FLUORINE-BEARING GARNETS FROM THE TESCHENITE SILL IN THE POLISH WESTERN CARPATHIANS

WŁODYKA, R. & KARWOWSKI, Ł
Department of Geochemistry and Petrology, University of Silesia, ul. Będzińska 60, 41-200 Sosnowiec, Poland
E-mail: rwlodyka@wnoz.us.edu.pl

The occurrence of fluorian calcic garnets is rather rare. They have been reported from metacarbonates, metasomatically altered alkaline igneous rocks and contact-metamorphosed basalts (MANNING & BIRD, 1990). In Polish Western Carpathians fluorine-bearing garnets were found in metasomatically altered nepheline syenites belonging to the teschenite-picrite association. Moreover, such garnets were described from nepheline syenites of the Shonkin Sag laccolith (NASK & WILKINSON, 1970) and Magnet Cove (FLOR & ROSS, 1989). A classic area of teschenites and related rocks is restricted only to the western part of the Outer Carpathians and extends in the NE direction for over 100 km from Hranice in Moravia, Czech Republic, to Cieszyn and Bielsko-Biała in Poland. The main products of the Cretaceous volcanic activity are shallow, subsurface sills with thickness varying from a few centimeters to 40 meters.

In this magmatic province the nepheline syenite occurs only as small irregular bodies with sharp boundaries in the upper parts of the teschenite sills or as veins cross-cutting the upper or lower chilled margins. In syenite, the alkali feldspars ($Or_{70-48}Ab_{28-48}An_{2-4}$) are Ba- and Sr-rich up to 6 wt% BaO and 3 wt% SrO, respectively. Nepheline ($Qz_{4-32}Ne_{80-62}Ks_{16-6}$) and feldspars constitute about 80 vol% of the rock. The mafic phase are represented by clinopyroxene (hedenbergite–aegirine), amphibole (kaersutite–ferro-kaersutite–hastingsite) and dark mica (lepidomelane). The two-step process of primary feldspars metasomatism led to formation of an adularia–albite paragenesis which is replaced by the following zeolites: analcime, natrolite, mesolite, thomsonite, heulandite, harmotome and ferrierite.

Within metasomatically altered syenite veins from Puńców sill, secondary F-bearing hydrogarnet was identified. They form small (up to 0.4 mm in length), irregular grains with anomalous birefringence among altered alkali feldspars. They contain up to 3.48 wt% fluorine substituted in the structure, equivalent to a 6.9 mol% substitution of fluorine for oxygen. Normalization of the microprobe analysis to 5 (X + Y) atoms yields the following formula: $(Ca_{2.968}Mg_{0.006}Mn_{0.020}Na_{0.018})_{3.012}$ $(Fe^{3+}_{0.225}Al_{1.731}Ti^{4+}_{0.022})_{2.004}$ $Si_{2.359}$ $(O_{9.474}F_{0.800}OH_{1.726})_{12.000}$, where OH was calculated by valence balance. Low analytical totals (94–97 wt%) suggest significant quantities of water molecule within the investigated garnet structure. This was confirmed by Raman spectroscopy (Fig. 1). The hydrogarnets presented are composed of 1.2 to 24.6% andradite, 57.7 to 76.5% grossular, 9.3 to 19.20 % hydrogrossular and 2.2 to 6.9 % fluorgrossular. Thus, the main variation is connected with the Al_2O_3/Fe_2O_3 ratio. According to existing nomenclature (RINALDI & PASSAGLIA, 1984), two names, hibschite and katoite were distinguished within calcic hydrogarnet group (hibschite with Gr ≥ 50 % and katoite for Gr < 50 %). From above results that the proper name for garnet investigated is hibschite, where OH^- and also F^- may enter the garnet structure at the Si position according to the scheme: $[SiO_4]^{4-} \leftrightarrow [(OH,F)_4]^{4-}$.

References

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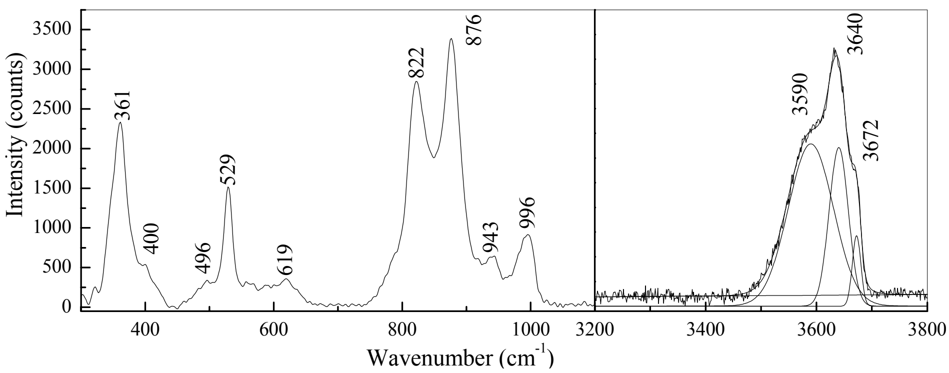

Fig. 1: Unpolarized Raman spectra of F-bearing garnet from the teschenite sill.