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ART. XLII.—*On Rœblingite, a new Silicate from Franklin Furnace, N. J., containing Sulphur Dioxide and Lead;* by S. L. PENFIELD and H. W. FOOTE.

MR. FRANK L. NASON, who has been especially interested in the geology and mineralogy of the zinc deposits of Franklin, New Jersey, has recently brought to our attention a mineral from the Parker shaft of the New Jersey Zinc Company, which owing to its unusual chemical composition is of especial interest. The mineral occurs in dense, white, compact masses, which consist of an aggregate of minute prismatic crystals. These when examined with the microscope show parallel extinction and a weak double refraction, but they are so minute that the system of crystallization could not be determined. The specific gravity is 3·433; hardness a trifle under 3. A chemical analysis of this material by Foote gave the following results:

	I.	II.	Average.		Ratio.		
SiO_2	23·51	23·66	23·58	·393		5·61	5·0
SO_2	9·01	8·99	9·00	·141		2·01	2·
PbO	31·07	30·99	31·03	·139		1·99	2·
MnO	2·46	2·51	2·48	·035	·520	7·43	7·
CaO	25·91	25·98	25·95	·463			
SrO	1·33	1·46	1·40	·014			
K_2O	·16	·09	·13	·001			
Na_2O	·43	·36	·40	·007			
H_2O	6·36	6·35	6·35	·353		5·04	5·
			100·32				

The ratio of $SO_2:PbO:H_2O$ is very close to 2 : 2 : 5, but that of the SiO_2 and the remaining bases to these constituents is not so simple. The nearest approach to a simple ratio is perhaps $SiO_2:SO_2:PbO:RO:H_2O = 5:2:2:7:5$, and this gives the rather complicated formula $H_{10}Ca_7Pb_2Si_5S_2O_{28}$. The water is driven off at a rather high temperature and is therefore to be regarded as hydroxyl. The formula given above may be regarded as a combination of five molecules of a silicate H_2CaSiO_4 and two of a basic sulphite $CaPbSO_4$ or $(CaO.PbSO_3)$. The theoretical composition for this formula is given below, together with the results of the analysis after substituting for MnO, SrO and the alkalies their equivalent of CaO and recalculating to 100 per cent.

	Found.	Theory.
SiO_2	23·8	22·1
SO_2	9·1	9·4
PbO	31·3	32·9
CaO	29·4	29·0
H_2O	6·4	6·6
	100·0	100·0

There must be some question as to the exact formula of the mineral, for the one proposed is complicated and the agreement between the results of the analysis and the theory is not so close as one would desire. It is not probable, however, that the mineral is a mixture, or, at least, that it contains much foreign material. If it were a mixture, one would expect the presence of some heavy lead mineral, considerably above 3·43 in specific gravity, with a lighter calcium silicate. In order to test this point some of the material was powdered, sifted to a uniform grain and placed in methylen iodide with a specific gravity of 3·29 when all of the powder sank. It is thus very definitely proved that wollastonite (specific gravity 2·9) or any related calcium silicate is absent.

The special points of interest connected with this mineral are that this is the first time that a sulphite has been observed in nature, and that silicates containing lead are very rare, having been observed up to the present time in only a few localities in Sweden.

The mineral fuses before the blowpipe at about 3 to a gray globule, and gives the pale blue flame of lead, which ceases after heating for some time. On charcoal with sodium carbonate in the reducing flame, lead globules and a coating of lead oxide are produced, and the residue reacts on silver for sulphur. With the fluxes, the reactions for manganese are obtained. In the closed tube, water is given off. The powdered mineral is dissolved with ease in acids, even when very dilute, and gelatinous silica is obtained upon evaporation. The odor of sulphurous anhydride may be obtained when the mineral is dissolved in a little hydrochloric acid, but this test is not very apparent.

Concerning the occurrence of the mineral, the following information has been received from Mr. Nason: The mineral occurs at the one thousand foot level, in or near the contact between granite and white limestone, where great veins and bunches of garnet rock are found. The associated minerals are garnet, titanite, zircon, phlogopite, axinite both massive and in drusy crystals, willemite in small, green, transparent crystals, datolite, barite, caswellite, calcite, arsenopyrite, sphalerite, rhodonite and rhodochrosite. The axinite, which occurs in veins and pockets in the garnet rock, is in places porous and full of cavities and these are completely filled at times with the masses of rœblingite. The largest mass that was found weighed about five pounds and was about the size and shape of a cocoanut.

The ore body and the rocks in the mine are greatly shattered and show frequent slickensides, and undoubtedly the agencies which produced the shattering movements were the ones which also produced the conditions necessary for the formation of the great variety of minerals observed at this locality.

The method used in analyzing the mineral is as follows:

The mineral was dissolved in nitric acid, and silica removed in the ordinary way, substituting nitric for hydrochloric acid, so that lead might not remain behind. When heated in the air bath at 140°, however, some manganese nitrate was decomposed and converted into a higher oxide which was insoluble in nitric acid. This was filtered off with the silica, and after washing, was dissolved by treatment with hydrochloric acid. The nitric and hydrochloric acid filtrates were evaporated to dryness separately and a further trace of silica was thus removed. Lead was precipitated from the slightly acid solution by hydrogen sulphide and determined as sulphate, and manganese and calcium were determined by the ordinary methods. The small amount of strontium was weighed with the calcium as oxide and separated by treatment with amyl alcohol. For the determination of sulphur dioxide, separate portions were used. The mineral was treated with strong bromine water and hydrochloric acid, and after being dissolved and standing for some time, the sulphuric acid formed was precipitated as $BaSO_4$. The precipitate was impure, containing silica and probably some lead sulphate, and it was purified in the ordinary way by fusion with sodium carbonate and reprecipitation with barium chloride. Water was determined directly by means of the closed tube method,* and alkalies by a Smith fusion.

At the request of Mr. Nason the authors take pleasure in naming this mineral rœblingite in honor of the celebrated engineer, Mr. W. A. Rœbling of Trenton, N. J. They also take pleasure in expressing their thanks to Mr. F. L. Nason and Mr. John A. Manley of New Brunswick, N. J., for the pains they have taken in supplying material for this investigation.

Mineralogical and Petrographical Laboratory,
Sheffield Scientific School, New Haven, April, 1897.

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* This Journal, III, xlviii, p. 31, 1894.