.

The question of tectonic environment under which such voluminous S-type granites have formed remains an elusive problem, considerable attention notwithstanding. A collisional environment has been popularly invoked. In view of the fact that the subduction-collision models that have been proposed to explain the tectonic evolution of the Malay Peninsula find little support from available geological, geochemical and geophysical evidence, the idea of crustal anatexis due to collisional thickening cannot be entertained. The apparent absence of large thrust structures west of the Bentong-Raub Line (compare, for example, Himalayan collision zone) also does not support thrust-controlled crustal thickening in the western block; neither does available gravity data. On the other hand, the assumption that the thickening was effected by the thrusting of eastern block over the western block has to be rejected. Otherwise it would

imply that the Main Range Province is an integral part of the eastern block inasmuch as the generation and emplacement of magmas would have to be confined to the overthrusted crust; and there is compelling evidence against it. Alternative tectonic models for the Malay Peninsula which are consistent with many geological evidence envisage a tensional regime during Permo-Triassic time. It is quite likely that Main Range granite magmatism occurred under intraplate tensional environment.