Sanguinite, a new Mineral; and Krennerite.

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(*a.*) *Sanguinite, a new Mineral.*

THIS mineral was found upon several specimens of argentite from Chañarcillo which were acquired for the British Museum in 1886.

The specimens consist of argentite in large drusy octahedra implanted on quartz or calcite, and associated with proustite and a little asbestos.

The proustite is mostly in the form of small brilliant prisms with scalenohedral terminations $\{20\bar{1}\}$, capped by the rhombohedron $\{110\}$, which are grouped upon the argentite. But dispersed on the argentite, together with these crystals of proustite, are a number of fine glittering scales, which present at first sight precisely the appearance of the pyrrhosiderite or göthite of Siegen, having the same bronzy red colour, and a lustre resembling that of earthy haematite when seen on the matrix, that is to say partly by reflected and partly by transmitted light. Under the microscope the scales are easily distinguished from göthite; they are without striations, remain dark when rotated between crossed nicols, and appear of a nearly blood-red colour by transmitted light; whereas scales of göthite are striated in one direction, and exhibit marked differences of absorption when rotated above the polariser.

Sanguinite was subsequently found on an older specimen in the British Museum Collection which had been supposed to be göthite or fireblende. On this specimen the scales are associated with calcite, argentite partly converted into silver, and a little copper pyrites, but no proustite. The intimate association of the scales with proustite, their colour, and their obvious derivation as an alteration-product from argentite suggest that they are probably a sulph-arsenite of silver, a conclusion which is fully supported by the necessarily incomplete chemical examination.

A quantitative analysis is precluded by the paucity of material; the scales are so excessively thin that although they are very conspicuous

upon the specimens owing to their brightness and colour, the whole if removed would probably weigh no more than a few milligrams. Some qualitative experiments have however enabled Mr. Prior and myself to prove the presence of sulphur, arsenic and silver. The material was carefully picked out scale by scale under the microscope and examined between crossed nicols, so that it was known to be free from proustite and argentite.

It is with difficulty soluble in strong nitric acid, behaving in all respects like proustite; the solution of several scales gave a perceptible precipitate with hydrochloric acid, soluble in ammonia.

About 50 of the scales, weighing altogether less than ·0003 gram, fused with sodium carbonate and potassium nitrate, and tested in the usual way for sulphate, gave a very evident precipitate with barium chloride. About the same quantity tested for arsenic by the Fresenius-Babo method gave a very distinct arsenic mirror; in the residue minute particles of metallic silver were visible, and treated with nitric acid it yielded a milky liquid containing silver cyanide, which became clear on addition of ammonia.

The only known minerals to which the scales might apparently be referred are proustite, xanthoconite, and the mineral from Chañarcillo described by Streng (*Neues Jahrb.* 1878, p. 917; and 1879, p. 547). The physical characters, however, so far as they can be observed, are as follows:—

Colour, by reflected light, black; by transmitted light, almost identical with that of proustite, but darker (Radde 1 h to 2 k), and yellowish red in the thinnest scales. Streak (colour of the powder), dark purplish brown (Radde 30 b nearly).

Crystalline system hexagonal or rhombohedral; fracture conchoidal.

The scales have a brilliantly reflecting surface, but are rarely smooth plates, being almost always curved and slightly crumpled. They are usually broken at the edges with a curved fracture, but are sometimes to be found with sharply defined rectilinear edges, which meet at an angle of 60°; there can be no doubt that they are true uniaxial hexagonal plates, for they remain dark between crossed nicols when viewed in the direction of their normal, but when tilted in any way are seen to be doubly refracting with an extinction which is always parallel to the normal.

The sign of the double refraction could not be determined on account of the extreme thinness of the scales; their average thickness is not more than 0·001 mm., and when 4 or 5 plates are superposed they become too opaque for optical examination.

Sanguinite is completely distinguished from xanthoconite, and Streng's mineral (which is probably either fireblende or rittingerite), by its colour, streak, and optical character; these characters are also sufficient to distinguish it from fireblende, which it somewhat resembles, and from rittingerite.

The distinction between sanguinite and proustite may seem less conclusive, since both are sulpharsenites of silver, hexagonal, uniaxial, and almost identical in colour by transmitted light.

On the other hand proustite never occurs in anything resembling hexagonal scales; in fact the basal plane does not exist as a smooth surface on the mineral; moreover, the proustite associated with sanguinite, which has apparently been formed contemporaneously with it by the alteration of the same crystals of argentite, is of the usual habit.

Finally, the streak of sanguinite is a dark purplish brown, somewhat like that of miargyrite, but darker, and quite different from the streak of proustite, which is, as I have shown, so characteristic as to distinguish that mineral with certainty even from arsenical pyrargyrite.

Another specimen from Chañarcillo consisted of 6-sided scales, having very much the appearance of sanguinite, grouped upon calcite with a little proustite. These, however, were found to be darker in colour than the sanguinite, and between crossed nicols show a bisectrix in the centre of the field, and indications of two optic axes; they also display a twin lamination which is never found in sanguinite.

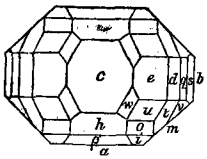
Their striking resemblance to that mineral suggests that they may be the corresponding sulphantimonite, especially as their colour is almost exactly that of pyrargyrite.

Possibly they may be referred to fireblende or rittingerite.

(*b.*) *Krennerite.*

Only three crystals of this rare telluride of gold from Nagyag have previously been measured; one by Krenner (*Ann. f. Phys. und Chem.*, vol. i. 1877, p. 636), who described the mineral under the name of Bunsenin; another by vom Rath (*Zeits. f. Kryst.* i. 1877, p. 614), who substituted the name Krennerite; the third by Schrauf (*Zeits. f. Krys.* ii. 1878, p. 235). Their observations lead to axial ratios, which do not differ much either from each other or from those adopted by myself.

The following description of a crystal taken from a specimen in the British Museum Collection supplies confirmatory measurements, and contributes 6 new forms to the 16 previously recorded.



In this specimen the Krennerite occurs in small striated prisms upon crystallised quartz, together with a little iron pyrites and some small crystals of tetrahedrite which are coated with copper pyrites; most of the prisms are terminated by the bright and characteristic basal cleavage plane; the one which was measured presented 10 forms which have previously been observed, namely:—

a	010	$\infty\bar{P}\infty$	*o*	111	P
c	001	0P	*i*	232	$\frac{3}{2}\bar{P}\frac{3}{2}$
m	110	∞P	*h*	011	$\bar{P}\infty$
e	101	$\breve{P}\infty$	*ρ*	021	$2\bar{P}\infty$
u	212	$\breve{P}2$	*b*	100	$\infty\breve{P}\infty$

and six new forms, namely:—

d	201	$2\breve{P}\infty$	*t*	211	$2\breve{P}2$
q	301	$3\breve{P}\infty$	*v*	632	$3\breve{P}2$
s	401	$4\breve{P}\infty$	*w*	214	$\frac{1}{2}\breve{P}2$

This prism was 0·5 mm. long and 0·75 mm. broad.

The axial ratios obtained from the measurements are

a : b : c =	...	1·0651 : 1 : 0·5388
Krenner found	...	1·0661 : 1 : 0·5440
vom Rath found	...	1·0630 : 1 : 0·5362
Schrauf found	...	1·0643 : 1 : 0·5399

Of the remaining six forms previously observed, which are not found on this crystal, it may be remarked that four belong to the prism zone in which the faces are vertically striated and scarcely capable of exact measurement; the terminal faces are bright and smooth. The following table contains all the reliable measurements of Krenner and vom Rath:—

	Miers.		Krenner.		vom Rath.	
	Observed.	Calculated.	Observed.	Calculated.	Observed.	Calculated.
	° ′	° ′	° ′	° ′	° ′	° ′
c e	26 50	..	27 0	27 2	..	..
c h	28 19	..	..	..	..	28 12
c d	45 20	45 20	..	..	..	..
c q	56 35	56 37	..	..	..	..
c s	63 48	63 42	..	..	..	..
c p	46 52	47 8½	..	..	..	..
a i	54 11	54 12	..	..	54 30	54 19
a o	64 21	64 19	..	..	64 15–30	64 24
a u	76 27	76 29	..	76 23	76 30	76 32
e u	29 47	29 49	30 5	30 2	..	..
a m	43 5	43 12	43 10	..	43 15	..
c t	49 4	48 54	..	..	..	..
c v	59 52	59 49	..	..	..	..
c w	15 58	15 59	..	..	..	..
c m	..	72 0	71 53	..	72 1½	..
e u	13 33	13 31	13 41	13 37	..	..
m u	..	61 55	61 46	61 42½	..	..
u u	..	52 14	52 20	..	..	..
i h	23 56	23 51	..	..	..	..
h u	29 2	29 0	..	..	..	..
u d	22 44	22 46	..	..	..	..
c o	36 26½	36 28	..	..	..	..