PHOSPHATE PARAGENESES IN THE »SEMMERINGQUARZIT« AND RELATED QUARTZ VEINS OF THE LOWER AUSTROALPINE »FISCHBACH« WINDOW, NORTH-EASTERN STYRIA, AUSTRIA

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The »Fischbach« window, located 40 km NNE of Graz, Styria, covers an area of about 30 km^2 and exposes upper Permian to Scythian, shallow aquatic quartzites to meta-quartzconglomerates (»Semmeringquarzit« s.l.) and few Scythian to Anisian metacarbonates. Occurrence of tremolite in the metacarbonates points to greenschist facies metamorphic conditions during Alpine orogenesis (WIESENEDER, 1961). These rocks are overthrusted by polymetamorphic, lower Paleozoic metasedimentary and Carboniferous metagranitoid rocks of the »Grobgneis« complex. Dark blue lazulite $(Mg,Fe)Al_2(PO4)_2(OH)_2$ in quartz veins within the »Semmeringquarzit« is known since ANKER (1809). First results of field, petrographic, SEM - quantitative EDX and XRD study of quartz veins and host quartzites reveal the presence of a wide variety of phosphate minerals, especially members of the beudandite-crandallite group, related to three different modes of occurrences.

1. Phosphate enrichments in quartzites and metaquartzconglomerates consist generally of up to 1 mm large, xenomorphic lazulite grains (X_{Mg} = 0.10–0.20) scattered throughout the quartz matrix and idiomorphic to xenomorphic, 5–20 µm, rarely up to 0.2 mm large svanbergite crystals mostly within flakes and aggregates of muscovite (Fig. 1). Lazulite and svanbergite enclose each other in some cases and the smaller svanbergite grains contain mm sized REE rich patches and rings. A phosphate mineral intermediate between svanbergite and goyazite is also associated with muscovite (Fig. 1). Heavy mineral layers in the »Semmeringquarzit« contain rutile, zircon, altered ilmenite, tourmaline and muscovite in variable proportions. Recrystallised lazulite (X_{Mg} = 0.25–0.30) and exsolved Ti-hematite (X_{Ilm} = 0.10–0.15) are abundant in some of these layers. Additionally, idiomorphic florencite –(Ce) $(Ce,La)Al_3(PO_4)_2(OH)_6$ –, rimmed by svanbergite, is found in one of these layers. In some cases, lazulite defines a sedimentary banding without heavy mineral enrichment. Locally, circular shells of lazulite and svanbergite of ca. 5 mm diameter occur, where quartz fabric inside and outside the shells is the same. These shells may probably represent former phosphate pellets. A very conspicuous, 6 x 6 x 0.6 cm sized, lenticular aggregate of fine grained muscovite, svanbergite, rutile and a few poikiloblasts of lazulite, surrounded by a 2–5 mm wide zone of coarse grained lazulite, svanbergite and quartz is documented in one quartzite sample. The origin of this structure is not clear at the moment, but the lazulite-rich rim suggests involvement of metasomatic reactions.

2. Lazulite-quartz veins are 0.5–10 cm wide and crosscut sedimentary banding and heavy mineral layers at a high angle, but are in most cases near parallel to the folia-

tion of the host quartzite. Lazulite is the major phosphate mineral and occurs as nearly always xenomorphic crystals up to 5 cm large, with concentric or complex patchy chemical zoning (core: X_{Mg} = 0.10–0.20, rim: X_{Mg} = 0.20–0.30). In some veins, lazulite is chemically homogeneous (X_{Mg} = 0.15). It can be confined to the central zone, to the contacts with the host quartzite or homogeneously distributed in the vein. Other primary phosphate minerals are rather rare and comprise svanbergite with appreciable goyazite component (Fig. 1), augelite $Al_2(PO4)(OH)_3$ and apatite. Exsolved Ti-hematite (X_{Ilm} = 0.08–0.16) is abundant, rutile, pyrite, barite, rarely tourmaline and xenocrystic zircon are additional non-phosphate minerals. Lazulite is also enriched in narrow cracks emanating from lazulite-quartz veins, but without visible quartz mobilisation. This type of occurrence leads to clearly metasomatic, up to 5 cm wide lazulite enriched zones in quartzite adjacent to some lazulite-quartz veins. A genetic model is proposed, where extensive fluid activity causes mobilisation of sedimentary phosphates in the quartzite and redeposition in quartz veins.

3. Supergene phosphate minerals are Ba-free goyazite and crandallite, both rimming and veining lazulite and svanbergite. Extensive solid solution exists between goyazite and crandallite, and complex chemical zoning is often observed (Fig. 1). The phosphate mineral which forms at the last stage in the parageneses is nearly Sr-free gorceixite $(Ba,Ca)Al_3(PO_4)(PO_3OH)(OH)_6$ with variable Ca-content (Ca/(Ca+Ba) = 0.05–0.20), replacing and rimming all other phosphate minerals.
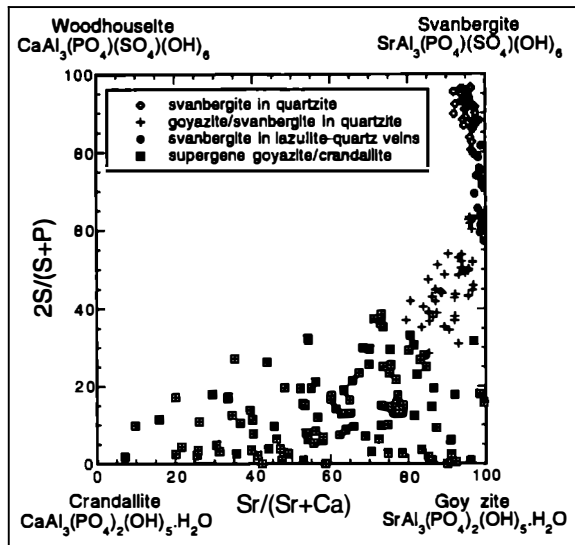

Fig. 1:
Chemical composition of Ca-Sr-Al phosphate-sulfates from the »Fischbach« window.

ANKER, J.M. (1809): Kurze Darstellung einer Mineralogie von Steyermark. - Verlag Franz Ferstl, Graz, 79 S.
WIESENEDER, H. (1961): Die Korund-Spinellfelse der Oststeiermark als Restite einer Anatexis. - Joanne-