⁴ Conner, *Amer. J. Math.*, **37**, 1915 (29).

⁵ Schottky, *Acta Math.*, **27**, 1903 (235).

⁶ Coble, *Amer. J. Math.*, **41**, 1919 (243).

⁷ Wirtinger, *Math. Ann.*, **27**, 1892 (261); *Untersuchung über Thetafunctioners*, Leipzig (1895).

⁸ Coble, *Amer. J. Math.*, **32**, 1910 (333).

⁹ Shenton, *Ibid.*, **372** 1915 (247).

¹⁰ Cf. Coble, *l. c.*, p. 352.

MELANOVANADITE, A NEW MINERAL FROM MINA RAGRA, PASCO, PERU

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Late in 1920 Mr. W. Spencer Hutchinson, Consulting Engineer for the Vanadium Company of America, brought to my attention three specimens of a mineral collected by him at Mina Ragra, Peru. He suspected that it was a new mineral, and this opinion was proved correct by chemical and optical examination. The formula is $2CaO.3V_2O_5.2V_2O_4$ and I wish to propose for it the name of Melanovanadite, in allusion to it being practically the only vanadium mineral of a deep black color.[1]

The mineral occurs in acicular bunches on black brecciated shale, the individual crystals being at most 3 mm. long.

The greater thickness of the needles is about 0.5 mm. ranging down to 0.1 and 0.01 mm. The color is black, luster almost submetallic, streak very dark reddish brown. The hardness is 2.5 the specific gravity 3.477 at 15° C. The habit of the crystals is prismatic, parallel to c, with monoclinic symmetry. The principal faces consist of a flat, striated prism, the longer diagonal being parallel to the b axis, minor pinacoidal faces, and usually well developed terminal faces of pyramids and smaller domes. The crystals have a perfect cleavage parallel to (010).

Under the microscope the crystals remain black except in very thin prisms which are translucent with brown color.

Flat cleavage pieces parallel to the clinopinacoid only become translucent when the thickness is about 0.003 mm. and then show maximum extinction of about 15°. Resting on the prism (100) the crystals become brown translucent with a thickness of about 0.03 mm. and then show lower extinctions of 12° to 13°, while these resting more nearly on the orthopinacoid extinguish at lower angles. The perfect cleavage being perpen-

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[1] The ending "vanadite" is an obsolete form of "vanadinite," but there can scarcely be any objection to using this form in the present case.

dicular to the poorly developed orthopinacoid, extinctions of $0°$ are rarely seen. Exact optical measurements are difficult on account of the deep color. Obscure hyperbolae show on the prism faces and it is probable that the plane of the optic axes lies parallel to the perfect cleavage (010). The absorption is very strong. The α ray is visible with dark yellowish brown color through the prism faces and the orthopinacoid and has according to a determination kindly made by Professor C. H. Warren a coefficient of refraction of 1.74; while the β and γ rays are somewhat higher but cannot be measured exactly on account of the strong absorption. The β and γ rays therefore lie in the 010 plane of perfect cleavage and their absorption is so strong that such cleavage pieces only become translucent in extremely thin plates, with dark reddish brown color, β and γ differing slightly in depth of tint. The double refraction is strong.

The material was analysed by Professor L. F. Hamilton of the Massachusetts Institute of Technology, who reported the following composition:

V_2O_5	52.61
V_2O_4	33.34
CaO	9.89
MgO	.27
$Al_2O_3Fe_2O_3$	1.89
Silica	1.66
	99.66

Assuming the alumina, iron oxide, magnesium and silica to be impurities from the admixed shale the analysis may be recalculated to:

V_2O_5	54.90
V_2O_4	34.78
CaO	10.32
	100.00

From this we calculate

$$V_2O_5 \quad \frac{54.90}{182} = 0.302$$

$$V_2O_4 \quad \frac{34.78}{166} = 0.209$$

$$CaO \quad \frac{10.32}{56} = 0.184$$

$$V_2O_5 : V_2O_4 : CaO = 302 : 209 : 184$$

or approximately $3:2:2$. The formula would therefore be

$$2\, CaO.3V_2O_5.2V_2O_4$$
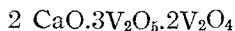
The calculated composition of this would be:

V_2O_5	55.16
V_2O_4	33.54
CaO	11.30
	100.00

Before the blowpipe the mineral fuses very easily to a brown liquid but gives no flame reaction for calcium. It gives strong bead reactions for vanadium. It is easily soluble, with apple green color, in HNO_3, HCl, and dilute H_2SO_4. Upon the evaporation the solution gives a red or brown residue. In potassium hydroxide melanovanadite is easily soluble with brownish color.

Editorial Note:—This issue of the PROCEEDINGS, those immediately preceding, and those immediately to follow, have been seriously delayed by the nation-wide printers' strike which began on May first, 1921.

The Editors and the publisher of the PROCEEDINGS desire to express their gratitude to the authors and to the subscribers for the patience which has been shown in respect to these trying delays and to assure them that all efforts are being made by all concerned toward getting the PROCEEDINGS back to regular and prompt publication with every indication that success will be assured in the very near future.

In such an emergency the printing of reprints has to be given second place as compared with the publication of the PROCEEDINGS but we hope to ship all reprints ordered without undue delay.

In order to facilitate the issuance of delayed numbers it has been necessary to make up the various articles in some cases in an order materially different from that of their receipt.