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CONTRIBUTIONS TO MINERALOGY, No. 48.

By F. A. GENTH.

ART. XIII.—*Contributions to Mineralogy*, No. 48; by
F. A. GENTH.

1. *Tetradymite*.

SEVERAL years ago, tetradymite was found two miles south of Bradshaw City, Yavapai County, Arizona. It occurs in crystalline masses, implanted in imperfectly crystallized, slightly ferruginous quartz, associated with pyrite. A few imperfect bladed crystals are visible suggesting an orthorhombic form, combination of the prism and brachypinacoid, with cleavage highly perfect brachydiagonal. Mostly in bladed crystalline masses, the largest blade in my specimens over 30^{mm} long and 6^{mm} broad. Some of the crystals, partly altered into a brownish white, amorphous substance, probably montanite, with a nucleus of tetradymite. After subtracting 15·6 per cent of quartz and 1·8 per cent of ferric oxide, the analysis gave:

Sulphur	4·50
Tellurium	33·25
Bismuth	62·23
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	99·98

This gives nearly: $\text{Bi}_2(\text{S}_{\frac{1}{2}}\text{Te}_{\frac{1}{2}})_2$, analogous to bismuthinite.

If the observation of rhombic forms is confirmed, it will place tetradymite (with exception perhaps of that from Schubkan), in its proper place in the system, in the group with stibnite and bismuthinite. The quantity of the altered mineral was too small for a fuller examination.

2. *Pyrite*.

The occurrence of arsenate of cobalt with the octahedral crystals of pyrite at the French Creek, Chester Co., Pa., Iron Mines, suggested the examination of the latter which was made in my laboratory by Mr. Aron Hamburger. The most perfect and purest crystals, averaging about 2^{mm} in size, gave the following composition:

S	54·08
As	0·20
Cu	0·05
Ni	0·18
Co	1·75
Fe	44·24
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	100·50

The cobalt arsenate which occurs as a very thin coating upon pyrite, calcite, byssolite, etc., has not the usual appearance of erythrite, it is generally in microscopic crystalline groups of an impure rose color. It is very rare and large masses, showing it, would not have given 0.1 gm. of pure material. In order to ascertain what its molecular composition might be, all portions of the specimens containing it were scraped off and in the resulting material the cobaltous oxide and arsenic pentoxide were carefully determined. I obtained: 0.0366 gm. $Mg_3As_2O_7$, and 0.0430 gm. $CoSO_4$, equal to: 0.0272 gm. As_2O_5 and 0.0208 gm. CoO . This gives the molecular ratios of As_2O_5 : CoO =1.18:2.8 or 1:2.36 instead of 1:3, probably owing to the substitution of some other base, perhaps CaO or MgO for a portion of the cobaltous oxide.

3. Quartz, pseudomorphous after Stibnite.

Mr. Wm. H. Schlemm, of Durango, Mexico, kindly sent me some fragments of a mineral from this locality for identification. There were about half a dozen pieces—most of them of a yellowish white dull earthy mineral intermixed with crystalline quartz. One of the specimens showed a coating of stibnite with a beginning alteration. Others contain the stibnite, with the prismatic and brachypinacoid planes, completely altered into a yellowish white quartz. A qualitative analysis proved the presence of very small quantities of antimonous oxide.

4. Gold in Turquoise from Los Cerillos, New Mexico.*

In many collections, specimens of gold enclosed in or associated with a bluish green mineral are represented as turquoise with gold from the celebrated locality Los Cerillos, New Mexico. Through the kindness of Messrs. Geo. W. Fiss and James W. Beath of this city, I received specimens for examination. They proved that neither contained any turquoise. Both are said to come from Arizona.

a. The specimens from Mr. Fiss consisted of a compact, slightly greenish sky-blue mineral. $H.=2$; $sp. gr.=2.487$. With finely granular grayish white quartz and finely crystalline, deep yellow gold, coating the bluish mineral and also disseminated through the quartz. The analysis of the blue mineral is given below (*a*), and, for comparison the analysis of a variety of turquoise from Los Cerillos, almost identical in appearance with the former (*b*).

* At my request, the distinguished archæologist Dr. Ad. F. Bandelier, under date, Santa Fe, New Mexico, April 15th, 1890, informs me that he never had seen any gold, associated with turquoise, from Los Cerillos, and that he had never heard of anyone who had found gold together with turquoise.

	a.	b.
Loss by ignition.....	14.30	19.93
SiO ₂	46.19	1.42
Al ₂ O ₃	38.82	40.81
Cr ₂ O ₃	0.82	----
Fe ₂ O ₃	----	2.19
Cu.....	----	8.83
P ₂ O ₅	----	26.52
	100.13	99.70

From this analysis it will be evident that the gold-bearing mineral is not turquoise, but a *chromiferous clay*.

b. Entirely different is the auriferous mineral received from Mr. James W. Beath. It consists of brown ferruginous quartz, apparently free from gold with a vein from 5 to 12^{mm} in width of a greenish blue quartz with crystalline, deep yellow gold disseminated. The analysis of the greenish blue mineral gave :

Loss by ignition.....	4.44
SiO ₂	86.75
CuO.....	8.60
	99.79

or a quartz with an admixture of about 19 per cent of chryso-colla.

5. Zircon.

With the masses of monazite at Mars Hill, Madison Co., N. C., is rarely associated zircon in crystals of considerable size. One, which I picked out from a lot of monazite, furnished the material for the following analysis. It was 40^{mm} long, 23^{mm} broad, rough and irregular, showed only the prism and several pyramidal planes. Spec. gr.=4.507. The analysis gave :

Loss by ignition.....	1.20
SiO ₂	31.83
ZrO ₂	63.42
Fe ₂ O ₃	3.23
	99.68

6. Scapolite.

At the Elizabeth Mine, French Creek, Chester Co., Pa., at a depth of 400 feet small crystals of scapolite have been observed, as a rarity ;—it appears to have resulted simultaneously with another variety of garnet from the alteration of essonite. They are filling cavities of a brownish gray and ash-gray

garnet, associated with magnetite, pyrite and remnants of the essonite. The crystals are columnar, the best are the smallest and show combinations of the 1st and 2d prism with the basal pinacoid; no pyramidal planes could be observed. The larger crystals are deeply striated, by which all planes are obliterated. Their size varies from 2^{mm} in length and 0.25^{mm} in thickness to 20^{mm} in length and 5^{mm} in thickness; frequently in groups. Colorless to white and grayish white. Spec. grav.=2.675. The analyses gave:

	a	b
Loss by ignition.....	1.50	1.51
CO ₂	2.63	not det'd
SiO ₂	52.30	52.26
Al ₂ O ₃	23.68	24.15
Fe ₂ O ₃	0.58	0.43
MgO.....	0.05	0.16
CaO.....	12.36	11.76
Na ₂ O.....	6.29	not det'd
K ₂ O.....	0.77	" "
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	100.06	

7. Garnet.

This garnet which results from the alteration of essonite shows occasionally dodecahedral and trapezohedral planes which are sometimes coated with a thin shell (not over 0.5^{mm} in thickness) of the original mineral of a bright cinnamon-brown color. The purest has a brownish gray or ash-gray color and a spec. gr. of 3.390. The analysis gave:

	a	b
Loss by ignition.....	0.51	} not det'd
CO ₂	1.71	
SiO ₂	41.42	41.69
Al ₂ O ₃	18.09	18.37
Fe ₂ O ₃	10.81	10.27
MnO.....	0.88	0.93
MgO.....	0.59	0.52
CaO.....	26.19	26.10
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	100.20	

8. Titaniferous Garnet.

The late Thos. S. Ash brought from the Jones Mine on Green River, Henderson Co., N. C., a variety of garnet which I have analyzed.

It is massive, of a splintery uneven fracture, has only slight indications of dodecahedral planes, brown color, spec. grav. =3.738. The analysis gave:

Loss by ignition	0.55
SiO ₂	35.56
TiO ₂	4.58
Al ₂ O ₃	4.43
Fe ₂ O ₃	20.51
FeO	1.88
MgO	0.17
CaO	31.90
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	99.58

9. *Allanite*.

In the hope to find among the minerals which were associated with the corundum and the pseudomorphs of spinel (pleonaste) after corundum, which I described in 1873 in the Proc. Am. Philos. Soc., xiii, pp. 361-406 the rare tscheffkinit, I examined two varieties which I had in my collection as allanite?

a. The first variety has a velvet-black color, shows a slight transparency with a greenish-black color and a vitreous luster. Sp. gr. = 3.546.

It is a pebble coated with white silica, resulting from partial alteration. The analyzed portion was of perfectly pure material (*a*).

b. The second variety is of a deep brownish black color, thin splinters with brownish black transparency, vitreous luster. Sp. gr. = 3.491. Two small pebbles, the surface slightly oxidized into a brown earthy coating. The material for the analysis was quite fresh and apparently pure (*b*).

	<i>a</i>	<i>b</i>
Loss by ignition	2.25	2.63
SiO ₂	31.67	32.04
ThO ₂	0.33	---
TiO ₂	---	0.12
CeO ₂	23.98	12.91
(LaDi) ₂ O ₃		10.24
Y ₂ O ₃	0.36	0.33
Al ₂ O ₃	12.20	14.02
Fe ₂ O ₃	4.42	7.17
FeO	10.89	7.52
MnO	2.52	0.37
MgO	2.08	1.47
CaO	9.37	11.34
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	100.07	100.16

10. *Lettsomite from Arizona and Utah*.

Messrs. Geo. L. English & Co. brought this rare mineral from two new localities, but only one specimen has been ob-

tained at each, the Copper Mountain Mine near Morenci, Graham County, Arizona, and at Copperopolis, formerly the American Eagle Mine, Tintic District, Utah. They very kindly placed all their material at my disposal which enabled me to make a fuller investigation and clear away the doubts existing as to the constitution of this mineral.

1. The Arizona mineral forms narrow seams in a siliceous gangue, coated with earthy varieties of limonite. The lettsomite occurs in incrustations up to a thickness of about 2^{mm}. In small cavities it shows thin fibers and small tufts often with a radiated structure. Its color is from a deep sky-blue to azure-blue; luster silky. Sp. grav. taken in alcohol 2.737.

Some of the lettsomite has undergone an alteration, beginning with a change into greenish yellow, and finally, by the loss of the cupric oxide, into a fibrous yellowish white mineral. At portions where the alteration has taken place the matrix is frequently coated with a cryptocrystalline, mammillary hydrous aluminum sulphate. Neither could be obtained in a quantity sufficient for a fuller investigation.

The analyses were made with almost pure azure-blue tufts (a) and nearly pure sky-blue radiating particles (b and c).

	a	b	c	Mean.	Mol. Ratio.	
Insoluble	0.46	0.38	0.48	0.44		
H ₂ O	not det'd }	34.47	21.89	21.89	1.216	7.8 8
SO ₃	12.38 }		12.59	12.49	0.156	1 1
CuO	47.40	46.34	46.39	46.71	0.590	3.8 4
Al ₂ O ₃	15.71	16.94	16.77	16.47	0.161 }	1.0 1
Fe ₂ O ₃	0.80	1.61	1.64	1.34	0.088 }	
	————	————	————	————		
		99.74	99.76	99.34		

Considering the slight loss of cupric oxide by beginning alteration, the ratio for SO₃ : CuO : Al₂O₃ : H₂O is 1 : 4 : 1 : 8 = Cu₄Al₂(OH)₁₂. SO₄ + 2H₂O, which gives the following percentage composition :

Al ₂ O ₃	102	15.88
SO ₃	80	12.56
4CuO	316	49.23
8H ₂ O	144	22.43
	————	————
	642	100.00

2. The lettsomite from the American Eagle Mine occurs upon a bluish green mineral, which appears to be amorphous, clay-like, and evidently a mixture of clay and lettsomite. The pure lettsomite forms a velvet-like coating of azure-blue silky fibers. The specimen being very small, only 0.055 grms. could be obtained for analysis, which gave :

SO ₃	12·60
CaO	49·54
Al ₂ O ₃	15·45
Fe ₂ O ₃	0·91
H ₂ O (by diff.)	21·40
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	100·00

closely agreeing with the above composition.

Chemical Laboratory, No. 111 S. 10th St., Philadelphia, April 6th, 1890.