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# GRAFTONITE-SARCOPSIDE INTERGROWTHS IN PHOSPHATE NODULAS FROM PEGMATITE AT MICHAŁKOWA, SOWIE MOUNTAINS BLOCK, SW POLAND

**Anna GROCHOWINA, Bożena GOŁĘBIOWSKA & Adam PIECZKA**

*AGH University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection; al. Mickiewicza 30, 30-059 Krakow, Poland*

Sarcopside $(Fe,Mn,Mg)_3(PO_4)_2$ and graftonite $(Fe,Mn,Ca)_3(PO_4)_2$ are the dominant minerals found in the phosphate nodules from the Michałkowa pegmatite in the Sowie Mountains block. The nodules are rather small with mainly varying brown coloration and with lamellar texture visible in hand specimen. Both minerals occur with other primary and secondary phosphates in the form of nodules like triphylite or ferrisicklerite, stanekite or wolfeite, members of the arrojadite and wyllieite groups, kryzhanovskite, fluorapatite and others. Apart of typical pegmatite minerals like quartz, microcline, albite, muscovite and biotite, only black tourmaline can be found. Pyrrhotite, pyrite and chalcopyrite, occurring in the form of tiny grains or veinlets, penetrating also the phosphate nodules are common.

Standard mineralogical investigations (light and reflected microscopy, XRD), combined with SEM-EDS analyses and WDS method were carried out to characterize these phases.

Graftonite and sarcopside form massive aggregates of euhedral crystals or lamellar intergrowths. Euhedral crystals of sarcopside are typically enriched in Mn and Mg. Ca is commonly absent or present in negligible amounts. MnO usually ranges between 10.0–11.0 wt. %; only locally reaches a higher content up to 13.3 wt. %, MgO content commonly reaching 4.0–5.0 wt. %, or only about 2.0 wt. % in Mn-rich compositions. The lamellar sarcopside shows compositional characteristics similar to the variety forming the euhedral crystals. In consequence, the Mn/(Mn+Fe) ratio that informs about a degree of Mn-Fe fractionation in the parental, pegmatite forming melt, attains in both morphological varieties of sarcopside rather low values, usually 0.18–0.20.

In graftonite the CaO content is higher in crystals co-occurring with euhedral sarcopside, reaching in this variety up to 11.0 wt. %, whereas the lamellar graftonite has only 6–7 wt. %

of the component. In both types of graftonite the contents of MgO are less than in sarcopside and they do not exceed 2.0 wt. %. Graftonite richer in Ca is simultaneously poorer in Mg. FeO content is higher in graftonite forming lammelar intergrowths with sarcopside (31.0–32.0 wt. %), and slightly lower in euhedral crystals (27.0–28.0 wt. %). Manganese is close similar in both varieties, whereas Zn is undetectable or present in a small content distinctly below 1 wt. % ZnO. The lower Mn/(Mn+Fe) values (0.36–0.39) are characteristic of lamellar graftonite; only slightly higher values (0.40–0.41) attains graftonite in association with euhedral sarcopside.

Both minerals show weakly varying compositions resulted from homovalent substitutions $(Fe, Mn)^{2+} \leftrightarrow Mg^{2+}$ and $Ca^{2+} \leftrightarrow (Fe, Mn)^{2+}$ marked in varying values of Mn/(Mn+Fe) ratio. The minerals crystallized from the parental P-bearing melt exsolved from pegmatite-forming silica melt during temperature decreasing. The formation of the massive or lamellar forms depends on a relationship between amounts of the exsolved Ca-and P-bearing melt and its Ca-negligible counterpart.

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