'Iron-rhodonite' (*from slag*) and pyroxmangite and their relation to rhodonite.

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THE pyroxmangite and rhodonite, here examined by X-ray methods, are from the Lewisian schists at Glen Beag, in the Glenelg district, Inverness-shire. The material was exhibited by Prof. C. E. Tilley at the meeting of the Society on November 5, 1936, and it has since been described by him.[1] The specimen of 'iron-rhodonite' was from the iron slag described by Whiteley and Hallimond, and is no. 7a in their table of analyses.[2]

The unit cell of the 'iron-rhodonite' was determined by means of the Weissenberg goniometer and the data obtained are compared in table I with Gossner and Brückl's determination for rhodonite.[3] The

Table I.

	Rhodonite.	'Iron-rhodonite.'	Pyroxmangite.
a	7·77 Å.	7·49 Å.	7·4 Å.
b	12·45	17·2	17·1
c	6·74	6·81	6·7
α	85° 10′	82° 48′	83°
β	94 4	94 20	94
γ	111 29	113 17	113

		$a:b:c$
Axial ratios	Rhodonite	0·624 : 1 : 0·541
	'Iron-rhodonite' ...	0·435 : 1 : 0·396
	Pyroxmangite	0·43 : 1 : 0·39

unit cell of pyroxmangite was determined by taking a Weissenberg photograph about the c-axis and oscillation photographs about the a- and b-axes. It has not been possible to determine the cell-dimensions of pyroxmangite as exactly as those of 'iron-rhodonite', since only very imperfect cleavage fragments were available; the

[1] C. E. Tilley, Amer. Min., 1937, vol. 22, p. 720. [Min. Abstr. 6–528.]

[2] J. H. Whiteley and A. F. Hallimond, Journ. Iron and Steel Inst., London, 1919, vol. 99, p. 201. [M.A. 1–164.]

[3] B. Gossner and K. Brückl, Centr. Min., Abt. A, 1928, p. 316. [M.A. 4–108.]

spacings and angles have here to be taken as $\pm 0{\cdot}1$ A. and $\pm 1^\circ$ respectively.

Oscillation photographs have also been taken about the *a*-, *b*-, and *c*-axes of the three minerals. The patterns of reflections on the photographs of 'iron-rhodonite' and pyroxmangite are identical and the corresponding intensities are very similar. On the photographs of rhodonite fundamental variations can be observed in the arrangement of the spots and in their relative intensities, apart from the large difference in the length of the *b*-axis.

Table II shows the intensities of the corresponding reflections of rhodonite, pyroxmangite, and 'iron-rhodonite' on Weissenberg diagrams taken about the *c*-axis. Columns 4 and 5 show the intensities on Weissenberg diagrams of 'iron-rhodonite' taken about the *a*- and *b*-axes; they may be helpful in further structure work on the mineral.

The data obtained show that the structure of the slag 'iron-rhodonite' of Whiteley and Hallimond is the same as that of pyroxmangite. On the other hand, there can be no doubt that rhodonite does not belong to the same solid solution series, although it shows many features in common. G. Tunell has already suggested the difference between pyroxmangite and rhodonite after examination of the powder photographs of the two minerals.[1]

TABLE II.

Rhodonite *c*-axis.		Pyroxmangite *c*-axis.		'Iron-rhodonite' *c*-axis.		*b*-axis.		*a*-axis.	
030	—	030	mw	030	w	001	w	030	vvw
050	vvw	050	—	050	—	002	s	070	w
070	m	070	vw	070	vw	003	ms	080	vw
080	—	080	vvw	080	vvw	004	vvw	090	vvw
090	—	090	w	090	w	007	vw	0.10.0	s
0.10.0	—	0.10.0	s	0.10.0	ms	008	vvw	0.14.0	vw
100	w	100	—	100	w	100	m	0.17.0	vw
200	s	200	m	200	m	200	ms	001	w
300	m	300	w	300	mw	300	vw	002	m
400	w	400	- -	400	—	$10\bar{5}$	w	003	w
$1.\overline{10}.0$	w	$1\bar{6}0$	vvw	$1.\overline{14}.0$	w	101	s	015	mw
$1\bar{8}0$	vw	$1\bar{5}0$	vvw	$1\bar{5}0$	—	102	s	014	m
$1\bar{3}0$	s	$1\bar{4}0$	vs	$1\bar{4}0$	s	104	w	013	m
$1\bar{2}0$	vvw	$1\bar{3}0$	w	$1\bar{3}0$	—	106	vvw	026	m

s = strong, m = medium, w = weak, vs = very strong, &c.

[1] G. Tunell in E. P. Henderson and J. J. Glass, Amer. Min., 1936, vol. 21, p. 293. [M.A. 6–528.]

TABLE II (*continued*).

Rhodonite *c*-axis.		Pyroxmangite *c*-axis.		'Iron-rhodonite' *c*-axis.		'Iron-rhodonite' *b*-axis.		'Iron-rhodonite' *a*-axis.	
140	vw	160	vw	160	vw	107	vvw	027	m
170	s	1.10.0	vs	1.10.0	vs	108	vvw	$02\bar{4}$	vs
$2\bar{6}0$	vw	$2\bar{4}0$	m	$2\bar{4}0$	ms	$20\bar{3}$	vw	$02\bar{3}$	w
$2\bar{3}0$	ms	$2\bar{1}0$	m	$2\bar{1}0$	m	201	vs	$02\bar{2}$	w
$2\bar{2}0$	vvw	230	—	230	vw	202	w	033	vw
$2\bar{1}0$	m	240	vw	240	vw	203	m	$03\bar{2}$	w
220	vw	250	mw	250	mw	$30\bar{2}$	w	$03\bar{3}$	w
230	vw	260	vvs	260	vvs	303	ms	043	w
240	vs	270	vw	270	vw	304	w	042	mw
250	w	280	vw	280	—	305	vw	$05\bar{4}$	m
2.10.0	vw	290	w	290	w	306	vvw	054	w
2.11.0	vw	2.13.0	vw	2.13.0	w	$40\bar{1}$	w	067	ms
$3.\bar{10}.0$	vvw	2.14.0	w	2.14.0	w	403	m	066	w
$3\bar{3}0$	mw	2.16.0	vw	2.16.0	mv	404	m	$06\bar{2}$	s
$3\bar{2}0$	w	$3\bar{4}0$	vvw	$3\bar{4}0$	vw	$50\bar{2}$	w	084	w
310	ms	310	w	310	mw	506	w	083	w
320	w	320	mw	320	m	505	s	082	w
340	w	330	w	330	mw	601	m	0.10.2	vvw
3.11.0	w	360	ms	360	mw	606	w	$0.10.\bar{1}$	m
$4\bar{9}0$	vvw	390	vw	$4\bar{8}0$	w			$0.10.\bar{2}$	w
$4\bar{2}0$	s	3.16.0	w	$4\bar{2}0$	m			$0.11.\bar{1}$	mw
410	m	420	w	420	ms			0.11.1	ms
440	vw	460	w	450	w			0.12.6	m
480	w	4.12.0	m	460	w			$0.12.\bar{4}$	vw
490	vw	4.13.0	m	4.12.0	mw			0.14.2	w
510	s			4.13.0	mw			0.14.1	s
550	m			$5\bar{7}0$	vw			0.15.2	m
610	w			$5\bar{6}0$	vvw			0.16.2	vw
620	mw			$5\bar{2}0$	w			0.16.3	w
$7\bar{1}0$	w			530	vw				
720	vw			5.10.0	vvw				
				$6\bar{2}0$	w				
				630	vw				
				640	vw				
				740	vw				

s = strong, m = medium, w = weak, vs = very strong, &c.

The indices of the planes are given according to Gossner and Brückl's orientation for rhodonite, in which (100), (010), and (001) correspond to $(\bar{1}\bar{1}0)$, $(00\bar{1})$, and $(1\bar{1}0)$ respectively referred to the axes of G. Flink (1885), as adopted in the treatises of Dana and Hintze. The first principal cleavage of all our fragments is parallel to (100), and the second principal cleavage is parallel to (001).

There is a marked similarity between the cleavage-zone distances of 'iron-rhodonite' and enstatite if the indices are correlated so that the first principal cleavages coincide.

'Iron-rhodonite'	...	9·7 [101]	...	10·4 [10$\bar{1}$]
Enstatite ...	...	8·8 [010]	...	9·1 [200]

The cell-volume V of 'iron-rhodonite' has been calculated, and its specific gravity determined by suspension in Clerici solution. The values of V, d, and the mass of the cell m show the following comparison with the values obtained by Gossner and Brückl for rhodonite:

		V.	d.	$\frac{m}{H\ (=1\cdot662\times10^{-24})}$.
'Iron-rhodonite'	...	866 Å.^{3}	3·79	1970
Rhodonite ...	...	605	3·65	1345

It has not yet been possible to determine n, the number of molecules in the cell, with certainty, as the chemical composition is only partly known. Only the percentages of FeO (35·0) and MnO (14·5) were determined by J. H. Whiteley, and we know that the remainder is composed of $CaSiO_3$ and $MgSiO_3$. The following rough computation gives $n = 15·3$, suggesting the possibility that the number of (Fe,Mn,Mg,Ca)SiO_3 molecules in the cell might be 16, which corresponds to the number of $MgSiO_3$ molecules in enstatite.

		Percentage of weight.	Molecular ratios.	n.
$FeSiO_3$	...	64·2	0·487	9·7
$MnSiO_3$	...	26·8	0·204	4·0
$MgSiO_3$, $CaSiO_3$	...	9·0	0·083	1·6
		100·0		15·3

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