due to the presence of admixtures of chalcopyrite. The distinctive feature of the Yugodzyr' cosalite is its relatively high silver content (more than 1%), whereas the relative amounts of this metal in the cosalites from Bukuka are 0.75% [5], Switzerland 0.66% [4] and Okna-de-Fer 0.32% [2].

N.I. Sludskaya's X-ray studies of the Yugodzyr' cosalite specimen yielded the results given in Table 2. In the intensity of the lines and the magnitudes of the distances between crystallographic planes, as Table 2 shows, the Yugodzyr' cosalite specimen is very similar to the cosalite from Betpak-Dala and the cosalite described by G.A. Harcourt (1942). Thus the lead-bismuth sulfide mineral from Yugodzyr' is a typical cosalite, both in its chemical composition and in its crystal structure.

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BETALOMONOSOVITE[1]

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(Presented by Academician A.P. Vinogradov, July 24, 1961)

The mineral described in this article was found by one of the present writers (V.I. Gerasimovskiy) in 1938 in the Lovozero alkaline massif (in the Kola Peninsula). In both chemical composition and X-ray powder pattern it closely resembles lomonosovite, and has therefore been named betalomonosovite.

Physical and chemical properties. Betalomonosovite occurs as laminate-tabular segregations up to 5 x 4 x 0.3 cm in size. It has not been found as crystals. The color of the mineral is light yellowish-brown, sometimes with a pinkish shade; the streak is white; the luster is vitreous and pearly on the cleavage planes and vitreous to oily on fracture surfaces; cleavage is perfect in one direction; fracture is uneven; the mineral is brittle; hardness is about 4 on the Mohs scale; the specific weight is 2.98.

Betalomonosovite is optically negative and biaxial; $\gamma = 1.779$, $\beta = 1.770$, $\alpha = 1.670$; $2V = \sim 24°$; $r > v$. Extinction is oblique relative to the perfect cleavage. Thin sections parallel to the perfect cleavage show oblique emergence of one of the optical axes. In thin section the mineral is colorless or shows a faint color (pale cinnamon-brown). In sections cut perpendicular to the cleavage, the mineral is always colored pale to light cinnamon-brown. This is probably a result of pseudoabsorption. The mineral is triclinic. Betalomonosovite is soluble in hot dilute HCl.

Chemical analysis of betalomonosovite was

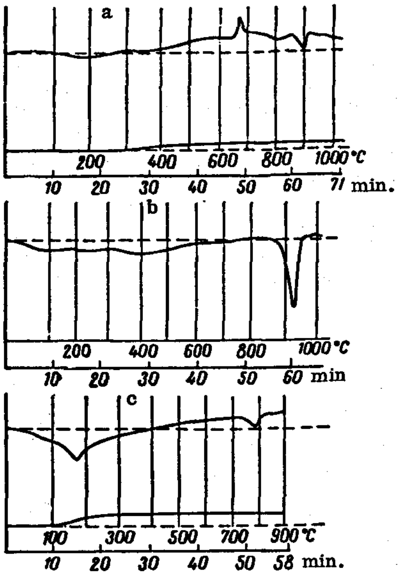

Fig. 1. Heating and weight-loss curves of betalomonosovite (a), lomonosovite (b) and murmanite (c). a - weighed sample 38.7 mg, weight loss 2 mg (5.17%); b - weighed sample 43.5 mg, no weight loss; c - weighed sample 42.6 mg, weight loss 4.4 mm (10.33%).

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[1] Translated from: Betalomonosovit. Doklady Akademii Nauk SSSR, 1962, Vol. 142, No. 3, pp. 670-673.

Table 1
Chemical Analyses of Betalomonosovite, Lomonosovite and Murmanite

Component	Beta-lomonosovite				Lomonosovite [2]	Murmanite [2]
		№ 2		Computed atomic ratios		
	№ 1, %	%	Atomic no.		№ 3, %	№ 4, %
P_2O_5	18,54	16,12	0,226	0,226=1	12,84	—
SiO_2	24,60	25,18	0,419	0,433=2	24,07	30,93
Al_2O_3	—	0,69	0,014		—	—
Nb_2O_5	3,05	4,78	0,036	0,422=2	3,00	7,71
Ta_2O_5						0,50
TiO_2	23,85	25,01	0,316		24,00	29,51
ZrO_2	2,24	1,89	0,015		2,10	1,40
Fe_2O_3	2,13	2,38	0,030		2,39	3,34
FeO	—	0,00	—		—	—
MnO	0,96	1,40	0,020		3,17	2,42
MgO	0,24	0,22	0,005	1,092=5	0,58	0,27
CaO	1,66	0,62	0,011		0,80	2,74
Na_2O	16,50	17,13	0,552		26,09	7,44
K_2O	Traces	0,88	0,020		—	0,56
$H_2O_{+110°}$	5,70	3,50	0,388		0,26	6,46
$H_2O_{-110°}$		0,16	—			6,06
F	—	—	—		—	—
Cl	—	—	—		Traces	—
Total	99,60	99,67	—		99,73	99,53
Analyst	T. A. Burova	M. Ye. Kazakova			T. A. Burova	T. A. Burova
Sp. gr.	2,98		—		3,13	2,766

Note: In computing the formula, the water content of the mineral was taken to be 4.60% (average of two determinations: 5.70% and 3.50% H_2O), with an additional allowance for a weight loss of about 5% H_2O because of the separation of water.
Note: Comma represents decimal point.

first made by T. A. Burova in 1939 and repeated in 1960 by M. Ye. Kazakova (see Table 1). For comparison, the table also shows the results of analyses of lomonosovite and murmanite. These data show that in its content of water and alkalies, betalomonosovite occupies an intermediate position in the series lomonosovite-murmanite, but in its contents of TiO_2, Nb_2O_5, SiO_2 and P_2O_5 it is closer to lomonosovite. The chemical composition of betalomonosovite, according to I. D. Borneman-Starynkevich's concept [1] of the nature of the minerals in the lomonosovite-murmanite group, may be expressed by the formula $Na_2Ti_2Si_2O_9 \cdot (Na, H)_3PO_4$. Isomorphous replacement of silica by phosphorus in this mineral is unlikely, since the phosphorus is readily leached from betalomonosovite with distilled water. For example, when powdered betalomonosovite was treated with distilled water and heated for up to 2 hours, 6.75% of the Na_2O and 6.46% of the P_2O_5 went into solution.

Table 2 gives the data on the X-ray powder patterns of betalomonosovite, and for comparison, of lomonosovite and murmanite, obtained under the direction of Ye. S. Makarov. This table shows that the X-ray powder pattern of betalomonosovite is closer to that of lomonosovite than to that of murmanite.

The heating curve of betalomonosovite (Fig. 1a), prepared by V. S. Mikhaylov of the Institute for the Geology of Ore Deposits, Petrography Mineralogy and Geochemistry of the USSR Academy of Sciences, shows a slight endothermic effect at the temperature of about 200° C; this is probably produced by the separation of water from the mineral. At about 650° C there is a sharp exothermic effect which is evidently caused by some change in the mineral, and at 900° C an endothermic effect that is, in all probability, due to the melting of the mineral. The heating curves of lomonosovite (Fig. 1b) and murmanite (Fig. 1c) are shown for comparison; it will be readily seen that the heating curves of these three minerals differ sharply from each other. In view of these differences, as well as the differences in their chemical compositions, betalomonosovite should be considered an independent mineral within the lomonosovite-murmanite group (see Table 3).

Conditions of occurrence and genesis. Betalomonosovite was first found on the right bank of the Tulbn'yunuay River (Lovozero massif) in a pegmatite body within a poikilitic sodalite syenite. The pegmatite body, 2.2 x 0.4 x 0.2 m in size, is composed chiefly of very large segregations (12 x 3 x 4 cm) of microcline. Secondary minerals that occur in large amounts are eudialyte, ramsayite, aegirite II, arfvedsonite, sodalite and zeolites;

Table 2
Interplanar Distances and Intensities of the Minerals of the Lomonosovite-Murmanite Group

Lomonosovite		Beta-lomonosovite		Murmanite		Lomonosovite		Beta-lomonosovite		Murmanite	
I	*d*, Å	*I*	*d*, Å	*I*	*d*, Å	*I*	*d*, Å	*I*	*d*, Å	*I*	*d*, Å
—	—	—	—	6	5,77	—	—	0,5	1,903	—	—
—	—	2	5,61	—	—	5	1,848	—	—	—	—
1	5,40	—	—	—	—	1	1,823	3	1,823	—	—
0,5—1	4,68—	2	4,68	—	—	6	1,778	—	—	—	—
	4,49	1	4,46	—	—	1	1,764	4	1,764	5	1,764
2	4,25	1	4,23	4	4,26	—	—	1	1,727	—	—
2	4,13	3	4,13	—	—	2	1,705	—	—	3	1,708
1	3,86	3	3,86	5	3,82	4	1,684	—	—	—	—
—	—	2	3,73	—	—	4	1,639	—	—	2	1,639
4	3,50	9	3,50	0,5	3,49	5	1,605	—	—	—	—
4	3,28	0,5	3,27	—	—	—	—	4	1,594	4	1,592
—	—	5	3,11	1	3,05	4	1,576	—	—	—	—
—	—	2	2,88	10	2,88	2	1,542	2	1,542	—	—
10	2,79	10	2,80	—	—	—	—	—	—	1	1,529
3	2,74	2	2,74	3	2,74	3	1,518	—	—	—	—
5	2,68	3	2,67	4	2,65	—	—	2	1,449	1	1,501
4	2,60	2	2,60	—	—	3	1,487	—	—	—	—
3	2,48	—	—	4	2,50	3	1,472	—	—	—	—
2	2,40	0,5	2,40	—	—	—	—	—	—	2	1,463
3	2,36	3	2,34	—	—	—	—	—	—	0,5	1,412
2	2,28	—	—	5	2,30	—	—	1	1,361	1	1,357
2	2,22	1	2,22	—	—	—	—	1	1,341	—	—
1	2,13	3	2,14	1	2,12	—	—	1	1,316	1	1,314
4	2,06	—	—	1	2,05	—	—	1	1,248	—	—
3	2,01	4	2,01	—	—	—	—	—	—	1	1,167
3	1,962	1	1,956	—	—	—	—	1	1,115	—	—
0,5	1,932	—	—	1	1,926	—	—	—	—	1	1,062

Note: Exposure conditions for lomonosovite and betalomonosovite: Fe-anticathode, Mn-filter, D = 57.3 mm; for murmanite: Ni-anticathode, Fe-filter, D = 57.3 mm.
Note: Comma represents decimal point.

Table 3
Comparison of the Properties of Betalomonosovite, Lomonosovite and Murmanite

Symmetry	Lomonosovite	Betalomonosovite	Murmanite
Symmetry	Triclinic	Triclinic	Monoclinic or triclinic
Form and size of min. segregation	Platy-tabular to 7 x 5 x 0.6 cm	Platy-tabular to 5 x 4 x 0.3 cm	Platy-tabular to 6 x 5 x 0.3 cm
Color	Dark brown to black	Light yellowish-brown	Pinkish-violet
Lustre	Vitreous, oily on fracture surface	Vitreous, oily on fracture surface	Vitreous, oily on fracture surface
Fracture	Uneven	Uneven	Uneven
Cleavage	Perfect	Perfect	Perfect
Hardness (Mohs)	3-4	4	2-3
Specific weight	3.13	2.98	2.77
Optical sign	Negative	Negative	Negative
Magnitude of 2V	56°	24°	60°
	r > v	r > v	r > v
γ	1.778	1.779	1.807
β	1.750	1.770	1.770
α	1.670	1.665	1.682
Color in thin section	Various shades of brown	Pale cinnamon-brown	Pale pink, sometimes brown
Chemical formula	$Na_2Ti_2Si_2O_9 \cdot Na_3PO_4$	$Na_2Ti_2Si_2O_9 \cdot (Na,H)_3PO_4$	$Na_2Ti_2Si_2O_9 \cdot H_2O$

more rarely, there is lamprophyllite, neptunite and chinglusuite (?).

Betalomonosovite also occurs in one of the pegmatite bodies on the left bank of the Tulbn'yunuay River; here it is contained within a eudialyte lujaurite. The pegmatite body can be traced for a distance of about 40 m and is up to 5 m thick in bulges. It is composed mainly of microcline, with considerably secondary contents of aegirite II, arfvedsonite, sometimes hackmanite, ussingite, nepheline, ramsayite, eudialyte, lamprophyllite and murmanite. Steenstrupite, neptunite and, rarely, sulfides (galena, sphalerite) are also encountered.

Talus piles in the valley of the Tulbn'yunuay River contain blocks of poikilitic sodalite syenite with pegmatitic areas in which the betalomonosovite is associated with lamprophyllite, murmanite, eudialyte, ramsayite and chinglusuite.

It is quite possible that betalomonosovite also occurs in the rocks of the Lovozero massif.

Betalomonosovite is in all probability a primary mineral formed under conditions similar to those in which lomonosovite is formed, but in a somewhat different environment where water also begins to take part in the mineralizing process. The composition of betalomonosovite includes from 3.56% to 5.70% H_2O.

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FLUOBORITE FROM CENTRAL ASIA[1]

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(Presented by Academician A.G. Betekhtin, September 1, 1961)

Fluoborite, a magnesium orthoborate with the formula $Mg_3(BO_3)(F, OH)_3$, was until recently considered one of the very rare minerals found only in a few isolated places of the world [2]. Lately, however, communications have begun to appear about discoveries of fluoborite and other endogenic borates at a number of points within the USSR, but fluoborite has not been known to occur anywhere in Central Asia.

In the course of a geologic investigation in the region where the Chatkal and Kuraminskiy Ranges, in one of the magnesium skarns the present writers found fluoborite associated with ludwigite, clinohumite and small amounts of serpentine and calcite. The fluoborite replaces the ludwigite, through which it passes in the form of veinlets, and is undoubtedly a decomposition product of the ludwigite. The great mass of fluoborite is concentrated in areas where the magnesium skarns are not replaced by ludwigite – that is, the fluoborite replaces the clinohumite.

Visually the fluoborite has a white color; only in the areas of the most complete replacement of the clinohumite, where the fluoborite is a dense, matted-fibrous, fine-crystalline mass, does its color take on a pinkish shade. In places the fine-crystalline fluoborite is intersected by small veinlets of more coarsely crystalline fibrous-acicular fluoborite whose individual crystals are oriented perpendicular to the vein selvages. This somewhat later fluoborite results from solution and recrystallization of the fine-crystalline earlier fluoborite, and contains no admixtures of other minerals.

The optical properties of both generations of fluoborite are absolutely the same, and may be characterized by the following data: the mineral is uniaxial and optically negative; $\beta = 1.551 \pm 0.001$; $\alpha = 1.521 \pm 0.002$; $\beta - \alpha = 0.030$. The specific weight is 2.92. There is no cleavage, but large individual crystals of fluoborite show a lamellar structure similar to that of endogenic ascharite, so that fluoborite can be easily confused with ascharite in thin sections, unless the refractive indices are checked.

In spite of the relative purity of the material, the samples taken for chemical analysis contained small amounts of clinohumite, serpentine and calcite. The calcite was removed by solution in 5% HCl and the clinohumite and serpentine by means of heavy liquids. Careful examination of the material under the binocular microscope then showed that some (a very small quantity) admixture remained in the sample; this remaining serpentine was inter-grown with the fluoborite. Corrections for this serpentine were thus made before recomputing the chemical data for the formula of the mineral (Table 1). According to the chemical formula of fluoborite that was obtained from these data, the F/OH ratio

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[1] Translated from: O flyuoborite v Sredney Azii. Doklady Akademii Nauk SSSR, 1962, Vol. 142, No. 3, pp. 674-676.