STEREOACTIVE LONE-PAIR BEHAVIOR OF Pb IN THE CRYSTAL STRUCTURE OF BIDEAUXITE: Pb\textsuperscript{2+}Ag\textsuperscript{+}Cl\textsubscript{3}F(OH)

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ABSTRACT

The crystal structure of bideauxite, Pb\textsuperscript{2+}Ag\textsuperscript{+}Cl\textsubscript{3}F(OH), cubic, \(a = 14.1273(6)\) Å, \(V = 2819.24(4)\) Å\(^3\), \(Fd\overline{3}m, Z = 16, D_{calc} = 6.26\) g.cm\(^{-3}\), has been solved by direct methods and refined to an \(R\) index of 2.8% for 324 observed (5\%) reflections measured with MoK\(\alpha\) X-radiation. There is one unique Ag site surrounded by an octahedral array of Cl anions, and one Pb site surrounded by nine anions with a very asymmetrical distribution of bonds and bond-lengths characteristic of stereoeactive lone-pair behavior of Pb\textsuperscript{2+}. Four (AgCl\textsubscript{6}) octahedra link by sharing corners to form an [Ag\textsubscript{2}Cl\textsubscript{16}] cluster, and these clusters link by sharing corners to form a three-dimensional chequerboard arrangement, with [Pb\textsubscript{2}OH\textsubscript{2}F\textsubscript{2}Cl\textsubscript{16}] clusters filling the interstices. The structure of bideauxite is not related to those of the paragenetically related minerals boléite and pseudoboléite.

Keywords: bideauxite, crystal-structure refinement, hydroxy-chloride.

INTRODUCTION

Bideauxite is a lead–silver fluor-hydroxy-chloride mineral, Pb\textsuperscript{2+}Ag\textsuperscript{+}Cl\textsubscript{3}F(OH), described by Williams (1970) from the Mammoth – St. Anthony mine, Tiger, Pinal County, Arizona. It is transparent where fresh and becomes lavender on exposure to strong light. It occurs as crystals up to 7 mm in maximum dimension. Bideauxite overgrows crystals of boléite and, in turn, is overgrown by matlockite and leadhillite, with associated sugary anglesite and surficial cerussite (Bideaux 1980). Among the secondary minerals of lead, halides are rare; a typical occurrence is in ancient metallurgical slags, such as Laurion, Greece. Recently, a similar paragenesis with rare lead oxychlorides was discovered in the Etruscan metallurgical slags of Baratti beach, southern Tuscany, Italy (Franzini & Perchiazzi 1992).

Both Canadian (MC and FCH) and Italian (SM, MP and NP) groups have long-term interests in the crystal chemistry of lead-(copper) oxide-hydroxy-chloride minerals (Hawthorne 1985, Hawthorne & Groot 1986, Cooper & Hawthorne 1995, Merlino et al. 1993, 1994, 1995, 1996, Pasero & Perchiazzi 1996, Kutze et al. 1999). In view of our interest in these minerals, both groups have solved the structure of bideauxite; we present the joint results here.

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