

NOTES AND NEWS

VONSENITE FROM ST. LAWRENCE COUNTY, NORTHWEST
ADIRONDACKS, NEW YORK*

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The opaque mineral vonsenite, a high-temperature ferrous ferric borate of the ludwigite-vonsenite series, occurs in skarn in the pyro-metamorphic magnetite deposit at Jayville, St. Lawrence County, New York. Chemical and microscopic data suggest that vonsenite is a major constituent of at least part of the chief magnetite-bearing zone at Jayville. A mineral of identical optical properties is present at the Clifton mine, near Degrasse, St. Lawrence County, New York. The geology of the district and its ore deposits is described in reports in preparation by Buddington and Leonard. Their account of the Jayville deposit is based on unpublished geologic mapping by Tyler and Wilcox [1942].

Vonsenite was found at Jayville by Leonard in 1947 in drill core from hole J 2 of the Jones and Laughlin Steel Corporation. The mineral was identified in 1951 by the *x*-ray work of J. M. Axelrod and spectrographic analysis by Janet D. Fletcher, both of the U. S. Geological Survey.

In hand specimen, the vonsenite looks the same as the fine-grained magnetite with which it occurs. The vonsenite forms black, granular aggregates with metallic (locally adamantine) luster. Powdered vonsenite will move when an alnico magnet is run along a glass tube containing the pure mineral.

Vonsenite is completely opaque in thin section. If the thin section is viewed in incident light, one sees that vonsenite is darker than the associated magnetite. If one examines polished specimens of ore with the naked eye, one sees that vonsenite is bluish relative to magnetite, and its reflectivity or "brightness" relative to magnetite is about the same as the reflectivity of magnetite relative to crystalline hematite.

In polished sections examined with the reflecting microscope, vonsenite shows the following properties: *Habit*—generally aggregates of polygonal grains; locally lath-, wedge-, and diamond-shaped crystals, commonly with rounded corners. Apparently contemporaneous with, or slightly younger than magnetite; cut by veinlets of hematite, and locally replaced by ragged blades of hematite. *Color*—very strongly pleochroic from light gray or light brown to light blue-gray. *Reflectivity*—maximum (light brown direction) about 13–16 per cent, minimum (light blue-gray direc-

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tion) about 10–12 per cent for green light. (These are preliminary measurements, subject to correction.) *Anisotropism*—very strong or extreme, from black to fiery orange. Extinction parallel to long edges of laths, but symmetrical in wedges and diamonds. No internal reflection. *Hardness*—scratching hardness F or greater, or about 6 on Mohs' scale. Polishing hardness less than that of hematite, and about equal to that of magnetite. *Magnetism*—pure mineral powder readily attracted to magnetized sewing needle. *Etch tests*—HCl positive; aqua regia weakly positive; HNO₃, FeCl₃, KOH, HgCl₂, H₂O₂ negative. Without x-ray, chemical, or refined optical data, the vonsenite would easily be mistaken for ilvaite. (Cf. Ramdohr, 1955, p. 811–812.)

A chemical analysis of 1.9 grams of nearly pure vonsenite, separated by W. T. Schaller, is given in Table 1. (The sample is field no. J 2.21, hole J 2, depth 299 feet; laboratory sample no. 144483; laboratory report IWC-473.)

TABLE 1. CHEMICAL ANALYSIS OF VONSENITE

| | Wt. per cent | Wt. per cent (recalc.) |
|--|----------------------|------------------------|
| FeO | 53.06 | 54.04 |
| MnO | 0.27 ^a | 0.28 |
| MgO | 0.55 ^b | 0.56 |
| Fe ₂ O ₃ | 29.59 | 30.14 |
| Al ₂ O ₃ | 1.45 | 1.48 |
| TiO ₂ | 0.13 | 0.13 |
| SnO ₂ | Present ^c | Present |
| B ₂ O ₃ | 13.13 | 13.37 |
| CaO | None | 100.00 |
| Acid insoluble | 1.80 | |
| | 99.98 | |
| Angelina C. Vlisidis, analyst, 1955 | | |
| G. of analyzed sample = 4.75 | | } W. T. Schaller |
| G. corrected for acid insoluble = 4.77 | | |

^a Amount of MnO recovered from the Mg precipitate. Total amount not determined.

^b Corrected for the contained MnO (0.27 per cent).

^c Not determined gravimetrically. Spectrographic determination (see below) indicates a small quantity, about 0.x per cent.

The recalculated analysis yields the oxide ratios 4.01:1.07:1.00, close to the ideal 4FeO·Fe₂O₃·B₂O₃. The composition may be expressed as 4[(Fe'^{1.92}Mn^{.01}Mg^{.04})(Fe''^{.96}Al^{.07}Ti^{.004})B^{.93}O₅], based on the structural formula of daSilva, Clark, and Christ (1955).

Spectrographic analysis, made in 1951 by Miss Fletcher, shows (report IWS-156):

| | <i>Per cent</i> |
|--------------------|-----------------|
| Fe, B | >5 |
| Mg, Si, Al | 1-5 |
| Sn, Pb, Zn, Mn, Ti | 0. x |
| Cu, Cr, Zr, Ba, Ca | 0.0x |
| Ag, Co, Ni | 0.00x |

Looked for but not found: As, Bi, Be, Au, Pt, Mo, W, Ge, Sb, Cd, Tl, Ga, V, Y, La, Th, Cb, Ta, U, Sr, Na, P.

In chemical composition, the Jayville vonsenite closely approaches the $\text{Fe}_2''\text{Fe}'''\text{BO}_5$ end-member of the ludwigite-vonsenite series. We use the term vonsenite on the advice of Dr. Schaller. The statement in Dana VII, 2 (Palache, Berman, and Frondel, 1951, p. 321; private communication from W. T. Schaller) that ludwigite and paigeite are isostructural with a complete series extending between them is incorrect, as shown by later studies and better *x*-ray diffraction patterns (Schaller, W. T., 1955, personal communication to Leonard). The statement should read: ludwigite and vonsenite are isostructural, and a complete series extends between them by mutual substitution of Mg and Fe'' . The data listed for no. 24.1.1.2 in Dana VII, 2 (p. 322) refer to ludwigite (Mg end-member) and to vonsenite (Fe'' end-member), not to paigeite.

TABLE 2. X-RAY POWDER DIFFRACTION DATA FOR JAYVILLE VONSENITE
($\text{FeK}\alpha$ radiation and Mn filter)

| <i>d</i> | <i>I</i> | <i>d</i> | <i>I</i> |
|----------|----------|----------|----------|
| 7.52 | w | 2.07 | ms |
| 6.16 | w | 2.01 | w |
| 5.17 | s | 1.940 | ms |
| 3.03 | w | 1.767 | w |
| 2.85 | mw | 1.602 | mw |
| 2.58 | vs | 1.539 | ms |
| 2.38 | ms | 1.504 | mw |
| 2.18 | ms | 1.404 | mw |

The measurements of these stronger lines were made by Fred A. Hildebrand, U. S. Geological Survey, on a film taken by him on a part of the analyzed sample. They are to be regarded only as cursory measurements.

Vonsenite from Riverside, California, was originally described by Eakle (1920). "Paigeite" (vonsenite) from the Kamaishi mine, Japan, was described by Watanabe and Ito (1954). Federico (1957) showed that

the breislakite of Vesuvius and Capo di Bove, Italy, is vonsenite. Later (Federico, 1958), she studied the alteration of breislakite and synthetic vonsenite. Vakar, Knipovich, and Shafranovskii (1934) described as ludwigite material whose $(\text{Fe}'' + \text{Mn})/\text{Mg}$ ratio relative to 5 oxygens is about 0.99/0.84. Pure vonsenite has been synthesized by Andrieux and Weiss (1944), Chevallier, Mathieu, and Girard (1948), Bertaut, Bochirol, and Blum (1950), and Federico (1958).

We wish to thank the Jones and Laughlin Steel Corporation, the Benson Iron Ore Corporation, and our colleagues in the Geological Survey for their cooperation in this study. A complete account of the Jayville vonsenite will appear in another journal.

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