Art. XXI.—*Margarosanite, a New Lead-Calcium Silicate from Franklin, N. J.*; by W. E. Ford and W. M. Bradley.

The new mineral to be described in the following paper was originally observed on specimens from Franklin, N. J., that came from about the 1000 ft. level of the Parker shaft on North Mine Hill and were collected during the year 1898. It was partially investigated by S. L. Penfield and C. H. Warren during their study of Franklin minerals which resulted in the description of the other new species, hancockite, glaucochroite, nasonite and leucophœnicite.* Partial analyses were made by both Penfield and Warren, but the investigation was never carried to a conclusion and the results obtained were not published. Their material has remained in the Brush Mineral Collection since that time and was added to several years ago by a few more specimens presented by the Foote Mineral Co. of Philadelphia. It is only recently that a complete and satisfactory investigation of this mineral has been possible. The results have shown that we have here another new species to add to the already long list of those peculiar to the Franklin locality.

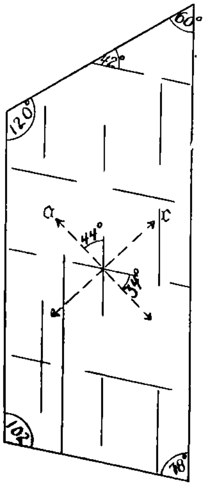
Margarosanite, as the new mineral is called, is a silicate essentially of lead and calcium. It occurs in lamellar masses composed of thin plates packed closely together and which in general show a rhombic outline due to cleavages. It is colorless and transparent, showing a distinct pearly luster. It has a hardness of 2·5–3; specific gravity of 3·991. In the oxidizing flame it fuses with some difficulty, the fragment assuming an amethyst color, but in the reducing flame, it fuses easily and quietly at about 2 to an opaque grayish glass. In the reducing flame it gives a pale azure-blue flame with an outer border of pale green. With fluxes on charcoal it gives a metallic globule of lead accompanied with the lead oxide coating. It gives the characteristic color tests for manganese when fused in the sodium carbonate or borax beads. It is decomposed by treatment with nitric acid, yielding separated silica.

The mineral shows three good cleavages. The principal cleavage is parallel to the tabular development of the mineral and is so perfect that it almost gives a micaceous character to the material. There are two other well-developed cleavages which are nearly, but apparently not exactly, perpendicular to the first. These are shown by the characteristic rhombic outlines of the broken plates of the mineral and by the numerous cleavage cracks existing within the sections. The traces of these latter cleavage directions upon the surfaces of the plates make angles with each other which are closely approximate to 102° and 78°. On a few of the plates an oblique terminal edge

---

* This Journal, viii. 339, 1899.

was observed which was due, apparently, to the presence of a crystal face, as no interior cleavage cracks parallel to it were observed. The trace of this face upon the surfaces of the plates made angles of about 120° and 60° with one of the cleavage directions and 42° and 138° with the other. This crystal form is not perpendicular to the chief cleavage but cuts across the edge of the cleavage plate at some oblique angle. These various relations are shown diagrammatically in the figure.



The two extinction directions in the sections make angles of about 44° and 46° with one of the cleavage directions and of 34° and 56° with the other. The faster of the two rays nearly bisects the smaller angle (78°) of the rhomb, formed by the two cleavages which are nearly perpendicular to the surface of the sections. In convergent light the sections show a biaxial figure with one optical axis revolving just outside the field of the microscope. The axis lies along the vibration direction a, so that the cleavage plates are at least nearly perpendicular to the optical axial plane. These optical facts are also summarized in the figure. The indices of refraction of the two rays vibrating in the section were determined by immersion in high refracting oils and low fusing solids with the following results: 1·730 ± ·002 and 1·795 ± ·005. Of these the value 1·795 must be close to that of the intermediate index of refraction, β. From a consideration of the above facts, it is probable that the mineral belongs in the triclinic crystal system.

Upon the specimens, on which the margarosanite was found, the following species were also observed: light and dark-brown garnet (almandite), hancockite, rœblingite, nasonite, franklinite, willemite, yellow axinite, datolite and a biotite-like mica which gave the characteristic reactions for manganophyllite. In some cases the margarosanite was found lying immediately upon barite. The cleavages and general characters of these two minerals are so similar, that it became necessary to separate the magarosanite with great care before analyzing it. This was done by crushing the material and picking it over grain by grain under a lens. In this way material of undoubted purity was obtained for the analysis.

The method of the analysis was simple and was briefly as follows. The mineral was decomposed by treatment with nitric acid with the consequent separation of silica. The solution was evaporated to dryness and after taking the residue up in dilute acid the silica was filtered off. The filtrate was again evaporated to dryness to remove the nitric acid and the residue treated with water to dissolve the nitrates. During this evaporation a small amount of basic lead nitrate was formed which was insoluble in water. This was taken up in a very little nitric acid. The lead was precipitated and weighed as the sulphide. The manganese was precipitated as a sulphide and, after precipitation as the basic carbonate, was weighed as Mn_3O_4. The calcium was determined as usual and the amount of water found by a direct determination, according to the Penfield method.

A number of complete and several partial analyses were made by Bradley, the majority of which showed close agreement with each other. Several of the better determinations in each case are given below :

					Average	Ratios				
SiO_2	33·73	33·73	33·98	33·39	33·71	·5581		3·00		1·00
PbO	40·15	43·30	43·89	43·67	43·50	·1951		1·04	·5986	1·07
CaO	21·61	21·62	21·97		21·73	·3873	·4035	2·16		
MnO	0·98	1·01	1·29	1·30	1·14	·0162				
H_2O	0·48	0·68			0·58					
					100·66					

These results are in substantial agreement with those of the partial analyses made earlier by Penfield and Warren. Since the water is in small amount and since it is driven from the mineral at a low temperature, it is thought to be hygroscopic in character and is not considered in the calculations. The analysis points clearly to a metasilicate formula for the mineral. The various bivalent oxides may be considered as isomorphous with each other and the formula given as $RSiO_3$, or in view of the ratio existing between the lead oxide and the calcium-manganese oxide, it may be written as $Pb(Ca,Mn)_2(SiO_3)_3$.

Below are given the theoretical composition of the last formula and the results of recalculating the present analysis with the elimination of the water and the substitution of calcium oxide for the small amount of manganese oxide present:

	Theory for $PbCa_2(SiO_3)_3$	Analysis recalculated
SiO_2	35·10	33·77
PbO	43·17	43·57
CaO	21·73	22·66
	100·00	100·00

The name margarosanite, which is proposed for this new species, has been derived from *μαργαρίτης*, *a pearl*, and *σανίς*, *a tablet* or *board*, in reference to its pearly luster and lamellar structure.

Mineralogical Laboratory of the Sheffield Scientific School
of Yale University. New Haven, Conn.,
April 18th, 1916.