

Late stage HFSE-enrichment in the Ditrău Alkaline Complex, east Carpathians

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The Ditrău alkaline massif represents a truncated ring-shaped Triassic to Jurassic miaskitic alkaline intrusion, for the emplacement of which various degrees of fractional crystallization, assimilation, as also fenitization have been invoked in the existing literature [1]. The youngest term of the intrusion is represented by nepheline syenite forming a network of anastomosing dikes which cross-cut older rock-types at spectacularly varying scales, as well as a central stock.

The alkaline syenite is dominantly leucocratic, containing macroperthitic K-feldspar and nepheline. The mafic phases are aegirine-augite and subordinate ferritaramite and biotite. Megaporphyric and pegmatoid varieties are frequent, the latter containing also apparently primary sodalite and cancrinite, along with relatively frequent flattened zircon bipyramids and magnetite. Melanitic garnet is a subordinate, but ubiquitous component, forming black anhedral masses that mantle feldspar and nepheline, and represent the site of elevated Ti, Zr and Nb contents. Garnet is chemically zoned, containing ragged dark-brown relics, almost opaque under the microscope and relatively free of inclusions, corroded by a lighter mantle rich in inclusions, light brown to orange under the microscope. The core compositions represent Mn-bearing melanite amounting up to 4% Ti, well over 0.5 % Zr and up to 0.1% Nb, along with up to 0.2% Na and microprobe-detectable K, while the mantles contain 1-2% Ti, 0.5% Zr, and Nb around the microprobe detection limit. The inclusions in the garnet mantle are abundant magnetite, baddeleyite (containing tenths of per cent U, Ca, Fe), niobian (> 3% Nb) zirconolite (> 3% Nb) and titanite. The latter displays concentric and partly oscillatory zoning, containing ca. 1% Al and ca. 2% Fe (decreasing outwards), as well as both Nb and Zr (0.5-1.5% each), enriched towards the rim.

The morphology, geometric relationships with the main silicate phases, internal structure of garnet as well as its inclusions suggest its crystallization towards the end of the magmatic stage, its corrosion and breakdown occurring due to incipient deuteric alteration. Garnet and the accompanying phases represent the main HFSE-sink of the rock.

[1] Jakab, G. (1998) *Pallas-Akademia Eds.*, **298 pp.**