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THE MORPHOLOGY OF McKELVYITE

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Mckelvyite crystals from four subsurface occurrences in Sweetwater County, Wyoming, were described by Milton, Ingram, Clark and Dwornik (1965). The mineral is a hydrous sodium barium rare-earth uranium carbonate, and the crystals were reported to be trigonal with the space group $P\bar{3}$ with only a few reflections which violated $P\bar{3}m1$ symmetry. The cell dimensions were given as a 9.174, c 19.154 Å, and the following forms were noted: $c\{0001\}$, $m\{10\bar{1}0\}$, $-m\ \{01\bar{1}0\}$, $r\ \{10\bar{1}1\}$, e

TABLE 1. GONIOMETRIC MEASUREMENTS OF MCKELVYITE CRYSTALS

Form	Number of crystals	Number of measurements	Measured range		Weighted Mean	
			ϕ	ρ	ϕ	ρ
c 0001	18	18	—	0°00′	—	0°00′
r $10\bar{1}1$	5	20	29°02′–30°04′	66°03′–68°08′	30°01′	67°18′
z $01\bar{1}1$	6	22	29°40′–30°06′	67°02′–68°12′	30°00′	67°23′
e $10\bar{1}2$	9	41	29°32′–30°12′	49°10′–50°27′	30°00′	49°50′
g $01\bar{1}2$	9	38	29°28′–30°16′	49°00′–50°17′	30°00′	49°57′

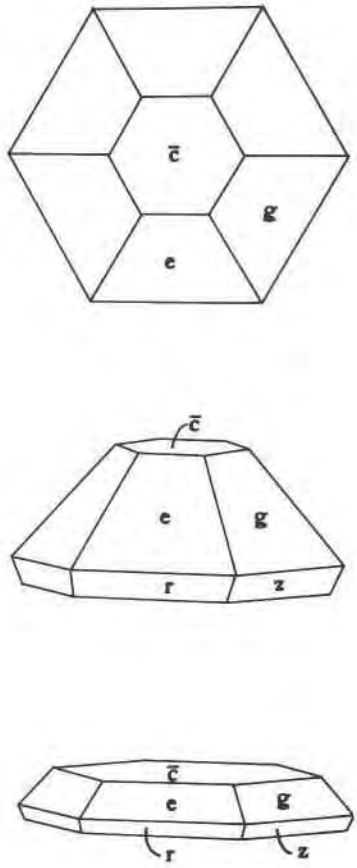

FIG. 1. Plan and projection drawings with $(000\bar{1})$ uppermost to show mckelvyite crystals in their most typical aspect. Other forms shown are $e\{10\bar{1}2\}$, $g\{01\bar{1}2\}$, $r\{10\bar{1}1\}$ and $z\{01\bar{1}1\}$.

TABLE 2 MCKELVYITE ANGLE TABLE
Ditrigonal-pyramidal—3 *m*

$a:c=1:2.077$; $p_0:r_0=2.395:1$

Form		Upper	Lower	ϕ	ρ	A_1	A_2
c	0001	x	x	—	0°00′	90°00′	90°00′
r	$10\bar{1}1$	x		30°00′	67°20′	36°57′	90°00′
z	$01\bar{1}1$	x		30°00′	67°20′	36°57′	90°00′
e	$10\bar{1}2$		x	30°00′	49°53′	48°32′	90°00′
g	$01\bar{1}2$		x	30°00′	49°53′	48°32′	90°00′

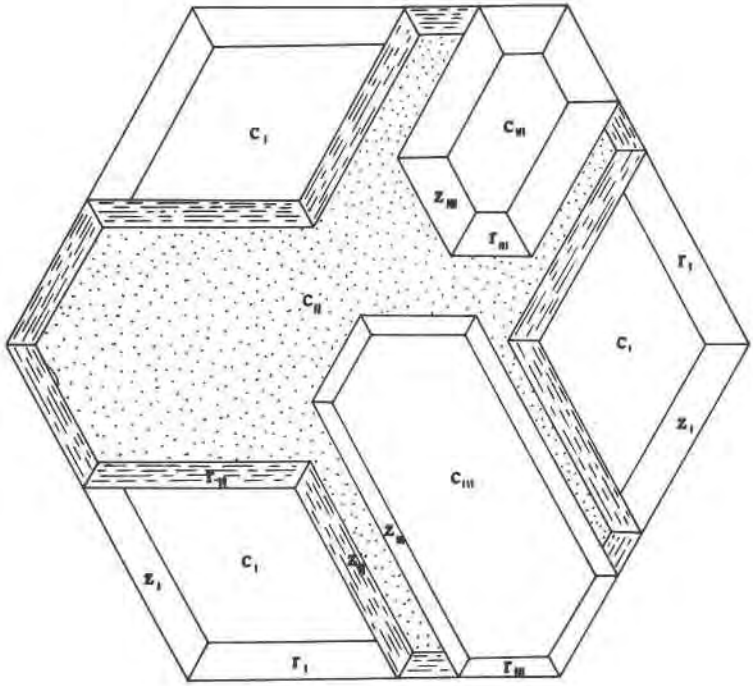

FIG. 2. Stacking of mckelvyite crystal plates in three-fold parallel array with (0001) uppermost.

$\{01\bar{1}2\}$. The present note reports the results of an independent investigation of the morphology of mckelvyite crystals.

The small size of the crystals (<0.5 mm), and the poor reflections made measurements difficult. Nine crystals were measured (Table 1). The pale green, larger crystals were expected to be morphologically different from the smaller, more platy, very dark green crystals, but all gave identical reflections and so are not distinguished from one another

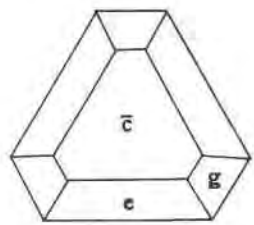

FIG. 3. Mckelvyite crystal suggesting trigonal symmetry.

in the table. Indeed, parts of some parallel crystal aggregates were found to vary from light to dark in color.

All the crystals are very simple in development with a maximum of six measureable forms. Weak and diffuse reflections were noted at times in the prism zone but were not measureable, and distinct prism faces were not observed under the microscope. An angle table is given in Table 2. The forms c $\{0001\}$, $\bar{c}$ $\{000\bar{1}\}$, e $\{10\bar{1}\bar{2}\}$, and g $\{01\bar{1}\bar{2}\}$ are dominant and usually are accompanied by r $\{10\bar{1}1\}$ and z $\{01\bar{1}1\}$ as a slight level on

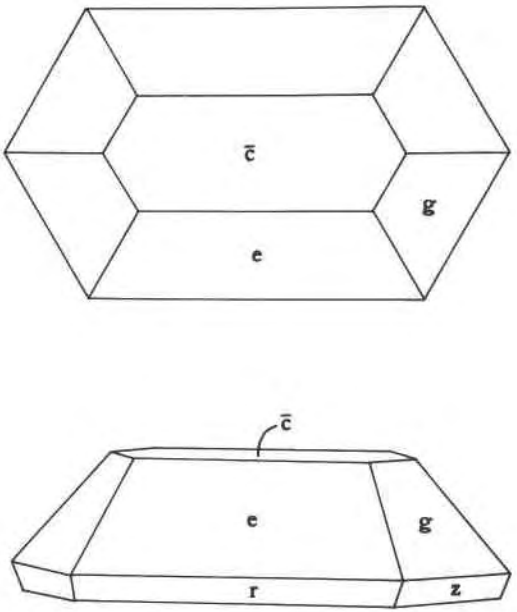

FIG. 4. Pseudo-orthorhombic appearance of mckelvyite crystals due to malformation.

the edge of the base (Fig. 1). All the crystals are decidedly hemimorphic and most appear to have the sixfold symmetry of the dihexagonal-pyramidal class, $6mm$. However, two types of malformation and a mode of aggregation suggest that they are truly ditrigonal-pyramidal, $3m$. In the original description peculiar three-fold radiating array was almost universally evident in aggregates of crystal plates (Fig. 2). Also, many crystals do not have an equant hexagonal outline but appear decidedly trigonal (Fig. 3). The possibility of space group $P3$ and the pseudo-symmetry of $P3m1$ was not mentioned previously, but these symmetries obviously are also compatible with the X-ray data. The assignment of a trigonal space group is supported by the morphological aberrations. This combined with the definite hemimorphic character of the crystals

indicates that the probable space group is $P3$ or $P3m1$ rather than $P\bar{3}$ as reported by Milton *et al.* Another kind of crystal malformation produces a pseudo-orthorhombic appearance (Fig. 4).

The axial ratio derived from goniometric measurement of the nine crystals is $c:a = 2.077$, in agreement with the ratio 2.087 from the cell dimensions of Milton *et al.* (1965).

This investigation was suggested by Prof. Charles Milton, George Washington University, and Dr. Joan R. Clark, U. S. Geological Survey after Prof. J. D. H. Donnay, The John Hopkins University called their attention to errors in the original description.

Reference

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NEW DATA ON NIGERITE[1]

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Bannister, Hey and Stadler (1947) showed that nigerite has the approximate formula (Zn, Mg, Fe) $(Sn, Zn)_2$ $(Al, Fe)_{12}$ O_{22} $(OH)_2$. They reported that it is trigonal with symmetry $\bar{3}m$, and a and c are equal, respectively, to 5.72 and 13.86 Å. The value of a is about four times the radius of an oxygen ion, while c is about six times the closest-packed oxygen interplanar distance.

Jacobson and Webb (1947) described nigerite overgrowths on the (111) planes of gahnite, and Bannister *et al.* (1947) noted the closest-packed structural correspondence in (111) of gahnite being parallel to (0001) of nigerite. McKie (1963) has pointed out the relation between nigerite, taaffeite and the högbomite polytypes, all of which have similar values of a, and values of c which are multiples of about 2.3 Å, the closest-packed oxygen interplanar distance.

In the course of a general study of polytypism, we obtained a specimen of nigerite from the Egbe District, Kabba Province, Nigeria, catalogue number M 24546 of the Royal Ontario Museum, Toronto, Canada. This material appeared to be identical to that described by Jacobson and

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