

Contrasting chemical characteristics of granite and syenite from Perhentian islands, Peninsular Malaysia

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The Perhentian intrusion is a reversely zoned complex exposed over several islands off the east coast of Peninsular Malaysia. The intrusion is made up of Perhentian Kecil Syenite rimmed by more evolved Perhentian Granite. The former consists of a variety of igneous rocks ranging in composition from syenitic to monzonitic and even gabbroic rocks whereas syenogranite dominated the latter pluton. Field relationships of the rocks suggest that the Perhentian granite is younger than the Perhentian Kecil syenite. Both plutons show different trends in the Q-A-P classification, thus the Perhentian Kecil syenite samples show a similar trend to the rocks from the alkaline province whereas the Perhentian granite samples plot in the field of granitoid formed by crustal fusion. The essential minerals in Perhentian Kecil syenite are K-feldspar, plagioclase, hornblende, pyroxene, quartz, biotite, sphene, epidote, apatite, zircon and magnetite whereas K-feldspar, plagioclase, quartz, biotite, hornblende, allanite, zircon, epidote and opaque phase make up the Perhentian granite. As in the field and petrographic characteristics, geochemistry of both plutons also show a different behaviour. The differences are:

1. Perhentian Kecil syenite trend evolved towards the nepheline normative whereas the Perhentian granite rocks seems to evolved towards the quartz normative on a TAS diagram.
2. Both pluton show a different ACNK trend with SiO_2 , thus the ACNK trend of the syenitic rocks increase whereas those from the granitic rock are decrease with increasing SiO_2 .
3. Plots of CaO and $(\text{Na}_2\text{O} + \text{K}_2\text{O})$ vs SiO_2 emphasise the alkali calcic character of the syenitic rocks i.e. alkali-lime index of 54.5, as well as very different character, in alkali term, of the Perhentian granite pluton in which the CaO and $(\text{Na}_2\text{O} + \text{K}_2\text{O})$ curves do not intersect. This is due to the lower CaO and higher $(\text{Na}_2\text{O} + \text{K}_2\text{O})$ contents of the granitic rocks which are constant over the SiO_2 ranges (71–75%).
4. In rocks from the Perhentian Kecil syenite, Ba, Ce, La, Rb, Th increase and Sc, V, Sr, Pb, Y, Zn and possibly Zr decrease with increasing SiO_2 . Trace elements in the Perhentian granite show some odd trends, thus Ce, Co, La, Nd, Pb, Th, Rb and Y neither increase nor decrease but produced a steeply vertical trends which is difficult to explain by simple fractional crystallisation.
5. Rocks from Perhentian Kecil syenite have high Sr and Ba compared to the Perhentian granite. All the Perhentian granite rocks plot below the line $\text{Ba}/\text{Sr} = 1$ and can be considered as low Ba-Sr granite.
6. The Perhentian Kecil Syenite has very high Sr/Y ratio compared to the Perhentian granite.
7. The Perhentian granite has low total REE (106–382) compared to the Perhentian Kecil syenite (224–450). The granite also has more restricted La_N/Lu_N ratios (0.96–58.8) compared to the syenitic rock which has more wider La_N/Lu_N ratios (30.7–218.5).

Field, petrology and geochemical study of the Perhentian rocks indicate that both Perhentian granite and Perhentian Kecil syenite are made up of individual batches of melt.
