

THE AMERICAN MINERALOGIST, VOL. 45, SEPTEMBER-OCTOBER, 1960

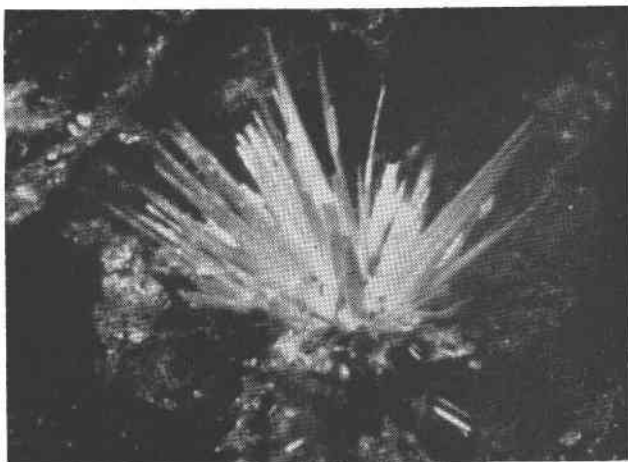
DEHYDRATION AND REHYDRATION OF FERRIMOLYBDITE  
FROM LOWTHER, NEW SOUTH WALESH. G. GOLDING, P. BAYLISS AND N. TRUEMAN,  
*The University of New South Wales.*

Powder diffraction data has been obtained for ferrimolybdate collected during 1959 from the surface of old prospecting shafts near Lowther, 90 miles west of Sydney, New South Wales. At this locality joint fissures in a porphyritic marginal phase of the Bathurst granite batholith are occupied by hydrothermal quartz veins containing small disseminated aggregates of intimately associated molybdenite, pyrite and chalcopyrite which have partly weathered to ferrimolybdate and goethite.

In addition to films of dull yellow ferrimolybdate coating fracture surfaces in the quartz, the Lowther specimens show radiating groups of sheaf-like units (Fig. 1) of bright yellow colour and silky lustre. Each unit, from 1 to 2 mm. long and about 0.2 mm. wide is itself a bundle of closely packed sub-parallel fibrous crystals. The sheaf-like units are partly embedded in goethite and project into the cells of goethite box-works or into cavities in the quartz formerly occupied by sulphides.

Single fibres, from 1 to 2 mm. long and about 2 microns wide, are transparent, with refractive indices approximately 1.75 across and 1.8+ along the length and show strong lengthwise light absorption, straight extinction and high birefringence.

The soft and friable character ( $H=1$ ), colour change from yellow through gray to orange on heating strongly and a chemical analysis on

FIG. 1. Ferrimolybdate from Lowther, New South Wales.  $\times 25$ .

0.5 gm. of goethite-contaminated material served to further verify the mineral as ferrimolybdate (Palache, Berman and Frondel, 1951).

In view of the reported ease with which ferrimolybdate loses water in a warm dry climate (Simpson, 1951) and because the samples although collected during a wet season had been subsequently stored for periods up to several months under variable conditions of summer humidity and temperature, reaching 40° C., x-ray determinations have been made on deliberately humidified and dehydrated as well as on untreated powder obtained from the bright yellow well-crystallized material after detaching adherent goethite under the binocular. The samples so obtained were slightly contaminated with quartz, molybdenite and goethite.

X-ray data (Table 1) was obtained by using the powder method, sample 1a by means of the geiger diffractometer and the rest photographically. Single crystal data was not obtained because of the small size and fragility of the fibrous crystals.

The sample treatment was as follows:

- 1a: Untreated.
- 1b: Untreated, water-mounted rod.
- 1c: Untreated, glycerol-mounted rod.
- 1d: Humidified over water for 100 hours, water-mounted rod.
- 1e: Desiccated over H<sub>2</sub>SO<sub>4</sub> for 50 hours, humidified over water for 100 hours, water-mounted rod.
- 2a: Heated at 50° C. for 1 hour, desiccated over silica gel for 50 hours, glycerol mounted rod.
- 3a: Desiccated over H<sub>2</sub>SO<sub>4</sub> for 50 hours, glycerol-mounted rod.
- 3b: Desiccated over H<sub>2</sub>SO<sub>4</sub> for 50 hours, heated at 50° C. for 100 hours, glycerol-mounted rod.
- 4a: Heated at 100° C. for 1 hour, glycerol-mounted rod.
- 4b: Heated at 250° C. for 1 hour, glycerol-mounted rod.

Where no significant differences in diffraction patterns are perceptible the data are combined.

The x-ray data indicate that the bright yellow, well-crystallized ferrimolybdate was fully hydrated as collected and suffered no perceptible change during storage under normal conditions of summer temperature and humidity. This ferrimolybdate gives characteristic lines of strongest intensity at 9.9 and 8.4 Å.

Progressive dehydration, however, results in significant variations in these low angle reflections indicating the progressive collapse of the crystal structure accompanying loss of water or hydroxyl groups. The data and the line clarity of the photographs suggest that this collapse takes place in definite stages.

The changes observed correspond broadly to the progressive weight

TABLE 1. X-RAY DIFFRACTION DATA FOR FERRIMOLYBDITE

Samples 1a to 1e		Sample 2a		Samples 3a, 3b		Samples 4a, 4b	
$d$ Å	I	$d$ Å	I	$d$ Å	I	$d$ Å	I
9.87	100						
8.40	55	8.40	50				
7.70	2	7.70	50	7.70	100		
6.73	20	6.73	5	6.73	20		
5.91	1	5.91	20	5.91	20	5.91	20
5.83	1	5.83	20	5.83	20	5.83	20
5.16	4						
		5.06	100	5.06	50	5.06	50
4.90	2						
		3.90	40	3.90	20		
3.50	5						
3.20	4	3.20	4	3.20	2		
3.08	20	3.08	60	3.08	60	3.08	100
		2.87	5	2.87	5	2.87	5
2.80	1						
2.70	2	2.70	2	2.70	2	2.70	2
2.59	2	2.59	2	2.59	2	2.59	2
2.55	2	2.55	2	2.55	2	2.55	2
2.50	1						
		2.17	1	2.17	1	2.17	1
		1.95	1	1.95	1	1.95	1
1.78	2	1.78	1	1.78	2	1.78	2
1.73	1	1.73	1	1.73	1	1.73	1
1.70	1						
1.63	4	1.63	1	1.63	2	1.63	2
1.61	2	1.61	1				
1.52	2	1.52	2	1.52	2	1.52	4

loss and to the progressive colour variation accompanying the progressive dehydration of ferrimolybdate from Western Australia as recorded by Simpson (1951).

After partial dehydration as for sample 3a, it is found that humidification will restore the sample to the fully hydrated condition as shown by sample 1e.

## REFERENCES

- PALACHE, C., BERMAN, H., AND FRONDEL, C. (1951), *The System of Mineralogy*, II, 1096. Wiley, New York.
- SIMPSON, E. S. (1951), *Minerals of Western Australia II*, 280-83, Govt. Printer, Perth.