

MAGMATIC DIFFERENTIATION PROCESSES DURING EVOLUTION OF NEOGENE CALC-ALKALINE MAGMATITES OF THE SUBVOLCANIC ZONE IN THE EAST-CARPATHIANS

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This paper evaluates Neogene calc-alkaline magmatism from Rodna-Bârgău Mts. based on new data on mineral compositions, and new major and trace element data for estimating specific chemical and P-T conditions of the different magmatic structures. Great variety of petrographic types (from basaltic andesites to rhyolites), preponderance of intermediary and basic rocks which form more extended intrusive structures compared with acid ones, as well as presence of cognate xenoliths only in the intermediary facies, deal with conjugate processes of assimilation, fractional crystallization, and repeatedly refilled magma chambers.

Amphiboles are the main mafic mineral within the magmatic rocks in the Rodna-Bârgău area. Most of the amphibole phenocrysts, especially those found in the andesites and microdiorites, as well as the amphiboles in mafic cognate xenoliths hosted by these rock types can be defined as magnesiohastingsites. The amphiboles belonging to more acidic facies (dacites, quartz andesites) are represented by tschermakite. The chemical composition of the amphiboles in cognate xenoliths is also relatively heterogeneous; it corresponds to various species such as magnesiohastingsite, magnesiohornblende, and pargasite.

Pyroxenes are present only in the more basic petrographical types, quantitatively subordinated to the amphiboles. They are also found in a number of cognate xenoliths. Within the cognate xenoliths the Ca-rich pyroxenes (diopside) is present, while in the host-rocks the Mg and Fe-rich variety (augite).

In most of the petrographic types the plagioclase feldspars (oligoclase to bytownite) show normal zoning, and oscillatory normal zoning. The normal oscillatory zoning indicates modification of the crystallization conditions (i.e. magma chamber refilling and/or rapid cooling during the emplacement of the intrusive body). Potassic feldspars (orthoclase, sanidine) are present in very small amounts, mostly in the cognate xenoliths.

The garnets are present only in the quartz andesites and dacites (1–2 wt% of the rock volume). The analyzed garnet crystals are almandine (over 55%). Garnets are fresh, with no inclusions and reaction zones.

Discrimination between two series of rocks is better evidenced in the K₂O–SiO₂ diagram. The first series comprises andesites, dacite, and rhyolite. It characterizes the medium- to low-K domain. The second series contains basaltic ande-

sites, andesites and microdiorites. It trends towards the high-K domain.

The major elements host rocks TiO₂, FeO, MgO, and CaO variation with SiO₂ content shows trends of negative correlation, whereas K₂O and Na₂O increase with increasing SiO₂. These trends are consistent with fractional crystallization starting from basic magmas. Rb, Nb, Pb, Sr, Zr, Y show a scattered variation with SiO₂. This indicates diverse conditions of magma generation for different magmatic structures. LIL and LREE enrichment as compared to primitive mantle deal with crustal assimilation processes.

Using Al content in hornblende as geobarometer and amphiboles-plagioclase geothermometer, we obtained a temperature range from 798 to 936 °C, and a more significant pressure variation from 6201 bars to 8886 bars. Generally, the cognate xenoliths display slightly lower P-T values compared with their host rocks. The pressure estimates for host rocks and cognate xenoliths suggest mid-crustal depths of approximately 15–25 km, which probably represent the depth of intermediate chambers where mixing-mingling processes took place.

Each intrusive structure encountered specific magmatic evolution processes, which have been controlled by absence or presence of an intermediate magmatic chamber and its depth, by magma volume, and by refilling of magma chamber. The acidic rocks from the medium to low-K series form much smaller structures, and the petrographic and geochemical characteristics are not consistent with the existence of intermediate magmatic chambers. The presence of primary magmatic garnets and the absence of cognate xenoliths indicate rapid ascent toward the surface.

The evolution of the rocks from high-K series was more complex; thus, the presence of intermediate large magma chambers situated in the upper crust where AFC processes took place is to be considered. These rocks are well crystallized, have high K and Sr content.

Within this chamber different process type could occur: complex magma mixing and crustal assimilation. Beside the assimilation process of the middle crust, an additional process of repeated fed of magma chamber could explained the abundance of cognate xenoliths, including pyroxenites, and the low SiO₂ content of these rocks. Such processes could also explain the chemical and isotopic heterogeneity of the cognate xenoliths found in these units.