Zoltaiite, a new barium-vanadium nesosubsilicate mineral from British Columbia: Description and crystal structure

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ABSTRACT

Zoltaiite, ideal formula BaV$_2$Si$_2$O$_7$, space group P3, a = 7.601(1), c = 9.219(1) Å, V = 461.34(1) Å$^3$, Z = 1, is a new mineral found on the eastern edge of the Shuswap metamorphic complex of British Columbia, Canada. It is a metamorphic mineral formed under greenschist-facies P-T conditions as part of an assemblage that includes quartz, celsian, apatite, phalerite, pyrrhotite, galena, and pyrite. Zoltaiite has a Mohs hardness of 6–7, no cleavage, an anhedral to semi-prismatic habit, and a calculated density of 4.83 g/cm$^3$. It is opaque with reflectance and color similar to those of phalerite. The strongest eight lines of the X-ray powder diffraction pattern [d in Å (hkl)] are 3.103(78)(021), 2.934(89)(212), 2.785(67)(013), 2.679(48)(022), 2.403(50)(211), 2.190(100)(212), 1.934(53)(213), and 1.438(63)(140). The empirical formula, derived from electron-microprobe analysis and the crystal structure, is Ba$_{0.98}$Ti$_{1.31}$V$_{0.69}$Fe$_{0.34}$Si$_{2.00}$O$_{7.28}$, based on O = 27. The crystal structure was solved by direct methods and refined on the basis of F$_0$ using all unique reflections measured with MoKα X-ray radiation on a CCD-equipped diffractometer. The final R factor was 3.2%, calculated using 659 unique observed reflections. The unit cell contains four layers of two types parallel to (001): X, an octahedral and tetrahedral sheet, and Y, an octahedral plus barium sheet; both layers are doubled through inversion centers resulting in the sequence XXY... Two consecutive equivalent layers are interconnected through shared octahedral edges, whereas consecutive non-equivalent layers are linked through shared corners. The high calculated density is consistent with the dense packing of the structure.

INTRODUCTION

Zoltaiite was discovered in a single rock sample from the Wigwam Pb-Zn deposit in southeastern British Columbia, Canada. This rock sample was contributed to the first author by Dr. Trygve Høy of the B.C. Geological Survey in response to a request for samples for a survey study of sphalerite geobarometry. Although the rock was not found to be suitable for sphalerite geobarometry, in the process of surveying the assemblage using backscattered electron (BSE) imaging and energy dispersive X-ray spectrometry (EDS), a mineral with very unusual vanadium-rich chemistry was noticed. Subsequent quantitative electron microprobe analyses made it clear that this was a new mineral.

The new mineral is named after Tibor Zoltai (1925–2003) in recognition of his contributions to mineralogy both as a researcher and as an educator. The IMA Commission on New Minerals and Mineral Names has approved the new mineral and the name.

The Wigwam deposit is located in the Akolkolex River area southeast of Revelstoke, British Columbia. The Akolkolex River area, positioned along the transition between the Shuswap metamorphic complex and the Selkirk Mountain fold and thrust belt, is described by Thompson (1972, 1978) as a structurally complex package of metasediments of Cambrian to Ordovician age. The Wigwam deposit is contained within the Badshot Formation, which is associated with other occurrences of lead-zinc mineralization locally and throughout the Kootenay Arc (Thompson 1978; Høy 1982). Although the Badshot Formation is dominated by variably metamorphosed limestones, the sulfide mineralization is closely associated with a thin gray band of quartzite. The mineralization of the Wigwam Deposit, as well as minor mineralization in other parts of the Akolkolex River area, is associated with hinge zones of structural folds. The fact that the sulfide layers themselves are folded, and the dominance of pyrrhotite over pyrite, have been taken as indicating that the mineralization pre-dated regional metamorphism and folding (Muraro 1966; Thompson 1978). Pelitic rocks in the area contain an assemblage of quartz, albite, muscovite, and chlorite that is typical of the chlorite zone of greenschist-facies metamorphism; an analysis of regional meta- morphism, including rocks of much higher grade to the west, traces out a P-T path that passes above the aluminosilicate triple point (Thompson 1972, 1978).

GEOLOGIC SETTING

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