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Cerchiaraite-(Fe), a new mineral from Big Creek, eastern Fresno County, California, USA

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Cerchiaraite-(Fe), the Fe-dominant analogue of cerchiaraite, occurs along Big Creek, eastern Fresno County, California, USA (type locality) and at the Cerchiara mine, Vara Valley, La Spezia, Liguria, Italy (co-type locality). The samples of the new mineral from Fresno County are found in parallel-bedded quartz-sanbornite vein assemblages associated with bazirite, diopside, muirite, pyrrhotite, Ba-rich tobermorite-11Å, traskite, calcite, witherite and titantaramellite. At the Cerchiara mine, the new mineral occurs in microfractures and veinlets in a Jurassic ophiolitic sequence. Associated minerals include aegirine, calcite, Mn-bearing diopside (variety “schefferite”), hematite, K-feldspar, norrischite and quartz.

Materials from all localities exhibits compositions intermediate between the Fe-Al and Fe-Mn end members. Electron microprobe analyses led to the following ideal structural formula: Ba4Fe3+4O_3(OH)3(Si4O12)[Si2O_3(OH)4]Cl, in which Fe3+ is the dominant cation in the octahedral site. Another new mineral, the Al3+ analogue of cerchiaraite, has been accepted (IMA 2012-011) with the proposed name cerchiaraite-(Al).

Cerchiaraite-(Fe) is tetragonal, space group I4/mmm, with a=14.3554 (12), c = 6.0065(5) Å, V = 1237.80(5) Å3 and Z = 2. Its crystal structure [R = 0.026 for 330 reflections with Fo > 4σ(F)] is essentially identical to that reported by Basso et al. (2000) for cerchiaraite. In the structure, SiO4 tetrahedra share corners to form four-membered Si4O12 rings about the 4-fold axes. The rings are corner-linked to edge-sharing chains of Fe3+O6 octahedra that run parallel to c. The framework thereby created contains channels centred about the 42 screw axes, in which two silicate dimers, Si2O7, per unit cell are statistically distributed. The Cl atoms are positioned on the 4-fold axes, alternating along c with the Si4O12. The Ba atoms are positioned around the periphery of the channels. The same sort of statistical distribution and high degree of distortion of the Si2 tetrahedra noted by Basso et al. (2000) in the structure of cerchiaraite is found in the structure of cerchiaraite-(Fe). The principal difference is that we obtained the best refinement by splitting the O5 site into three sub-sites (two sites in the Rietveld refinement). Considering that the chemical analyses show significant deficiencies in Si and excesses of Cl relative to the ideal structural formula, it seems reasonable to hypothesize that the excess Cl may be accommodated in the vicinity of the partially occupied Si2O7 silicate group.

Basso R., Lucchetti G., Zefiro L., and Palenzona, A. (2000) Cerchiaraite, a new natural Ba-Mn-mixed-anion silicate chloride from the Cerchiara mine, northern Apennines, Italy. Neues Jahrbuch für Mineralogie, Monatschefte, 2000, 373-384