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CHAPMANITE, A NEW HYDROUS FERROUS SILICO-ANTIMONATE, FROM SOUTH LORRAIN, ONTARIO

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Recently, when on a visit to the Keeley Mine in South Lorrain, near Cobalt, Ontario, the writer obtained from Dr. J. Mackintosh Bell some specimens of a pulverulent olive-green mineral, which occurs in association with very rich silver ores in well-oxidized portions of the veins at the Keeley Mine. Dr. Bell¹ has called attention to the deep weathering observed in some parts of this mine.

The principal associated mineral is silver, which is usually quite massive, although a considerable part is very finely divided and intimately associated with the green mineral. A sample containing 9.5 per cent. of metallics was found to have a specific gravity of 3.817. If it be agreed that the metallic portion is silver with a specific gravity of 10.5, the specific gravity of the pure green mineral must then be 3.578. The finely-divided green mineral, when examined under the microscope in methylene iodide, is seen to be strongly doubly-refracting, and to possess indices of refraction which are always greater than 1.75. Dr. E. S. Larsen kindly examined some of the sample prepared for analysis, and reports as follows: "The material is very fine-grained, and my data are only approximately correct. It is in minute prisms or laths, with practically parallel extinction. γ is parallel to the length. α is probably normal to a flat face. The mineral is probably orthorhombic, and I think it optically negative, probably with a moderate or rather small axial angle. The following indices are only approximate: $\alpha=1.85$: $\gamma=1.96$."

¹Bell, J. M., *Econ. Geol.*, Vol. 18, p. 684, 1923.

For analysis a sample was prepared by taking the mixed powder and separating the green mineral by means of an electro magnet. Material which had passed through 100 mesh and been subjected to magnetic selection was found to contain nearly 10 per cent. of metallics. When heated with hydrochloric or sulphuric acid, the mineral is practically insoluble, as it is when heated with nitric and tartaric acids. On the other hand, it is very readily dissolved in hydrofluoric acid, so that a separation can be made by this means from the metallics. Some of the analytical results which follow are based on an analysis of the solution obtained from treatment with hydrofluoric acid, some are based on an analysis of the pure green mineral after the metallics had been removed by nitric acid, and others were obtained by treating the complex mixture containing both the green mineral and the metallics. In all cases the results are based on the pure green mineral minus the metallics.

The analysis by E. W. Todd follows:

FeO.....	33.91	NiAs ₂		Chapmanite
Ni.....	.36	.471		.471
Co.....	.03	.006	} .009	
Cu.....	.17	.0005		
Bi.....	.20	.003	} .018	
As.....	1.28	.001		
Al ₂ O ₃28	.017		
SiO ₂	28.28	.471		.471
Sb ₂ O ₃	31.65	.099		.099
H ₂ O.....	3.46	.192		.192
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	99.62			

From the above analysis it is apparent that the new mineral can be represented by the formula: 5FeO.5SiO₂.Sb₂O₃.2H₂O. The state of oxidation of the iron was determined by dissolving the mineral in hydrofluoric acid and titrating with potassic permanganate. Very concordant

results were obtained for water on air-dried material. This is the first natural silico-antimonate to be reported, though several titano-antimonates have been described,—lewisite, mauzeliite, and derbylite.

A portion of the sample containing 76.3 per cent. of chapmanite, and 23.7 per cent. metallics, was heated in an electric oven for periods of twenty hours at gradually increased temperatures, to determine the rate of loss of the water. Calculated on pure chapmanite the result is as follows:

110°	loss	.44%
137°	“	1.04%
158°	“	1.02%
185°	“	1.23%
205°	“	1.41%
235°	“	1.43%
270°	“	1.37%

At 270° the mineral lost its green colour and became pale brownish, due, apparently, to a change in the state of oxidation of the iron which would result in an increase in weight. No definite result was to be anticipated by heating beyond this temperature. It appears probable, therefore, that one molecule of water is held more loosely than the other.

An incomplete analysis by E. W. Todd of the portion insoluble in hydrofluoric acid gave the following result:

Silver.....	87.35
Iron.....	2.10
Cobalt.....	1.04
Nickel.....	absent
Copper.....	trace
Mercury.....	.28
Bismuth.....	.52
Arsenic.....	6.21
Antimony.....	1.12
Sulphur.....	trace
Insoluble.....	.15
Total.....	<u>98.75</u>

The metallics are therefore to be regarded as composed of silver and diarsenides of iron and cobalt, probably loellingite and safflorite, or smaltite. The complete absence of nickel is very remarkable.

The new mineral appears to be of a secondary nature, formed as a result of the leaching effected by circulating water. Its association with silver, often very finely divided, suggests that it is one of the products of the oxidation of dyscrasite, which is now known to be a eutectic of silver and a silver antimonide, probably Ag_3Sb .¹

The writer suggests that this new mineral be called chapmanite, in honour of his predecessor, the late E. J. Chapman, who was professor of Mineralogy and Geology in the University of Toronto, from 1853 to 1895.

¹*Univ. of Toronto Studies, Geol. Ser. 12, 1921, p. 20.*