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1956/61

KASOLITE FROM THE EL SHARANA MINE, SOUTH ALLIGATOR RIVER, N.T.

by

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Two specimens from the El Sharana Mine, South Alligator River, N.T., were submitted by J. H. Lord of the Darwin office for determination of a radioactive mineral which occurred as encrustations along joints and cracks in a bluish-black carbonaceous, silicified, shaly rock. The mineral varied in colour from a bright orange to orange-brown, and formed thin encrustations ranging up to 0.5 mm in thickness. The encrustations consisted of acicular crystals ranging from 0.06 to 0.3 mm in length, and having an adamantine lustre. They form a felted mass on which occasional radial aggregates are developed. Isolated rosettes of crystals are also scattered over the shale away from the main encrustations. Tested on the Austronic B.G.R.I. counter, the mineral gave more than 20,000 C.P.M., which is the maximum reading of the instrument.

A qualitative spectrographic analysis gave strong positive results for lead, uranium and silica. Taken in conjunction with the optical data (see below), these results suggested that the mineral is the hydrated lead uranium silicate, kasolite, a mineral which had previously been described only from the Belgian Congo and, very recently, from Scotland.

To further test this possibility, a mixture consisting of 38% PbO, 48% UO_2, and 10% SiO_2 * — the approximate theoretical composition of kasolite — was prepared from spectrographically pure chemicals. A weighed quantity of this mixture was then arced under identical conditions as a sample of the same weight of the pure mineral scraped from the specimen. Comparison of the two spectrograms on the densitometer showed that the composition of the artifical mixture and the mineral sample were the same (see plate).

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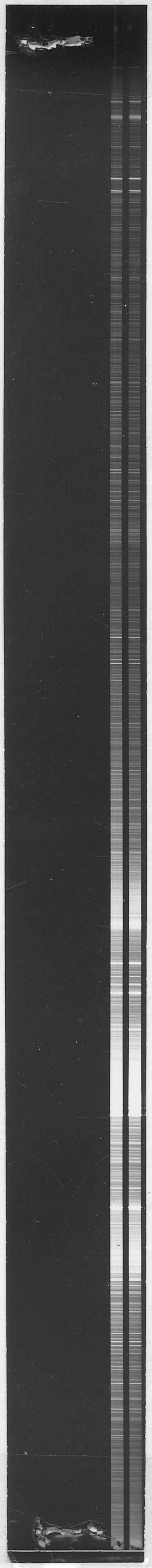
* Four percent of gelatine was added to make up for water of crystallization in kasolite.

No X-ray powder diffraction data are available for this mineral, so the following spacings are listed for future reference.

Cobalt K_α radiation - $\frac{d}{n}$ in kX units	
I	$\frac{d}{n}$
2	6.34
1	6.04
2	4.16
6	3.50
10	3.22
7	3.038
8	2.891
1	2.716
1	2.637
½	2.459
½	2.395
½	2.344
6	2.162
½D	2.106
½	2.023
6	1.954
5	1.866
6	1.729
7	1.667
2D	1.451
2D	1.362
2D	1.325
2D	1.295



Spectrograms from the region 5000Å to 2800Å showing perfect match.
Top Spectrum - sample prepared from "specpure" chemicals of the composition of kasolite.
Bottom Spectrum - actual mineral from "El Sharana" Mine.

The optical properties of the mineral have been determined as follows:

> $N_x = 1.955$, $N_y = 1.96$, $N_z = 1.98$; biaxial with (+)$2V = 50°$ to $52°$; extinction near $0°$; pleochroic with X = Y = bright yellow, and Z = colourless to very pale grey; crystals length-fast, acicular, prismatic with pyramidal terminations, and flattened parallel to b.

Refractive indices are only approximate, but are of the correct order of magnitude. It has not been possible as yet to standardise the immersion media employed in the determinations, though the liquids probably differ from their rated values only in the third decimal place. D'Arcy George (1) lists the refractive indicies of kasolite as $N_x = 1.877$, $N_y = 1.880$, $N_z = 1.935$; Larsen and Berman as $N_x = 1.895$, $N_y = 1.910$, $N_z = 1.950$; and Winchell as $N_x = 1.89$, $N_y = 1.90$, $N_z = 1.967$. As it has been spectrographically established that the El Sharana kasolite has approximately the same composition as analysed specimens of this mineral, even though its refractive indices are considerably higher, it is apparent that its refractive indices must depend to some extent on other factors, the most important one probably being the degree of hydration.

Pleochroism, where observed, is strong and distinctive, but only few crystals show the pleochroism noted. This is due to the strong development of certain prism faces, with the relative subordination of the pinacoids, so that when held in fluid immersion media most crystals tend to rest in such a position that only the X and Y vibration directions are observed. The crystals are too small to permit goniometric measurements.

Most crystals are euhedral, elongated prismatic with perfectly developed prism faces and equally perfect pyramidal terminations at their free ends. There is a weak to moderately well expressed basal cleavage which produces a stepped appearance on transversely broken crystals.

Kasolite is a hydrated lead uranium silicate having the formula $PbO.\ UO_3.\ SiO_2.\ H_2O$ (D'Arcy George); $Pb_2\ U_2O_4\ Si_2O_8.\ H_2O$ (Winchell); or $3PbO.\ 3UO_3.\ 3SiO_2.\ 4H_2O$ (Larsen and Berman). An inspection of these formulae shows that the proportions of the oxides of lead, uranium and silica to one another remain constant, but that the degree of hydration shows some variation. This variation in water of crystallisation probably accounts for the observed differences in refractive indices.

References

1. D'Arcy George, 1949. U.S. Atomic Energy Comm. RMO-563, p.197.

2. Larsen and Berman, 1934. U.S.G.S. Bull.848, p. 142.

3. Winchell, A. N., 1951. ELEMENTS OF OPTICAL MINERALOGY; 4th ed., p.530, NEW YORK, John Wiley and sons, Inc.