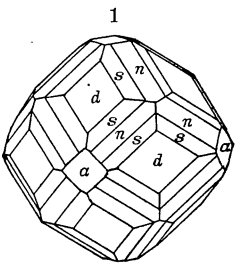
ART. XXIV.—*Eglestonite, Terlinguaite and Montroydite, New Mercury Minerals from Terlingua, Texas;* by ALFRED J. MOSES.

1. *Eglestonite, an Isometric Oxychloride of Mercury.*

THE most abundant material in the specimens received from Mr. B. F. Hill so resembled minute crystals of sphalerite that the first test made was for a zinc coating. The material occurs, so far as observed, only as crystals which rarely exceed one millimeter in diameter and are sometimes isolated and at other times united loosely in a crust which readily crumbles under pressure into separate well developed crystals, evidently isometric and with the dodecahedron the predominating form. The associated minerals are the later described terlinguaite and montroydite, calomel, native mercury and calcite.

Crystalline Form of Eglestonite.—The crystals are usually sharply and beautifully developed, but in some specimens are pitted and the cavities filled with metallic mercury. The system is isometric and the class hexoctahedral. With the two-circle goniometer the forms identified were *a* {100}; *d* {110} *n* {112} and *s* {123} as shown in fig. 1. The dodecahedral planes are the largest.



The following table gives the angles obtained from twenty-nine faces on one-half of a crystal, one mm. in diameter. The calculated angles are also given.

	Form.	Faces Reflecting.	ϕ Measured.	ϕ Calculated.	ρ Measured.	ρ Calculated.
a	001	1			0°	
	010	4	0°		90°	
d	110	4	45° 0½′	45°	90°	
	011	4	0°	0°	44° 58′	45°
n	112	4	45° 02′	45°	35° 17′	35° 16′
	121	7	26° 30′	26° 34′	65° 50′	65° 54′
s	123	2	26° 32′	26° 34′	36° 45½′	36° 42′
	132	2	18° 26½′	18° 26′	57° 40′	57° 41′
	231	1	33° 35′	33° 41′	74° 22′	74° 30′

Chemical Analysis of Eglestonite.—The analyses here recorded were made by Mr. J. S. McCord, Assistant in Mineralogy at Columbia University. The method used was chosen after an attempt to obtain an electrolytic determination of the mercury by dissolving ·2465 gms. of very carefully picked material in nitro-hydrochloric acid, precipitating as sulphide and dissolving in hot solution of sodium sulphide. This solution

in a dish of platinum was subjected for five hours to a current of about two volts. Two separate weighings of the dish and mercury showed a loss between the times of weighing corresponding to over two per cent. (·0055 gms.). It was therefore decided that with the large dish surface and the small amount of available material the method was not safe.

By trial Mr. McCord found that in a narrow closed tube of hard glass 75^{mm} by 6^{mm} external diameter and with low red heat, mercuric chloride volatilized and was redeposited with a loss of less than two-tenths of one per cent. Mercuric oxide yielded metallic mercury with a loss almost exactly that of the oxygen.

Analyses I and II were therefore made by heating carefully picked crystals in such a weighed tube and determining the loss, which in the proved absence of water and carbonic acid was assumed to be oxygen. The sublimates of mercury and chloride of mercury were then dissolved from the tube by nitric acid, the chlorine determined as silver chloride and the difference between the weight of the chlorine and the weight of the sublimates was taken as mercury.

In analyses III, IV and V the method was varied. The weighed powdered crystals were mixed with dried soda free from chlorine and heated in one of the closed tubes described until the mass was bright red and all sublimate had been driven clear of the fused mass. When cool the tube was cut just above the fused mass and the piece containing the sublimate carefully weighed. The sublimate was then dissolved in nitric acid and the dried tube again weighed. The difference was mercury. For safety the solution was tested for chlorine and in one analysis a small amount was found and added to the rest.

From the other piece of the cut tube the soda fusion was dissolved in hot water acidified with nitric acid and the chlorine determined as silver chloride. Each sample was separately picked.

	I.	II.	III.	IV.	V.
Grams taken.....	·0768	·0618	·2048	·1404	·1097
Per cent oxygen ...	2·60	2·26	....	....	....
" chlorine...	8·72	7·24	7·81	7·68	8·20
" mercury ..	88·67	90·45	90·72	88·25	89·70

The average of these determinations corresponds closely to the empirical formula $Hg_6Cl_3O_2$.

	Percentages in $Hg_6Cl_3O_2$.	Percentages by analysis.			Group proportion.
O	2·391	2·43	÷ 15·88	=	·1530 or 2·036
Cl.....	7·946	7·93	÷ 35·18	=	·2254 " 3·000
Hg	89·666	89·56	÷ 198·49	=	·4512 " 6 005
	100·003	99·92			

Other Characters of Eglestonite.—Luster, brilliant adamantine to resinous. Color, varying between brownish yellow and yellowish brown but darkening quickly on exposure to sunlight and becoming nearly black but retaining a high luster. In powder, greenish yellow to canary yellow, becoming quickly green and finally black on exposure to light. Transparent if smooth-faced. Brittle and without observed cleavage. Hardness between 2 and 3. Specific gravity by direct weight of two carefully picked samples 8·327, as follows:

	I.	II.
Grams taken	·2576	·4548
Loss in water	·0310	·0545
Specific gravity	8·309	8·345

Heated on charcoal, volatilizes completely without fusion and forms a slight grayish sublimate.

Heated in the closed tube, decrepitates, becomes orange-red, evolves dense white fumes and deposits a white non-crystalline sublimate which is slightly yellow hot, drives without fusing, is soluble in nitric acid and gives the chlorine tests with copper oxide. Later the orange-red residue volatilizes completely, forming a mercury mirror beyond the ring of chloride.

In dilute nitric acid the crystals become opaque and pinkish white but retain their shape and there is a visible formation of metallic mercury. On heating, the mercury dissolves with effervescence and the pinkish white residue is also slowly but completely dissolved.

In cold hydrochloric acid the crystals do not whiten but in hot acid the surface becomes gray from metallic mercury, which dissolves with a very slight effervescence. The greater portion of the crystal is insoluble even in concentrated cold acid.

If hydrochloric acid is added during the dissolving in nitric acid there is a heavy precipitate formed, but on heating this and the opaque white residue dissolve quickly and completely.

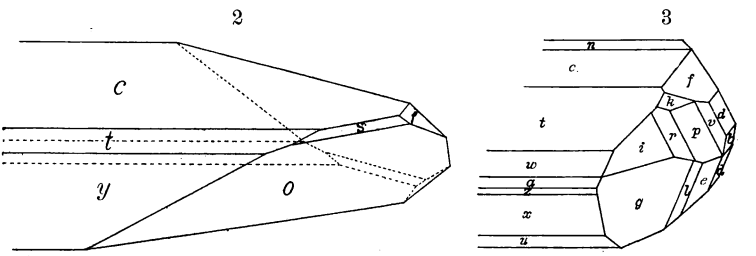
Name of Eglestonite.—For this substance, an isometric and hexoctahedral oxychloride of mercury, the name Eglestonite is proposed in honor of the late Prof. Thomas Egleston, founder of the Columbia School of Mines and for many years professor of mineralogy and metallurgy in Columbia University.

2. *Terlinguaite, a Monoclinic Oxychloride of Mercury.*

On the specimens which show the eglestonite there is generally found a bright sulphur-yellow material usually as an agglomeration of imperfect striated crystals and less frequently as doubly terminated crystals of not over one millimeter in

length. This material on examination is found to be quite distinct from the eglestonite with which it is associated. In one of the specimens the central portion was a mass of this yellow substance and outside of this was a thick crust of eglestonite crystals, while scattered through the crust were globular masses of native mercury coated with the oxide montroydite.

Crystalline Forms of Terlinguaite.—Few crystals were satisfactory for measurement. Four were measured which may be briefly described as follows:



Crystal 1.—Very minute and complex, yielding reflections from about twenty definite polygonal faces. No figure was drawn because of the difficulty of judging relative development of forms. *a*, *c*, *m*, *y*, *h*, *g*, *a*, λ were the most prominent forms.

Crystal 2.—Larger and simpler than crystal 1, and elongated parallel to the axis $\bar{b}$. The principal forms are shown in fig. 2 in approximately the relative size.

Crystal 3.—Short and relatively thick and complex crystal. The principal forms are shown in fig. 3.

Crystal 4.—Tabular parallel *a* {100}. Showing prominently also *e*, γ and π and less prominently δ, *d*, *t*, *u*, *x*, *i*, *s*, *g*, λ. No drawing was made of this crystal.

The crystals were mounted with their most prominent zone normal to the vertical circle. The axis of this zone proved to be the only axis of symmetry and therefore was the axis of $\bar{b}$ of the monoclinic system. By trial in the stereographic projection the forms denoted by *c* and *a* were found to be the most prominent zone centers and were chosen as {001} and {100}.

The angles obtained by measuring with the axis $\bar{b}$ normal to the vertical circle were transformed to the conventional ϕ and ρ angles referred to a pole plane at right angles to the $\dot{c}$ axis and to a meridian through {010}. These angles are here tabulated and with them the calculated angles for the particular indices and calculated axial elements.

Forms.		Measured Coordinate Angles.		Calculated Coordinate Angles.		Remarks.
		ϕ	ρ	ϕ	ρ	
c	{001}	90° 00′	15° 44′	------	-----	Well developed on 1, 2 and 3.
b	{010}	0 00	90 00	------	------	Minute face on 3.
a	{100}	90 00	"	------	------	Large on 4. small on 1 and 3.
θ	{130}	33 07	"	33° 08′	------	Microscopic on 3.
δ	{230}	52 21	"	52 33	------	Microscopic on 4.
d	{011}	7 48	64 13	7 53	64° 02′	Well developed on 3, poorly on 4.
f	{013}	22 28	36 20	22 34	36 17	Fair on 3, minute on 1 and 2.
h	{015}	34 50	26 12	34 43	26 19	Minute face on 1.
t	{106}	90 00	43 14	90 00	42 56	On all four crystals, prominent on 3.
y	{103}	"	57 57	"	57 39	Prominent on 2, small on 1.
w	{101}	"	76 25	"	76 31	Striated face on 3.
n	{$\bar{1}$06}	$\bar{9}0$ 00	20 30½	$\bar{9}0$ 00	20 09	Minute faces on 3.
u	{$\bar{1}$03}	"	45 40	"	45 26	Indistinct on 3 and 4.
m	{$\bar{5}$08}	"	65 25	"	65 37	Large dull face on 1.
x	{$\bar{7}$, 0, 10}	"	67 40	"	67 43	Striations on 100 of No. 4. large face on 3.
z	{$\bar{1}$01}	"	74 08	"	74 30	Fine edge on 3.
v	{$\bar{1}$55}	27 31	66 19	27 55	66 31	Narrow minute face on 3.
p	{$\bar{1}$33}	38 11	68 42	38 21	68 54	" " "
r	{11, 25, 25}	45 08	70 58	45 00	70 50	Minute triangular face on 3,
i	{7, 11, 11}	53 59	74 30	54 10	73 56	Minute faces on 3 and 4.
s	{111}	64 22	78 04	64 30	78 03	" 2 and 4.
λ	{1, 3, 15}	53 16	34 15	53 23	34 17	" 1 and 4.
π	{136}	42 26	53 59	42 55	54 13	Distinct on 4.
k	{134}	39 17	63 20	39 57	63 12	Distinct triangular on 3.
e	{$\bar{1}$33}	$\bar{2}\bar{6}$ 54	66 14	$\bar{2}\bar{7}$ 13	66 22	Prominent on 3 and 4.
l	{$\bar{1}\bar{1}$, 25, 25}	$\bar{3}\bar{6}$ 12	68 22	$\bar{3}\bar{5}$ 52	68 16	Large striated face on 3.
g	{$\bar{1}\bar{3}$, 20, 20}	$\bar{4}\bar{8}$ 37	72 02	$\bar{4}\bar{8}$ 36	71 59	Very prominent on 3, visible on 4.
o	{$\bar{1}$11}	$\bar{6}\bar{1}$ 02	76 32	$\bar{6}\bar{1}$ 12	76 40	Very prominent on 2, visible on 1 and 3.
γ	{$\bar{9}$77}	$\bar{6}\bar{7}$ 42	79 28	$\bar{6}\bar{7}$ 16	79 15	Prominent on 4.
β	{$\bar{1}$, 3, 15}	2 40	22 03½	2 18	22 08	Minute face on 1.
q	{$\bar{1}$15}	$\bar{5}\bar{1}$ 21	32 51	$\bar{5}\bar{1}$ 41	33 16	Small but distinct on 1.
a	{$\bar{1}$13}	$\bar{5}\bar{6}$ 34	51 00	$\bar{5}\bar{7}$ 02	51 14	Minute faces on 1 and 2.

The value of β was determined to be 74° 16′, the average of determinations from the angles of c, f and h.

The ratio between the axes was determined to be

$$\dot{a} : \bar{b} : \dot{c} = 0{\cdot}5306 : 1 : 2{\cdot}0335$$

the average of eleven determinations for each axis from the angles of p, s, m, k, e, l, g, o, γ, q and a, two for $\dot{a}$ from the t and x angles and two for $\dot{c}$ from the f and h angles. The maximum deviations from the average were for $\dot{a}$ ·0139, for $\dot{c}$ = 0·0214. Much more complex indices could be chosen for some of the forms which would check more accurately the measured angles, but as a certain error is undoubtedly due to a blurring of the images from the microscopic faces, it is believed the simpler indices chosen are generally correct.

Chemical Analyses of Terlinguaite.—Analyses I, II and III were made by Mr. McCord by fusion with soda in a closed tube as described under eglestonite. Analysis IV was made to determine the loss by heating. All samples were separately picked. The results tabulate as follows:

	I	II	III	IV
Grams taken	·1960	·1078	·0874	·06635
Per cent oxygen				3·47
" chlorine	7·78		8·00	
" mercury	88·67	87·38	88·64	

These determinations lead to the simple empirical formula of Hg_2ClO as follows:

	Percentages in Hg_2ClO.	Percentages by analysis.	Group proportions.
O	3·544	3·47 ÷ 15·88 =	·2185 or ·974
Cl	7·852	7·89 ÷ 35·18 =	·2242 " 1·000
Hg	88·604	88·24 ÷ 198 49 =	·4445 " 1·983
	100·000	99·60	

Other characters of Terlinguaite.—Luster, brilliant adamantine. Color, sulphur-yellow with a slightly greenish tinge, very slowly darkening on exposure to an olive green. Color of powder lemon-yellow, also slowly becoming olive-green. Transparent or nearly so. Hardness between 2 and 3. Brittle or sub-sectile.

Specific gravity on very carefully picked samples 8·725, higher than eglestonite by 0·316.

	I	II
Quantity taken	·4443	·4545
Weight in water	·3934	·4024
Specific gravity	8·728	8·723

Between crossed nicols there is distinct double refraction. The crystals can be viewed only normal to the $\overline{b}$ axis and show extinction parallel to this.

Heated on charcoal and in the closed tube, behaves like eglestonite except that a little oxide appears to be formed, giving a pinkish tinge to the white sublimate.

In nitric acid behaves like eglestonite but dissolves more rapidly. In hydrochloric acid becomes white but does not appear to dissolve.

Distinctions from Eglestonite.—The most convenient distinctions are the yellow color and the very slow change of color to olive-green as compared to the brownish color and rapid change to black with eglestonite. The eglestonite crystals are usually easily recognized. In testing, the double refraction and the more rapid solution of the terlinguaite are characteristic.

The name Terlinguaite.—This name should be limited to the yellow monoclinic oxychloride of mercury here described in order to remove the confusion at present existing. Mr. W. H. Turner* first used the name terlinguaite in the following words: "In addition to cinnabar, mercury occurs in the native form and as a white coating and *as yellow-green* crystals. Prof. S. L. Penfield has identified the . . . greenish crystals as an oxychloride of mercury forming a new mineral species for which I have suggested the name terlinguaite."

To the miners in the Terlingua district terlinguaite is "a heavy soft† cadmium yellow substance in masses or powder with a distinct green shade. It blackens on exposure and gives by rough retort tests 60 to 70 per cent of mercury." Some of this material has been recently sent to me and will be examined; the description, however, suggests a mixture of eglestonite and terlinguaite.

Prof. Penfield sent me by request the best two of the specimens received from Mr. Turner and at the same time wrote that "I have never given these minerals more than superficial examination and they may not be oxychlorides; I simply suggested that they might be." One of these specimens received from Prof. Penfield was undoubtedly the material here described as terlinguaite, crystal 4 having been taken from the specimen and the color change to olive-green on exposure being very pronounced. The other specimen, although apparently an oxychloride, was evidently the undetermined mineral spoken of in No. 5 of this article.

Of the three possibly different substances to which the name terlinguaite has hitherto been applied we have therefore

1st. The mineral here described.

2d. The undetermined rough yellow crystals mentioned in No. 5.

3d. The pulverulent yellow masses.

It is therefore proposed that the name terlinguaite be definitely limited to the mineral here described.

3. *Montroydite, Mercuric Oxide in Orthorhombic Crystals.*

Associated sparingly with the eglestonite and terlinguaite and in one or two instances occurring as masses of an inch or more on a side there was found a third new mineral. The most frequent occurrence was as a velvety incrustation of orange-red needles projecting from the surface of little hollow spheres and hollow pipe-like stems. The supporting material forming the sphere or pipe was metallic in luster, white to

* The Terlingua Quicksilver Mining District, Brewster Co., Texas, by W. H. Turner, Mining and Scientific Press, San Francisco, July 21, 1900.

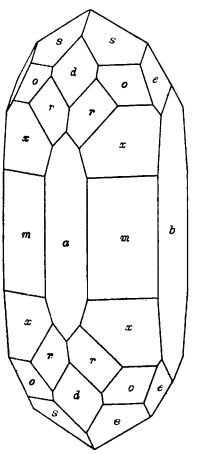
† From a letter by W. P. Jenney.

gray in color, and although possessing very much the solidity of a soft amalgam and spoken of by Mr. Hill as a mixture of cinnabar and mercury, was nevertheless entirely volatile and so far as qualitative tests went was simply metallic mercury.

In addition to the minute needles forming the velvety crusts there were numerous larger transparent needles of darker red color and of a length often exceeding one mm. These were in most instances poorly terminated, striated and composite, but occasional crystals showed terminations and the best of these crystals was carefully measured in the two-circle goniometer.

Crystalline Form of Montroydite.—A very perfect doubly terminated and highly modified crystal exceeding slightly one mm. in length by one-third mm. in breadth, and suggesting under the hand glass a general resemblance in habit to some crystals of topaz, was mounted with its longest direction normal to the vertical circle and the orthorhombic symmetry being soon made evident, this direction was retained as that of the vertical axis. The most prominent pyramidal form $\dot{x}$, fig. 4, being very acute, the pyramid o in the same vertical zone was chosen as the unit form. The more prominent forms shown in fig. 4 are a {100}; b {010}; m {110}; d {101}; x {331}; o {111}; s {112}; r {211} and e {132}. In addition to these, faint reflections were obtained from faces of microscopic dimensions corresponding to w {311} and t {122}.

4



The faces s are less prominent in the real crystal than in the drawing from the presence of indeterminate truncating faces.

In the calculation of the elements $\dot{c}$ and $\breve{a}$ most of the occurring forms were considered and in proportion to the sharpness of the signals yielded by their faces. The results were as follows:

Form.	Factor.	Value of $\breve{a}$.	Value of $\dot{c}$.
m	3	·63625	
o	2	·63707	1·1918
x	8	·63748	1·1894
w	2	·64406	1·1960
t	1	·63729	1·1985
r	2	·63956	1·2037
e	3	·63670	1·1941
Average		$\breve{a} = ·63797$	$\dot{c} = 1·1931$

The form s {112} was not used in this calculation because

although two evident faces were found their signals were very faint and their angles not sure.

The comparison between the measured angles and the angles calculated to the determined indices and axial elements is as follows:

Form.	Faces Reflecting.	ϕ Measured.	ϕ Calculated.	ρ Measured.	ρ Calculated.
$a\{100\}$	2	90°		90°	
$b\{010\}$	2	0°		90°	
$m\{110\}$	4	57° 32′	57° 28′	90°	90°
$d\{101\}$	1	89° 56′	90°	61° 58′	61° 52′
$o\{111\}$	3	57° 30′	57° 28′	65° 44′	65° 44′
$x\{331\}$	4	57° 29′	57° 28′	81° 26′	81° 27′
$s\{112\}$	2	58° 20′	57° 28′	48° 53′	47° 54′
$r\{211\}$	1	72° 16′	72° 18′	75° 48′	75° 42′
$e\{132\}$	3	27° 38′	27° 25′	63° 41′	63° 37′
Also,					
$w\{311\}$	2	77° 53′	77° 59′	80° 02′	80° 06′
$t\{122\}$	2	38° 07′	38° 05′	56° 43′	56° 35′

Chemical Analysis of Montroydite.—With great difficulty, picking crystal by crystal, ·0506 grams of pure material was obtained and very carefully heated alone in one of the small closed tubes described under eglestonite. The sublimate formed appeared to be entirely metallic. The dissolved sublimate gave no test for chlorine. It was therefore assumed, for want of further material, that the sublimate was mercury and the loss oxygen. The percentages are very close to those of mercuric oxide HgO.

	Percentages Analysis.		Percentages HgO.
Loss on heating	7·13	O	7·408
Sublimate	92·87	Hg	92·592

Other Characters of Montroydite.—Luster, adamantine to vitreous. Transparent. Color of larger crystals, a red darker than crocoite and nearer realgar; minute crystals orange-red. Color of the powder a little lighter than color of crystals. Not noticeably affected by sunlight. Brittle. Hardness less than 2. Specific gravity not determined.

Under the microscope there are indications of cleavage oblique to the length and with crossed nicols there is extinction parallel to the length.

Heated in the closed tube volatilizes completely and forms a sublimate of metallic mercury.

Dissolves easily and quietly in cold nitric or cold hydrochloric acid.

The name Montroydite.—The name Montroydite is suggested in honor of Mr. Montroyd Sharpe, one of the owners of the mines at Terlingua.

4. *Crystallized Calomel.*

One of the specimens from the cavity which yielded the minerals just described consisted of tabular crystals of calomel not suitable for measurement. Some specimens obtained by Mr. W. P. Jenney, from the district but not from the cavity however, yielded measurable crystals of two types:

1. Square prismatic crystals, fig. 5, sometimes 4 to 5^{mm} in length by 1 to 1½ in breadth.

2. Tabular crystals flattened parallel to one of the faces of *a* {010}. Fig. 6 shows, in orthographic projection, two such individual crystals in parallel position with the *a* {113} planes relatively large.

The forms are the same in both types and consist of:

c {001} somewhat rough; *a* {010} slightly curved; *r* {111} dull; *a* {113} bright and *z* {013} minute.

Between the two individuals, as shown in fig. 6, and in the prismatic zone a single reflection was obtained corresponding very closely to a face of a new form {120}.

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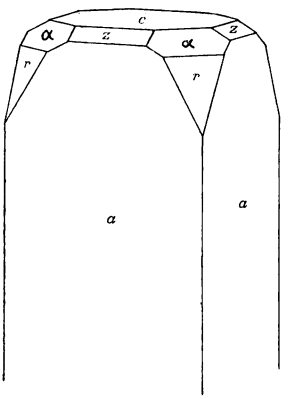

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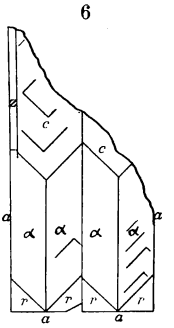

The essential measured and calculated angles were

	Measured.	Calculated.
cr	67° 50′	67° 41′
ca	38 45	39 05
cz	30 14	29 52

5. *An undetermined yellow mercury mineral.*

The second specimen received from Prof. Penfield and one received from Mr. W. P. Jenney show small yellow needles and short prismatic crystals which suggest hexagonal prisms and a basal cleavage. There was not sufficient material for analysis but the closed tube test showed mercury and apparent mercurous chloride suggesting an oxychloride, and the fact that the color did not noticeably change on long exposure indicated a different species from those described. An optical test made by carefully rubbing a basal cleavage down to transparency showed an indistinct biaxial brush in convergent light and double refraction in parallel light. The symmetry is therefore not higher than that of an orthorhombic class.

Two crystals were measured but the results were entirely unsatisfactory, the apparent faces being irregular and frequently yielding two reflections several degrees apart. The only suggestion resulting from the measurements was a very acute orthorhombic or monoclinic form, the faces making an angle with the apparent basal cleavage of about 85½ degrees. Pending the obtaining of more material the substance can not be described definitely.