Isokite and triplite from Bohemia.

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[Read 6 June 1957.]

Summary. Isokite ($CaMgPO_4F$), a new mineral homologous with sphene, was described late in 1955 from a Rhodesian carbonatite plug. A fine-grained variety is now reported from Bohemia, where it occurs as a replacement of (probably a hydrothermal alteration product of) coarse medium brown 'later' triplites. It is intimately associated with fine-grained apatite that along with quartz formed post-isokite.

SOME work on pegmatite phosphates by the writer in September 1954 yielded an X-ray powder pattern from a sample in the University of Chicago collection labelled 'triplite from Schlaggenwald, Bohemia (Foote, Philadelphia)' that could not be identified. However, from the powder-pattern data given recently with the description of the new mineral isokite (ĭ-sŏk′-īt; *not* ī′-sō-kīt) by Deans and McConnell (1955), it was realized that this was probably the same as the writer's unknown. A sample of the Rhodesian isokite yielded the powder pattern given as no. 173 in fig. 1. This is substantially identical with the pattern from the unknown mineral in the Schlaggenwald triplite specimen as shown in no. 183 of fig. 1.

Slavkov and its triplite.

Horni Slavkov (German name: Schlaggenwald) is in the Karlsbad Hills of north-western Bohemia about 11 km. south-south-west of Karlsbad and 20 km. north-north-east of Marienbad. The Karlsbad Hills, which are south of the Eger (Ohře) River, are underlain by granites intrusive into gneisses and schists; in fact the geology is very similar to that of the Erzgebirge north of the river. Slavkov and Krásno nad Lesy (German name: Schönfeld; 3 km. to the south-south-west of Slavkov) were the centre of the great tin-mining industry of Europe in the sixteenth century. Mining was important here as early as the twelfth to fourteenth century, but by 1870 (Groth) the mines were closed down and had caved in; nothing but a single pillar of granite was left exposed (Phillips, 1896, p. 437). Kratochvil (1943) gives 376 references for this locality, but the latest is 1934. He lists nearly 100 mineral species from Slavkov (including the phosphates apatite, pharmacolite, scorodite, triplite, and wavellite, as well as autunite and torbernite) and gives 13 references to triplite from here, the earliest one by Glueckselig in 1854. In 1910 Lazarevič quoted Cornu as stating that the Slavkov triplite stage embraced the paragenesis (here meaning *association*): quartz, cassiterite, triplite, chalcopyrite, and molybdenite. The triplite would thus seem to occur in connexion with the tin veins, though in places these carry enough felspar so that they resemble pegmatites. In fact Cornu states that there is a felspar mine on the Mückenberg which is $5\frac{1}{2}$ km. south-west of Slavkov and $1\frac{1}{2}$ km. north-east of Lauterbach. Triplite-bearing pegmatites near Königswart and Punau in the vicinity of Marienbad have been described by Sellner (1924) and earlier writers. According to Cornu the contact metamorphic minerals from Slavkov are found in the Reinbachtal, which is only 4 km. west of Slavkov; while wollastonite and diopside, as well as manganoan siderite (oligonite), baryte, and fluorite, occur at Hub (midway between Krásno and Slavkov). No reference has been found that gives the exact locality of the triplite, and there is no indication that two generations of this mineral may be present. The Foote Mineral Company has no record to show the exact source of these triplite specimens.

Stelzner (1906, p. 932) states that a steeply-dipping gneiss block is embedded in the granite of the Lauterbach–Schönfeld–Schlaggenwald district. This block is intruded by three stock-like masses of fine-grained granite. In these the tin ores occur as stockworks of topaz-bearing greisen; they are also found in veins in the gneiss. Fiala (1947) calls this a biotitic katagneiss, and says that the Huberstock, the largest one of the three, some 570 by 180 m., which lies south of Slavkov, was the most important. The smallest one, the Klingenstock, is north-west of Krásno (Schönfeld). Between these is the Schnödenstock, 180 by 90 m., and the road from Slavkov to Krásno crosses its eastern edge. These three stocks occur along a north-east–south-west line.

In 1946 Dr. Jan Kutina collected samples of greisen from a dump on the Schnoedenstock. These carry vein-like masses of medium brown vitreous to resinous-lustred triplite up to 1·5 cm. thick forming irregular indefinite boundaries with the greisen. Brownish-pink, dull-lustred, fine-grained apatite (megascopically very similar to the isokite) is commonly present between the triplite and the greisen. Small anhedra of chalcopyrite and veinlets of quartz also occur in both the triplite and apatite. Grains of chalcopyrite and cassiterite are found in the associated greisen. Molybdenite and fluorite also occur in triplite specimens from this locality in the mineral collections of Charles University. Kutina collected from a fresh dump; mining in this area was rejuvenated on a small scale during World War II, in the main for tungsten. On this dump were pieces of a felspar–quartz–mica pegmatite; but no triplite was found in this rock. Aplites are common in the area, and tourmaline-

TABLE I. Analyses of triplites.

	Slavkov.			*Schoen-feld. Otto*† (1936).	*Koenigswart.*‡		*Punau.*§
	*Dark.**	*Light.**	*von Kobell* (1864).		*Sellner* (1924).		
CaO	3·4	10·0	2·20	1·80	6·89	4·90	8·68
MnO	27·5	21·5	30·00	28·48	31·96	33·40	22·94
FeO	29·6	21·9	26·98	25·80	24·84	26·50	16·50
MgO	0·7	6·0	3·05	7·20	tr	tr	15·54
Fe_2O_3	—	—	—	—	0·17	1·43	—
TiO_2	0·16	0·22	—	—	—	—	—
P_2O_5	—	—	33·85	31·98	31·87	30·44	32·14
F	—	—	8·10	7·64	3·29	3·34	5·70
Other	—	—	—	—	0·64	0·42	0·90
Total			104·18	102·90	99·66	100·43	102·40
Less O for F			3·40	3·21	1·39	1·40	2·40
Total			100·78	99·69	98·27	99·03	100·00
D	3·886	3·828	3·77		3·88		
α	1·680	1·662	1·672‖	1·664			
β	1·689	1·667		1·674			
γ	1·702	1·680	1·683‖	1·680			

* Spectrographic analyses (each constituent to $\pm 5\%$ of its figure); all iron calculated as FeO.

† Otto states that this sample is from a pegmatite; Heinrich must be wrong when he says this is from Germany. The last three samples in the above table are from Bohemia, not Moravia (as stated in Hintze, Dana, and Heinrich).

‡ Density from Lazarevič (1910); analyses by W. Stanczak.

§ Recalculated from an analysis with 8·10 % insoluble. Punau (or Punnau) is 10 km. south-east of Marienbad.

‖ *n*-values for Slavkov triplite. R. Rost, Min. Abstr., 1946, vol. 9, p. 205.

bearing pegmatites are known. Fiala notes that red orthoclase–albite–quartz pegmatites are typical of the border of the greisen stocks.

The Slavkov triplites as represented by the specimens at hand contain two forms of the mineral. One is very dark brown and the other is medium or chestnut brown. The two do not occur in the same hand specimen. Both of them are thoroughly fresh. The dark material, which occurs in massive chunks and is veined by chalk-like apatite, has a light-grey (greenish tinge) streak, pitchy adamantine lustre with one indifferent cleavage. Its composition is shown in table I. The light-

TABLE II. X-ray powder data for triplite (Å.).

Indices.*	1. d.	1. I.	2. d.	2. I.	3. d.	3. I.	4. d.	4. I.	5. d.	5. I.
011(?)									5·16	1−
$\bar{2}02$, $\bar{2}11$	4·27	1					4·306	1	4·27	1
211	3·62	4	3·6553	1+	3·6460	2	3·659	5		4
					3·5060	1/4				
112	3·41	2	3·4304	2−	3·4115	3	3·431	4		4
			3·3426	2						
			3·3067	2−						
			3·2741	1						
020	3·23	6	3·2543	2	3·2395	6	3·257	7		6
$\bar{3}12$, $\bar{1}21$	3·03	8	3·0417	6	3·0291	7	3·053	9		8
400†	2·86	10	2·8675	10	2·8601	10	2·874	10		10
220, $\bar{4}02$	2·83	1			2·8177	1/4	2·832	1/2		
$\bar{4}11$	2·73	1			2·7283	1	2·740	2		
022	2·69	1			2·6789	1/4	2·691	1		
$\bar{2}22$	2·60	2	2·6057	1+	2·5920	1+	2·614	3		
$\bar{3}21$	2·53	1			2·5619	1/4	2·531	3		
312			2·5181	1−	2·5140	1−	2·489	2		
$\bar{2}04$	2·471	1			2·4762	1/4				
004‡	2·377	1					2·400	1/2		
$\bar{4}13$	2·316	1					2·340	1		
321, 222, $\bar{1}23$	2·290	1			2·2913	1/4	2·305	1		
402	2·218	2	2·2236	1/4	2·2193	1−	2·230	3		
303, $\bar{5}12$, 510	2·179	1	2·1519	1/4	2·1439	1	2·186	1/2		
420, 123, $\bar{5}03$, $\bar{4}04$	2·148	2			2·1259	1/4	2·156	3		
$\bar{3}23$, 501, $\bar{4}22$	2·108	3	2·1122	1−	2·1044	1−	2·120	4		
	2·012	3			2·0099	1/2	2·024	4		

1. d.	1. I.	2. d.	2. I.	3. d.	3. I.	4. d.	4. I.	5. d.	5. I.
1·975	1					1·979	1/2		
						1·949	1/2		
1·917	1	1·9173	1/4	1·9212	1/4	1·920	3		
				1·9111	1/2	1·892	1/2		
1·833	1	1·8341	1/4			1·843	2		
1·825	1			1·8165	1/4	1·823§	2		
1·815	1	1·7954	1/4	1·7853	1/2	1·800	2		
1·788	1					1·776	1		
1·765	1	1·7600	1/4	1·7540	1/4	1·767	2		
1·744	1			1·7395	1/4	1·750	2		
1·672	1					1·680	3/4		
						1·660	1/2		
1·638	2					1·640§	3		
1·627	2								
1·600	2					1·602	2		
						1·584	1/2		
1·565	1					1·566	2		
						1·541	2		
1·524	1					1·523§	1		
1·520	1								
1·471	1					1·474§	1		
1·453	3					1·459	2		
1·435	1					1·439	1		
1·414	1					1·418	1		
1·394	1					1·398	1/2		
(8 more lines)						(37 more lines)			

1. Serra Branca, Brazil. Lindberg, Amer. Min., 1950, vol. 35, p. 72. Fe/Mn radiation.
2. Dark triplite, Slavkov. Guinier–de Wolff multiple camera (calibrated), Co-$K\alpha_1$ radiation. I have no explanation for the apparent splitting of the (020) reflection into 4 lines.
3. Light triplite, Slavkov. Same data as last.
4. Dark triplite, Slavkov. Fe/Mn radiation, 11·5 cm.-diameter camera. Spacings measured by Leon Atlas, 18 April 1949.
5. Light triplite, Slavkov. Same data as last. Given only to show presence of 5·16 line, and intensities of major lines.

* Computed graphically by the Peacock–Bloss technique (Amer. Min., 1952, vol. 37, p. 588), assuming space-group *I 2/m*.

† Included in the range 2·85 to 2·92 are also 121, 103, 303, 013, and 213.

‡ Included in the range 2·36 to 2·42 are also 411, 501, and 213.

§ Broad and diffuse line.

Note. Approximate spacings for both light and dark triplite from Finland using Cu/Ni radiation with a 5·7-cm. diameter camera are given by A. Volborth, pp. 32–33.

coloured triplite occurs as small vitreous to resinous-lustred irregular anhedra embedded in fine-grained dull-lustred light-brown isokite and fine-grained light grey apatite. It has a white streak and shows no cleavage. A spectrographic analysis appears in table I. X-ray powder-diffraction data for these two triplites are given in table II. While the spacings for the light triplite are definitely consistently smaller than those for the dark triplite, any intensity differences or differences in lines present are very minor. The weak 5·16-Å. line seen in most light triplite films is absent in those made from the dark triplite.

It is probable that these triplites are of two generations. While this is not mentioned by Heinrich, it seems to be a fairly common phenomenon. Thus at the 'White Rock' (quartz core) pegmatite just north-east of Koenigswart (20 km. south-west of Slavkov and 7 km. north-west of Marienbad) Lazarevič describes two kinds of triplite: dark brown compact coarse-grained aggregates with an adamantine-oily lustre, one good cleavage and a poor one normal thereto; and light-brown, fine-grained, dull-lustred, indistinct cleavage. At Hagendorf, 40 miles south-west of Slavkov and barely across the Bavarian border, Schmid (1955, p. 353) describes two triplites; the older is chestnut brown and commonly in felspar, the younger is light brown and generally in quartz. Volborth (1954, p. 27) has an older dark brown and a younger reddish-brown triplite in the Viitaniemi (Finland) pegmatite. The isokite in the Slavkov specimens has been found only in the light brown triplite samples.

The Slavkov triplite seems to have been distributed very widely; thus many museums probably contain samples of Bohemian isokite; this was true for the Chicago Natural History Museum. At the XXth International Geological Congress Slavkov triplite (presumably with isokite) was seen in the collection of the Instituto de Geología of the Universidad Nacional de Mexico.

Isokite.

Isokite from the type locality (15 miles east of Isoka [pron. Ĭsōk'a] in Northern Rhodesia) occurs in the samples at hand as radiating white fibres or needles in globular masses less than a millimetre in diameter. These are sprinkled through a limonite-stained coarsely-crystalline ankeritic dolomite composing a carbonatite plug which cuts granitic and micaceous gneisses. Apatite is a principal accessory mineral. The isokite is considered to have replaced the dolomite in a late stage of metasomatic activity.

A large (2 by 5 cm.) thin section was cut from a specimen of the light-brown Slavkov triplite which had a 15-mm. wide fissure vein of coarse green apatite across one end. A photograph of it (no analyser) appears in fig. 2. A portion of it (taken with an analysing polaroid filter) together with an explanatory 'geologic map' is shown in fig. 4, and photomicrographs of selected areas appear in fig. 3.

Neglecting the coarsely crystalline green apatite vein (analysis: Otto,

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FIG. 1. X-ray powder diffraction photographs of minerals homologous with isokite; natural size, Fe/Mn radiation, 114·6-mm. diameter camera. 188—Durangite, Durango, Mexico. Yale Brush no. 586; 187—Sphene, Pitcairn, New York. Univ. of Chicago no. 763; 183—Isokite, Bohemia; 173—Isokite, Rhodesia; 201—Tilasite, Långban, Sweden. Riksmuseet no. 339, 650.

FIG. 2. Photomicrograph (no analyser) of large thin section from Slavkov specimen. Sides of squares of grid are 2 mm. long. Upper one-third is mainly apatite, fragment of which at upper left was broken off in grinding. The three circles indicate areas shown in more detail in fig. 3. See text for further description.

FIG. 3. Photomicrographs (crossed polars) of portions of the large thin section, as outlined by circles on fig. 2.

A1: From L4 area of fig. 2. Shows mostly a portion of a single anhedron of triplite (light grey) cut by replacement veinlets of apatite (black or dark grey). Polars not quite crossed, thus holes (fragments torn from the triplite) appear light grey. Cleavage cracks are obvious. Speckled or mottled white to grey to black areas through the triplite are the replacing isokite.

A2: Shows the portion in the circle of A1 in more detail; polars truly crossed, so holes are black. Both of these make it clear that the apatite was the last of the three minerals formed.

B1: From J9 area of fig. 2. The two isolated masses of triplite (light grey; lower left and upper right) are parts of a single anhedron. The fine-grained apatite appears dark grey to black; part of it is as two replacement veinlets, but that across the top is a portion of the large mass of such apatite along row I of fig. 4. Isokite is the most abundant mineral present.

B2: Detail from upper right circle of B1. Shows the isolated part of the triplite crystal (light grey with a dark tear-fragment spot and cleavage cracks), much fine-grained apatite, and masses of fine-grained isokite in lower left and lower right.

B3: Enlargement from lower left circle of B1. Excellent to show three masses of a single triplite anhedron (upper left, left, and below the centre) isolated from one another by isokite replacement, then cut by an apatite vein.

C1: From T4 area of fig. 2. Apatite-quartz vein on left, triplite anhedron on right, isokite between. There is everywhere a selvage of apatite separating the quartz from the isokite.

C2: Detail from portion shown by circle in C1. Triplite at top and in lower right; these constitute a small part of the large single crystal of triplite making up the lower right portion of fig. 2. Nearly all of the rest of C2 is isokite; a little apatite is found at the lower left and along the triplite cracks.

FIG. 4. Photomicrograph (crossed polars) of central portion of the large thin section, together with explanatory diagram. Here H refers to a hole in the thin section.

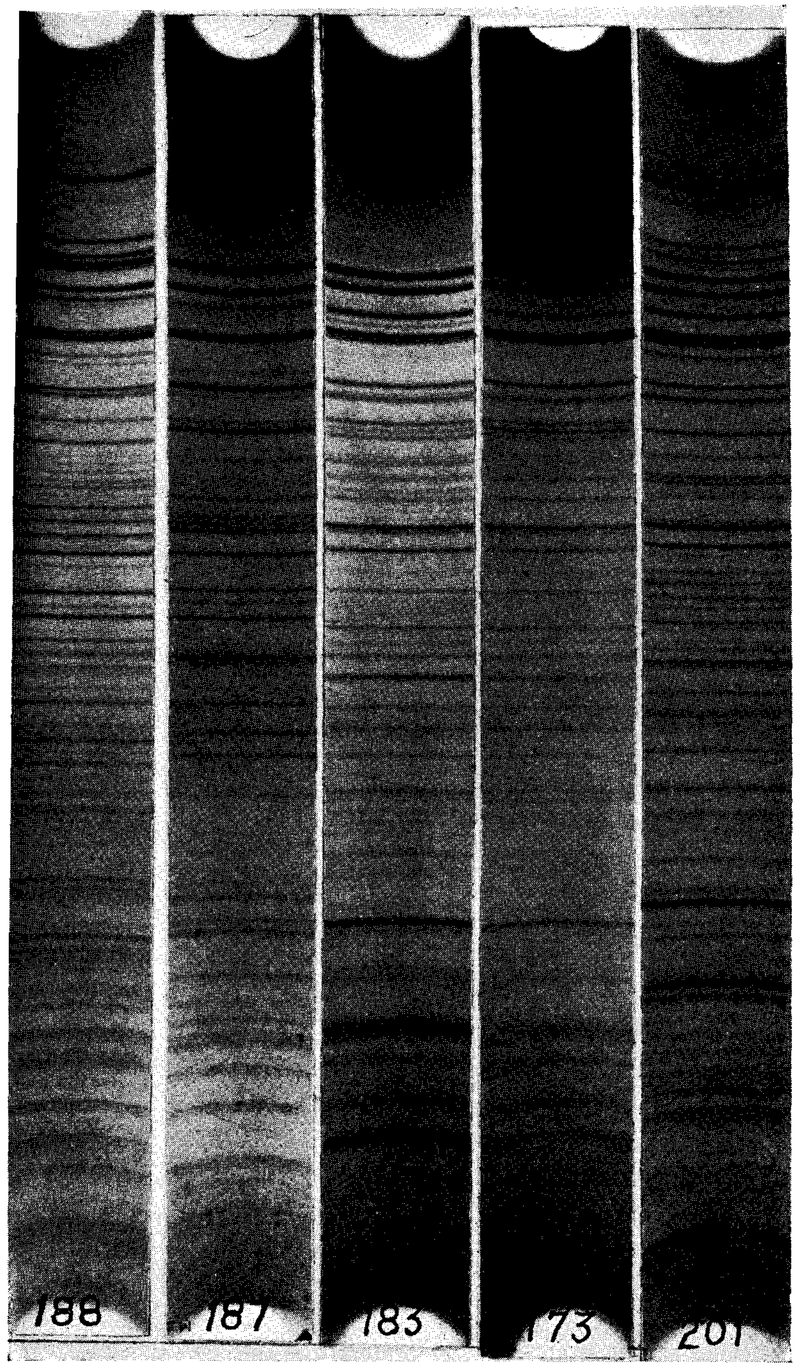

FIG. 1.

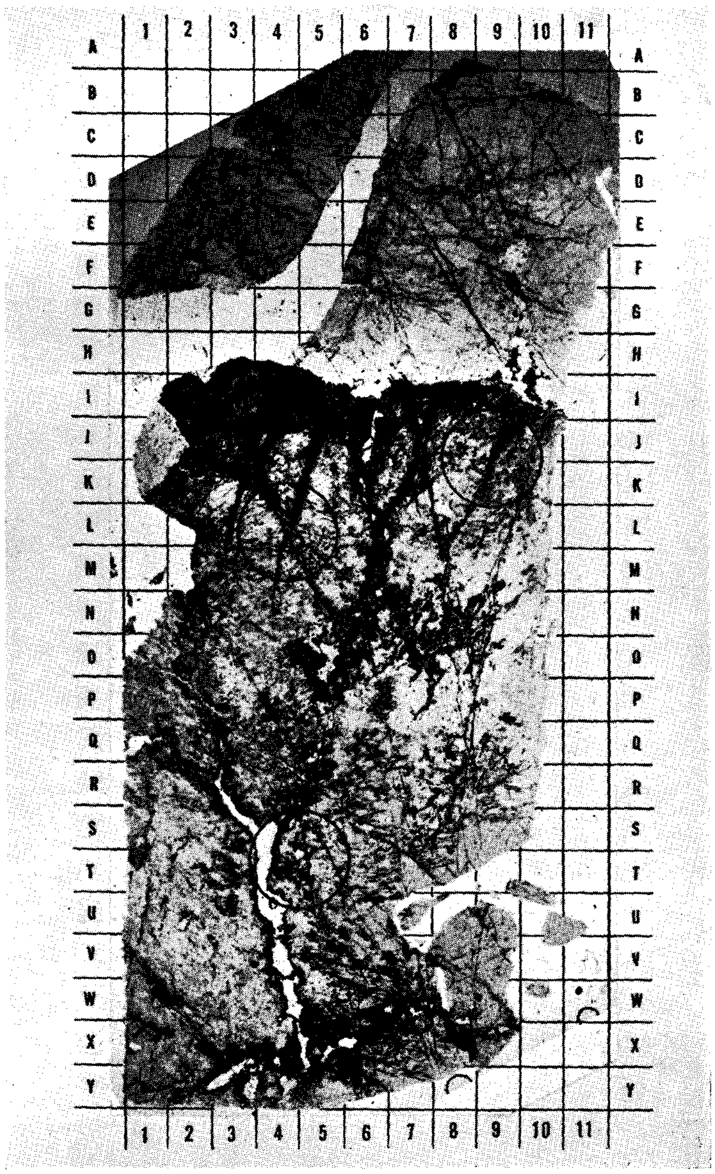

Fig. 2.

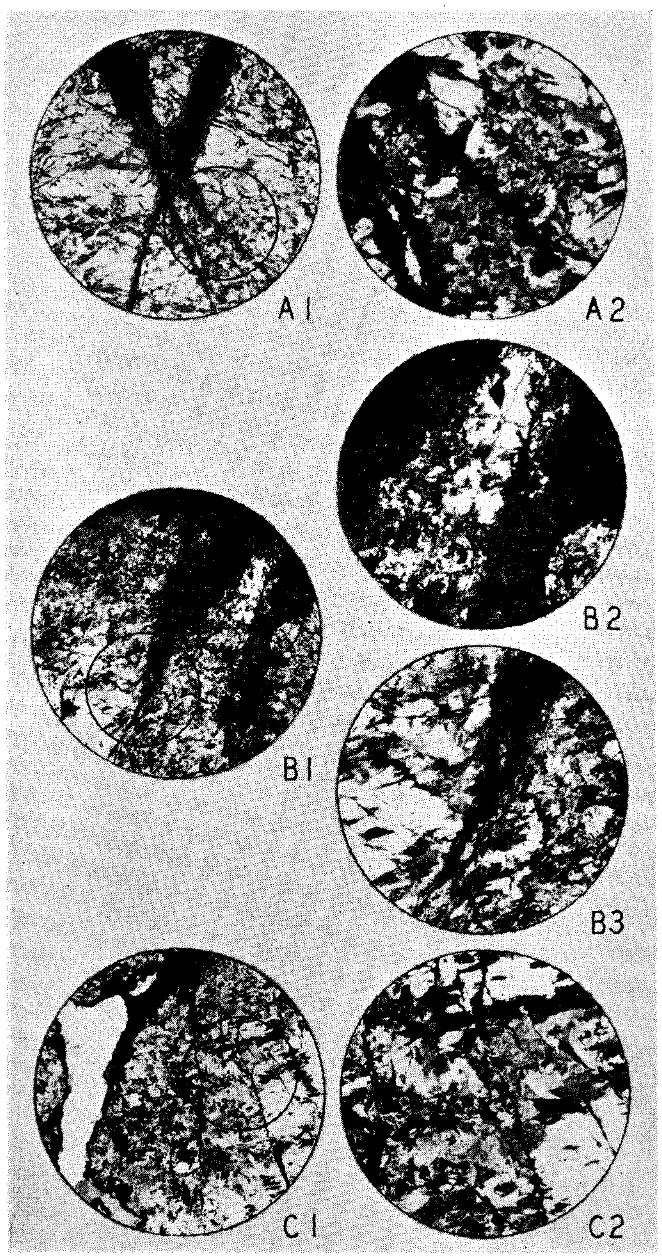

FIG. 3.

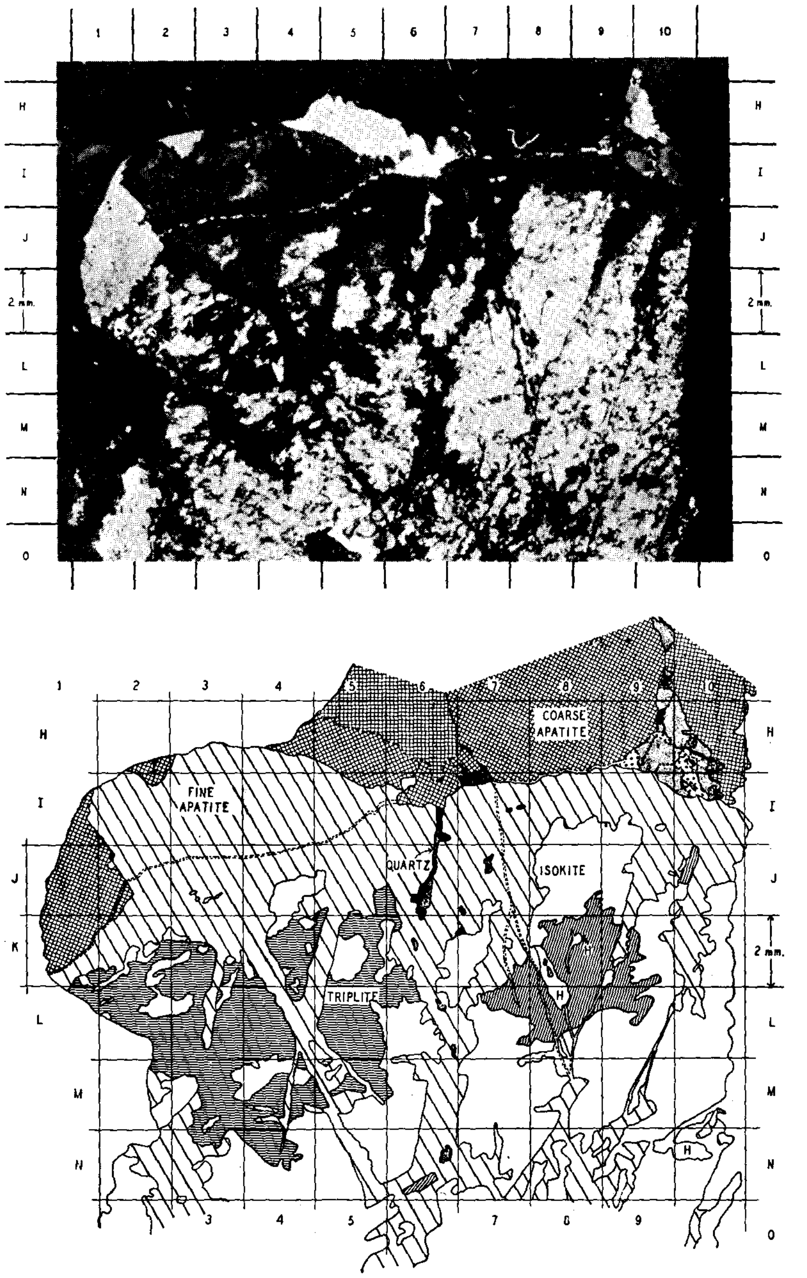
1 2 3 4 5 6 7 8 9 10
H I J K L M N O
2 mm.
COARSE APATITE
FINE APATITE
QUARTZ
ISOKITE
TRIPLITE
H

FIG. 4.

1936, p. 112) across one end, this Slavkov thin section consists in the main of three large corroded triplites; by far the largest makes up the 'south-east' (map parlance) quarter of the specimen (fig. 2), but the other two in the upper half show up well in fig. 4. A quartz vein splits the lower part of the specimen along a near-vertical line; it actually extends intermittently all the way up the middle of the specimen. It is fringed with narrow borders of fine-grained apatite, outside of which is isokite; not a great part of the latter occurs to the east of the vein, but the whole south-west portion of the section is isokite, as is a central east–west band $\frac{1}{2}$ to 1 cm. in width. The isokite and triplite are differen-

TABLE III.

	Triplite $8[(Mn,Fe,Mg,Ca)_2PO_4F]$.	Isokite $4[MgCaPO_4F]$.	Apatite $2[Ca_5(PO_4)_3F]$.
Space-group	$I\ 2/m$(#12)	$C\ 2/c$(#15)	$C\ 6_3/m$(#176)
$a{:}b{:}c$	12·0:6·5:10·0	6·52:8·75:7·51	9·36:6·88
β	105°42′	121°28′	—
Unit-cell volume	750	$731\times\frac{1}{2}$	$696\times3/4$
Cations per $8(PO_4)$	16	16	$10\times4/3 = 13·3$
Density	3·9	3·3	3·2

tiated in fig. 4 (crossed polaroids), since the former is fine-grained, and so appears speckled. The fine-grained apatite shows up well in fig. 2 (no analyser) as medium to dark grey, nearly black; it occurs near the top and along some of the straight upper veins. The courses of the latter are controlled presumably by the triplite cleavages. If this is true, the triplite was obviously once much more extensive than it is at present. The fact that the two large triplites shown in fig. 4 are broken up into very irregular corroded masses by the isokite, both of which minerals are cut by replacement veins of apatite, indicates rather clearly a sequence triplite–isokite–apatite.

Table III presents certain changes involved in the alteration of triplite to isokite; data are also given on apatite. Examination of the thin section shows that triplite was extensively altered to isokite; this would require the removal of Mn and Fe, the major cations of most triplites, with ion-for-ion replacement by Mg and Ca, with the latter two in (at least approximately) a 1:1 balance. There is little evidence from the thin section that either triplite or isokite was altered into apatite. In fact the bold veins of fine-grained apatite cutting these two minerals, and partly replacing the triplite, and probably the isokite to a much less extent, indicate strongly that apatite as such was introduced later. The quartz present as fissure-vein fillings with a selvage of fine apatite is so closely associated with the latter that the two were probably deposited from the same solutions, though the quartz apparently formed slightly later. Locally there are very minor amounts of opaque alteration products of the phosphates.

The Slavkov isokite is very fine grained and no crystal faces were seen. Employing the universal stage double variation technique, and working with grains smaller than 100 mesh, it was found that most

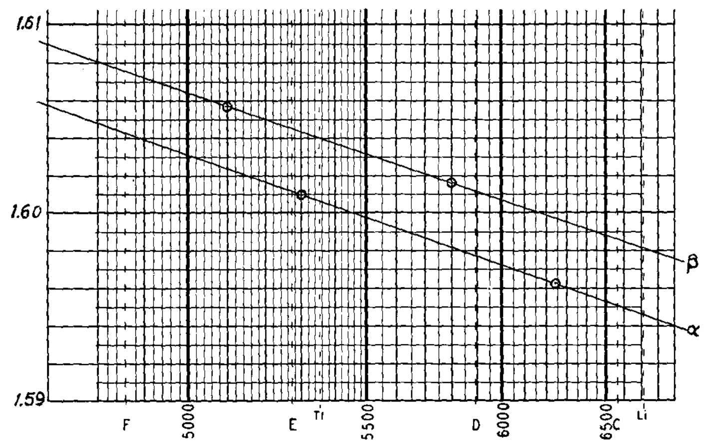

FIG. 5. Dispersion curves for α and β of Slavkov isokite.

grains if not actually nearly fibrous consisted of three or more differently oriented crystals. Study of a crystal in one grain yielded the dispersion curves for α and β shown in fig. 5, each line being based on but two points as indicated. These curves give for Na light $\alpha = 1{\cdot}5977$, $\beta = 1{\cdot}6012$. Since the crystal showed somewhat undulatory extinction, these results are probably about $\pm 0{\cdot}001$. The crystal was positive with $2V = 39^\circ \pm 2^\circ$. In several attempts no grain was found suitable for the determination of γ by this technique. Using these values a graph indicates that γ is about 1·629. Employing ordinary immersion techniques, the highest measured value obtained was γ' of about 1·619 for Na light. Thus the assumed best values for Slavkov isokite for Na light are (with $2V = 39^\circ$) $\alpha = 1{\cdot}597$, $\beta = 1{\cdot}600$, $\gamma = 1{\cdot}623$. The Rhodesian isokite was found to have $\alpha = 1{\cdot}590$, $\beta = 1{\cdot}595$, $\gamma = 1{\cdot}615$, with $2V = 51^\circ$. No dispersion was observed in the interference figure of the Slavkov isokite. Assuming b = acute bisectrix (as determined on the Rhodesian isokite) any dispersion should be of the crossed type. This was tested against the extinction position of the trace of the optic plane for yellow and violet light. No difference greater than the probable error in readings was noted. The associated fine-grained apatite has (Na light) $\omega = 1{\cdot}633$, $\epsilon = 1{\cdot}628$, both $\pm 0{\cdot}002$.

A sample of Slavkov isokite, which unfortunately was contaminated with apatite (presumably some 35 % of the latter), subjected to spectrographic analysis showed: CaO, 40·0; MgO, 15·5; MnO, 1·5; TiO_2, 0·22; Fe, 1·5. The sample probably had enough triplite in it to account for the Mn and Fe.

X-ray diffraction powder data on isokite are given in table IV for three radiations. Using cobalt radiation (col. 2) with the Guinier–de Wolff multiple camera where the patterns of the Bohemian and Rhodesian isokite appear next to each other on the same film, the differences are very minor: the former lacks the 2·89 line, the latter lacks the 2·70 line, and the 2·787 line of the latter (the one whose measurements are given in col. 2) appears as a doublet on the former. Other differences are so minor as to be barely discernible. In particular there is no measureable difference in the spacing of any of the lines, showing substantial identity of unit-cell dimensions and angles; the reversal in relative intensities of the 3·18 and 3·02 lines (as compared to the values of cols. 3 and 4) is interesting. The results from the two isokites using iron radiation are given in cols. 3 and 4; here the spacings are measured much less exactly. The most pronounced distinction is the difference in relative intensities of the 2·787 line. Also the weak 1·74, 1·77, and 1·83 lines are much more apparent in the film from the Bohemian specimen, as are the 2·70 and 3·40 lines; on the other hand the weak 4·38 and 2·89 lines are apparent only in the film from the Rhodesian sample. The failure to be able to index the 2·04 line is puzzling; the $(\bar{2}21)$ line should have a spacing of 2·60 rather than 2·63.

Acknowledgements. I am particularly indebted to Dr. Jan Kutina of Charles University (Prague), not only for the details of his mineral collecting at Slavkov and his descriptions of Slavkov specimens in the University Museum, but also for his preparation of a translation of Fiala's paper. Oiva Joensuu made the spectrographic analyses. W. F. Schmidt did the photography. Samples of the Rhodesian isokite were supplied by W. H. Bennett of the Mineral Resources Division of the British Colonial Geological Surveys through the kindness of G. E. Howling. Slavkov isokite was loaned me by H. Changnon of the Chicago Natural History Museum through the courtesy of S. K. Roy. The durangite specimen was furnished by Horace Winchell, and that of tilasite by Frans E. Wickman.

TABLE IV. X-ray powder data for isokite (Å.)

Indices.*	1. d.	1. I.	2. d.	2. I.	3. d.	3. I.	4. d.	4. I.
020	4·38	w					4·37	1·2
021	3·62	vw						
$\bar{1}12$	3·45	vw	3·4409	1				
apatite?			3·4172	½	3·41	1—		
$\bar{1}31$			3·3186	1—	3·31	½		
002			3·2077	2				
111	3·185	vvs	3·1795	8	3·18	10	3·18	10
$\bar{2}02$	3·023	vvs	3·0211	10	3·01	8	3·01	9
?	2·887	vvw					2·89	½
200	2·784	m	2·7868	5	2·79	6†	2·78	2
apatite?					2·70	1½	2·70	½
$\bar{2}21$?	2·630	vvs	2·6287	7	2·62	7	2·62	9
022, 130	2·586	m	2·5903	6	2·57	3	2·57	2+
$\bar{2}22$	2·487	vw						
$\bar{1}32$	2·301	s	2·3026	4	2·30	3	230	4
112			2·2332	2—	2·24	1		
040, 131	2·222	m†	2·2201	2—	2·22	2	2·22	3†
003, $\bar{3}12$, $\bar{2}23$	2·105	m	2·1066	2	2·10	1½	2·10	2
041	2·069	m	2·0729	1—	2·065	1	2·07	2+
?	2·041	m	2·0421	2	2·035	1½	2·04	2
$\bar{3}13$	1·962	w			1·96	½	1·96	½

Indices.*	1. d.	1. I.	2. d.	2. I.	3. d.	3. I.	4. d.	4. I.
221	1·946	vw			1·935	1	1·95	½
$\bar{1}33$	1·886	vw			1·88	½		
$\bar{2}04$	1·872	w	1·8738	½	1·87	½	1·875	1+†
310	1·837	vvw			1·83	1		
$\bar{2}41$, 132, 042	1·807	m	1·8062	¼	1·80	½	1·81	2
$\bar{2}42$, $\bar{1}14$	—	—	—	—	1·77	½	—	—
$\bar{3}32$	1·740	vvw			1·74	½		
240	1·720	s	1·7215	3	1·720	4	1·72	5
202, $\bar{3}14$	1·705	m	1·7054	½†	1·705	1½	1·705	1
113	1·684	vvw						
	1·671	vvw						
	1·656	m	1·6573	3—	1·655	3	1·655	3
004	1·602	vvw			1·605	1—		½
	1·557	m	1·5571	¼	1·555	1	1·555	2
	1·539	vvw			1·535	½		½
$\bar{3}31$	1·522	vvw			1·520	½		½
	1·510	vvw			1·510	½		½
	1·495	vvw			1·495	½		½
	1·479	m	1·4804	½	1·48	2	1·48	2
	26 more lines (all w or less)							

1. Deans and McConnell, Cu-$K\alpha$ radiation, 19-cm. camera. Rhodesia.
2. Guinier–de Wolff multiple camera (calibrated), Co-$K\alpha_1$ radiation.
3. Fe/Mn radiation, 11·5-cm. camera, spacings measured with Nies scale (spacings not accurate; listed because of intensities). P 190, Bohemia.
4. Same as last, except P 174, Rhodesia.

* Computed graphically by the Peacock–Bloss technique (Amer. Min., 1952, vol. 37, p. 588).

† Broad and diffuse line.

Addendum

The optical properties of the Slavkov triplites listed in the first two columns of table I have recently been determined by two of my students using the double variation technique on the universal stage, with results as follows:

	*Dark triplite**				*Light triplite†*			
λ.	*C.*	*D.*	*E.*	*F.*	*C.*	*D.*	*E.*	*F.*
α	1·6785	1·6802	1·6824	1·6845	1·6592	1·6626	1·6668	1·6707
β	1·6868	1·6883	1·6903	1·6922	1·6625	1·6662	1·6711	1·6755
γ	1·6999	1·7012	1·7031	1·7049	1·6752	1·6787	1·6832	1·6873
V_A‡	38·3	38·3	38·3	38·3	29·1	29·0	28·9	28·8
V_B‡	39·4^5	39·1	38·6	38·1^5	30·9	30·4	29·8	29·2
2V	77·7^5	77·4	76·9	76·4^5	60·0	59·4	58·7	58·0

* α, β, and V measured by S. Ghose; γ calculated from these results by D. J. F.; thus the γ-values would presumably have rather large errors if there were even small ones in the α or β figures. Later actual measurements by Ghose show that these γ values are substantially correct, at least in the D–E range.

† All values measured by G. Chao (except V for F light).

‡ The differences in the two V-values determined for each wave-length confirm the presence of inclined dispersion (thus $b \rightarrow \beta$) with $r > v$.

A. S. Povarennykh (1950) has described triplite and apatite in the hydrothermal veins of southern Kazakhstan. Here the apatite is also post-triplite. At depth the apatite forms borders of the triplite masses, but in the upper horizon the apatite almost completely replaces the triplite. This is a mangan-triplite with only very minor amounts of Ca and Mg. On the other hand the analysis of the apatite shows 2·17 % MgO. This is so unusual that the writer is inclined to suspect that this apatite may contain some isokite.

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