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one of our countrymen, Mr. Gordon, who had travelled across this desert, sought to realize, be established, the journey across the desert of Gobi will soon be thought nothing of.

As to Bokhara, of which Englishmen have only painful recollections, on account of the murder of our distinguished officers, Conolly and Stoddart, we now know that two Russians, MM. Gloukovsky and Tatarinof, who were for seven months captives there, have added much knowledge to that acquired by their accomplished countrymen Khanikoff and Lehmann in 1842.

Those of our associates who may now visit St. Petersburg may see pictorial views of Khodjend, Tashkend, and all the places taken from the Kokandians in the recent advance of the Russians along the Syr Daria and now forming parts of the great new province of Turkestan. I learn also, in reference to this region, so recently opened out to the civilized world, that M. Struve, the son of the great Russian astronomer, has prepared a map of the whole province of Turkestan, on a scale of 40 versts to the inch.

Deeply interested as we must all be in this grand opening out to geographers of a vast unknown country, my first request to my eminent friend Admiral Count Lütke must be, that as President of the Imperial Geographical Society and also of the Imperial Academy, he will procure for our Society copies of the maps which, to their great credit, the Russian geographers have prepared.

ART. V.—*Contributions from the Sheffield Laboratory of Yale College.* No. XVI. *Contributions to Mineralogy;* by BEVERLY S. BURTON, Ph.B., Assistant in the Sheffield Laboratory.

I. *Enargite from Colorado.*

AMONG a series of ores received by Prof. Brush from Dr. Chas. Johnson of Colorado was a lustrous grayish black mineral, labelled "Sulph-antimonid of copper with arsenic," from Willis' Gulch, Colorado. It was found in a vein associated with iron pyrites and quartz. It has a perfect cleavage giving a brilliant metallic luster. Sp. gr.=4·43. H.=3. In the closed tube the mineral decrepitates and at a higher heat fuses, giving a sublimate of sulphur and sulphid of arsenic. In the open tube yields sulphurous acid and fumes of antimony with a crystalline sublimate of arsenous acid. B.B. on charcoal affords a strong odor of arsenic and a faint white coating of antimony. The roasted mineral treated with soda gives a globule of me-

tallic copper. A qualitative analysis of the mineral showed the presence of sulphur, copper, antimony, arsenic and iron.

In the quantitative analysis the mineral was decomposed by the chlorine method; about one gram of it was placed in the bulb of an ordinary reduction tube and treated in the usual manner with a slow stream of chlorine gas, the volatilized product being made to pass through a mixture of chlorhydric and tartaric acids. The apparatus employed was the same as recommended by Rose with the exception that the U tube was replaced by a tube filled with glass fragments saturated with the acid mixture. The action of the chlorine was continued for nearly an hour, when the bulb was detached and the chlorids of copper and iron were dissolved in dilute chlorhydric acid, leaving a small insoluble residue of undecomposed mineral. The copper was thrown down from the hot solution by sulphydric acid, under which circumstances it is easily washed without fear of oxydation; it was then dried and weighed as disulphid (Cu_2S). The iron was determined in the filtrate as sesquioxyd and reserved for the addition of the volatile portion. From the acid solution containing the volatilized chlorids the sulphur was thrown down as sulphate of baryta, and after removal of the excess of baryta salt, the arsenic was separated by the ammonia-magnesia solution. The antimony was precipitated from the filtrate by sulphydric acid, the precipitate dried at 100° C., and the antimony determined by heating a portion of it in a dry current of carbonic acid, and from this the total amount was calculated. The small portion of iron in the filtrate from the antimony was thrown down as sulphid, redissolved and converted into sesquioxyd and added to the portion previously obtained. Two analyses conducted in this manner gave:

	I.	II.	Mean.
Sulphur,	31·46	31·67	31·56
Copper,	47·34	47·82	47·58
Arsenic,	17·67	17·93	17·80
Antimony,	1·25	1·50	1·37
Iron,	1·17	·91	1·04
	98·89	99·83	99·35

In No. 1, the insoluble residue was 2·16 pr. ct., in No. 2, 1·79 pr.ct., which amounts have been deducted from the above results. The ratio of the equivalents of arsenic, copper and sulphur is 1 : 6 : 8, giving the formula $3Cu_2S+AsS_5$. This is the composition of Breithaupt's *Enargite* as determined from Plattner's* analysis of the mineral from Peru, and also of the so-called Guayacanite from Chili, analyzed and described by Field.†

* Pogg. Ann., lxxx, 283.

† This Journal, II, xxvii, 252.

It is also in close accordance with Dr. Genth's* analysis of the enargite from Brewer's mine in South Carolina. The results demonstrate the mineral to be enargite, and this conclusion is fully sustained by its physical characters.

II. *Argentiferous Jamesonite.*

In the metallurgical collection of the Sheffield Scientific School is an interesting suite of ores from the Sheba Mine, Star City, Nevada, and among these Prof. Brush found an argentiferous sulph-antimonid of lead which he handed me for quantitative examination. The mineral is of a bluish white color, is massive to coarsely fibrous or columnar, and is associated with quartz, zinc-blende and tetrahedrite. H.=2·5. Sp. Gr.=6·03.

In the closed tube gives a sublimate of sulphur and sulphid of antimony. In the open tube affords sulphurous and antimonial fumes. B.B. on charcoal gives copious fumes of sulphur and antimony, with a coating of oxyds of antimony and lead, and yields a globule of lead, which on cupellation affords silver. A qualitative examination gave evidences of sulphur, antimony, lead, silver, copper and iron.

In the quantitative analysis the mineral was decomposed by chlorine as described under enargite. The contents of the bulb tube were removed and treated with dilute chlorhydric acid, brought upon a filter, washed with hot water, and the chlorid of lead thus dissolved was precipitated as sulphate. From the filtrate the copper was thrown down as sulphid by sulphydric acid gas. The residue containing the undecomposed mineral with chlorid of silver was washed upon the filter with ammonia to dissolve the latter, and the silver was subsequently separated as chlorid by acidulating the solution with nitric acid. As the first determination of sulphur proved low, an additional absorbent was attached to the end of the tube filled with glass fragments in the form of a nitrogen bulb apparatus, containing the mixture of chlorhydric and tartaric acids and a separate determination made; by this means the amount of sulphur was increased more than half a per cent. The antimony was determined as in the enargite. The results of two analyses were as follows:—

	I.	II.	Mean.			
Sulphur,	....	19·06	19·06	1·19		5
Antimony,	29·08	29·45	29·26	·24		1
Lead,	44·25	43·68	43·86	·424	·50	2
Silver,	6·15	6·13	6·14	·056		
Copper,	1·72	1·39	1·55	·024		
Iron,	·05	·05	·05			
		99·76	100·02			

* This Journal, II, xxiii, p. 420.

No. 1, gave 1·34 pr. ct. insoluble residue, and No. 2, 1·72 pr. ct. which have been deducted from the above. The ratio of the combined equivalents of the lead, silver and copper to the antimony and sulphur is as 0·50 : 0·24 : 1·19 or very nearly 2 : 1 : 5, giving the formula $2(Pb, Ag, Cu)S + SbS_3$. This corresponds to the formula of Jamesonite, of which it seems to form an argentiferous variety. The content of silver may indicate its possible relation to Brogniardite, an antimonial sulphuret of lead and silver of like atomic proportions but containing a much larger amount of silver than the Nevada mineral. For the analyses the mineral was selected with great care, and it appeared perfectly homogeneous.

III. *Argentiferous Tetrahedrite.*

This mineral was one of a number presented to the metallurgical museum from the De Soto Mine, Star City, Nevada. It occurs in compact masses of a light gray color and is associated with quartz, zinc blende and pyrites. It is readily selected entirely free from impurities. Specific gravity 5·00. On examination it gave the pyrognostic characters of tetrahedrite, and the globule of copper obtained by reduction of the roasted assay gave on cupellation a comparatively large globule of silver.

For the analysis the same method of decomposition was employed as with the preceding minerals, with this modification: instead of using a bulb reduction tube, a straight tube was substituted in which the mineral was placed in a porcelain boat, and a nitrogen bulb tube was also added to the absorption apparatus as in the examination of Jamesonite. After the chlorine had been allowed to act a sufficient length of time, the boat was withdrawn and treated with dilute chlorhydric acid, and the chlorid of copper, thus separated from the insoluble chlorid of silver, was then precipitated with sulphydric acid and weighed as disulphid. The chlorid of silver was separated from the insoluble residue by solution in ammonia. It was found by use of the boat that a more perfect decomposition was effected than with the bulb reduction tube, and as it is much more convenient for the removal of the non-volatile chlorids, its use can be highly recommended to all who have occasion to employ this method of decomposing sulphids. In removing the chlorid of sulphur which condenses in the bend of the tube connected with the absorption apparatus, I have found that this does not readily absorb moisture from the air, even standing as directed for twenty-four hours, but this may be easily effected without generating heat by drawing a slow current of moist air through the apparatus by means of an aspi-

rator. The sulphur and the antimony were determined as in the previous analyses. The iron and zinc in the filtrate from the antimony were thrown down by sulphid of ammonium, redissolved in chlorhydric acid, the iron precipitated by ammonia in excess, and the zinc subsequently separated by carbonate of soda. Two analyses gave :—

	I.	II.
Sulphur,.....	24·35	24.54
Antimony,.....	27·35	27·86
Copper,.....	27·40	27·42
Silver,.....	14·59	14·49
Zinc,.....	2·31	....
Iron,.....	4·27	....
Insoluble, ...	0·35	0·56
	100·62	

This corresponds closely with the argentiferous tetrahedrites analyzed by Rose and Klaproth from Wolfach.

These analyses were undertaken at the suggestion of Prof. Brush, and I would here express my thanks to him for his kind assistance in the above examinations.

ART. VI. — *On the occurrence of thick beds of Bituminous Gneiss and Mica Schist in the Nullaberg, parish of Ostmark, Province of Wermland, in Sweden;* by L. I. IGELSTRÖM.*

THE parish of Ostmark, as well as other parts of western and northern Wermland, is filled with high and steep hills of hyperite, between which the common crystalline rocks, gneiss, hornblende, mica schist and others, intervene. The bituminous gneiss and mica schist occur interstratified in common reddish granite-gneiss at the western part of the high and precipitous Nullaberg, occupying a thickness of more than 120 feet, and extending along almost the whole side of the mountain. The dip of the strata is about 70° eastward, and they are covered first by a bed of hyperite, and then with parallel strata of other granitoid rocks.

Generally, the bituminous substance is rather uniformly distributed, through the range, in the gneiss as well as in the mica schist, and the entire mass has a black color. The naked eye is hardly able to discern any particles of coal. When coarsely ground the rock resembles gunpowder, but when ground finer, it grows darker, either of the color of soot, or resembling pyro-

* Translation received from the author. Published in Swedish in the Œfv. Ak. Stockholm, 1867.