Art. XV.—*Empressite, a New Silver-Tellurium Mineral from Colorado;* by W. M. Bradley.

Some years ago, what appeared to be a new mineral was found in the Empress-Josephine Mine in the Kerber Creek District of Colorado by Professor R. D. George of the University of Colorado. No analyses were made at that time, but qualitative tests were obtained which showed the presence of silver and tellurium. Several small specimens were recently sent to the writer for investigation. They were all massive in structure, careful inquiries having failed to locate any material showing crystal faces. The mineral occurs in very fine granular and compact masses associated with galena and native tellurium. It is metallic in luster, and gives a grayish black to black streak. The fracture is finely conchoidal to uneven, and upon such surfaces the color is a pale bronze. The mineral is brittle to friable, and has a hardness between 3 and 3·5. The specific gravity was determined as 7·510. In the oxidizing flame on charcoal it fuses at 1 giving a heavy white coating of tellurium dioxide and a black globule, which if placed in the reducing flame gives on cooling white dendritic points of silver on its surface. Prolonged heating in the oxidizing flame gives a globule of silver. In the open tube a faint white sublimate of tellurium dioxide is formed which if strongly ignited fuses to colorless globules. The mineral is readily soluble in hot dilute nitric acid.

The specimen selected for analysis was examined under a microscope and was found to contain several very minute seams of non-metallic mineral matter which was practically all removed by crushing the specimen to very fine grains and

then picking out by the aid of a lens any fragments which showed adhering white material. The method of analysis may be briefly stated as follows: After dissolving the mineral in nitric acid and filtering off traces of insoluble matter the silver was precipitated and weighed as silver chloride. Tellurium was essentially determined by precipitating it in the metallic state by sulphurous acid. Traces of tellurium contained in the filtrate were recovered by precipitating it as tellurium sulphide, the resulting precipitate being dissolved by a solution of bromine in dilute hydrochloric acid and the tellurium finally precipitated and weighed as TeO_2 according to the method of Browning and Flint.*

The results of the analyses follow:

	I	II	Average	Ratios	
Insoluble	·38	·39	·39		
Ag	45·16	45·17	45·17	·418	1·00
Te	54·62	54·89	54·75	·429	1·03
Fe	·30	·15	·22	·003	
	100·46	100·60	100·53		

From the analysis it will be seen that the mineral gives a ratio of practically Ag : Te : : 1 : 1, which fact points strongly to the conclusion that the formula AgTe represents a new mineral species. The name empressite has been given to it by Professor George on account of the fact that it was found in this particular mine. While the above ratio does not give a formula that is in harmony with the generally accepted views relating to valence, nevertheless if considered from a metallographic standpoint it will be seen to be but one of many compounds which show irregularities if attempts are made to interpret them by means of valence. A table of such compounds may be found in Desch's Metallography.† Some typical examples are as follows:

Silver-Aluminum Series.

Ag_3Al
Ag_2Al

Aluminum-Gold Series.

Al_2Au
$AlAu$
$AlAu_2$
Al_2Au_5

*This Journal, xxviii, 112, 1909.

†Longmans, Green & Co., London and New York; second edition. Appendix, pp. 399–418.

It is generally recognized that the formulæ of inter-metallic compounds cannot be rationalized on the basis of our common ideas of valence. The silver-tellurium system has been worked out by the customary thermal-micrographic method. Guertler* in his handbook on metallography reviews the work of various authors, principally Pellini and Quercigh, and concludes that there are two compounds in the series, namely, Ag_2Te, which is identical with the isometric hessite, and a compound of questionable character, viz. AgTe or Ag_2Te_3. Abnormalities in the equilibrium relations interfere with the exact determination of this formula. Guertler, however, regards AgTe as the more probable one. This compound is formed by reaction between Ag_2Te and the liquid at 444°. It undergoes polymorphic transformation at 412°. There is no intercrystalline solubility throughout the entire series, or in other words no solid solution. The natural mineral empressite, which corresponds very closely to the atomic ratio Ag : Te, exhibits a structure wholly in conformity with the conclusions stated above. Upon metallographic examination of a polished section it was found to be a structurally homogeneous substance, showing large irregular light and dark polygonal grains with no interstitial matter. It thus appears to be a definite compound with the formula AgTe.

In conclusion the author wishes to express his thanks to Professor George, who so kindly furnished the material that made this investigation possible, and also his indebtedness to Professor C. H. Mathewson of the Sheffield Scientific School, who made the metallographic examination.

Mineralogical Laboratory of the Sheffield Scientific School
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* Vol. I, Part II, 924–926.