Geochemical contrast between Beroga (Kuala Kelawang pluton) and Semenyih (Kuala Lumpur pluton) granites in Kuala Kelawang area, Negeri Sembilan

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Abstract— Geochemical data of both Semenyih and Beroga granites, in the central part of Main Range Granite, show that they are madeup of different magma pulses. The Beroga granite is more basic, containing 67.22 – 68.02% SiO_2, whereas the Semenyih granite consists of more evolved rock (SiO_2: 70.36 to 73.48%). Both are S-type granite which suggests that the source rocks were metasediments. Geochemically, they are part of the Main Range Granite. The Semenyih granite is charcterised by high Rb/Sr ratio, which suggests that the magma is highly evolved and contains less enclaves compared to the Beroga granite.

Keywords: Main Range Granite, geochemistry, granite, Western Belt

INTRODUCTION

The central part of the Main Range Granite of Peninsular Malaysia comprises several granitic bodies such as Kuala Lumpur, Jelebu, Bukit Tinggi and Kuala Kelawang plutons (Liew 1983; Cobbing *et al*., 1992). The Kuala Kelawang pluton is located at the southeastern part of the Kuala Lumpur pluton. The contact between these granites can be found at the north of the Titi Kerawang area. In this area, the Kuala Kelawang pluton is represented by the Beroga granite and the Kuala Lumpur pluton is represented by the Semenyih granite (Figure 1). This paper will discuss the contrasting geochemical differences between the Beroga and Semenyih granites.

Granite samples of both granites were collected at the Titi Kerawang and Jeram Gading areas. The country rock of both granites is the Jelebu Schist that consists of four rock types: schist, phyllite (greenschist facies), amphibolite schist and serpentinite. The main structural elements in the study area are a series of subparallel NW-SE trending faults. This fault system is part of the Bukit Tinggi fault zone and has been traced from Kuala Kubu Baru, through Bukit Tinggi down to the study area. The faults can be seen cutting through the Semenyih granite along the Kuala Kelawang – Hulu Langat road cut south of Bukit Gelanggang. This area has been cut by the Kongkoi fault along the Kongkoi valley which forms an 8 km linear surface expression of breciated granite and contorted schist.

FIELD DESCRIPTION OF THE BEROGA AND SEMENYIH GRANITE

Beroga granite

The Beroga granite forms an irregular body along the southern part of the study area. The main outcrop is found at the Titi Kerawang township north of Kuala Kelawang. The granite is biotite-rich with distinct K-feldspar megacrysts. It is dark grey and contains xenoliths of schist and other microgranular enclaves (Figure 2). The granite weathers to a reddish soil which can be easily differentiated from the Semenyih granite. The biotite forms interconnecting clots ranging from 2 mm to 10 mm across. The percentage and texture of the biotite in this rock is rather unusual compared to other Main Range granites. The mineral can be up to 20% in a single hand specimen whereas for the other Main Range granites, the average biotite content ranges from 5% to 10%. The biotite in the Beroga granite may have resulted from dispersion of the mafic and metasediment enclaves in the magma. This is evident from various types of mafic microgranular enclaves in the granite.

The main granite type is megacrystic coarse to medium grained biotite granodiorite (Figure 3). The essential minerals of the Beroga granite are quartz (30%), K-feldspar (40%), plagioclase (23%) and biotite (7-10%) (Shu, 1989).

Semenyih granite

The Semenyih granite forms the Kongkoi hill with the highest point at Bukit Kongkoi (950 m). It is the main

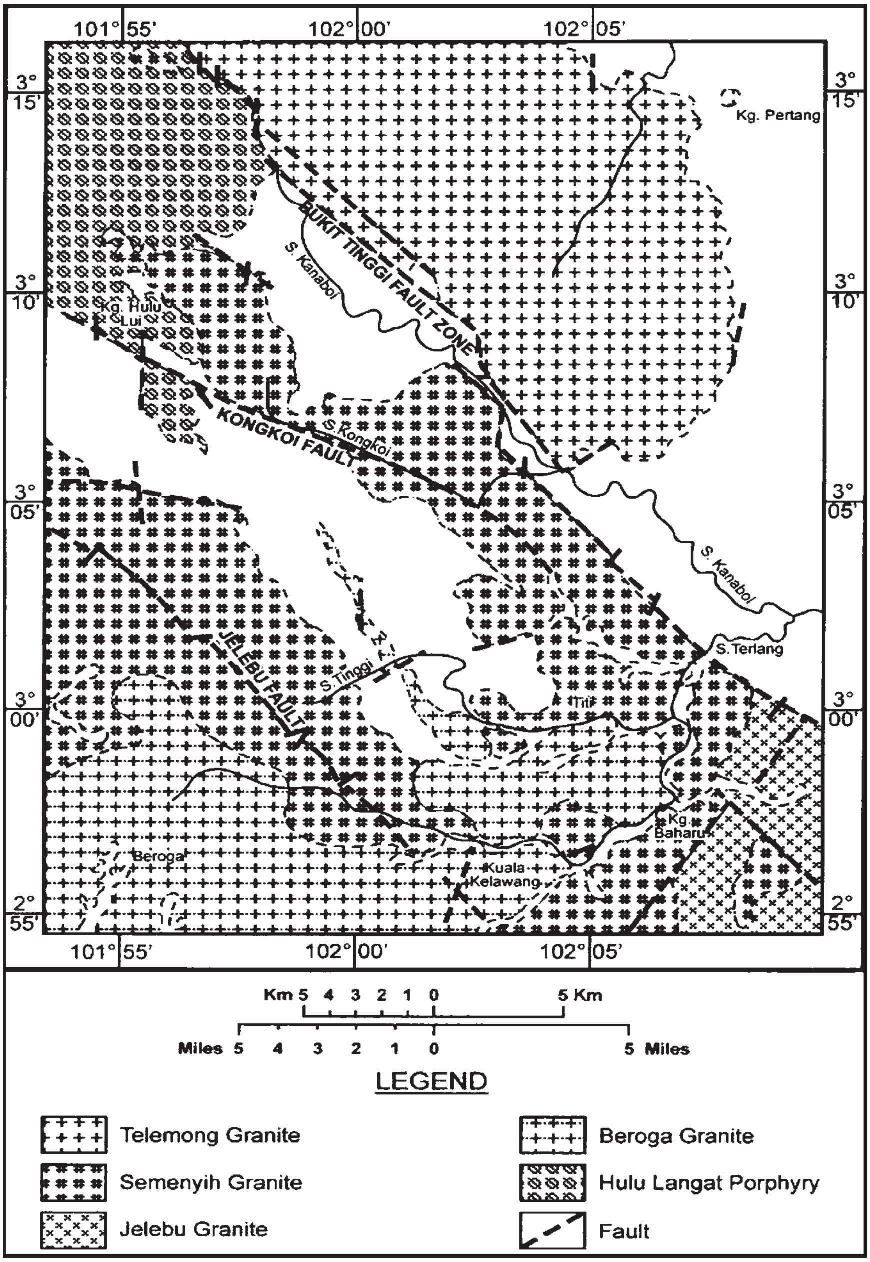

Figure 1: Map showing different types of granites from Kenaboi and surrounding area, Negeri Sembilan. Modified from Shu (1989).

rock type in the northwest of Hutan Simpan Kenaboi, Negeri Sembilan. The outcrop of this granite is found at the Kongkoi – Chennah road cut. Shu (1989) shows that the eastern part of the Semenyih granite in the Kongkoi area is faulted. The Semenyih granite is consisting of coarse to medium grained biotite granite (Figure 4) and commonly intruded by microgranite, coarse grained leucogranite, aplite and pegmatites. The main rock type of the Semenyih granite is coarse grained biotite muscovite granite. The phenocrysts usually make up less than 10% of the rock and consist of euhedral K-feldspar ranging in size from 2.5 cm to 3.8 cm.

GEOCHEMISTRY

Ten granitic rock samples from the study area have been analysed for major and trace element contents. There are six samples from Beroga granite, three samples from Semenyih granite and two samples from the foliated Semenyih granite. The Beroga granite has low SiO_2 (67.22 – 68.02%) contents compared to the Semenyih granite (70.36 to 73.48% SiO_2). This shows that the Beroga granite lies on the mafic end of the Main Range Granite (Figure 5). The Harker diagram shows clear trends of decreasing TiO_2, Al_2O_3, Fe_{total}, Na_2O, MgO, CaO and P_2O_5 with increasing SiO_2. K_2O and MnO increase with increasing SiO_2. All units have high alkali contents, with the following Na_2O+ K_2O ranges: Beroga granite (7.0 to7.9%) and Semenyih granite (7.6 to 9.7%). On the Na_2O vs K_2O diagram (Figure 6) all samples plot in the S-type field, which suggest that all the three magmas originated from a sedimentary source with probable candidate being pelitic and greywacke.

The Beroga granite also has low Rb contents and Rb/Sr ratios and high Fe_{total}, CaO, MgO, TiO_2, P_2O_5, Ba, Sr, Sc,

Figure 2: Field occurrence of the Beroga granite with two types of mafic enclaves. Note the abundance of biotite clots forming an interconnecting pattern.

Figure 3: Photograph showing the Beroga granite with euhedral K-feldspar phenocrysts.

Figure 4: Semenyih granite from Kampung Lesung, Kenaboi. The granite is characterised by a porphyritic coarse grained texture and slightly pinkish colour.

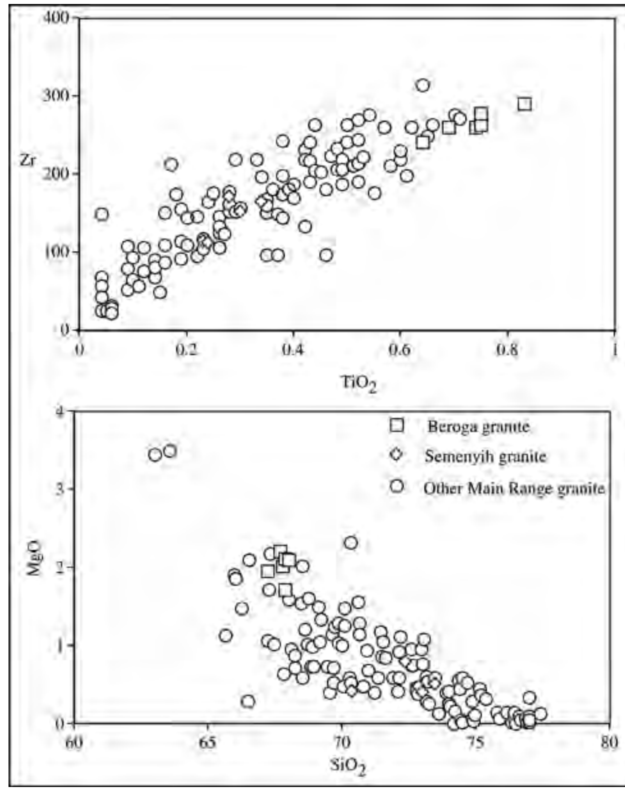

Figure 5: Zr (ppm) vs TiO_2 and MgO vs SiO_2 plots for the granitic rocks from the study area and comparison with other main Range granite.

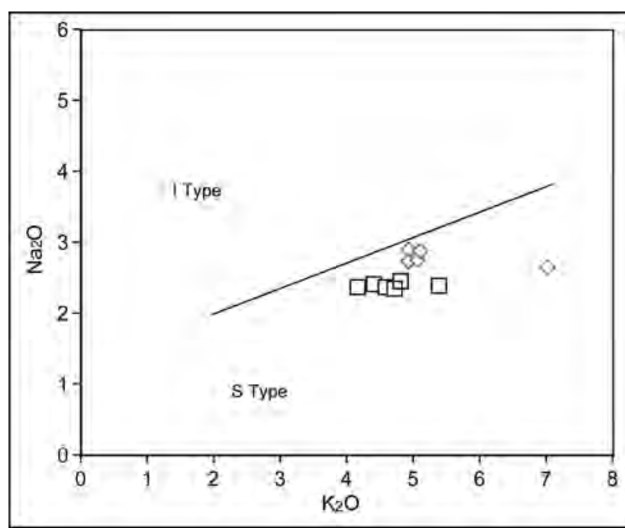

Figure 6: Na_2O vs K_2O plot for the granitic rocks from the study area. Symbol as in Figure 5.

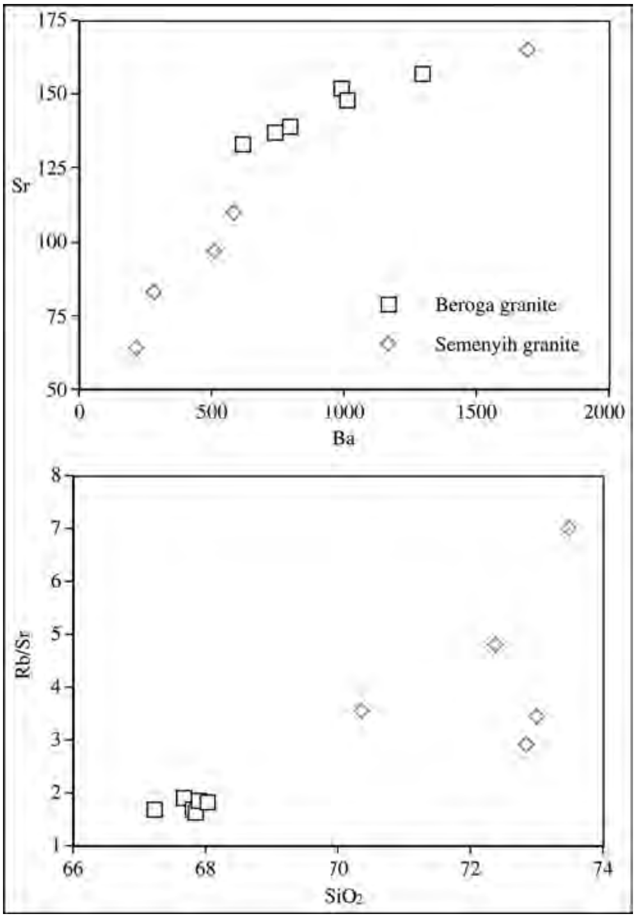

Figure 7: Sr(ppm) vs Ba(ppm) and Rb/Sr vs SiO_2 for the granitic rock from Kenaboi area.

Ni, Nd, V and Zn compared to the Semenyih granite. On the Sr vs Ba diagram (Figure 7), both Beroga and Semenyih granites show a good positive correlation which suggests that K-feldspar, biotite and plagioclase were being removed in the differetiation sequence. The trend is in contrast to the Sempah porphyry, where all the samples are scattered. Participation of plagioclase in the Semenyih magma is also evidence from Rb/Sr vs SiO_2 (Figure 7). The Rb/Sr ratio for the Semenyih granite (Rb/Sr: 2.8 to 7) is higher compared to Rb/Sr ratio of both Beroga granite samples (Rb/Sr: 1.6 to 1.9). The low value of the Beroga rocks suggests that the magma is less evolved compared to the Semenyih magma.

CONCLUDING REMARKS

The Beroga granite is characterised by biotite contents up to 25% and forming interconnecting clots with size up to 2 cm across. It is also characterised by abundant xenoliths and other enclaves. Among the enclaves are pelitic and various modifications of fine to medium grained biotite rich enclaves. It is interpreted that the biotite clots were resulted from dispersion of the enclaves in the Beroga magma. The formation of the biotite clots, as a result of assimilation and contamination of the host rock can be explained in term of the mechanical, thermal and chemical interaction between magma an the xenoliths. Field observations showed that xenolith assimilation is widespread in the Beroga granite and that different stages of assimilation can be observed.

Mechanical, thermal and chemical interactions between enclaves and their host rocks occurred at different crustal levels in magma chambers, in the conduits or after emplacement. These interactions are controlled by physical and chemical contrasts between enclaves and magma and may be simultaneous, all of them contributing to enclave assimilation (Maury & Didier, 1991). During the ascent of the Beroga magma the wall rock (pelitic country rock) will fall into the magma. Thermal contrast between the xenoliths and host magma led to various transformations, from the unaffected xenoliths to the fused ones. Because they have been incorporated in magma at greater depths and have been heated for a longer period of time, the metamorphic xenoliths show the most intense changes, and their original features may be sometimes unrecognizable. Compositional differences between host rocks and enclaves will be reduced as a result of chemical interaction. The rate of the chemical transformation depends on the chemical contrast between enclaves and host rocks and on the degree of their melting.

The geochemical studies show that the Beroga granite which is part of the Kuala Kelawang pluton is more basic compared to the Semenyih granite. The latter is more evolved and contains fewer enclaves. However both Semenyih and Beroga magmas are S type (Figure 6) and this suggests that the source rocks were metasediments. This is consistent with the other Main Range Granite magmas.

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