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POLIANITE PSEUDOMORPHS

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ABSTRACT

A study of the morphology, composition, x-ray data and optical properties of rare polianite pseudomorphs from Um Bogma mine, Egypt, shows that they are pseudomorphs after an unknown orthorhombic mineral.

INTRODUCTION

The manganiferous iron ore deposits of Um Bogma district, west central Sinai, Egypt, are believed to be a late Tertiary mineralization (Ball, 1916; Fenine, 1931; Attia, 1956; Gill and Ford, 1956; El-Shazly, 1957). The ore is composed essentially of pyrolusite, manganite, psilomelane, wad, goethite, and minor amounts of barite, siderite, and other rare minerals.

Very small cystals about 2 to 4 mm. in length and 0.4 mm. in diameter occur rarely in cavities in some specimens. Morphological, microchemical, x-ray, and optical examinations of the crystals was carried out by the writer (Nakhla, 1958). Additional information is included in this paper.

DESCRIPTION

The rare crystals occur as single individuals or as parallel untwinned groups, and a few exhibit a fibrous radiating structure. The crystals shown in Fig. 1, are characterized by vertical and deeply striated prisms, terminated by well developed, steep smooth pyramids, commonly with a sharp pointed end. The mineral is dark steel gray in color, with metallic lustre, and black streak. It is barely scratched by a steel needle. It possesses a perfect cleavage parallel to (010), and has an even fracture. Blowpipe tests are identical to those of polianite.

The morphological investigation shows that the system is orthorhombic, probably dibipyramidal. The calcuted ϕ and ρ values (Table I) correspond to an axial ratio $a:b:c=0.729:1:1.084$. Figures 2 and 3 illustrate the habit of the crystals. Additional tiny faces too small to give signals were located approximately by direct reflections. These are shown in Fig. 4.

A microanalysis carried out on 6.612 mg. of the dried material proved that the chemical composition of the mineral is essentially manganese dioxide (MnO_2).

An x-ray powder pattern was made using a 9.0 cm. diameter camera, Cu Kα 30 Kv, and 10 M.A, with powder mounted on glass fiber supports. There is a close agreement with polianite (or pyrolusite). Furthermore, Dr. Carapezza of Palermo University, Italy, kindly carried out an x-ray

Table I. Phi and Rho Values for (*hk*0) Faces which Yielded Sharp Reflections or Bands

hkl	Calculated values		Measured values and range		Remarks
	ϕ	ρ	ϕ	ρ	
010	00°00′	90°00′	0°55′±30′	89°41′± 6′	Weak band
140	18°58′	90°00′	18°50′±10′	89°45′±12′	Strong band—no signals
130	24°34′	90°00′	24°56′±20′	89°50′± 2′	Strong band—no signals
250	28°45′	90°00′	28°49′± 4′	89°48′±30′	Strong band—no signals
120	34°26′	90°00′	34°40′±30′	89°44′±13′	Medium band
470	38° 6′	90°00′	38° 4′±30′	89°58′± 4′	Strong band
350	39°27′	90°00′	39°45′±30′	90°21′±15′	Strong band
230	42°27′	90°00′	42°18′±18′	89°48′±24′	Strong band and sharp signal
340	45°48′	90°00′	45°36′±48′	90°11′± 8′	Weak band
450	47°40′	90°00′	47°41′± 7′	89°37′±18′	Strong band and sharp signal
670	49°37′	90°00′	49°28′±16′	89°54′±12′	Strong band and sharp signal
110	53°54′	90°00′	53°31′±49′	89°58′± 5′	Medium band
430	61°20′	90°00′	61°10′±25′	89°32′±25′	Strong band
320	64° 4′	90°00′	64° 7′±58′	89°53′±23′	Strong band
530	66°22′	90°00′	66°29′±29′	90° 3′± 4′	Strong band
210	69°58′	90°00′	69°21′±28′	89°37′± 9′	Medium band
520	73°45′	90°00′	73°15′±10′	89°45′±20′	Very weak band
310	76°18′	90°00′	77°00′±50′	89°55′±15′	Weak band
100	90°00′	90°00′	90°18′±20′	89°55′±10′	Weak band
321	64° 5′	78°36′	64° 5′±12′	78°36′±16′	Very sharp signal

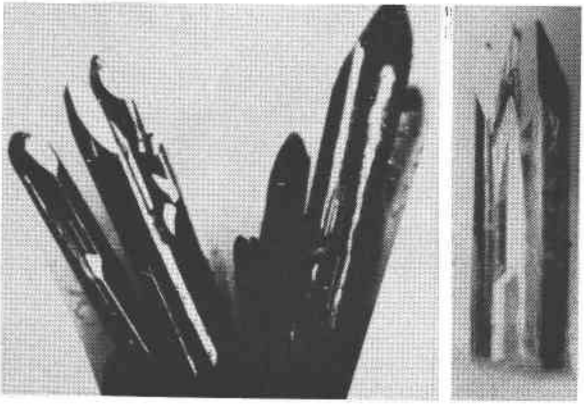
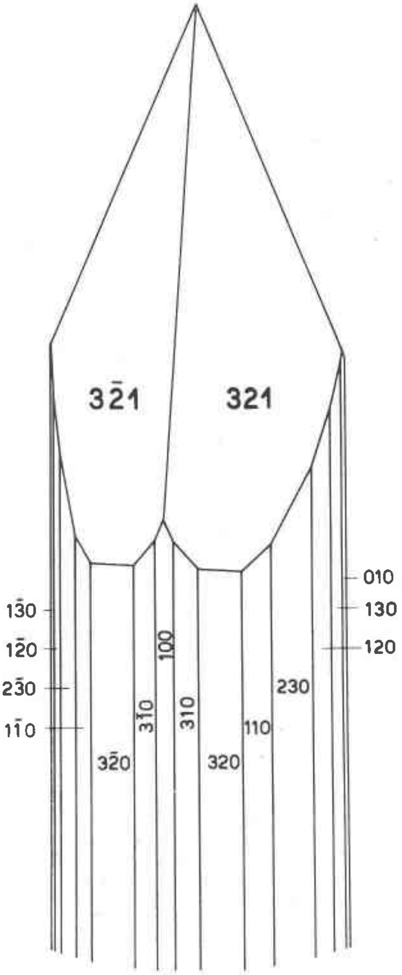


Fig. 1. Photographs of the polianite pseudomorphs. ×150.



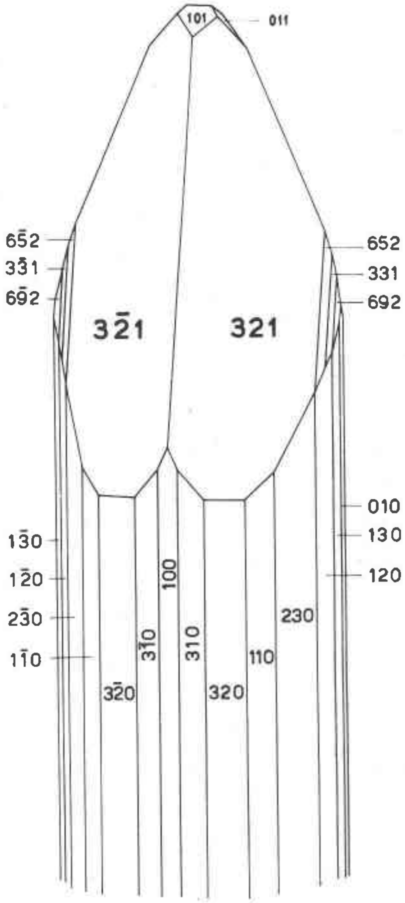


FIG. 2. (Left) Drawing showing the most common type.
FIG. 3. (Right) Habit rarely shown.

analysis on a rotating crystal, and after determining the unit-cell dimensions he concluded that the actual structure is that of polianite.

Mineralographic examination of the mineral showed that the color, reflectivity, anisotropism, and etch reactions are identical with those of polianite as given in the standard texts.

It seems obvious that we are dealing with a pseudomorph of polianite after an unknown orthorhombic mineral. Köchlin (1888) described similar pseudomorphs from Macskamezö in Hungary, which were repre-

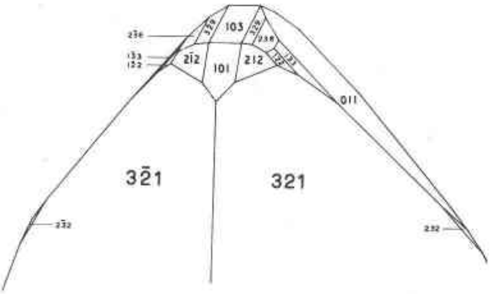


FIG. 4. Top of crystal showing the extremely small (*hkl*) faces observed by direct reflection.

sented as manganite. Similar examples were also reported by Kossmat (1905), Goldschmidt (1918) and Strunz (1943).

In the present case, however, the interfacial angles, the axial ratio, and the strange habit of these pseudomorphs do not fit those of manganite. Furthermore, the predominant and excellently developed (321) pyramidal faces which characterize these pseudomorphs, would yield very complicated symbols when referred to the manganite axial ratio. Neither does the polianite seem to be pseudomorphous after huebnerite, lepidocrocite or kentrolite.

There is an apparent close relation between the crystallographic data here given and that for the mineral lautite (CuAsS), although this seems improbable because of their chemical compositions. If the indices assigned to these pseudomorphs have the last figure doubled, there is fairly close agreement of phi and rho values with those of lautite, as seen in Table II. The corresponding axial ratios are 0.729:1:1.084 and 0.691:1:2.090. However, lautite crystals are elongated parallel to [100], rather than [001].

It would seem preferable to state that these "crystals" with the composition and stucture of polianite are pseudomorphs after an unknown

TABLE II. PHI AND RHO VALUES FOR POLIANITE AND LAUTITE

Polianite (Nakhla)			Lautite (Palache, *et al.*)		
hkl	θ	ρ	*hkl*	φ	ρ
321	64°05′	78°36′	322	65°15′	78°40′
101	90°00′	56°05′	102	90°00′	56°31′
232	42°28′	65°35′	234	43°58′	65°20′
122	34°27′	52°45′	124	35°53′	52°13′

mineral that could be determined only if fresh crystals of the original mineral are found. However, this seems to be a remote possibility, as diagenetic processes have concealed the original characteristics of the ore, and have produced pseudomorphism throughout the manganese deposits of Um Bogma mine.

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