EMMONSITE, A FERRIC TELLURITE.

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A year or more ago I had opportunity, through the kindness of Mr. R. C. Hills, to examine a mineral from near Tombstone, Arizona Territory—the exact locality of occurrence being unknown—which has proved to be a new species.

It was of a yellowish green color, translucent, and occurred in crystalline scales and patches throughout a rather hard and brownish gangue, composed of an intimate mixture of lead carbonate, some quartz, and much of a brown substance containing iron and tellurium, both in an oxidized state, besides water.

By no chemical or mechanical means could sufficient of the green mineral be separated entirely from any of the other components of the mass except the lead carbonate, which latter was removed by weak nitric acid after partial pulverization of the sample. Much of the quartz could be separated by Sonnstadt's solution, but not all. Microscopical examination of the final product showed the presence of small quantities of a second and perhaps a third mineral, which from the results of analysis were supposed to be gypsum and calamine. Considerable of the brown iron-tellurium substance remained also inseparable owing to its possessing nearly the same density as the green mineral.

The results achieved on this mixture are by no means satisfactory, because of the small amount at disposal, but enough was accomplished to establish the identity of a new mineral species. Were there any certainty that other specimens could be obtained, I should content myself with giving merely a preliminary notice at the present time. As all attempts to secure more material have, however, been futile, it seems best to make public the results already arrived at.

Crystal form is entirely wanting, but a principal direction of cleavage is distinctly observable. To Mr. Whitman Cross I am indebted for the following data: "System probably monoclinic. The good cleavage plane may represent the clinopinacoid, for while extinction in it never seems to take place exactly parallel to the longer axis of the fragments, all those which allow of tests perpendicular to the cleavage plane do extinguish — to its trace. Plates parallel to the cleavage generally show that two directions of less perfect cleavage exist, which are nearly at right angles to each other. Extinction 8° 12° from one of these directions. Refraction strong. Pleochroism very slight. Position of optical axes not determinable."

Qualitative tests showed the presence of tellurium and iron as chief constituents with smaller amounts of selenium, zinc, calcium, and water. The test for sulphuric acid, to confirm the suspected presence of gypsum, was unfortunately neglected until it was found that the sample was exhausted.

In a closed tube the mineral fuses to a deep red globule; water, followed by a faint sublimate of selenium and a stronger one selenious oxide, appear in the upper part of the glass, while lower down a slight sublimate is formed resembling tellurium, and finally one of tellurious oxide, fusible to colorless drops. Weak acids are slow in action; stronger ones, especially hydrochloric acid, dissolve quite readily.* The hydrochloric acid solution contains the iron as the per-salt. The specific gravity of a small sample containing probably not less than 20 % of quartz and other foreign substances was 4.83 at 17°c.; hence the pure mineral undoubtedly has a density of not less than 5.

In the series of results given below, amounts of quartz varying from three to five per cent. have been deducted. Partial analyses I, II, and III were made upon material containing a small per cent. of the brown substance frequently mentioned. Since it seemed probable that this might have been derived from the green by alteration—a supposition supported by the fact that the first action of weak acids was to alter the latter into a similar looking brown stuff—it was determined to procure by some means sufficient material free from the supposed alteration product to allow of making a fairly accurate estimation of tellurium and iron. A decigram and a half of the green parti-

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* The brown constituents of the gangue, containing, so far as observable, the same chemical constituents as the green mineral, is much less readily acted on, and even strong boiling hydrochloric and nitrohydrochloric acids dissolve it entirely only after prolonged action.

cles was secured by hand-picking after great labor. The analysis of this is given under IV. The microscopical examination showed that it was still not free from supposed gypsum and calamine, and analysis revealed the presence of both zinc and calcium. A qualitative test upon a few fragments showed the presence of a very considerable amount of water, more than could by any possibility have come from admixed hydrated minerals. Water is, therefore, an essential constituent of the new mineral. It should be mentioned that the water given under analysis I. was estimated by heating with special care with lead oxide and collecting in a calcium chloride tube. During this heating a very slight sublimate of silenium only appeared, and the water was entirely neutral to litamus paper.

	I.	II.	III.	IV.
Te (Se)	59.77	59.15	59 05	59.14
Fe	14.00	14.06	14.90	14.20
ZnO				1.94
CaO				0 56
H_2O	3 28			

Comparison of the results of IV with those of I, II, and III shows that the proportions of tellurium and iron in the green and the brown minerals are, undoubtedly, very nearly alike. The means of each set of four results may then be taken as probably not far from correct. These are, for Te (Se) 59.28, for Te 14.29. An estimation of selenium was made in the combined tellurium precipitates and 0.53 per cent found. The mean percentages then are, Te 58.75, Se 0.53, Fe 14.29, H_2O unknown. For the reason given above it is assumed that the zinc and calcium do not belong to the mineral. The atomic ratio for Fe: Te (Se) is then 1:1.82: or, for (Fe_2): Te (Se) 1:3.65.

In forming a conclusion as to the probable state of oxidation of iron aud tellurium, the following observed fact is of first importance. On boiling with hydrochloric acid no chlorine whatever is given off and moreover all the iron is in solution as per chloride. Hence, prior to completing the analysis, it was considered that if the mineral were a ferrous tellurate it must have the TeO and TeO_3 in the proportion; 2:1 and the per centages of iron and tellurium consequently nearly equal.

The proportion actually found was very different, such that if the mineral were a tellurate a large amount of chlorine would have been driven off above that required to per oxidize the ferrous oxide. The only conclusion possible, then, is to consider the mineral a *ferric tellurite*, hydrated.

That this is a correct conclusion is supported by the following consideration. The Te, Se, and Fe of analysis IV require 20 94 per cent oxygen on the assumption of the ferric tellurite composition. This added to the other percentages furnishes a total of 96.78, leaving 3.22 % for water and possible SO_3 and SiO_2 (for gypsum and calamine if present). When calculated on the basis of a ferrous tellurate, however, there is required 26.25 per cent of oxygen, making the total 102.19 without including the water known to be present, and possible SO_3 and SiO_2.

The atomic ratio 1:3.65 for Fe_2: Te leads to the molecular ratio $3Fe_2O_3$: $11TeO_2$, but further tests upon larger quantities of pure material are necessary to show whether this or a simpler ratio is the true one.

That this mineral is not identical with the ferrotellurite* of F. A. Genth is certain from the assurance of Prof Genth himself, to whom a sample was sent for comparison. I have therefore no hesitation in considering it new. and take great pleasure in naming it *Emmonsite*, in honor of Mr. S. F. Emmons of the U. S. Geological Survey.

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* Proc. Am. Phil Soc., Philad. 1877, XVII, 119; or Zeitschr. f Kryst., II, 8., and Dana, app. III, 46.