Wilfley Table ahead of the scheelite from this mine. A binocular inspection showed a black finely crystalline powder which was later determined to be uraninite at the University of Toronto. On receipt of this information the company made a thorough search of the mine and provided a suite of ore which was considered to be the most likely for the occurrence of radioactive minerals. This material which consists largely of quartz, pyrrhotite, pyrite, chalcopyrite, and minor molybdenite, failed unfortunately to produce further amounts of uraninite. From the above it would appear that the uraninite was a local accessory mineral but its occurrence warrants a close watch on further developments at this mine and in the surrounding area.

THE CHILDRENITE-EOSPHORITE PROBLEM

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On the basis of an exhaustive optical study of the childrenite-eosphorite series, Professor C. S. Hurlbut (*Am. Mineral.*, **35,** 793–805, 1950) concludes that these minerals should be classified in the monoclinic system. Previous morphological (*Dana's Textbook of Mineralogy*, 732, 1932) and x-ray diffraction (Barnes, *Am. Mineral.*, **34,** 12–18, 1949) examinations have placed childrenite in the orthorhombic system.

Professor Hurlbut has found the same x-ray extinctions for a single and for a twinned crystal of Newry eosphorite as those previously reported by one of us (Barnes, *Am. Mineral.*, **34,** 12–18, 1949) for Tavistock childrenite. Through the kindness of Professor Hurlbut we have been able to examine crystals of his Newry eosphorite optically and have confirmed the twinning and extinction angle. We have also observed his fourlings in a crystal of childrenite ground parallel to (010). There is thus no conflict regarding the experimental data which, on the basis of x-ray diffraction symmetry alone, leads to the space group $Bba2$ or $Bbam$ but apparently must be reduced to $B2_1/a$ (with $\beta = 90°$) to accommodate the optical data.

The essential difference between the diffraction symmetry of the monoclinic space group $B2_1/a$ (with $\beta = 90°$) and that of the orthorhombic space group $Bba2$ (or, $Bbam$) is the b glide plane perpendicular to a in the latter. This can readily be observed by comparing the reciprocal lattice nets for the zero and upper levels of crystals belonging to the two space groups (see, for example, Figure 5 of a previous paper (Barnes, *Am. Mineral.*, **34,** 166, 1949) on lindgrenite $B2_1/c$ where the c glide is equivalent to an a glide and β may be visualized as 90°, and Figure 7 of a previous paper (Barnes, *Am. Mineral.*, **34,** 16, 1949) on childrenite $Bba2$).

Thus, although the *b* glide in *Bba*2 automatically introduces 2_1 along *b*, a *b* glide is not introduced in $B2_1/a$ by 2_1. In the figures mentioned it will be observed that the first levels of the a^*c^* nets, the second levels of the a^*b^* nets and the zero levels of the b^*c^* nets are not identical. In terms of extinctions, $(0kl)$ reflections should be absent when $(k+l)$ is odd in *Bba*2 due to the *b* glide, but should be present in $B2_1/a$ except in the special case $(0k0)$.

In order to be certain that possible weak reflections forbidden by *Bba*2 had not been missed in earlier work, precession photographs have been taken of crystals of Devonshire and of Cornwall childrenite and of Rumford (Black Mountain), Buckfield and Newry eosphorite. As a final test, zero level, *a* axis Weissenberg photographs of a Rumford eosphorite crystal were obtained with *Mo* radiation and various exposure times. Results are shown in Table 1.

TABLE 1

O level, *a* axis Weissenberg, *Mo* radiation

Exposure (hours)	Number of reflections		
	Observed	Possible	
		$B2_1/a$	*Bba*(2)
5	33	102	54
20	63	218	118
100	91	408	210

By "possible" reflections is meant the total number permitted by the space group over the *sin θ* range for which spots appeared on the photographs. As Table 1 shows, there were 48 more reflections possible for $B2_1/a$ than for *Bba*2 on the first film, 100 on the second and 198 on the third film. *Not one of these spots was present.* It seems most unlikely that every one was absent because its intensity was too weak to affect the film in the times of exposure employed.

There is no doubt, therefore, that a real anomaly exists between the optical and *x*-ray diffraction data in the case of the childrenite-eosphorite series. We have started a systematic structure investigation in the hope that the answer is to be found there.

In this connection we have re-examined the possible piezoelectric properties of various childrenite and eosphorite crystals using a detector modelled after that of Stokes (*Am. Mineral.*, **32,** 670–677, 1947). We have been unable to get a positive effect so that it is possible that childrenite and eosphorite, if orthorhombic, should be assigned to the space group *Bbam* rather than to *Bba*2. Both space groups are being considered in the structure investigation.

THE UNIT CELL OF LINARITE

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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, $(0k0)$ 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.