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# VONSENITE. A PRELIMINARY NOTE ON A NEW MINERAL

ARTHUR S. EAKLE

*University of California*

Specimens of a coal-black, lustrous mineral were collected at Riverside, California, by Mr. M. Vonsen of Petaluma. His determinations with the blowpipe gave reactions for the rare mineral ludwigite, but the structure and appearance of his mineral were so unlike all known ludwigites that a further investigation seemed necessary to establish its true identity.

The occurrence is in the form of a large boulder-shaped mass directly on a contact between limestone and granite. The massive mineral resembles and merges into magnetite, and probably has been overlooked because of the assumption that it was that mineral. Chlorite, green pyroxene and thin plates of a white talcose mineral occur associated.

The color of the mineral is black and the streak and powder is brownish black. The luster is brilliant metallic, and the smooth faces occasionally show an iridescence. It is very brittle and breaks with a slight conchoidal fracture. No definite cleavage direction could be observed, but there is a tendency to part normal to the prismatic zone. H. = 5; G. = 4.21. The mineral is perfectly opaque in thin sections, and is non-magnetic.

*Crystallography.*—The structure is granular massive, forming compact and friable masses. Imperfectly formed individual crystals can be obtained from the friable masses, especially where in contact with the seams of chloritic material. The crystals are short prisms and sometimes have the four faces of the unit prism complete, but most of them are very imperfectly formed. Excellent reflections can be obtained from the prismatic faces but the terminating faces were missing on all the crystals examined; it is consequently not definitely established whether the

mineral is orthorhombic or monoclinic,- altho the horizontal parting indicates it to be orthorhombic.

Several of the crystals were measured with the reflecting goniometer, giving good sharp readings. The prism which is common to all, and which predominates, is taken as the unit prism, giving the partial axial ratio: $a : b : c = 0.7558 : 1 : ?$

Forms and measurements:

$b(010)$, $m(110)$, $l(210)$, $n(140)$, $x(160)$.

| | Measured | Calculated |
|---|---|---|
| $110 : 1\bar{1}0$ | 74°10′ | — — |
| $110 : 010$ | 52 53 | 52 55 |
| $110 : 210$ | 16 35 | 16 23 |
| $110 : 140$ | 34 37 | 34 37 |
| $010 : 160$ | 12 11 | 12 26 |

*Composition.*—The average composition of the material thus far studied proved to be:

| | % | Ratio |
|---|---|---|
| FeO | 39.75 | 0.552 |
| MgO | 10.71 | 0.268 |
| $B_2O_3$ | 14.12 | 0.202 |
| $Fe_2O_3$ | 34.82 | 0.218 |
| | 99.40 | |

This ratio corresponds to the ludwigite formula, $3(Fe, Mg)O.B_2O_3 + FeO.Fe_2O_3$ in which the ratio of Fe : Mg, in the borate, is near 5 : 4; the calculated composition on this basis is:

FeO 40.39, MgO 11.22, $B_2O_3$ 14.73, $Fe_2O_3$ 33.66, sum 100.00%

The analyses yielding the above average were generally made from different samples, which were hand picked, in order to get the purest possible material. They indicated that a variation possibly existed in the amount of MgO present, since duplicate analyses of one sample gave 7.43 and 7.79 percent. MgO, while other samples varied between 9.26 and 11.51 percent. The low MgO result was attributed to its precipitation with the iron, as the $Fe_2O_3$ determined by weight was about 4 percent. higher than that given by volumetric determination. Whether this variation exists, and whether the amount of $B_2O_3$ also varies, has not been definitely determined.

The mineral fuses at 3 to a black magnetic globule. It is completely soluble in HCl and $H_2SO_4$. The HCl solution gives a strong borate reaction with turmeric paper, altho the green boron flame is difficult to obtain.

The analyses of ludwigite from Hungary by Ludwig and Sipöcz and from Montana by Schaller show it to be essentially a magnesium borate plus the magnetite molecule, with part of the magnesium replaced by a subordinate amount of ferrous iron. The Riverside mineral, however, is essentially a ferrous borate plus the magnetite molecule with part of its iron replaced by a subordinate amount of magnesia. Its distinctive difference in composition, and its manifest difference in structural and optical characters from ludwigite, justifies the writer in proposing the new name *vonsenite*, after its discoverer, for the mineral.

## THE GOLDSCHMIDT TWO-CIRCLE METHOD. CALCULATIONS IN THE HEXAGONAL SYSTEM

CHARLES PALACHE

*Harvard University*

### Forms and Symbols

The gnomonic projection of a hexagonal crystal presents a grouping of face-poles of hexagonal or trigonal pattern. The axes of reference used to determine the symbols may be either of two sets of lines; each set intersects mutually at 60 degrees; the two sets are turned to each other 30 (or 90) degrees. Symbols and axial ratio may be determined from either set, and may later be transformed to accord with a choice of the other. The determination as to which set is to be used in a given case is somewhat arbitrary, and the dual choice introduces some confusion in the study of this system.

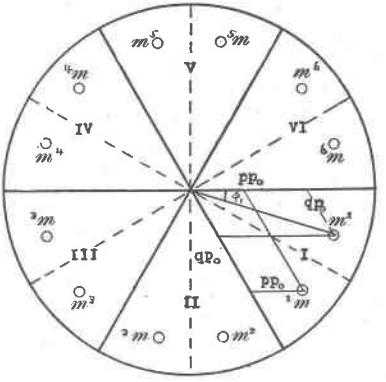


Fig. 27

In figure 27 the two sets of axes are shown by heavy and dotted lines; there is also shown the numbering of the sectants and the method of indicating by exponents the position of a face (m) on the crystal. In the holohedral crystals all sectants are identical. For two faces the coördinates are shown in the figure, and the Goldschmidt symbol is derived as in the systems with rectangular axes, by measuring along any two adjacent axes the coördinate lengths which fix the position of the face-pole.