

Schieffelinite, a new lead tellurate-sulphate from Tombstone, Arizona

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SUMMARY. Found at the Joe and Grand Central mines, Tombstone, Arizona, USA, in quartz gangue with girdite, rodalquilarite, bromargyrite, and gold. Crystals orthorhombic, tabular to scaly on {010} up to 1 mm; H = 2, colour white, $D_{\text{meas.}} = 4.98 \pm 0.12$.

Chemical analysis gave PbO 58.2%, TeO₃ 28.6, SO₃ 6.8, H₂O 4.7. Easily fusible to red-brown slag and soluble in cold, dilute acids.

Crystals orthorhombic *Cmcm*; $a = 9.67 \text{ \AA}$, $b = 19.56$, $c = 10.47$. Strongest lines 9.778 (10), 3.426 (6), 3.250 (6B), 3.560 (5B), 3.338 (5), 3.033 (5), 2.934 (5), 2.603 (5). $D_{\text{calc.}} = 5.15$, $Z = 16$. Indices are $\alpha = 1.897$, $\beta = 1.940$, $\gamma = 1.942$, $2V_{\alpha} = 24^{\circ}$; $\gamma \parallel a$, $\alpha \parallel b$, $\beta \parallel c$.

The mineral and name have been approved by the Commission on New Minerals and New Mineral Names, IMA.

THE first piece of schieffelinite found on the dumps of the Joe shaft, at Tombstone, was a large chunk of shattered vein quartz. It had been thoroughly oxidized with only goethite relics after pyrite remaining. The tellurides once present had been converted to rodalquilarite, several unknown tellurites or tellurates, girdite, and schieffelinite. This is the type specimen for both schieffelinite and girdite. Native gold (probably supergene) and bromargyrite were also abundant in this piece. Subsequent excavations in the area produced a small number of other pieces, usually with somewhat simpler mineralogy. Empressite was noted in some samples, only in the absence of girdite.

In the samples found, girdite and schieffelinite appear to be younger than rodalquilarite for they often encrust fractures cutting seams of rodalquilarite.

Physical properties. Schieffelinite is invariably platy or scaly, usually occurring in clusters of randomly intergrown scales with individuals up to 1 mm in size. A few minute but highly perfect crystals were found in vugs near fresh pyrite and empressite. These crystals are perfectly colourless and flawlessly clear whereas more poorly formed scales tend to be milky white. The lustre is adamantine.

The Mohs hardness is 2, and cleavage on {010} (the plane of flattening) is easy. The specific gravity was determined in toluene on a 3.2 mg sample in the powder basket on the Berman balance. The value obtained was 4.98 ± 0.12 . No fluorescence was noted in either long or short wavelength ultraviolet.

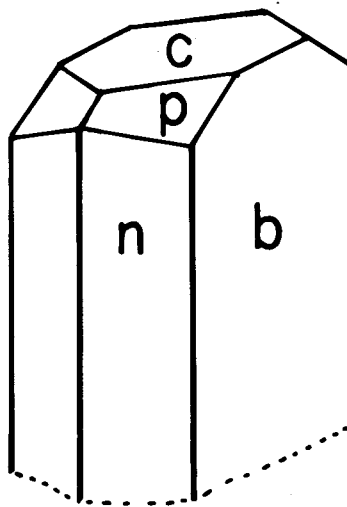


FIG. 1. Crystal form of schieffelinite.

Crystallography. Although a few highly perfect crystals were found, none were large enough for goniometry. However, one crystal was measured on the spindle stage with a polarizing microscope. It is pictured in Fig. 1. This crystal seems typical of all, tabular on b {010}, modified by c {001}, p {133}, and n {320}. Like all of the crystals examined it shows no evidence contrary to orthorhombic $2/mmm$ symmetry.

X-ray study of another crystal using rotation and Weissenberg level photographs established the space group as *Cmcm* with $a = 9.67 \text{ \AA}$, $b = 19.56$, $c = 10.47$. Powder data were used to refine the cell

TABLE I. X-ray powder data for schieffelinite. Cr-K α radiation, 114 mm camera

$I_{est.}$	$d_{meas.}$	$d_{calc.}$	hkl	$I_{est.}$	$d_{meas.}$	$d_{calc.}$	hkl
10	9.778	9.778	020	5	2.603	2.600	171
1	8.642	8.668	110	1	2.512	2.514	153
4	7.145	7.145	021			2.505	114
2	4.837	4.835	200	2	2.384	2.382	063
1	4.480	4.480	112			2.380	081
2	4.356	4.334	220			2.388	172
2	3.760	3.760	132	2	2.348	2.350	313
5B	3.560	3.572	042			2.355	134
		3.551	202			2.347	420
6	3.426	3.426	151	3	2.130		
		3.438	240	1	2.080		
5	3.338	3.338	222	3	2.032		
6B	3.250	3.266	241	3	1.956		
		3.237	113	2	1.905		
		3.259	060	1	1.878		
5	3.033	3.043	311	2	1.817		
2	2.982	2.980	152	2	1.784		
5	2.934	2.931	133	1	1.744		
2	2.870	2.873	242	2	1.710		
4	2.772	2.767	062	3	1.656		
4B	2.692	2.684	170	3	1.642		
		2.702	260				

and they are presented in Table I. For the cell chosen, $Z = 16$, thus $D_{calc.} = 5.15$.

Chemistry. Duplicate analyses for Pb, Te, and S were planned after microchemical and spectrographic analysis showed only these constituents. All of the tellurium was shown to be present as Te^{+6} . The results of the analyses are shown in Table II. Column 4 shows theory for $Z = 16$ with complete substitution of S for Te assumed. As shown in column 5, however, a formula with Te_5S_3 is equally plausible with $Z = 2$.

TABLE II. Chemical analysis of schieffelinite

	1	2	3	4	5
PbO	58.2%	59.2%	0.265	58.1%	58.6%
TeO ₃	28.6	29.1	0.166	30.0	28.8
SO ₃	6.8	6.9	0.086	7.2	7.9
H ₂ O	4.7	4.8	0.266	4.7	4.7
	98.3	100.0		100.0	100.0

(1) PbO and TeO₃ on 957 and 700 μ g samples; SO₃ on 1.890 mg and 889 μ g; water by Penfield method on 989 μ g.

(2) Analysis of column 1 set to 100%.

(3) Ratios.

(4) Theory for $Pb(Te,S)O_4 \cdot H_2O$.

(5) Theory for $Pb_8(TeO_4)_5(SO_4)_3 \cdot 8H_2O$.

Schieffelinite is readily soluble in cold dilute HCl or HNO₃. In the closed tube it fuses easily to a red-brown slag evolving water, then SO₂, finally a sublimate of TeO₂ when taken to ignition.

Optics. In thin section schieffelinite resembles molybdophyllite or wickenburgite upon casual inspection. Plates tend to lie along hairline fractures in the gangue and they are always length slow with parallel extinction since $\alpha \parallel b$, the plane of flattening ($\gamma \parallel a, \beta \parallel c$).

Dispersion of the optic axes is weak, $v > \rho$, easily seen in basal plates which give centred interference figures with $2V(-) = 24^\circ$. The indices of refraction for the NaD line are $\alpha = 1.897$, $\beta = 1.940$, $\gamma = 1.942$.

Comments. Schieffelinite is named to honour the memory of Ed Schieffelin, the prospector who discovered the Tombstone district about 100 years ago. Several dozen pieces have been found but the total amount of mineral they contain is estimated at only 200 mg. Type material will be provided for the British Museum (Natural History) and the Geological Museum of the University of Arizona.

Although clearly unlike any other lead tellurates/tellurites that have been described recently, there could be confusion with dunhamite (Fairbanks, 1946, see also Dunham, 1935) because it is a supposed PbTeO₃. Attempts to locate type dunhamite have been futile, but I have examined considerable

amounts of Te-rich material from the type locality. There is a mineral in this that should probably be taken as dunhamite, but no schieffelinite was observed.

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