Petrogenesis and T-fO₂ estimates of Mt. Monzoni complex (Central Dolomites, Southern Alps): a Triassic shoshonitic intrusion in a transcurrent geodynamic setting

COSTANZA BONADIMAN, MASSIMO COLTORTI and FRANCA SIENA

Istituto di Mineralogia, Università di Ferrara, C.so E. 1° d’Este, 32, I-44100 Ferrara, Italy

Abstract: The Mt. Monzoni middle Triassic intrusion (Central Dolomites, Southern Alps) is elongated in ENE-WSW direction, along a regional transcurrent fault system, and covers an area of 4.6 km², with the following lithologies in surface exposure: clinopyroxenites (8.5 %), gabbros, monzogabbros, and minor olivine-gabbros (50.5 %), and monzonites (41 %). Quartz syenitic and shoshonitic basalt dykes occur within the intrusive massif and in the neighbouring country rocks respectively.

The shoshonitic orogenic affinity of the complex is corroborated by mineral parageneses and geochemical features: K₂O/Na₂O 0.7-1.0; LaN/YbN 8-11; LILE enrichment and marked Nb negative anomaly in primordial mantle-normalized spidergrams. The apparent discrepancy between the "orogenic" character of this magmatism and the Triassic transcurrent "anorogenic" setting of its emplacement can be explained by considering mantle sources which inherited subduction-related geochemical components from the Hercynian orogenic cycle.

The elongated shape of the intrusion and its zonal arrangement suggest that magma emplacement and fractionation were dynamically controlled by ENE-WSW transcurrent tectonics active during the Triassic time.

Petrography, bulk rock and mineral chemistry, as well as mass balance calculations, in agreement with field volume estimates, indicate that shallow level fractional crystallization in a nearly closed system played a dominant role in the petrogenesis of the complex. Removal from a parental gabbroic magma of 8.2 % solid fraction gave rise to clinopyroxenite mesocumulates. The subsequent evolution from differentiated gabbros to monzogabbros can be accounted for by the removal of about 51.8 % of gabbroic assemblages, whereas monzonites, corresponding to a liquid fraction of 39 %, were in turn generated from monzogabbros. Magma fractionation and cumulus processes appear to have been mainly dependent on its growth rate and filter pressing, due to concomitant transpressive tectonics, which determined squeezing of the differentiated monzonitic magma southwestward.

Crystallization temperatures and oxygen fugacities have been calculated using a modified version of the Burkhard (1991) model for biotite - K-feldspar - magnetite equilibrium: the obtained T°/log f₀₂ paths closely fit the NNO synthetic buffer with ranges of 1044-867°C/7.9-11.6 for gabbros, 818-804°C/13.0-13.5 for monzogabbros, 851-769°C/12.0-14.7 for monzonites, and 589°C/19.0 for quartz syenite.

The restricted range of Sr-Nd isotopic ratios (⁸⁷Sr/⁶⁰Sr: 0.7041-0.7048; ¹⁴³Nd/¹⁴⁴Nd: 0.5123-0.5124) for the main lithologies of the complex confirms that fractional crystallization from a common gabbroic parent magma was the dominant petrogenetic process. The distinctly higher ⁸⁷Sr/⁶⁰Sr isotopic ratios recorded in dykes (0.7065-0.7079) and in the border facies of the intrusion (0.7053-0.7055) could be due to contamination by the country rocks.

Key-words: shoshonitic magmatism, anorogenic setting, geothermobarometry, Monzoni complex, Southern Alps.