An iron-rich optically-positive hypersthene from Manchuria.

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In a recent paper[1] the occurrence was described of a very iron-rich orthorhombic pyroxene in thermally metamorphosed iron-rich rocks in Manchuria. The crystals are commonly 2–5 cm. in length, but some are larger, and they are accompanied by grunerite, small garnets, and disseminated magnetite. Some of these crystals are optically positive, and the following data were obtained on one crystal.

	Wt. %.	No. of atoms on basis of 6 oxygens.		
SiO_2 ...	45·95	1·975		2·000
Al_2O_3 ...	0·90	0·046	0·025	
			0·021	
TiO_2 ...	0·10	0·003		(Fe+Mn) as % of (Fe+Mn+Mg) = 88 %.
Fe_2O_3 ...	0·31	0·010		
FeO ...	41·65	1·491		1·998
MnO ...	5·02	0·182		
MgO ...	3·49	0·225		
CaO ...	1·43	0·066		
H_2O+ ...	0·65	—		
H_2O- ...	0·09			
	99·59			Analyst, N. F. M. Henry.
Sp. gr. ...	3·88			

The refractive indices measured ($\pm 0{\cdot}001$) in sodium-light are:

α 1·755, β 1·763, γ 1·773, $\gamma - \alpha$ 0·018. 2V 83° $\pm$ 2°.

Pleochroism very weak, α yellowish, β and γ greenish. Dispersion very strong, $r > v$ (over γ). The orthorhombic symmetry was verified by X-ray photographs.

The most recent diagram of optic properties in the orthorhombic

[1] K. Tsuru, A remarkable association of several thermal and stress minerals in the Yu hsi kou iron-bearing district. Memoirs of the Ryojun College of Engineering, Manchuria, 1935, vol. 8, no. 8, p. 174.

pyroxenes[1] shows the variation up to 83 % mol. $(Fe+Mn)SiO_3$, but if these curves are slightly extrapolated it is found that the new data fall perfectly on to them. The form of the 2V curve in this region is such that a very small change in the percentage of the end-molecules produces a very large change in the optic axial angle, and different values of 2V can be obtained from adjacent crystals. For a mineral with 85 % mol. $(Fe+Mn)SiO_3$, $2V = 90°$, and for higher percentages of this end-molecule the mineral becomes optically positive. This shows the existence in this series of an optically positive region which extends to 15 % from the iron end-molecule and which balances the enstatite region at the other end of the series. It is proposed that the name 'orthoferrosilite', put forward previously (N. F. M. Henry, 1935, p. 225) for the $FeSiO_3$ molecule in this series in analogy with the 'clinoferrosilite' of Bowen, should apply also to minerals of this series with up to 15 % mol. $MgSiO_3$. The actual mineral for which data has been given above could then be described as $En_{12}Of_{88}$.

The discovery of this mineral is of importance for two reasons. It shows the existence of an optically positive region exactly corresponding to the enstatite area and, although it extends our knowledge of the series only 5 % nearer the end-molecule, it does show the approximate correctness of the curves for the various properties as far as these have been drawn. It seems quite probable that still more iron-rich members of this series will be discovered.

A few grains of this mineral were heated in an evacuated silica tube by means of an electric furnace with a thermo-regulator. When held at 934° C. for 2½ hours the mineral showed no change, but when held at 940° C. for the same period of time, each crystal inverted to a disoriented aggregate of coarsely twinned monoclinic crystals, exactly as described by N. L. Bowen and J. F. Schairer.[2] This temperature is rather lower than would have been expected from their diagram (loc. cit., p. 164), but the form of the inversion curve (KY) is not very well known in this region, while the effect of other constituents on the inversion point is unknown. The monoclinic form has γ 1·780, which fits on to the curves given by N. L. Bowen and J. F. Schairer (loc. cit., p. 198).

[1] N. F. M. Henry, Some data on the iron-rich hypersthenes. Min. Mag., 1935, vol. 24, pp. 221–226.

[2] N. L. Bowen and J. F. Schairer, The system $MgO-FeO-SiO_2$. Amer. Journ. Sci., 1935, ser. 5, vol. 29, p. 169. [M.A. 6-352.]