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ART. IV.—*Rickardite, a New Mineral*; by W. E. FORD.

THE new mineral to be described in this paper was first brought to the writer's attention by Mr. T. A. Rickard of New York. A qualitative examination proved that it contained copper and tellurium, and no such combination having been hitherto described, the mineral seemed worthy of investigation. Through the courtesy of Mr. Rickard, sufficient material was afterward obtained for making a quantitative analysis, the results of which are given below.

Rickardite occurs at Vulcan, Col., in the Good Hope mine owned by Dr. Loui Weiss. The vein mineral is chiefly pyrite, with which occurs native tellurium in unusually large masses, some of which measure fully three inches across. Other associated minerals are petzite, berthierite in imbedded prisms resembling stibnite, and a greenish brown micaceous substance, perhaps roscoelite. A large body of native sulphur also was found in the vein. Rickardite itself occurs in small lense-shaped masses, generally rather intimately associated with native tellurium.

The material for analysis was broken up and carefully gone over by hand to free it from any adhering gangue and only perfectly clean and homogeneous fragments were used. The method of analysis was simple. The powdered mineral was oxidized by nitric acid, which was subsequently removed by evaporation with sulphuric acid. To the strong sulphuric acid solution a liberal amount of hydrochloric acid was added and then sulphur dioxide gas was led into the solution, which precipitated the tellurium in metallic form. This precipitate was filtered onto a Gooch crucible, dried in the air bath at 100° C. and then weighed. In the filtrate copper was precipitated by hydrogen sulphide and determined as cuprous sulphide by igniting in a stream of hydrogen. Careful tests were made for gold, silver, lead, selenium, sulphur, arsenic and antimony with only negative results.

The analysis follows:

	I.	II.	Average.	Atomic ratios.
Cu=	40·68	40·81	40·74	·6489=4·00
Te=	59·36	59·06	59·21	·4737=2·93
Total	100·04	99·87	99·95	

These results give the ratio Cu:Te=4·00:2·93, or very nearly 4·00:3·00, and the formula for rickardite therefore is Cu_4Te_3 . This gives as the theoretical composition of the mineral, Cu=40·51; Te=59·49, which agrees very closely

with the analytical determinations. Rickardite is therefore not only a new mineral but also a new type of telluride, for no such four to three relation between metal and tellurium has hitherto been noted in the group of tellurides. The mineral may be regarded as consisting of one molecule of cuprous telluride and two of cupric telluride, $\text{Cu}_2\text{Te}\cdot 2\text{CuTe}$.

Rickardite has an unusual and beautiful purple color, which rivals in intensity the deepest purple tarnish ever seen on chalcocopyrite or bornite. The color, however, in the case of Rickardite is not due to any tarnish, for it shows on a fresh fracture and the powder of the mineral, even when ground very fine, is of the same deep color. The mineral is massive in character with an irregular fracture. Its hardness is 3.5 and its specific gravity was determined as 7.54. It is fusible at 1 and gives a pale azure blue flame color tinged in the outer parts with green. Alone on charcoal before the blowpipe it gives a white coating of TeO_2 , and fuses to a brittle globule of copper telluride. Fused with sodium carbonate and borax on charcoal it gives a coating of TeO_2 , and a brittle globule of telluride, yielding only with considerable difficulty a malleable globule of copper. Roasted in the open tube the mineral fuses to a semi-transparent mass of brown color, which is apparently some combination of the oxides of tellurium and copper, and only a faint sublimate of TeO_2 is formed on the walls of the tube. Heated in the closed tube it fuses and undergoes no further change. Heated in concentrated sulphuric acid it gives the characteristic reddish-violet color of tellurium. When dissolved in nitric acid, the solution neutralized with ammonium hydroxide gives the deep blue color of copper.

It is a pleasure to name the mineral Rickardite after Mr. T. A. Rickard, the editor of the Engineering and Mining Journal of New York, who obtained the material for investigation and supplied the data as to its occurrence. Thanks are also due Dr. Weiss of the Good Hope mine, who has been careful to secure all specimens which might be of scientific interest. In conclusion, the writer wishes to express his indebtedness to Prof. S. L. Penfield for his constant advice and assistance during the preparation of this article.

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