Geochemistry and Sr isotopes of the rocks of the Plana pluton, Srednogorie zone, Bulgaria

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The Plana pluton represents a large intrusive body (about 400 km^2), located ca. 60 km SE from Sofia and belongs to the Apuseni-Banat-Timok-Srednogorie Late Alpine belt (ABTS). The rocks of the pluton range gradually from small volumes of gabbroic rocks in the periphery, to granitoids (mainly granodiorites) in the central parts of the body. The rock varieties are gabbro-pyroxenites, gabbro, monzogabbro, monzodiorites, quartz-diorite, quartz monzodiorite, quartz monzonite, to granodiorite and granite as well as granite-aplites and pegmatites. The pluton is probably a result of *in situ* crystallization that led to the formation of cumulative gabbroic rocks in the periphery and the consecutive increasingly more evolved rock types within the center. Magmatic enclaves were found in the whole intrusion area, indicating the magma mixing processes.

The geochemical characteristics of the rocks of the Plana pluton demonstrate the typical signature of subduction related magmas. The ORG normalized patterns for the granitoids exhibit all the distinctive characteristics for Ca-alkaline VA granites [1]. The samples are enriched in K, Rb, Ba, Th, Ce and Sm relative to Ta, Nb, Hf, Zr, Y, Yb. The degree of LILE and LREE enrichment relative to HFSE correlates with SiO_2 and alkali content. On the Rb – (Yb+Ta) and the Rb-Hf-Ta discrimination diagrams the granitoids plot unequivocally in the VAG field.

All the rocks (except some cumulative gabbroic rocks and aplites) exhibit general enrichment in LREE relative to HREE. The more evolved the sample, the higher the La/Sm and La/Yb ratios, which could be attributed to CPx and Hb fractionation. A negative Eu anomaly appears with the formation of monzonites due to Pl fractionation while further differentiation keeps the Eu anomaly relatively constant.

Aplitic granites strikingly differing from all of the other rocks were established in the pluton. They exhibit large negative Ba anomalies, strong Rb enrichment and raised Nb and Ta abundances. They have characteristic “V”-shaped normalized REE patterns with HREE enrichment, low La/Yb values, very steep increase in LREE/MREE, and a large negative Eu anomaly. Their characteristics could account both for WP and syn-COL granites, but their $^{87}Sr/^{86}Sr$ values of 0.7185 are high and favoured a crustal origin and thus a syn-COL tectonic setting is rather more appropriate. The syn-COL origin is further supported by the position of the rocks on a Rb – (Yb+Ta) discrimination diagram and the Rb-Hf-Ta plot. However, their actual mode of formation still remains uncertain, and further investigations are to be made.

The $^{87}Sr/^{86}Sr$ isotope measurements are in the range of 0.7043-0.7050 which supports a mantle source for the rocks of the Plana pluton with slight crustal contamination. The results are similar to those obtained for other Late Cretaceous bodies in the Srednogorie zone. The $^{87}Sr/^{86}Sr$ values for the geochemically different aplites is 0.7185, indicating crustal dominated source for this rock type

References:

[1] Pearce et al., 1984. Trace Element Discrimination Diagrams for the Tectonic Interpretation of Granitic Rocks. *J.Petrology, 25, part 4, pp. 956-983*