LETTERS TO THE EDITORS

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Two New British Minerals

A WHITE mineral coating joint-faces in quarries in the Northampton Ironstone (Inferior Oolite) was long ago recorded as allophane. During the six-inch geological survey of that ironstone field during 1939–44 comparable material was widely recognized, and this note is published with the concurrence of the Director of the Geological Survey and Museum.

Exceptional developments were observed at the Lodge Pit of the Irchester Ironstone Co., two miles south of Wellingborough. Here the white material is present in its usual form as a wall coating associated with limonite and gypsum; but there are also widened joints or fissures up to one foot across occupied by white mineral enclosing fragments of oxidized ironstone. The white matrix of this fissure breccia includes compact, white mineral with a conchoidal fracture and a white plastic clay-like mineral.

Preliminary optical examination by Dr. J. Phemister had suggested the presence of more than one mineral, and it was noteworthy that the plastic material rapidly loses water in air and crumbles to a white powder which on wetting does not regain its plastic character. The air-dried material is fine-grained, anisotropic, with a mean refractive index close to 1·510.

X-ray examination reveals two predominant powder patterns, one corresponding to the fully hydrated mineral with longest spacing 12·9 A.; and a second pattern, easily distinguished from the first, with a longest spacing of 9·2 A. The pattern of the fully hydrated mineral was obtained free from that of the air-dried mineral by X-ray examination of a wet sample which had been kept in contact with water and sealed in a lithium-glass capillary. A few specimens yielded the X-ray halo pattern characteristic of allophane (hydrated aluminium silicate), and halloysite was also identified.

The silica percentages recorded by Mr. C. O. Harvey in the following partial analyses, made in the Geological Survey Chemical Laboratory, of two air-dried samples (Nos. 1 and 2) probably correspond to admixture of up to 5 per cent of allophane.

Chemical analyses of the new basic aluminium sulphate, basaluminite

	1	2	Composition for calc. $2Al_2O_3.SO_3.10H_2O$
	%	%	%
SiO_2	2·4	3·6	—
SO_3	15·6	14·2	17·2
Al_2O_3	43·0	41·3	44·0
Fe_2O_3	0·3	0·2	—
P_2O_5	tr.	1·0	—
Water (by difference)	38·7	39·7	38·8

The composition of the air-dried material is close to that of the mineral felsobanyite; but powder photographs of specimens of the latter in the British Museum collections are quite different from those of the Irchester minerals. It is suggested that the air-dried mineral should be called basaluminite to distinguish it from aluminite $Al_2O_3.SO_3.9H_2O$. The water content of the fully hydrated mineral with the longest spacing 12·9 A., for which the name hydro-basaluminite is suggested, is still unknown. Specimens maintained under conditions of constant temperature and humidity approach constant weight very slowly. Hydro-basaluminite loses approximately 50 per cent by weight at 16° C. in ten days, before it reaches constant weight and yields only the powder pattern of basaluminite.

As the plastic mineral can only be preserved indefinitely in the presence of water, it may well be that if suitable precautions are taken in the collection and preservation of other clays and clay-like substances other hydro-varieties of known minerals may be discovered.

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Structure of Co_2Al_9

IN an earlier note[1] the determination of the unit cell and space-group of the phase which exists in equilibrium with the restricted solid solution of cobalt in aluminium was described. The ideal composition was shown to be represented by the formula Co_2Al_9. The space-group is P_{2_1}/a, and recent work has given more accurate values of the parameters, as follows: $a = 8·5565 \pm 0·0005$ A., $b = 6·290 \pm 0·005$ A., $c = 6·2130 \pm 0·0005$ A., $\beta = 94·760° \pm 0·005°$.*

From X-ray data obtained with molybdenum $K\alpha$ radiation it has proved possible to determine the structure by Fourier methods. Patterson projections on (010) and (001) together with a Patterson–Harker three-dimensional section at $(x\frac{1}{2}z)$ gave an indication of the positions of all twenty-two atoms in the unit cell. These positions were then confirmed, and the parameters refined, by two-dimensional Fourier synthesis. Final values of the parameters are:

Atom	x	y	z	
Co	0·333	0·615	0·265	± 0·001
Al_0	0	0	0	
Al_1	0·268	0·962	0·405	
Al_2	0·231	0·290	0·089	
Al_3	0·999	0·193	0·389	
Al_4	0·042	0·615	0·216	

The structure can be described as consisting of layers of aluminium atoms lying approximately in the planes $(0yz)$, $(\frac{1}{2}yz)$, etc., with cobalt atoms lying between the planes, slightly nearer to the planes at $x = \frac{1}{4}, \frac{3}{4}$. This layer structure is related to the habit of the crystals, which grow as plates parallel to the (100) plane. Each Co has a regular array of nine nearest neighbours—four in the plane $(\frac{1}{2}yz)$, four in the plane $(\frac{1}{4}yz)$ and one in the plane $(0yz)$, say; and these polyhedra of Al atoms are arranged with shared edges and corners in the (0 and $\frac{1}{2}yz$) planes, and shared edges in the $(\frac{1}{4}, \frac{3}{4}yz)$ planes. Observed values of interatomic distances lie for Co-Al within the range 2·38–2·52 A., and for Al-Al within the range 2·70–3·00 A.; the former are low compared with Pauling's predicted values[2], while the latter agree reasonably well.

An estimate of the number of electrons contained within the Co peak in the $(h0l)$ and $(hk0)$ Fourier syntheses, based on the assumption that the

* Note that here the x and z axes have been interchanged, compared with those given in ref. (1).