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Crystallographic and chemical constraints on the nature of the proustite–pyrargyrite solid-solution series

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Abstract

The present paper reports a crystal-chemical study of minerals belonging to the proustite–pyrargyrite group by evaluating 32 natural samples of proustite and 27 samples of pyrargyrite from different localities that have variable chemical compositions. The unit-cell parameters were modeled as a function of the Sb contents. The *a* parameter is strongly influenced by the As ↔ Sb substitution, whereas the influence on the *c* parameter is very minor (nearly constant trend). The following equations were obtained from the linear fitting of the data:

$a_{pred} = 10.8433(3) + 0.2019(4)Sb$ (apfu)
$c_{pred} = 8.7189(6) + 0.0059(9)Sb$ (apfu)
$V_{pred} = 887.77(7) + 34.0(1)Sb$ (apfu).

The crystal structure of the members of the proustite–pyrargyrite solid solution consists of two sets of spiral chains parallel to the **c**-axis. Each chain contains alternating Ag and S atoms, with each chain being connected by As and Sb atoms, which are the apices of flat pyramidal AsS_3/SbS_3 groups. Each S atom is part of a different Ag-S chain.

The compositional data support the concept that proustite–pyrargyrite solid solutions re-equilibrate and exsolve to near end-member upon cooling. Examples of intermediate compositions are rare in nature and must have quenched above the solvus.

Keywords: Sulfosalts, electron microprobe, proustite, pyrargyrite