American Mineralogist, Volume 62, page 818, 1977

Phosphophyllite, variation in composition

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Abstract

Fourteen analyses of phosphophyllite from Hagendorf, Germany, and Potosi, Bolivia, indicate that manganese substitutes for iron only up to a 1:1 ratio. The manganese analog was not found.

Phosphophyllite, $Zn_2(Fe,Mn)(PO_4)_2 \cdot 4H_2O$, was first described by Laubman and Steinmetz (1920) as pale blue monoclinic crystals from the Hagendorf pegmatite, Bavaria, Germany. The analysis and formula, however, were grossly in error, and were later rectified by Steinmetz (1926), who then published a new analysis of this mineral. Prior to this present study, these have been the only analytical results available. In view of the broad and extensive mutual substitution of manganese and iron in secondary phosphates and the lack of additional analyses, we decided to analyze a large number of phosphophyllite specimens as part of a systematic search for a manganese end-member.

Eleven specimens from Hagendorf and three from Potosi, Bolivia, were partially analyzed with an ARL-SEMQ electron microprobe using an operating voltage of 15 kV and a beam current of 150 nA. Standards used were synthetic ZnO for zinc, manganite for manganese, hornblende for magnesium and iron, and apatite for calcium and phosphorus. The data were corrected using a computer data-refinement program.

Calcium and magnesium are present only as traces in all specimens examined. Microprobe scans of selected samples from both localities indicate that only iron, manganese, zinc, and phosphorus are present in significant amounts. The sought-for manganese analog was not found, although in one Hagendorf sample, NMNH #B14317, the Mn:Fe ratio was 51:49 by weight. Given the experimental error of the microprobe technique, a new mineral name for material with manganese greater than iron is not justified at this time, and should await the probable future discovery of a member with manganese significantly greater than iron.

In phosphophyllite from Hagendorf, Germany, manganese substitutes for iron up to the 1:1 ratio, and is present in all samples from this locality. The variation in composition for Hagendorf material is as follows: FeO 8.34–13.88 percent, MnO 2.09–8.59 percent, ZnO 34.25–36.00 percent, and P_2O_5 32.27–33.94 percent.

The crystals from Potosi, Bolivia, are well known to collectors for their beauty, large size, and rare-gem potential. They were discovered in the mid-1950's in the Krause vein, Potosi, Bolivia, but nothing is known about the nature of the occurrence. The material is remarkably consistent in composition. An average of three closely-agreeing partial analyses, with water determined on one sample by the Penfield method, gives: FeO 16.18 percent, MnO 0.14 percent, ZnO 34.59 percent, P_2O_5 32.29 percent, H_2O 15.99 percent, sum = 99.19 percent.

In summary, 14 partial analyses of phosphophyllite demonstrate the miscibility of manganese and iron in Hagendorf phosphophyllite and suggest the possible existence of a member with manganese greater than iron. The Bolivian material is essentially manganese-free and conforms to the formula $Zn_2Fe(PO_4)_2 \cdot 4H_2O$. A tabulation of the analyses is available from the authors on request.

References

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Manuscript received, December 1, 1976; accepted for publication, February 18, 1977.