MINERALOGY AND MINERAL CHEMISTRY OF HORNBLENDITES FROM THE DITRĂU ALKALINE MASSIF (ROMANIA) AND ITS PETROGENETIC RELATIONS

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The Ditrău Alkaline Massif [DAM] is a Mesozoic alkaline igneous complex, which is situated in the S-SW part of the Ghiurghiu Mountains in the Eastern Carpathians (Romania). Petrographically the DAM is exceptionally diverse, and consists of different type of rocks: hornblendites, gabbros, diorites, monzodiorites, monzonites, nepheline syenites, granites, monzosyenites, syenites, quartz syenites, alkali feldspar syenites, lamprophyres and tinguaites. The massif is the result of a long lasting (Middle Triassic–Lower Cretaceous), two phased (Middle Triassic–Upper Triassic and Lower Cretaceous) magmatic process (PÁL-MOLNÁR, 2010).

Horblendites are representative primitive rocks of the massif, thus the determination of their mineralogy and mineral chemical composition is essential for understanding the magma processes, which formed the DAM. Several varieties can be found here such as olivine-pyroxene hornblendite, pyroxene-hornblendite, plagioclase-bearing hornblendite and pure hornblendite.

The aim of this paper is the discussion of mineralogy and mineral chemistry of hornblendites and the estimation of their impact on the petrogenesis of the rocks.

Chemical analysis of the minerals were performed on a Cameca SX-50 (acceleration voltage of 15kV, and probe current 20 nA) electron microprobe at the University of Bern, Switzerland.

The main rock forming minerals are amphibole, pyroxene, plagioclase, biotite and a small amount of apatite titanite and magnetite.

Olivine is often altered and can be found only in olivine-pyroxene hornblendite. The Fo content varies between 74–98%, referring to a crystallization from a relatively primitive magma.

The amphibole content could reach even 90 wt% among the other rock forming minerals. The following amphibole types were identified: pargasites, kaersutites, ferrokaersutites and magnesiohastingsites.

Among the plagioclases albite ($Ab_{78–98}$) is dominating, due to late stage processes.

Biotites are represented by annite, which present in all the samples except in olivine-pyroxene-hornblendites.

Pyroxenes are mainly diopsides, aegirine-augites and augites. Additionally ferro-enstatite occurs in olivine-pyroxene hornblendite. The pyroxenes are zoned, in some cases as a diopside core and augite and/or aegirine augite rim, suggesting metasomatic alteration of pyroxenes among rim and cleavages.

The composition of clinopyroxenes is a sensitive indicator of the nature of magma and crystallization history. Ti vs. Al ratios (0.191–0.246) in the pyroxenes indicate high crystallization pressure. The pyroxenes formed under the following p-T conditions: max. 1150°C and 18–22 kbar (using the thermobarometry of NIMIS, 1999).

According to the thermometry of RIDOLFI *et al.* (2010), amphibole composition is estimated at max. 1000°C, and 7–10 kbar using the method of ANDERSON & SMITH (1995) and HOLLISTER *et al.* (1987).

The mineralogical composition of the different types of hornblendites indicates a fractionational crystallization process. Thus, the most primitive rock is olivine-pyroxene hornblendite, whilst the most differentiated one is plagioclase-bearing hornblendite.

Based on the evaluated pressure and temperature values of amphiboles and pyroxenes magnesiohastingsite and pargasite could have crystallised at around 50 km depth, whilst diopside and augite could have formed at around 60–65 km depth. The composition of amphiboles and pyroxenes of the DAM hornblendites suggests that the primitive melt originated from the upper mantle, more than 70 km depth.

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