GEOCHEMISTRY AND SR-ND WHOLE-ROCK ISOTOPE DATA FOR THE LEVETINA GNEISS (CENTRAL SWISS ALPS): FIRST RESULTS AND INTERPRETATIONS OF PETROGENESIS

BEFFA FLORIANO A.D., BÖHM, CH.O. & MEIER M.

Institute of Isotope Geology and Mineral Resources, ETH-Zentrum, CH-8092 Zürich.

The Leventina granitoid gneiss mass, which outcrops in the Central Swiss Alps south of the Gotthard unit, forms the lowermost tectonic unit of the Penninic nappe complex. It is exposed for a length of 40 km in the Leventina valley and reaches up to 7 km in width. The Leventina gneiss is separated from the Gotthard unit by the predominant para- and mixed gneisses of the Lucomagno unit and by the Mesozoic sediments of the Piora zone. Occasional mylonitic zones between the Leventina and Lucomagno units attest to overthrust movement of the Lucomagno relative to the Leventina unit. The metamorphic grade reached amphibolite conditions of ca. 600–650°C and 5.5–6 kbar during the Alpine orogeny.

Besides small lenses of paragneiss and amphibolites, three petrographic types of metagranitoids are distinguished in the Leventina gneiss unit: (a) coarse to porphyritic, leucocratic granite gneiss, (b) fine to coarse, leucocratic granodioritic to granitic gneiss and (c) mesocratic mica-rich granodioritic gneiss. (b)-type granodioritic to granitic gneiss builds up the central/ southern core of the Leventina unit and shows gradual transition to the (a)-type granitic gneiss. The latter becomes strongly foliated towards the margin, showing a folded to laminated fabric. (c)-type granodioritic gneiss occurs as small lenses embedded in (a)- and (b)-type gneisses.

Geochemical discrimination reveals the original composition of the three types of Leventina metagranitoids and their igneous origin: (a) monzogranite to syenogranite, (b) trondhjemitic granodiorite, and (c) granodiorite to quartz-monzodiorite. (a)- and (b)-types show peraluminous character, whereas (c) indicates some meta-aluminous affinity. In addition, different Eu anomalies corroborate the petrological variations between the three types. Harker-type variation diagrams, MORB normalized multi-variation diagrams as well as different REE compositions (MREE and HREE) and (La/Sm)N fractionation demonstrate two distinct differentiation trends from calc-alcaline to calcic characteristics: I) from (c) to (a) and II) from (c) to (b). The above geochemical features, suggesting the existence of two different granitic melts, are in agreement with field observations and point to a differentiation path I) involving slight contamination by country rock, in contrast to differentiation path II).

Additional geochemical trends observed are: 1) high K/Rb ratio and enrichment in HREE-rich mineral phases such as xenotime and apatite towards the northern margin of the Leventina unit, 2) depletion in HREE and a higher (Gd/Yb)N fractionation in the southern zone of the Leventina unit. The latter may be related to fluid-rock interaction as expressed e. g. by the frequent occurrence of pegmatites and aplites.

First Rb/Sr whole-rock data yield a Variscan errorchron age of 325 ± 18 Ma (95 % c.l. ext.), which concurs with apparent U-Pb ages of zircon fractions [1]. The initial $^{87}Sr/^{86}Sr$ ratio of 0.7052 ± 0.0003 supports an I-type origin of the Leventina metagranitoids. The Lucomagno S-type orthogneisses yield a substantially different age of 290 + 4/-3 Ma (U-Pb single-zircon data; Rb-Sr errorchron age ≈ 281 Ma) and a higher initial $^{87}Sr/^{86}Sr$ ratio of 0.7112 ± 0.0029 [2]. By the discrepancy in both initial $^{87}Sr/^{86}Sr$ ratios and an apparent Rb/Sr whole-rock age the Variscan orthogneisses from the Leventina and Lucomagno units can be clearly distinguished.

Geochemical discrimination analysis using major and trace elements implies a collisional, probably syn-collisional, tectonomagmatic regime for the generation of the Leventina metagranitoids. εNd and εSr initial values of about -4.9 and +37 indicate an EMI source reservoir comparable to lower crust.

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