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THE GEOLOGY AND ORE DEPOSITS OF GOLDFIELD, NEVADA

BY

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ASSISTED IN THE FIELD BY

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In June, 1907, W. J. Sharwood[a] published a drawing of a thin section of Mohawk ore in which he shows particles of native gold embedded in a dark "sulpho-telluride," which he found—

gave strong reactions for sulphur, tellurium, copper, and iron, also for arsenic, antimony, gold, and silver (about 6 per cent and 1 per cent, respectively, of the two last)—a composition agreeing with the admixture of tetrahedrite and telluride suggested in the editorial referred to. To all outward appearance, however, the material seems to be uniform in character and gives no evidence of being such a mixture.

In a thin section of another specimen of Goldfield ore Sharwood detected particles resembling sylvanite associated with native gold. The dark-gray mineral supposed by Sharwood to be a mixture of tetrahedrite and calaverite is further described under "Goldfieldite." The particles thought to be sylvanite may have been marcasite, the resemblance of the marcasite of this ore to sylvanite in color, luster, and striations being deceptively close.

PROUSTITE.

Ruby silver (Ag_3AsS_3) has been noted on only a single specimen, purporting to come from the Florence mine, and preserved in a private collection in Goldfield. The identification of the mineral was made by Mr. Garrey, who examined the specimen but was unable to obtain it for confirmatory tests. The occurrence of proustite in the district can not, therefore, be regarded as established.

POLYBASITE.

The mineral polybasite, essentially a sulphantimonite of silver $(Ag_9SbS)_6$, has not been identified with certainty in the Goldfield ores. Crystals of a form and color resembling polybasite were observed by Mr. Garrey, associated with a little ruby silver, in the specimen of ore referred to in the preceding paragraph. The ore was said to have come from the Florence mine.

GOLDFIELDITE.

At the time of second visit to the district, in 1908, specimens were secured of the dark tellurium- and gold-bearing material from the Mohawk mine for the purpose of determining its mineralogical and chemical character. A piece of rich ore from the Mohawk-Combination lease (a consolidation of the Sheets-Ish and Kalfus leases) was broken up and the fragments of the dark telluric crust picked as free as possible from the gangue. These were crushed to pass through a 40-mesh screen and freed from fine dust. The grains were picked over several times under a lens and a separation effected into (1) yellow grains, (2) gray grains, and (3) mixed grains and gangue. The yellow grains proved to be marcasite.

The gray portion when examined under the microscope appeared homogeneous with the exception of a few minute specks of gold embedded in the gray mineral. The latter is dark lead gray with a high metallic luster. It is brittle, breaks with a conchoidal fracture, and has a hardness of 3 to 3.5, although on account of the brittleness of the material it appears to be somewhat softer when crushed. No crystal faces have been detected. The small quantity of purified material, only 1.2 grams in all, was analyzed by Doctor Palmer with the following result:

Preliminary chemical analysis of goldfieldite.

Copper	33.49	Gold	0.51
Sulphur	21.54	Silver	.18
Tellurium	17.00	Gangue	2.00
Antimony	19.26		
Arsenic	.68		101.57
Bismuth	6.91		

Of the gold about 0.40 per cent in terms of the whole analysis is combined, presumably with tellurium, and 0.11 per cent is native.

Doctor Palmer states that the mineral is essentially a cupric sulphantimonite in which part of the antimony is replaced by arsenic and bismuth and part of the sulphur by tellurium. He

[a] Gold tellurides: Min. and Sci. Press, vol. 94, 1907, p. 731.

suggests that the analytical results approximate closely the formula $5CuS.(Sb,Bi,As)_2(S,Te)_3$. The minerals geocronite ($5PbS.Sb_2S_3$) and stephanite ($5Ag_2S.Sb_2S_3$) have analogous formulas whereas the known copper sulphantimonites and sulphantimonates are all cuprous salts.

As bismuthinite is a common mineral in these ores, the possibility that the material analyzed might be an intimate mixture of bismuthinite with some other mineral has been considered. If the analysis be calculated in molecular proportions, and the constituents of bismuthinite (Bi_2S_3) be subtracted, the following molecular quantities remain:

Cu	0.527	As	0.009
S	.624	Au	.002
Te	.133	Ag	.001
Sb	.160		

For famatinite the theoretical proportions are: Cu, 0.6; S, 0.6; Sb, 0.2; so that the residue after subtraction of bismuthinite does not correspond very closely to famatinite, even if the tellurium be ignored. This constituent, it is to be observed, is far in excess of any quantity which could be accounted for as combined with the gold and silver, and a part of the gold is known to be free.

While determinative work on minerals such as the sulphantimonites, which rarely show crystal form and are often intergrown with other minerals, is as a rule more or less unsatisfactory, there seems to be no escape from the conclusion that the present mineral is a new species. It is provisionally so regarded and "goldfieldite" is suggested as an appropriate name. It is hoped that additional material can be secured for further analytical and microscopical investigation in the near future.

In some ore, especially that of the Mushett lease, the association of goldfieldite and famatinite is very close, and it is possible that such ore may contain intermediate species or varieties.

ENARGITE.

Crusts of a dark-gray brittle compound of copper, arsenic, antimony, and sulphur are characteristic of the ore of the Victor and Gold Bar mines. The substance is similar in habit and appearance to a mineral which is commonly associated with the rich ores near Goldfield and which, as will be shown, appears to correspond more nearly to famatinite than to any other known species. It presents some differences, however. It lacks for the most part the reddish tint of the famatinite, is rather more brittle, shows more tendency toward crystalline structure, and is not associated with rich ore. The crystal habit of the mineral is prismatic, the faces being longitudinally striated. It has at least one cleavage, although the crystals are too few and imperfect to permit determination of its crystallographic orientation. Mr. W. T. Schaller was able to isolate one crystal with rather uneven faces, which gave the following goniometric readings in the prism zone:

$$100 \wedge 110 = 41^\circ 30'$$
$$100 \wedge 120 = 60^\circ 30'$$
$$\bar{1}00 \wedge 1\bar{1}0 = 40^\circ 30'$$
$$\bar{1}00 \wedge 100 = 179^\circ 30'$$

These agree fairly well with the calculated angles for enargite, which are—

$$100 \wedge 110 = 41^\circ 04'$$
$$100 \wedge 120 = 60^\circ 09'$$
$$\bar{1}00 \wedge 1\bar{1}0 = 41^\circ 04'$$
$$\bar{1}00 \wedge 100 = 180^\circ 00'$$

As enargite and famatinite are isomorphous, however, the measurements serve only to rule out tetrahedrite, which contains the same constituents as famatinite or enargite, although in different proportions. It will presently be shown that the composition of the mineral called famatinite in this report is not normal, but indicates a variety between that mineral and its isomorph, enargite. It is likely that at Goldfield there are various representatives of the