

NEW SC-RICH PHOSPHATE MINERALS FROM THE TRUTZHOFFMÜHLE APLITE, NE BAVARIA, GERMANY

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In addition to the occurrence of kolbeckite in phosphate assemblages of the Bavarian Forest (DILL et al., 2006), primary scandium-bearing phosphate minerals have been discovered in an apatite-rich sample from the Trutzhofmühle apatite, Bavaria (DILL et al., 2008). In polished section AS7848 (BGR collection, Hannover), at least three different Sc-phosphates were characterized using electron beam techniques. All minerals carry high Sc and Zr, besides Ba, K, Ca, Fe, Mn, U and other elements. One of the minerals occurs as grains large enough to produce thin slices using the FIB technique for TEM work. Unfortunately, the original sample specimen was not kept, so that this one polished section now serves as the only reference source of the new minerals.

The specimen contains three grains of a Sc-Ba-K-Zr phosphate (informally named “oberpfalzite”) and several grains of a Sc-Zr phosphate-silicate phase informally termed “trutzhofmuehlite”. The three “oberpfalzite” grains are all euhedral, up to 80 µm in size, compositionally zoned and hosted by Mn-rich hydroxyl apatite. They show a reflection behaviour similar to apatite in reflected light and thus are not easily visible under the reflected light microscope. “Trutzhofmuehlite” occurs as smaller, roundish, partly zoned grains in a matrix of secondary Fe-Al silicate, and as rims around zircon. Phase 3, Ca-Na-Sc-Fe-Mn-(Zr) phosphate, was only observed forming rims around apatite.

The chemical composition of “oberpfalzite” is complex. Besides the major elements Sc, Ba, K, Zr and P, minor amounts of Na, Mg, Al, Ca, Ti, Mn, Fe and Pb were detected. The composition, calculated from the median of 31 EMPA and SEM analyses and based on 48 oxygen, corresponds to $(K_{3.5}Ba_{1.5}Sc_{7.4}Zr_{1.4}Fe_{0.9}Mn_{0.3})_{15}[(PO_4)_{12}]$. Taking heterovalent substitutions into account, a simplified structural formula of $(K,Ba,Ca,Pb)_5(Sc,Zr,Fe,Mn)_{10}[(PO_4)_{12}]$ is considered reasonable. Raman spectroscopy using a 532 nm laser showed fluorescence and two broad peaks at 435 and 1055 cm⁻¹, respectively. No vibrational bands indicative for the presence of OH-groups or water were detected. The TEM investigation at GFZ Potsdam showed that “oberpfalzite” is a cubic phase with a = 10.1297 Å, space group I-43d (220).

The mineral assemblage in the manganese apatite sample consists of zircon, monazite, quartz, chlorite and various phosphates. Phase 1 (“oberpfalzite”) is interpreted as a primary magmatic phosphate. During reaction with quartz and silicates, this mineral becomes unstable forming phase 2 (“trutzhofmuehlite”). In addition, phase 2 may also form via reaction involving zircon and apatite. Phase 3 may have formed by reaction of apatite with phase 1 or another Sc-rich precursor mineral.

DILL, H.G., MELCHER, F., GERDES, A., WEBER, B. (2008): Canadian Mineralogist, 46, 1131-1157.

DILL, H.G., WEBER, B., FÜSSL, M., MELCHER, F. (2006): Mineralogical Magazine, 70, 281-290.