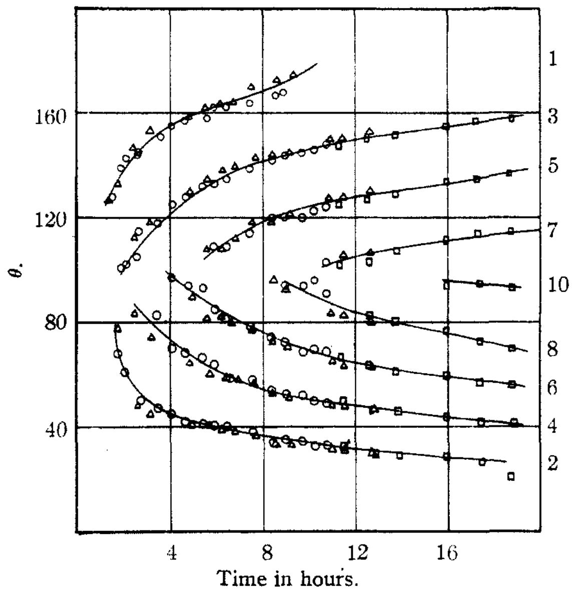

Fig. 1.—Position of orders in a growing sulfur sol as a function of time: ○, run 5; Δ, run 7; □, run 11.

shown in Fig. 1. In this figure, θ is the angle made with the negative direction of incident light propagation by the ray scattered to the observer. The curves are numbered according to the direction in which the orders move as the droplets grow. The θ values for odd numbered curves increase with time while the θ values decrease with time for even numbered curves. The orders corresponding to even-numbered curves are polarized in a horizontal direction (to the plane determined by the ray to the observer and the incident light ray), while for the odd-numbered orders the polarization is in a vertical direction.

These data were obtained at 25°. Exploratory runs at 40° indicate an approximate doubling of the rate of obtaining a given size for a 15° rise in temperature. A study is being made of the rate of growth of sulfur particles as a function of temperature and concentration.

These data can be correlated approximately at this time with unpublished data of Barnes and LaMer on the transmission of light by similar monodispersed sols. They show that after five hours the droplets have grown to 0.4 μ radius and after nineteen hours to 0.6 μ. Microscopical examination of a five-hour sol prepared similarly showed uniform particles of about 0.4 μ.

A more accurate correlation between particle size and the position of orders is being investigated.

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THE STRUCTURE OF CUBANITE, $CuFe_2S_3$ AND THE COÖRDINATION OF FERROMAGNETIC IRON

Sir:

The structure of cubanite is of particular interest since this mineral is ferromagnetic. The solution of its structure has shown that the coördination of the iron atoms is unique.

Cubanite is orthorhombic, space group[1] *Pcmn*. The cell has the following dimensions, $a = 6.45$, $b = 11.095$, $c = 6.221$ *kX*. This cell contains 4 $CuFe_2S_3$. The structure has been uniquely determined with the aid of intensity data derived from Weissenberg photographs made with molybdenum radiation. The copper atoms and one-third of the sulfur atoms each occupy the equipoint 4*c* (reflection planes), while the iron atoms and the remaining sulfur atoms are in the general position, 8*d*. The structure is defined by the following approximately determined parameters (origin at inversion center)

	(*u*) *x*	*y*	(*v*) *z*
Cu	$^7/_{12}$	($^1/_4$)	$^1/_8$
S_1	$^{11}/_{12}$	($^1/_4$)	$^1/_4$
Fe	$^1/_{12}$	$^1/_{12}$	$^1/_8$
S_2	$^5/_{12}$	$^1/_{12}$	$^1/_4$

The metals are each surrounded by four sulfur atoms in almost undistorted tetrahedral coördination. The sulfur atoms are also surrounded by four metals in tetrahedral coördination. The environment of the S_1's is an almost undistorted tetrahedron of two copper atoms and two iron atoms while the environment of the S_2's is a distorted tetrahedron of three iron atoms and one copper atom. The structure may be regarded as made up of vertical slices of the wurtzite arrangement (containing and surrounding the symmetry plane of cubanite), joined to identical but inverted slices by means of the sharing of one of the edges of each iron coördination tetrahedron.

The structure is unusual in that one edge of the tetrahedral coördination of each iron atom is shared with that of another iron atom. As a consequence of this, the iron atoms are brought together in pairs across the shared edges. This strongly suggests that the iron atoms, in addition to being bonded to four sulfur atoms, are bonded to one another in pairs. This unusual bond arrangement is doubtless the cause of the ferromagnetism of the crystal.

A detailed account of the structure determination, together with refined parameters, will appear elsewhere.

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(1) M. J. Buerger, *Amer. Mineral.*, **22**, 1117–1120 (1937).