POWDER DIFFRACTION DATA ON SYNTHETIC Li_3PO_4

Int.	d(kX.)	Indices	Int.	d	Int.	d
5	5.217	200	2	1.676	2	1.191
1	4.372	110	1	1.640	2	1.185
1	4.180	--	2	1.606	2	1.166†
10	3.976	201	1	1.584	2	1.159†
10−	3.792	011	2	1.559	1	1.150
6	3.547	111, 210	1	1.542	1	1.139
4	3.053	211	3	1.526	omit two weak lines	
$\frac{1}{2}$	2.902	—	5	1.513	2	1.101
8+	2.667⎱*	310	1	1.494	1	1.086
5	2.608⎰	311	1	1.468	2	1.081
7	2.420	112	1	1.402	1	1.069
5	2.309†	212, 410	5	1.377	omit about three weak lines	
$\frac{1}{2}$	2.194	121	omit two weak lines		3	1.023⎱*
1	2.152	312	2	1.293	1	1.020⎰
1	2.067	402	3	1.285⎱*	omit two weak lines	
$\frac{1}{2}$	1.897	510	2	1.278⎰	2	1.003⎱*
1	1.875	113	1	1.264	2	1.002⎰
2	1.838	511	1	1.254	omit five weak lines	
4	1.783⎱	222				
3	1.767⎰*	421				
$\frac{1}{2}$	1.741	601				
$\frac{3}{4}$	1.706	313				

Fe/Mn radiation in a Straumanis-type 114.6 mm. camera. Intensities by visual estimation; measured by Leon Atlas. * doublet; † diffuse line.

the $A(XO_4)$ type where they belong according to a strict purely-chemical interpretation.

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AN OCCURRENCE OF GORCEIXITE IN ARKANSAS*

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An unusual occurrence of radially fibrous botryoidal gorceixite, $BaAl_3(PO_4)_2(OH)_5 \cdot H_2O$, has been found in sec. 16, T. 2 S., R. 18 W., 6

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miles from Hot Springs, Garland County, Arkansas. Material collected in July 1956, by the Arkansas Geological and Conservation Division, was submitted to the Denver Area office of the U. S. Atomic Energy Commission. The gorceixite occurs on the south limb of one of the southwest plunging anticlines in the Zig Zag Mountains in the Arkansas novaculite, which is Devonian and Mississippian in age. The locality is within 10 miles of the Magnet Cove intrusive area and the Chamberlain Creek barite deposit.

The gorceixite in the form of spheroids, up to one centimeter in diameter, coated with black goethite (Fig. 1), occurs as incrustations in narrow fractures about $\frac{1}{4}$ inch wide in the Arkansas novaculite. The interiors consist of whitish radially fibrous gorceixite containing soft brown limonite between the fibers (Fig. 2). Under the microscope the gorceixite is very clouded and seems almost opaque. It has low birefringence and an index of refraction of approximately 1.61. Lathlike grains are length positive and show parallel extinction in polarized light.

A semiquantitative spectrographic analysis by Pauline J. Dunton of the U. S. Geological Survey follows:

Weight per cent	Element
M	Al, P
7	Ba, Fe
3	Sr
1.5	Ca
0.3	Si, As, U
0.15	Y, V
0.07	Mo, Sb
<0.05	Na
0.03	Ce, Cr, Cu, Nd
0.015	Dy, Er, Gd, La, Sc
0.007	Mg, Ti, Yb
0.003	Zr
0.0015	Mn, Ga
0.0007	Pb
0.0003	Be, Co, Ni

NOTE: Figures are reported to the nearest number in the series 7, 3, 1.5, 0.7, 0.3, 0.15, etc. M = major constituent—greater than 10 per cent. Sixty per cent of the reported results may be expected to agree with the results of quantitative methods.

Practically all the iron represents limonite impurity, which was demonstrated by first dissolving the limonite with repeated washings of concentrated HCl. From obviously impure gorceixite, the resultant product became almost white gorceixite, which was then sintered with Na_2O_2 at 440° C. After bringing the sinter product into solution and acidifying it, the sensitive potassium ferrocyanide test for Fe^{+++} was applied and only a trace of Fe was indicated. Gorceixite is extremely insoluble—so
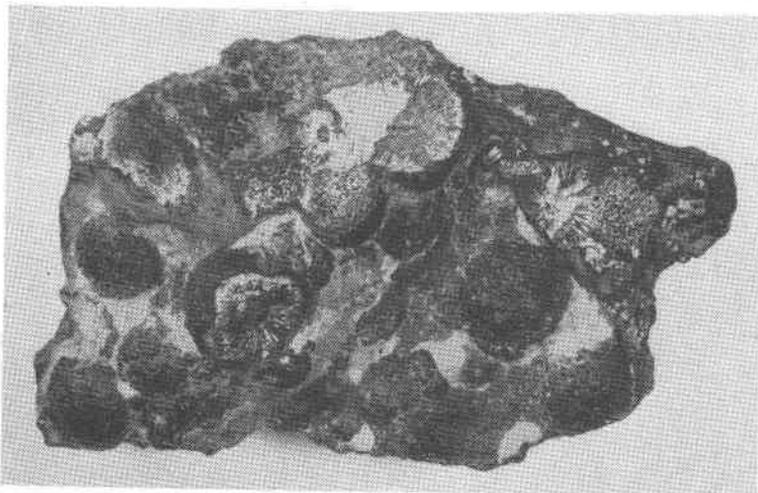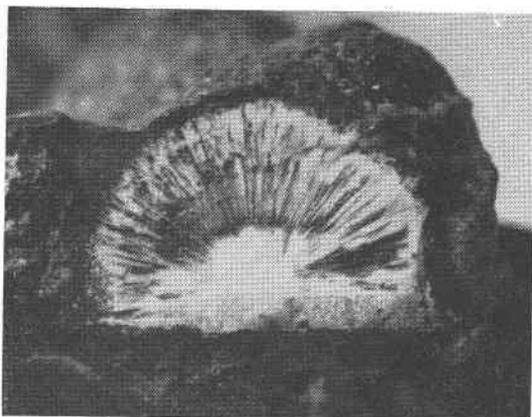
FIG. 1. Spheroids of gorceixite. ×2.5.

Photographs by Wendell Walker, U. S. Geological Survey

FIG. 2. Interior of spheroid showing radially fibrous gorceixite. ×8.

much so that Na_2CO_3 and $NaHSO_4$ fusions failed to bring it into solution. Presence of water in the mineral is shown by closed-tube test on material leached free of limonite by acid. Sulfate was tested for and not found.

Uranium and the rare earths are important trace elements in this occurrence of gorceixite. The rather large amount of Sr present suggests an isomorphous series between gorceixite and goyazite, $SrAl_3(PO_4)_2(OH)_5 \cdot H_2O$.

An x-ray powder photograph of this mineral taken by Richard P. Marquiss of the U. S. Geological Survey matched a mineral described as gorceixite from Dale County, Alabama (Charles Milton et al., this issue).

This work is part of a program being conducted by the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

OPTICS OF THE EOSPHORITE-CHILDRENITE SERIES

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Hurlbut (1950) discussed the evidence that the childrenite-eosphorite series $Mn_{1-x}Fe_xAl(PO_4)(OH)_2(H_2O)$ is indeed a continuous isomorphous series, citing examples with $x=0.04$, 0.14, 0.16, 0.23, 0.32, 0.33, 0.39, 0.47, 0.85, and 0.91, and giving in summary a variation diagram relating the optical properties and specific gravity to the weight per cent of FeO as determined by chemical analysis. Hurlbut's Table 2, summarizing the data on which his diagram is based, shows two apparently discontinuous changes. The optic orientation is practically constant with $X=b$ and $Z \wedge c = 3°$ to $8°$ throughout the eosphorite half of the series ($x<0.5$), then changes to $X=b$ and $Y \wedge c = 6°$ to $8°$ for childrenite ($x>0.8$); moreover, in the interval $0.5 < x < 0.8$, for which there are no data, the dispersion of 2V also reverses.

These changes can be explained easily if the curves for $n_\perp$ and $n_\parallel$, representing the refractive indices for the principal vibration-directions that are respectively almost perpendicular and almost parallel to c, cross one another in the neighborhood of $x=0.6$ to 0.7; analogous changes of axial plane are well known in other mineral series such as lithiophilite-triphylite, and always result in a change of the dispersion of 2V in passing through the composition for which $2V=0°$, in addition to the exchange of positions by two of the principal vibration directions—either X and Y, or Y and Z. In such a case there should also be a small range of compositions with crossed-axial-plane dispersion, *i.e.*, with the optic plane for one end of the spectrum at right angles to that for the opposite end; such a condition is easily recognized by abnormal interference colors in certain grains and thin sections of the mineral. Dispersion of 2V, if observable in such minerals, is $r>v$ on one side of the uniaxial composition and $r<v$ on the other. The obvious test of this hypothesis for eosphorite-childrenite is to find or make a crystal of manganoan childrenite with composition near $x=.65$, and observe whether such a crystal has