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The pearceite-polybasite group of minerals: Crystal chemistry and new nomenclature rules

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Abstract

The present paper reports changes to the existing nomenclature for minerals belonging to the pearceite-polybasite group. Thirty-one samples of minerals in this group from different localities, with variable chemical composition, and showing the 111, 221, and 222 unit-cell types, were studied by means of X-ray single-crystal diffraction and electron microprobe. The unit-cell parameters were modeled using a multiple regression method as a function of the Ag, Sb, and Se contents. The determination of the crystal structures for all the members of the group permits them to be considered as a family of polytypes and for all members to be named pearceite or polybasite. The main reason for doubling the unit-cell parameters is linked to the ordering of silver. The distinction between pearceite and polybasite is easily done with an electron microprobe analysis (As/Sb ratio). A hyphenated italic suffix indicating the crystal system and the cell-type symbol should be added, if crystallographic data are available. Given this designation, the old names antimonpearceite and arsenpolybasite are abandoned here and the old names pearceite and polybasite, previously defined on a structural basis (i.e., 111 and 222), are redefined on a chemical basis. The old name pearceite will be replaced by pearceite-*Tac*, antimonpearceite by polybasite-*Tac*, arsenpolybasite-221 by pearceite-*T*2*ac*, arsenpolybasite-222 by pearceite-*M*2*a*2*b*2*c*, polybasite-221 by polybasite-*T*2*ac*, and polybasite-222 by polybasite-*M*2*a*2*b*2*c*. Since all polytypes are composed of two different layers stacked along [001]: layer A, with general composition $[(Ag,Cu)_6(As,Sb)_2S_7]^{2-}$, and layer B, with general composition $[Ag_9CuS_4]^{2+}$, the chemical formulae of pearceite and polybasite should be written as $[Ag_9CuS_4][(Ag,Cu)_6(As,Sb)_2S_7]$ and $[Ag_9CuS_4][(Ag,Cu)_6(Sb,As)_2S_7]$, respectively, instead of $(Ag,Cu)_{16}(As,Sb)_2S_{11}$ and $(Ag,Cu)_{16}(Sb,As)_2S_{11}$, as is currently accepted. The new nomenclature rules were approved by the Commission on New Minerals and Mineral Names of the International Mineralogical Association.

Keywords: Pearceite-polybasite, nomenclature rules, crystal chemistry, X-ray data, chemical composition