CRYSTALLOGRAPHIC NOTES ON STEPHANITE IN A SILVER ORE FROM MEXICO.

By Earl V. Shannon.

Assistant Curator, Department of Geology, United States National Museum.

The following short note contains the results of a crystallographic examination of several specimens of silver ore labeled as having come from the Campania mine, Sultepec, Mexico. The specimens were received by this department from the Division of Mineral Technology and probably originally formed part of the exhibits at the Panama Pacific Exposition (San Francisco, 1915). The measurements identify the silver mineral as stephanite, although its appearance and habit are such that its identity was not suspected prior to the crystallographic examination. The number assigned the material in the museum catalogue is 90,937. The best specimens have been transferred to the mineralogical collections, while a larger one of poorer quality is preserved in the study collection of silver ores.

The stephanite forms brilliant striated and highly modified prismatic crystals, elongated in the vertical direction (*c* axis), very unlike the tabular habit usually assumed by this mineral. Although other localities have frequently furnished twins according to several laws, especially pseudohexagonal forms produced by twinning on *m* (110), no evidence of twinning was seen in the present specimens unless the arrangement of striations on a single face of one crystal contains such evidence.

The crystals, which reach 1.5 cm in length, with a diameter of 0.4 cm, lie scattered through coarsely crystalline white to colorless or slightly greenish calcite and project into small vuggy cavities in a manner suggesting that the silver mineral and its gangue were deposited simultaneously. The only other silver mineral contained in the specimens is polybasite, which occurs in a single small vug as incompletely developed crystals, which rest upon and are evidently younger than the stephanite. Included in the calcite-stephanite vein filling are numerous crushed fragments of a wall rock which has the appearance of a highly sericitic fine-grained schist or shale. These inclusions contain more or less pyrite, either as scattered crystals or a fine-grained replacement. The stephanite is dark lead-gray in color and shows a brilliant conchoidal fracture with only traces of cleavage.

The mineral gives the usual blowpipe reactions for stephanite, and the essential constituents were found by appropriate chemical tests to be silver, antimony, and sulphur, while arsenic and lead were proven absent.

No. 2479. Proceedings U. S. National Museum, Vol. 63, Art. II.

1

Three crystals were measured in detail, and upon these 39 forms were found, 7 of which are new for the species. These 3 crystals are represented as nearly as practicable in their actual development in the Figures 1 to 3. The terminal faces of crystal 1 are highly lustrous, but all of the larger faces are marked by discontinuous grooves parallel to the plane m $(1\bar{1}0)$ in the drawing. On crystal 2, the pyramidal faces are all horizontally striated by reentrant angles, while the dome (021) has two sets of striations parallel to (110) and $(\bar{1}10)$ meeting down the center of the face. All of the faces in the prismatic zone are deeply striated. These striae do not, however, produce any rounding of the angles, but they consist of minute and very sharp reentrant angles. Thus, a single sharp and brilliant signal may result from simultaneous reflection from half a hundred narrow lines in exactly parallel position. In this respect the drawings are greatly generalized, only the major repetitions and reentrant angles being shown.

In the following table are given the averages of the angles measured on the three crystals:

Forms and angles on stephanite.

| Letter.	Symbol. Miller.	Symbol. Gdt.	Quality.	Faces.	Measured. φ °	Measured. φ ′	Measured. ρ °	Measured. ρ ′	Calculated. φ °	Calculated. φ ′	Calculated. ρ °	Calculated. ρ ′
c.................	001	0	Excellent.................	3	..	..	0	00	..	..	0	00
b.................	010	000	.....do.................	5	0	00	90	00	0	00	90	00
λ.................	310	300	.....do.................	5	78	06	90	00	78	09	90	00
New.............	540*	⁴⁄₄ ∞	.....do.................	1	63	44	90	00	63	17	90	00
o.................	110	∞	Very good.................	7	57	44	90	00	57	49	90	00
O.................	230	∞ ³⁄₂	Poor.................	1	46	43	90	00	46	39	90	00
U.................	120	∞ 2	Medium.................	2	38	29	90	06	38	28	90	00
G.................	5.11.0	∞ ¹¹⁄₅	.....do.................	1	35	36	90	00	35	51	90	00
π.................	130	∞ 3	Fair.................	6	28	05	90	00	27	55	90	00
New.............	3.10.0*	∞ ¹⁰⁄₃	Medium.................	1	25	09	90	60	25	30	90	00
New.............	290*	∞ ⁹⁄₂	.....do.................	1	20	12	90	00	19	27	90	00
I.................	150	∞ 5	Poor.................	2	17	30	90	00	17	38	90	00
....	1.15.0	∞ 15	Fair.................	2	6	20	90	00	6	11	90	00
g.................	201	20	Good.................	1	90	05	65	43	90	00	65	20
β.................	101	10	Fair.................	1	90	07	47	53	90	00	47	26
b.................	203	²⁄₃ 0	Good.................	1	91	37	37	49	90	00	35	59
ε.................	041	04	.....do.................	1	0	00	69	42	0	00	69	57
d.................	021	02	Excellent.................	2	0	00	53	43	0	00	53	52
κ.................	043	0 ⁴⁄₃	Poor.................	1	0	60	42	02	0	00	42	24
k.................	011	01	Good.................	3	0	11	34	20	0	00	34	25
l.................	023	0 ²⁄₃	Excellent; very poor.........	4	0	00	24	35	0	00	24	33
N.................	331	3	Good.................	2	57	52	75	33	57	49	75	28
r.................	221	2	.....do.................	3	58	06	68	51	57	49	68	46
p.................	332	³⁄₂	Very good.................	1	58	22	62	29	57	49	62	36
P.................	111	1	Excellent.................	8	57	57	52	09	57	49	52	08
h.................	112	½	Good.................	8	57	56	32	31	57	49	32	45
New.............	225*	²⁄₅	Excellent.................	1	58	22	27	05	57	49	27	14
m.................	113	⅓	Excellent; poor.............	5	57	55	23	19	57	49	23	13
q.................	114	¼	Very good.................	1	57	27	17	48	57	49	17	50
New.............	118*	⅛	Poor.................	1	57	55	8	55	57	49	9	08
H.................	122	½ 1	Medium.................	2	38	48	41	21	38	28	41	11
w.................	131	13	Poor.................	2	28	12	66	56	27	55	66	44
v.................	132	½ ³⁄₂	Good.................	1	27	54	49	26	27	55	49	18
New.............	133*	⅓ 1	Poor.................	3	28	03	37	45	27	55	37	42
ω.................	134	¼ ³⁄₄	.....do.................	1	28	22	30	21	27	55	30	10
New.............	3.10.5*	⅗ 2	Good.................	1	25	37	57	37	25	30	56	37
W.................	3.11.3	1 ¹¹⁄₃	Fair.................	1	22	07	69	36	23	26	69	56
T.................	142	½ 2	Good.................	3	22	07	55	46	21	40	55	51
....	155	⅕ 1	.....do.................	3	17	36	35	46	17	38	35	42
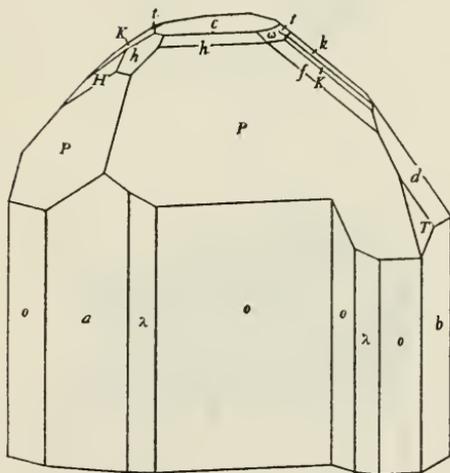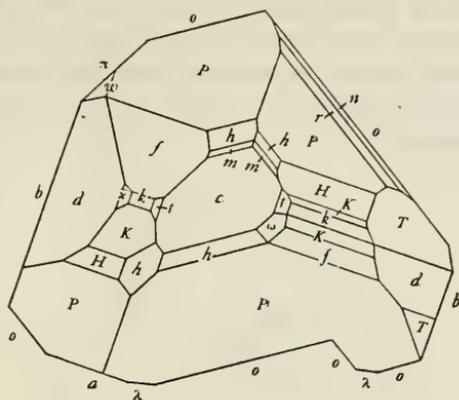
FIG. 1.—STEPHANITE CRYSTAL 1 SHOWING ACTUAL DEVELOPMENT.

The order of agreement between the measured and calculated angles is very good for the principal forms. The forms here given as new are as follows:

540 ($\frac{5}{4}\infty$). This form was found once only as a moderately broad face yielding an excellent signal on crystal 2, as shown in Figure 2. Angles:

	ϕ	ρ
Measured	$\phi=63\ 44$	$\rho=90\ 00$
Calculated	$\phi=63\ 17$	$\rho=90\ 00$
Difference	$\phi=\ 0\ 27$	$\rho=\ 0\ 00$

The agreement is satisfactory. However, in common with the other prismatic forms here listed as new, this form does not fit into the rhythmic series when its zone is analyzed according to Goldschmidt's Law of Complication. Extra or irrational forms are not rare with this mineral.
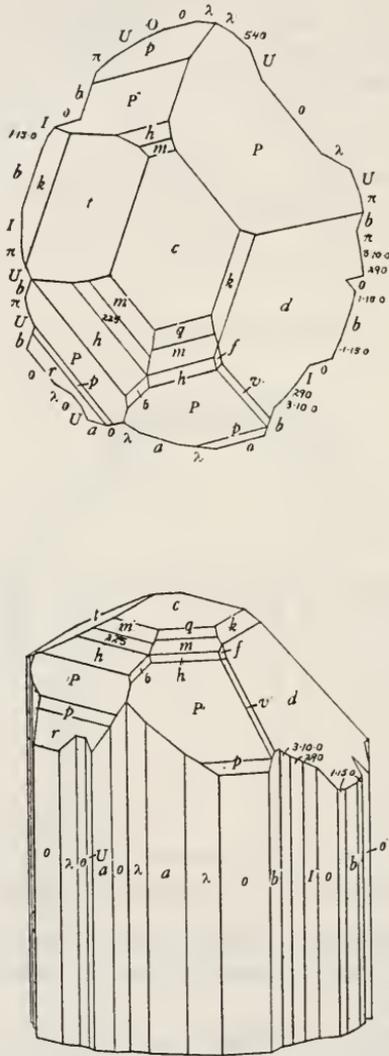
FIG. 2.—STEPHANITE CRYSTAL 2 WITH FORMS (225), (290), (3-10-0) AND (1-15-0) SHOWING ACTUAL DEVELOPMENT.

3.10.0 ($\infty\frac{10}{3}$). Observed only once as a broad line face yielding a moderately good signal on crystal 2. Angles:

Measured	$\phi=25\ 09$	$\rho=90\ 00$
Calculated	$\phi=25\ 30$	$\rho=90\ 00$
Difference	$\phi=\ 0\ 21$	$\rho=\ 0\ 00$

290 ($\infty\frac{9}{2}$). Like the preceding, seen only as a single relatively narrow face yielding a moderately good signal on crystal 2 and shown in Figure 2. Angles:

	° ′	° ′
Measured	$\phi=20\ 12$	$\rho=90\ 00$
Calculated	$\phi=19\ 27$	$\rho=90\ 00$
Difference	$\phi=\ 0\ 45$	$\rho=\ 0\ 00$
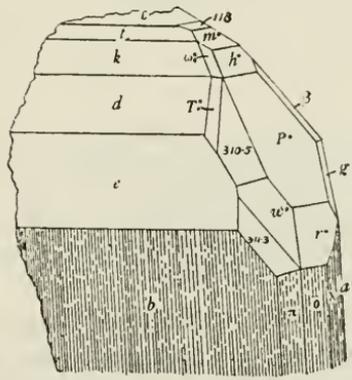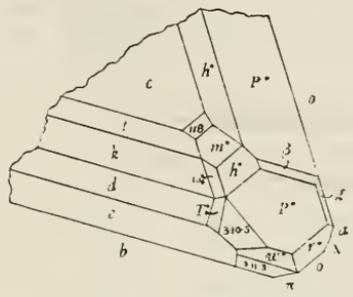
FIG. 3.—STEPHANITE CRYSTAL 3 WITH FORMS (118), (3-10-5) AND (3-11-3) SHOWING ACTUAL DEVELOPMENT.

225 ($\frac{2}{5}$). Observed as a single relatively prominent face yielding an excellent signal on crystal 2, as shown in Figure 2. Angles:

	° ′	° ′
Measured	$\phi=58\ 22$	$\rho=27\ 05$
Calculated	$\phi=57\ 49$	$\rho=27\ 13$
Difference	$\phi=\ 0\ 33$	$\rho=\ 0\ 08$

118 ($\frac{1}{8}$). Observed as a single small face yielding a comparatively poor signal on crystal 3, as shown in Figure 3. Angles:

	° ′	° ′
Measured	$\phi=57\ 55$	$\rho=\ 8\ 55$
Calculated	$\phi=57\ 49$	$\rho=\ 9\ 08$
Difference	$\phi=\ 0\ 06$	$\rho=\ 0\ 13$

133 ($\frac{1}{3}$1). A form not previously recorded, although there are listed in Goldschmidt's Winkeltabellen two forms, (13.39.40) and (3.9.10), which are very close to it. The new form was observed as three faces—two on crystal 1, shown in Figure 1, and one on crystal 2, shown in Figure 2. Angles:

|		
Measured, crystal 1	ϕ=28 03	ρ=37 45—poor.
Measured, crystal	ϕ=27 44	ρ=37 43—poor.
Measured, crystal 2	ϕ=27 54	ρ=37 47—very good.
Calculated, 133	ϕ=27 55	ρ=37 42
Calculated, 13.39.40	ϕ=27 55	ρ=37 05
Calculated, 3.9.10	ϕ=27 55	ρ=34 54

The form is thus well established.
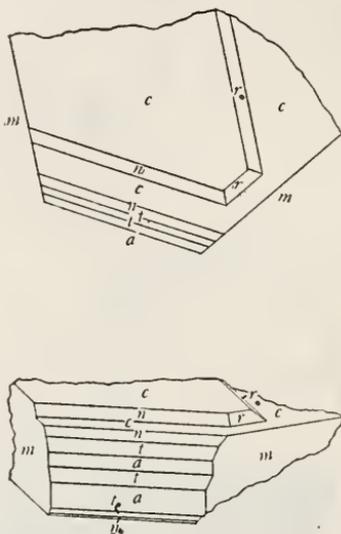
FIG. 4.—POLYBASITE CRYSTAL SHOWING ACTUAL DEVELOPMENT.

3.10.5 ($\frac{3}{5}$ 2). This form is represented by a single relatively prominent face yielding a good signal on crystal 3, as shown in Figure 3. Angles:

Measured	ϕ=25 37	ρ=57 37
Calculated	ϕ=25 30	ρ=56 37
Difference	Φ= 0 07	ρ= 1 00

The polybasite crystals are black in color and very lustrous. The best crystal was measured and is faithfully reproduced in the drawing Figure 4. Oriented as drawn, the angles are in very close agreement with those given in the Winkeltabellen. The crystals do not exhibit any unusual features, the habit being tabular, as is characteristic of the mineral. They show the usual step structure, as indicated in the drawing, this tendency being manifested also in hexagonal or triangular markings on the basal pinacoid. The streak of the polybasite is dark red, and, in the absence of distinct crystals, it might be mistaken for pyrargyrite.