SMITHSONITE FROM BROKEN HILL MINE, RHODESIA*

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ABSTRACT

Well-formed crystals of smithsonite, erroneously labeled calcite, have been found on old specimens from Broken Hill Mine, N. W. Rhodesia. The crystals are in two distinct habits. New forms observed are: $B\{12\cdot 8\cdot \overline{20}\cdot 1\}$, $X\{7\cdot 4\cdot \overline{11}\cdot 2\}$, $j\{21\cdot 7\cdot \overline{28}\cdot 12\}$, $Y\{25\overline{7}3\}$. Spectrographic analysis on crystals of Type 1 gives impurities MgO=0.1, CaO=0.001; type 2: MgO=0.5, FeO=0.4, CaO=0.05, CdO=0.05, PbO=0.1. G. Type 1=4.424; Type 2=4.405. For both types nO=1.850, nE=1.623±0.002.

In 1950 when the quarters of Economic Geology at Harvard were changed from one building to another, many specimens came to light that had not been seen in many years. Mr. Richard Gaines, who was in charge of the moving, came across four beautifully crystallized specimens from Broken Hill Mine, N. W. Rhodesia, labeled "Cerussite and Calcite."

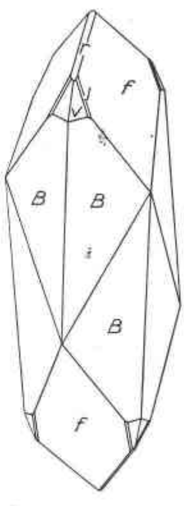

FIG. 1

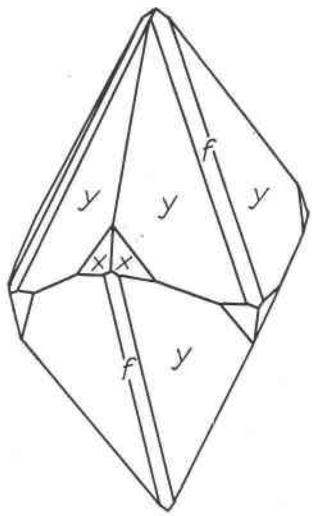

FIG. 2

Smithsonite, Broken Hill Mine, N.W. Rhodesia.

The well-formed colorless and transparent "calcite" proved to be smithsonite.

Morphology. Smithsonite crystals have been described from the Broken Hill Mine by Spencer (1908) and Mountain (1926). Spencer's

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crystals were small and showed the forms *v* $\{21\bar{3}1\}$ and *s* $\{05\bar{5}1\}$. Mountain's crystals were larger, 7 millimeters long, with the single form *f* $\{02\bar{2}1\}$.

The new material displays two distinct habits, neither of which is similar to the habits of the crystals previously described. Both types show new forms. Type 1 is represented by a single specimen and Type 2 by three specimens. The single specimen, about 5 centimeters square, is coated with many sharp, well-defined crystals ranging from 1 to 10 millimeters in length. The habit of these crystals is shown in Fig. 1. The large scalenohedron faces, *B*, are of a new form $\{12.8.\overline{20}.1\}$. They show brilliant reflections and give a remarkable constancy of angular measurements. The form *j* $\{21.7.\overline{28}.12\}$, also new, is represented only by small faces which are not found on all crystals. Other forms present are *r* $\{10\bar{1}1\}$, *f* $\{02\bar{2}1\}$ and *v* $\{21\bar{3}1\}$.

Three specimens are coated with crystals of similar habit showing the forms represented in Fig. 2. The crystals are intergrown with one another and it is difficult to obtain a single individual for goniometric measurements. A new form, *y* $\{25\bar{7}3\}$, dominates the crystals and its faces are usually striated parallel to the intersection with *f* $\{02\bar{2}1\}$. Another new form, *X* $\{7.4.\overline{11}.2\}$, is present on some crystals. On one specimen there is a crown-like growth, about one centimeter in diameter, all part of a single crystal, as shown in Fig. 3. Around the girdle of this crystal are small spherical masses of siderite.

Weissenberg photographs of the Type 1 smithsonite give the unit cell dimensions, $c_0 = 14.96$ kX, $a_0 = 4.65$, which are in very close agreement with those given in the seventh edition of Dana's *System of Mineralogy.*

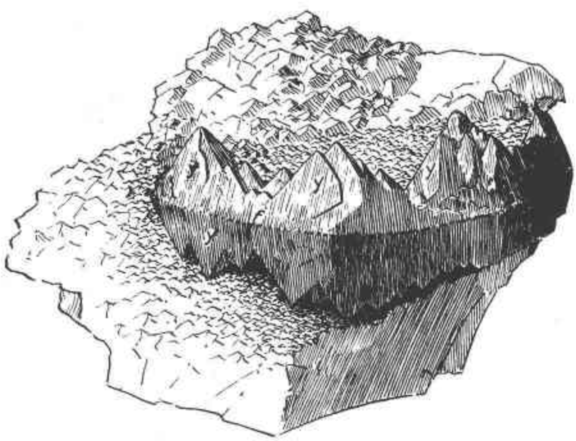

FIG. 3. Type 2, Smithsonite.

TABLE 1. SMITHSONITE ANGLE TABLE

Smithsonite—$ZnCO_3$
Hexagonal—R; hexagonal scalenohedral
$a:c=1:0.8063;\ \alpha=103°28'$
$p_0:r_0=0.9311:1;\ \lambda=\ 72°20'$

Form	ϕ	$\rho=C$	A_1	A_2
r $10\bar{1}1$	30°00′	42°57½′	53°49½′	90°00′
f $02\bar{2}1$	−30°00′	61°46′	90°00′	40°16′
*B $12\cdot 8\cdot\overline{20}\cdot 1$	6°35′	86°28½′	53°30′	66°21′
*x $7\cdot 4\cdot\overline{11}\cdot 2$	8°57′	77°26′	52°09′	69°29′
v $21\bar{3}1$	10°53½′	67°54½′	52°39½′	72°20½′
*j $21\cdot 7\cdot\overline{28}\cdot 12$	16°06′	62°56½′	50°05′	77°39′
*y $25\bar{7}3$	−13°54′	62°42′	46°06′	51°58′

* New forms.

Table 2 gives a summary of the data on which are based the observed new forms.

TABLE 2. SMITHSONITE

Form	ϕ	ρ	Range ϕ	Range ρ	No. of Faces
$12\cdot 8\cdot\overline{20}\cdot 1$	6°32′	86°28′	6°27′– 6°37′	86°25′–86°30′	30
$7\cdot 4\cdot\overline{11}\cdot 2$	8°51′	77°18′	8°45′– 9°03′	77°10′–77°30′	12
$21\cdot 7\cdot\overline{28}\cdot 12$	16°10′	63°02′	15°59′–16°15′	62°52′–63°25′	21
$25\bar{7}3$	−13°48′	62°45′	−13°06′–14°33′	62°35′–63°00′	27

Chemical Composition. Two spectrographic analyses of each type of smithsonite were made by Dr. Harold C. Harrison. The approximate amounts of the impurities found spectrographically are given in Table 3.

The small percentage of impurities in the Type 1 material shows it to be very nearly pure $ZnCO_3$, probably the purest smithsonite reported.

TABLE 3. IMPURITIES IN SMITHSONITE

	Type 1	Type 2
MgO	0.1	0.5
FeO	—	0.4
CaO	0.001	0.05
CdO	—	0.05
PbO	—	0.1

The specific gravity 4.424 of Type 1, as determined by four measurements on the Berman balance, approaches very closely the calculated specific gravity of 4.43. The specific gravity of Type 2 is 4.405. The refractive indices of both types as determined by the immersion method, are the same for sodium light: nO = 1.850 and nE = 1.623 ± 0.002.

References

Mountain, E. D., *Mineral. Mag.*, **21**, No. 113, 51 (1926).
Spencer, L. J., *Mineral. Mag.*, **15**, No. 68, 35 (1908).

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