The Malayer plutonic complex: field geology, petrography and geochemical interpretation

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Abstract: The geochemical signatures like discordant variation of major and trace elements among felsic-intermediate and basic rocks and mafic enclaves of Malayer region on binary variation plots, decreasing values of FeO, TiO2, MgO, MnO and CaO accompanied with increasing of SiO2 content from basic to felsic rocks, and decreasing Ni, Cr and Co with increasing SiO2 are considered as indications of magma mixing/mingling event in the petrogenesis of high potassium calc-alkaline granitic rocks of the Malayer region. Felsic and basic rocks of Malayer pluton show different REE pattern (LREEs/HREEs), where Eu-anomalies values such as LaN/SmN content as an index for concentration of LREEs and GdN/YbN content as an index for the concentration of HREEs are different. The relative enrichment in LILEs (e.g. U, Th, Ba, Rb, Cs, K) than HFSEs (Y, Yb, Zr, Ti, Tb, etc), constant variation of compatible elements (such as V, Ni, and Cr) in the differentiated phases, and negative anomaly of Nb and Ta can be attributed to the role of the components from the subducted oceanic plate as long as crustal components in the formation of granitic magma. The results show that magmatic differentiation associated with crustal contamination and partial mixing (or mingling) is responsible for the formation of granitic and dioritic intrusions, while magmatic enclaves are generated by magma mixing process. Negative Eu-anomaly in the felsic-intermediate rocks with respect to their concordant REEs variations suggests plagioclase fractionation plays role in their petrogenesis. The non-concordant REEs variations and less enriched LREEs in basic rocks are consistent with partial melting process of an ultrabasic source. The heat transfer and further crustal anatexis may lead to extensive granitization. The mixing of basic magma and anatectic melts is suggested as being responsible for the generation of microgranular mafic enclaves and basic dykes.

Keywords: Malayer plutonic rocks; magma mixing; magmatic fractionation; partial melting.