MAJOR ELEMENT MODELING OF THE BRNJICA GRANITOIDS (EASTERN SERBIA)

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The Brnjica granitoid pluton has an exposed area of ca. 27 km^2 intruding Proterozoic gneisses (subordinate micaschist and amphibolite) and Ripheo-Cambrian metavolcanosedimentary series with a variety of green rocks. The Brnjica granitoids occur in the Kučaj terrane (KRSTIĆ & KARAMATA, 1992), the oldest rocks of which are the Proterozoic Osanica metamorphic rocks, followed by the late Proterozoic to early Cambrian "Green Complex". During the Variscan magmatism the Brnjica pluton intruded the above rock formations, as a late- to post-kinematic intrusion, causing an extensive thermal metamorphic phenomena (KARAMATA & KRSTIC 1996; VASKOVIC & MATOVIC,1997).

The Brnjica pluton, comprising tonalite (TON), granodiorite (GRD), two-mica granite (TMG) and leucogranite (LG), has Fe-biotite and magnesiohornblende, as main mafic mineral constituents. Muscovite occurs subordinately. Plagioclase is of oligoclase-andesine composition. Pressure of 2.3 to 4.1 kb and temperatures from 626 to 813 °C were calculated for TON, using hornblende and co-existing hornblende and plagioclase compositions respectively. SiO_2 in TON and GRD ranges from 64.2 to 68.25 wt.% and from 67.7 to 72.5 wt.% while in TMG is 73.8 wt.% and in LG 75.7 to 75.9 wt.%. Most of the oxides (TiO_2, Al_2O_3, Fe_2O_3t, MgO and CaO) in TON and GRD form well-correlated trends. In TMG and LG most of the elements (TiO_2, Fe_2O_3, MgO, CaO, Na_2O, K_2O and total alkalies) follow the general trend of GRD. All samples analyzed are slightly peraluminous with A/CNK=1.0-1.3. Based on the R1-R2 diagram, the TON and most of the GRD plot in the pre-plate collision granites (VAG). The granites and the most evolved GRD plot in the syn-collision granite field or around it. Combined mineral and rock major element chemistry suggests the involvement of fractional crystallization for the evolution of the Brnjica rocks. Major element modeling, using the less evolved (BRJ-208) and the most evolved (BRJ-223L) samples as parental and daughter magma respectively, requires 24% (F=0.76) crystallization of the assemblage $Pl_{55.5}Kfs_{8.4}Bt_{9.8}Hbl_{21.1}Ap_{0.3}Mgt_{2.1}Ttn_{2.9}$ for the evolution of the TON. In the model for the GRD evolution the less evolved sample BRJ-227 and the most evolved sample BRJ-231 were used as the parental magma and as the daughter magma respectively. The model requires 50% crystallization (F=0.5) of the mineral assemblage $Qz_{24.9}Pl_{52.3}Bt_{18.2}Zrn_{0.1}Ap_{1.5}Mgt_{1.7}Ttn_{1.2}$ to give the daughter magma (BRJ-231). A model using the most evolved TON (BRJ-223L) as parental for the evolution of GRD failed to give reliable results. The TON could originate in the crust by melting of amphibolites and basalts under various P-T conditions, which gives melts having 61-67 wt% silica. The GRD could also originate in the crust by melting of amphibolites, basalts and pelites, which gives melts with 64-70 wt% silica. Lastly, the source of the granites could be crustal melts produced by melting of amphibolites, gneisses, graywackes and pelites.

References

BATCHELOR, R. A. & BOWDEN, P. (1985). Chem. Geol., 48: 43-55.
BEARD, J. S. & LOFGREN, G. E. (1991). J. Petrol., 32: 365-401.
BEARD, J. S. *et al.* (1994). J. Geoph. Res., 99: 21591-21603.
GARDIEN, V. *et al.* (1995). J. Geophys. Res., 100: 15581-15591.
HOLLAND, T. & BLUNDY, J. (1994). Contrib. Mineral. Petrol., 116: 433-447.
HOLTZ, F. & JOHANNES, W. (1991). J. Petrol., 32: 935-958.
KARAMATA, S. & KRSTIC, B. (1996): In *"Terranes of Serbia and neighbouring areas"* 25-40.
MONTEL, J. M. & VIELZEUF, D. (1997). Contrib. Mineral. Petrol., 128: 176-196.
PICKERING, J. M. & JOHNSTON, D. (1998). J. Petrol., 39: 1787-1804.
RAPP, R. P. & WATSON, E. B. (1995). J. Petrol., 36: 891-931.
RAPP, R. P. *et al.* (1991). Precambrian Res., 51: 1-25.
SCHMIDT, M. W. (1992). Contrib. Mineral. Petrol., 110: 304-310.
SKJERLIE, K. P. & JOHNSTON, D. A. (1993). J. Petrol., 34: 785-815.
VASKOVIC, N. & MATOVIC, V. (1997). Proc. Intern. Symp. *"Geology in the Danube Gorges"*, 130-141.