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NOTES ON SOME NEW RHODONITE SPECIMENS FROM FRANKLIN FURNACE, NEW JERSEY

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The rhodonite of a recent find at Franklin Furnace, N. J., presents such an unusual habit and appearance that specimens have been sent to the writers for identification, by Col. Roebling, R. B. Gage, F. A. Canfield, and Ward's Natural Science Establishment, and the identification of the mineral as rhodonite has been reluctantly accepted by the connoisseurs of New Jersey minerals. For this reason and because the material presents several features of interest, an analysis of the rhodonite and brief description of the associated minerals are presented herewith.

The specimens consist of drusy surfaces from the lining of narrow, partly open seams cutting fine banded franklinite-willemite ore. The minerals deposited in these seams, and evidently later than the enclosing ore, include zoned rhodonite, yellow axinite, white barite, willemite crystals, and a radiated brown mineral which has not yet been definitely identified.

The rhodonite occurs in freely developed crusts made up of prismatic forms which reach 3 millimeters by 5 millimeters in size and have an elliptic cross section and serrated edges. They are terminated by a lustrous and somewhat curved face. When closely examined these are seen to have a lozenge shaped core of deep pink rhodonite surrounded by an outer zone made up of small crystals of a paler or more brownish color, the contact between the two zones being sharp. The core shows fine polysynthetic twinning, although the major portion has a single orientation, the laminae in twin position being very thin. The outer zone, although

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made up of numerous small crystals, shows no twinning and extinguishes as a unit, indicating that its component crystals are in exactly parallel position. The three prominent cleavages shown by the mineral extend uninterrupted through inner and outer zones alike, showing that there is perfect crystallographic continuity, the difference in extinction ($\pm 10°$) between the core and the outer zone being attributed to change in optical orientation with change in composition. The three cleavages are perfect and about equal in prominence. Of these, one is parallel to the curved lustrous face shown by the mineral, while two are in the zone approximately perpendicular to this face. Of the latter, one coincides exactly with the plane of the polysynthetic twinning, while neither is parallel to the crystal faces which make up the serrations of the outer crust. By carefully splitting out cleavage fragments and measuring them on the goniometer it was found that the curved terminal face of the groups is the form M $(1\bar{1}0)$ and the twinning plane is c (001), while the bounding faces of the outer crust are pyramids in the zone m (110) $\wedge m'$ $(\bar{1}\bar{1}0)$, probably q (221) and $n(\bar{2}\bar{2}1)$, (Dana's orientation). This orientation assumed, the angles measured on the cleavages compare as follows with the angles given for rhodonite by Dana:

	Measured	Calculated
$m(110) \wedge M(1\bar{1}0)$	92° 40′	92° 28′
$c(001) \wedge m(110)$	67° 03′	68° 45′

The prominent cleavages thus are parallel to the planes c (001), $m(110)$ and $M(1\bar{1}0)$.

A sample consisting of the core portion of these rhodonites was separated for analysis, the analyzed powder being found by optical examination to contain less than 1 per cent of the material of the outer zone. The results of the analysis are as follows:

SiO_2	44.76
FeO	.99
MnO	40.83
CaO	10.12
ZnO	3.26
MgO	.76
Ignition	.06
Total	100.78

This analysis indicates a rhodonite of ordinary composition, being slightly higher in lime and a little lower in zinc than the

normal Franklin Furnace fowlerite. The material of the outer zone could not be separated from the specimens available in amount sufficient for analysis, but its optical properties show that it also is a rhodonite but, as shown by the lower indices of refraction, higher in lime than the inner core. It thus grades toward the highly calciferous bustamite recently described by the writers.[2] It is hoped that enough of these zoned rhodonite crystals can be secured to separate the material of the outer zone for an analysis. If any one has material they are willing to sacrifice, the authors will undertake the separation and analysis.

The microscope shows that the two zones are separated by a rather sharp boundary after the manner of zoning in some feldspars. The material analyzed was essentially homogeneous and was made up of 99 per cent of the central pink zone. Its optical properties are: Optically+, 2V moderately large, dispersion $\rho < \nu$ easily perceptible, crossed dispersion rather strong.

$\alpha = 1.716$ $\beta = 1.720$ $\gamma = 1.732$

Sections normal to the most perfect cleavage are at about right angles to the composition plane of the twin lamellae and to two other cleavages whose traces are at an angle of about 68°. The poorer of these two cleavages is parallel to the twin lamellae. Such cleavage fragments show unsymmetrical extinction and the main cleavage piece gives extinction angles of about 22° measured against the trace of the twin lamellae and show the emergence of an optic axis just out of the field of the microscope. The other small twin lamella gives somewhat larger extinction angles. Fragments lying on the other cleavage that shows the twin lamellae also gives unsymmetrical extinction at small angles.

A specimen kindly lent the authors by Col. Roebling has the outer, nearly colorless zone better developed. The optical properties of the inner zones are: Optically+, 2V large, crossed dispersion strong;

$\alpha = 1.708$ $\beta = 1.716$ $\gamma = 1.724$

Those of the outer, nearly colorless zone are: Optically+, 2V moderate, dispersion slight, crossed dispersion strong;

$\alpha = 1.687$ $\beta = 1.692$ $\gamma = 1.709$

These properties indicate a rhodonite near bustamite, although the birefringence is rather high.

[2] *Am. Min.*, 7, 95, 1922.

The willemite which occurs on one specimen of this rhodonite is in pale green to colorless transparent hexagonal crystals showing only the unit prism and the basal pinacoid. These crystals reach an extreme length of 6 mm. with a diameter of 1 mm. They rest upon the rhodonite. Optically they are uniaxial and positive, with $\omega = 1.690$ and $\epsilon = 1.720$, approximately.

The axinite is abundant as sheaves of bright yellow crystals aggregated in approximately parallel position. It is the characteristic yellow axinite from Franklin. The largest crystals reach 15 mm. in length.

Barite occurs as transparent, colorless to white cleavable masses, having normal optical properties.

One mineral occurs on four specimens of the rhodonite which it was not possible to identify. This is doubtless a new hydrated manganese silicate. It forms rosettes of acicular radiating needles and blades of a brown color which rest upon, and are evidently later than, the rhodonite. The rosettes reach an extreme diameter of 20 mm. with individual blades 10 mm. by 1 mm. Optically the mineral is biaxial and negative, with 2V very small; dispersion $\rho < \nu$ rather strong; indices of refraction, $\alpha = 1.563$, $\beta = \gamma = 1.593$; $\gamma - \alpha = .030$. Under the microscope the mineral is transparent and colorless, and is in the form of thin flat laths. The optical direction Z is nearly perpendicular to the flat face of these, Y nearly parallel to the length, and X nearly perpendicular to the thin edge. Other cleavages apparently bevel the edges of these laths. Sections perpendicular to the acute bisectrix appear to show about parallel extinction. Sections perpendicular to Z show twinning with the composition plane perpendicular to the face and parallel to the length and give symmetrical extinction of about 2°. The only silicate minerals known which approach these optical properties are certain micas, from which this mineral differs in other respects. In the forceps the mineral melts in the flame of a bunsen burner to a brown transparent glass bead and yields neutral water at a moderate temperature in the closed tube. With borax in the oxidizing flame it yields the purple bead of manganese. It is decomposed by hydrochloric acid with separation of skeletons of silica and the solution contains only a trace of iron, very little alumina and no lime, but abundant manganese. The presence of zinc could not be established in the very small amount of material available for testing. It is hoped that enough of this material for analysis may be obtained at some future time.