group *Bbam* rather than to *Bba*2. Both space groups are being considered in the structure investigation.

The Unit Cell of Linarite

L. G. Berry, *Queen's University, Kingston, Ontario, Canada*

Linarite, a basic sulphate of lead and copper, occurs in deep azure blue monoclinic crystals. The colour is distinctly brighter than azurite. The crystals are elongated along *b* and have been described as tabular on *c*(001) also on *s*($\bar{1}$01). The opportunity to make a single crystal *x*-ray study of this mineral was provided by a specimen of linarite with cerussite from Red Gill, Cumberland from the mineral collections of Queen's University. Two other specimens yielded material for this study, one labelled "mixite" (Queen's Museum) from American Eagle Mine, Tintic, Utah, and the other from an unknown locality. Much of the formal work was done as student exercises in a graduate course at Queen's University.

Rotation, Weissenberg and later Precession films yield the following crystal lattice dimensions expressed in terms of two closely similar unit cells.

I	$a=9.70$	$b=5.65$	$c=4.68$ A,	$\beta=102°40'$
II	$a=9.80$	$b=5.65$	$c=4.68$ A,	$\beta=105°04'$

The systematic extinctions, (0*k*0) present only with $k=2n$, are characteristic of the space group $P2_1/m$ in either setting. Morphological studies indicate holohedral symmetry for linarite.

The unit cell dimensions give axial ratios in close agreement, I with Kokscharov (1869, Dana, *System*, 1892) and II with Goldschmidt (*Winkeltabellen*, 1897).

I	$a:b:c=1.7168:1:0.8283$	$\beta=102°40'$
	$a:b:c=1.71613:1:0.82962$	$\beta=102°37\frac{1}{2}'$ (Kokscharov)
	$a:b:c=1.7216:1:0.8297$	$\beta=102°41'$ (Robertson, 1925, *Min. Abs.* **3**, 295, 1928)
II	$a:b:c=1.7346:1:0.8283$	$\beta=105°04'$
	$a:b:c=1.7352:1:0.8296$	$\beta=105°11'$ (Goldschmidt)

The structural setting (I), which has the least oblique cell is the setting chosen by Kokscharov (1869) and followed by Dana (1892). Our crystals all show flattening on *s*($\bar{1}$01). In Goldschmidt's setting the plane of flattening becomes *c*(001). The settings are related by the transformation formula $\bar{1}0\bar{1}/010/001$ (Kokscharov to Goldschmidt).

Table 1 gives the *x*-ray powder pattern for linarite indexed as far as the spacing 2.09 A. The measured spacings are in substantial agreement with the data given by Waldo (*Am. Mineral.*, **20**, 575, 1935). The pattern is reproduced in Figure 1.

New determinations of the specific gravity of linarite

5.30 Red Gill, Cumberland (Berman balance)
5.25 Mono County, California } C. Frondel, private
5.26 Rezbanya, Hungary } communication—May 13, 1946

combined with the volume of the unit cell and any of the closely agreeing analyses clearly indicate a structural formula:

$$2PbO \cdot 2CuO \cdot 2SO_3 \cdot 2H_2O = 2[PbCuSO_4(OH)_2]$$

with calculated specific gravity 5.319.

TABLE 1. LINARITE—$PbCuSO_4(OH)_2$: *X*-RAY POWDER PATTERN
Monoclinic, $P2_1/m$; $a=9.70$, $b=5.65$, $c=4.68$A, $\beta=102°40'$; $Z=2$

I	*d*(meas.)	*hkl*	*d*(calc.)	*I*	*d*(meas.)	*hkl*	*d*(calc.)	*I*	*d*(meas.)	*hkl*	*d*(calc.)
2	4.82A	110	4.851A	1	2.81A	020	2.825A			410	2.182A
4	4.48	$\bar{1}01$	4.518	1	2.68	120	2.707	4	2.16A	311	2.181
7	3.53	210	3.628	3	2.56	$\bar{3}11$	2.587			$\bar{1}12$	2.161
		011	3.551	1	2.39	021	2.402			320	2.105
		300	3.155			$\bar{1}21$	2.395	4	2.09	$\bar{2}02$	2.097
10	3.12	111	3.153	3	2.30	$\bar{4}01$	2.318			$\bar{3}02$	2.078
		$\bar{2}11$	3.105	3	2.24	$\bar{2}02$	2.259				
2	2.94	201	2.977			$\bar{2}21$	2.249				

I	*d*(meas.)	*I*	*d*(meas.)	*I*	*d*(meas.)	*I*	*d*(meas.)	*I*	*d*(meas.)
6b	1.791A	½	1.532A	1	1.324A	½	1.118A	1b	0.869A
1	1.758	½	1.514	½	1.299	2	1.056	1b	0.860
½	1.734	1	1.492	½	1.287	1	1.047	1b	0.849
2	1.675	½	1.439	1	1.214	½	1.025	2b	0.839
½	1.631	1	1.400	2	1.192	1	0.993	½b	0.830
½	1.610	1	1.375	1	1.152	1	0.914	1	0.821
3	1.566	½	1.347	½	1.130	1b	0.896	1	0.813

b—broad line; using CuKα=1.5418A, mass factor 1.6602.

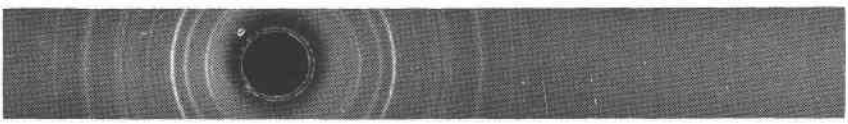

FIG. 1.—*X*-ray powder photograph, Cu/Ni radiation, 1°θ=1 mm. on film, actual size print.

THE UNIT CELL OF MAGNETOPLUMBITE

L. G. BERRY, *Queen's University, Kingston, Canada*

Magnetoplumbite was described by Aminoff (*Geol. För. Förh.* **47**, 283, 1925) from Långban, Sweden, with cell dimensions and analysis by Almström. The mineral was later re-analysed by Blix (*Geol. För. Förh.* **59**, 300, 1937); this later analysis showing the true valence state of the manganese. Adelsköld (*Ark. Kemi.*, **12** (29), 1938) determined lattice