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On Monticellite crystals from a steel-works mixer slag.

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THE mineral here described was exhibited at the meeting of the Iron and Steel Institute held on May 6, 1920, in illustration of a paper by Mr. J. F. Wilson,[1] who found that slags yielding these crystals had a composition approximating to the orthosilicate ratio. The slag was obtained from a metal-mixer ladle of about ten tons capacity, and consisted of a network of interlacing rhombic prisms, from which the mother-liquor had withdrawn, leaving material on which it has been possible to make fairly accurate measurements. Mr. Wilson very kindly arranged to place at the disposal of the present authors the specimen[2] on which this account is based.

Analysis.—The crystals, after being powdered and sieved, were passed through a magnetic separator, which removed a small amount of material containing particles of the groundmass. The following is the analysis of the purified material; unfortunately a specimen of the massive slag was not available:

[1] J. F. Wilson, Journ. Iron and Steel Inst., 1920, vol. 101, p. 265 [Min. Abstr., vol. 1, p. 164].

[2] M.P.G. Inv. No. 12766.

			Molecular equivalents.	
SiO_2	...	34·80	... 0·580	0·588
TiO_2	...	0·24	... 0·008	
Al_2O_3	...	0·27	... —	
Fe_2O_3	...	trace	... —	
FeO	...	4·11	... 0·057	1·175
MnO	...	13·39	... 0·188	
MgO	...	17·65	... 0·441	
CaO	...	28·45	... —	
(CaO [1]	...	27·38)	... 0·489	
P_2O_5	...	0·905	—	
CaS	...	0·055	—	
		99·870		J. H. Whiteley, Anal.

The specific gravity is 3·20.

Crystallography.—The crystals are from ½ to 1 cm. in length and from 1 to 2 mm. in thickness. They have the habit usually found for monticellite in slags, being prismatic with the forms *k* and *b* in equal development, and terminated by small *m* faces. The faces are slightly dulled and marked with spots of slag, but yield very consistent readings. Doubly-terminated crystals are not uncommon, but could not be detached from the mass without breaking. The fracture is conchoidal. The following readings were obtained from seven crystals:

Angle	$kk''' =$ (021) : (02$\bar{1}$).	$mm''' =$ (110) : (1$\bar{1}$0).	$bm =$ (010) : (110).	$bk =$ (010) : (021).
No. of readings ...	10	5	10	10
Highest	81° 59′	47° 27′	66° 44′	41° 6′
Lowest	81 25	47 13	66 5	40 39
Mean	81 44	47 19	66 19½	40 50
Calculated ...	*	*	66 20½	40 52

Orthorhombic, $a : b : c = 0{\cdot}4382 : 1 : 0{\cdot}5779$.

Forms: *b* {010}, *m* {110}, *k* {021}.

Optical Properties.—The crystals are transparent and very pale brown in colour; they show little or no pleochroism and have straight extinction parallel with the prism-edges. The crushed mineral forms small irregular flakes with moderate birefringence. The optical sign is negative, the acute bisectrix being parallel with the *b* axis and the axial plane parallel with the face *c*. The following refractive indices were measured on an artificial prism by normal incidence on the face *b*,

[1] After deduction of CaO present as $Ca_3(PO_4)_2$. If this amount of CaO is regarded as being present in the form of monticellite, the molecular composition is R''_2SiO_4, 16·5; $CaR''SiO_4$, 83·5 mols. per cent.

by total reflection from the face b, and by total reflection from an artificial plane parallel to b:

	Prism.	Natural face b.	Artificial face b.	Accepted value.
α	—	1·669	1·668, 1·662	1·668
β	1·675	—	1·673	1·674
γ	1·679	1·687	1·680	1·680

The high values for the natural face are probably due to slight enrichment in iron in the surface layer.

By immersion in methylene iodide the axial angle was found to be $2V = 74\frac{1}{2}°$, a value which happens to be identical with that calculated from the above indices.

Remarks.—In habit and physical properties these crystals agree with various monticellites previously obtained from furnace slags. The analysis presents, however, the interesting feature that 16·5 molecules per cent. must be regarded as true olivine present in solid solution, whereas in the earlier analyses the amount of lime present is sufficient to satisfy the monticellite formula $Ca(Mg, Fe, Mn)SiO_4$. The physical properties accord with this result, both the density and the mean refractive index being approximately those calculable by the rule of mixtures.[1] The rules governing the variation of the birefringence and of the axial ratios for isomorphous series are not at present sufficiently well ascertained to permit a comparison of these properties; it must suffice, therefore, to observe that the influence of the olivine present is clearly evidenced in the increased values of $a : b$ and $c : b$ in comparison with those for monticellite, and in the enhanced birefringence.

[1] It is hoped to deal more fully with this aspect of the olivine group in a later paper.