Pottsite, a new vanadate from Lander County, Nevada

S. A. WILLIAMS

Globo de Plomo Enterprises, Douglas, Arizona, USA

Abstract

Pottsite occurs in the oxide zone of a tungsten mine northwest of Potts, Lander County, Nevada, and is named for the locality. It occurs with scheelite, clinobisvanite, bismutite, and vanadinite. The colour is yellow, luster adamantine. $D_{obs.}$ is 7.0, $D_{calc.}$ 7.31. Uniax $(-)\ \omega = 2.49, \varepsilon = 2.37$. Microprobe analysis gave PbO 32.4, Bi_2O_3 34.0, V_2O_5 26.6; H_2O by Penfield method 6.71% (total 99.71%), leading to $HPbBi(VO_4)_2 \cdot 2H_2O$. Crystals are tetragonal $I4_122$, $a = 11.084$, $c = 12.634$ Å. Strongest powder diffraction lines are 4.618 (9), 4.168 (3), 3.210 (4), 3.062 (10), 2.476 (4), 2.252 (3).

KEYWORDS: pottsite, new mineral, vanadate, Lander County, Nevada, USA.

Occurrence

AT the type locality, workings have explored tungsten mineralization in tactites adjoining a granodiorite intrusion. The intrusion is only weakly endomorphosed to epidote–albite near the contacts, and then chiefly along joints. The tactites, originally carbonate sediment, have been converted to garnet (close to andradite), diopside, and coarsely crystalline calcite, and the distribution of these three minerals seems guided by vagaries in the original bedding. Other minerals in the tactite include epidote, actinolite, and clouds of minute apatite beads in some laminae. Scheelite and rare molybdenite are disseminated, mostly in garnetite beds, and seem quite compatible with the prograde assemblage.

During retrograde metamorphism, certain beds were flooded with coarse clear quartz. Though its general distribution seems guided by fractures cutting the tactite, large portions of rock have been partly replaced, usually the diopside-rich bands. Disseminated within the quartz are junoite and rare chalcopyrite. Finally, the tactite was cut by late fractures along which occur pyrite, chlorite, and crystalline hematite.

Pottsite is a product of oxidation that followed these events. Junoite was first replaced by waxy green bismutite streaked with grey cerussite; the green bismutite then lost copper and became chalky white. Typically the bismutite was then converted to a powdery orange (unknown) bismuth vanadate which, in turn was replaced by clinobisvanite. Sparkling crusts of this mineral are commonplace in fractures anywhere close to oxidized junoite. In a few spots pottsite has replaced the unknown bismuth vanadate instead of clinobisvanite. It does not occur in association with clinobisvanite. Pottsite may be corroded and whiskered with yellow vanadinite needles.

Scheelite grains in proximity to these vanadates have become bright lemon yellow and are crumbly and friable. Their colour is due to films of vanadates (not all identifiable) on cleavage planes or fractures in the crystals.

Molybdenite scales in the vicinity are replaced by milky white powellite. At the close of the oxidation sequence copper reappeared in the most severely oxidized areas as chrysocolla plus traces of a pistachio green (unknown) copper vanadate.

Open fractures in the assemblage are filmed with late opal and allophane.

Physical properties

Pottsite is a bright yellow colour (aureolin, RHS12A) with a very pale yellow streak. Crystals are brittle, with no good cleavage, and have a Mohs hardness of $3\frac{1}{2}$.

The specific gravity was determined using the Thoulet method, and Clerici solution was employed as a suspension medium. Early attempts were plagued by bubbles which adhered to the wax pellet; another brand of wax tried did not seem to suffer from this problem. One attempt (using a

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102 μg fragment of pottsite) gave a value of about 7.0; the calculated density is 7.31 g/cm^3.

In thin section pottsite is cloudy yellow and could easily be confused with nadorite, or even cervantite when fine grained. It is uniaxial (−) and the indices were determined in S-Se melts as $\omega = 2.40$, $\varepsilon = 2.30$ (Li).

Crystallography

Minute ($\frac{1}{2}$–1 mm) euhedral crystals were found in one specimen. They are bipyramids or stubby prisms terminated by pyramids. Forms found include {110}, {101}, {103}, and {211}; typically {101} is the dominant form. The goniometric data give $a:c = 1:1.13$. No cleavage or twinning was observed.

Weissenberg and rotation study gives $a:c = 1.141$ with $a = 11.084$, $c = 12.634$ Å. The space group indicated by the results is tetragonal, $I_1 422$. If Z = 10, then $D_{calc} = 7.31$ g/cm^3.

Indexed powder data for Cr-$K\alpha$ radiation are given in Table 1. Single crystal studies also employed Cu-$K\alpha$ radiation.

Table 1. X-ray powder data for pottsite

$d_{meas.}$	$I_{est.}$	d_{calc}	hkl	$d_{meas.}$	$I_{est.}$	$d_{calc.}$	hkl
8.324Å	1	8.332Å	011	2.035Å	1	2.032Å	251
5.559	½	5.542	020	2.014	2	2.013	334
4.618	9	4.615	121	1.965	½	1.968	026
4.168	3	4.166	022			1.962	053
3.938	1	3.937	013			1.962	343
3.210	4	3.209	123	1.952	3	1.952	235
3.158	2	3.158	004			1.950	244
3.062	10	3.065	132	1.843	2	1.847	060
2.983	2	2.987	231			1.841	145
2.931	2	2.930	114			1.849	253
2.778	½	2.777	033	1.805	½	1.805	136
		2.771	040			1.804	161
2.624	½	2.613	330	1.753	1		
		2.630	141	1.698	½		
2.476	4	2.479	240	1.676	2		
2.252	3	2.251	125	1.628	1		
2.184	3	2.184	051	1.599	2		
		2.184	341	1.523	3		
				plus 16 lines to 1.2Å			

Cr-Kα radiation, 114 mm diameter camera

Chemistry

In cold 16% HCl pottsite quickly turns chalk white but does not dissolve. It is unaffected by cold 20% KOH. The mineral is readily soluble in cold 15% HNO_3, however.

Water was determined (and observed) by the Penfield method on a 216.1 μg sample. Following water loss, the mineral fuses readily to a tan, syrupy slag.

Microprobe analysis for Pb, Bi, and V followed XES qualitative analysis which showed only those elements. Standards employed were Pb, Bi, and V. Three points were analysed, giving PbO 31.6, 31.8, 33.8; Bi_2O_3 33.7, 33.8, 34.5; V_2O_5 26.2, 26.8, 26.8%. No compositional zoning was detected within crystals. The results lead to the empirical formula $H_{10.18}Pb_{0.99}Bi_{1.0}(VO_4)_{19.9} \cdot 20H_2O$, or $HPbBi(VO_4)_2 \cdot 2H_2O$. The special site for hydrogen is assigned merely to provide charge balance. No other monovalent cation could be found in the mineral.

Discussion

No analogous compounds could be found in the literature, and the presence of several other unknown phases in addition to pottsite suggests unusual oxidation conditions that have not been thus far paralleled by laboratory investigations, or by oxidation conditions at other localities.

Type material will be provided to the British Museum (N.H.). The new mineral and name have been approved by the Commission on New Minerals and New Mineral Names, IMA.