STRONTIAN APATITE[1]

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Abstract

An apatite from a syenite dike near Libby, Mont., has 11.6 per cent SrO, a specific gravity of 3.35, and indices of refraction of $\omega=1.638$ and $\epsilon=1.634$. It is believed to be deuteric in origin.

Occurrence

The apatite described in this report came from a dike on the upper part of the ridge between Kearney and Rainy Creeks in the Rainy Creek district near Libby, Mont., and near the Vermiculite mine (Larsen and Pardee, 1929, p. 108). The dike, which cuts apatite pyroxenite, is a syenite with streaks and patches of darker-colored rock rich in pyroxene, sphene, and apatite. Apatite makes up as much as 10 per cent of some of these streaks and yellow sphene even more. The apatite here described came from one of these streaks. The form of the streaks and the way in which the pyroxene and sphene penetrate the large feldspar crystals strongly indicate that the minerals are deuteric in origin. Most apatite in igneous rocks has a specific gravity a little below 3.20, but in attempting to separate the apatite and sphene of this rock the apatite was found to have a much higher specific gravity; most of it was suspended in or just sank in methylene iodide (sp. gr. 3.33).

The indices of refraction and other optical properties of this apatite are within the range of those of apatite commonly found in igneous rocks. When strontium replaces calcium in minerals the indices of refraction are not greatly changed but there is a large change in the specific gravity. The apatite here described, therefore, was tested spectrographically for strontium and was found to be high in that element. Apatite from other parts of the dike that contained the strontian apatite had normal specific gravities and contained little strontium. The sphene associated with the strontian apatite contained little strontium.

Description

Analytical data on strontian apatite from Montana and on a similar apatite from Kola Peninsula, Russia, are shown in Table 1.

The strontian apatite from Libby, Mont., is very much like the apatite from Kola Peninsula called saamite by Volkova and Melentev (1939),

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TABLE 1. ANALYSES AND PROPERTIES OF STRONTIAN APATITE

	From Montana[1]		From Kola Peninsula, Russia[2]
	Weight per cent	Molecular proportion	Weight per cent
SiO_2	0.14	2	1.55
Al_2O_3	0.38	4	0.34
Fe_2O_3	0.27	2	0.12
TiO_2	0.04	1	0.00
MnO	0.02	—	0.05
CaO	46.3	825 }	42.38
SrO	11.6	112 }	11.42
BaO	0.06	— } 10×94.5	0.00
MgO	0.25	6 }	0.05
Na_2O	0.10	2 }	0.13
K_2O	0.02	—	0.07
P_2O_5	39.2	272 3×91	38.33
As_2O_3	<0.001	—	0.00007
F	2.57	135 2×67	3.73
Ignition loss	0.14		0.10
	101.09		101.67
O=F	−1.08		−1.57
Total	100.01		100.10
Specific gravity	3.35 (by pycnometer)		3.355
ω	1.638		
ϵ	=1.634		

[1] Strontian apatite from vicinity of Libby, Mont. (R.C. 158). Analysis by Mary H. Fletcher made on sample dried at 110°C. Alkalies determined by flame photometer by Charles A. Kinser. MgO determined spectrographically by Claude Waring. Sample had more than 99 per cent apatite and checks very closely with the theoretical composition of apatite—$10(Ca_{0.88}Sr_{0.12})O \cdot 3P_2O_5 \cdot 2F$.

[2] Strontian apatite or saamite, Mt. Poachvrimchorr, Kola Peninsula, Russia. Analysis by E. K. Vacharov (Volkova and Melentev, 1939). V_2O_5 not determined. As_2O_3, 0.00007; ZrO_2, 0.001; ΣTR_2O_3, 3.22; and H_2O, 0.28.

except that the Kola mineral has more than 3 per cent of rare earths. It seems better to eliminate the name saamite and to call the Libby and Kola minerals strontian apatites (Schaller, 1930).

Strontian hydroxylapatite has been prepared artificially by Klement (1939) and strontian chlorapatite by Carobbi (1950). Carobbi gives the indices of refraction of the artificial strontian chlorapatite as: $\omega = 1.658$, $\epsilon = 1.664$ (these data indicate crystals that are optically positive). Natural chlorapatite has $\omega=1.667$, $\epsilon=1.664$, and sp. gr. $=3.20$. Here, too, strontium has little effect on the indices of refraction of apatite.

An x-ray powder pattern of strontian fluorapatite was taken with CuK_α radiation (1.5418 Å). This pattern is identical with that of fluorapatite except for a slight difference in spacing. The lattice constants of strontian fluorapatite were calculated by Evelyn Cisney from measurements of the powder pattern. A comparison of these lattice constants with those of fluorapatite (Winchell, 1951) is as follows:

	a_0 (*in Å units*)	c_0 (*in Å units*)
Fluorapatite	9.38[2]	6.89[2]
Strontian fluorapatite	9.41 ± 0.01	6.91 ± 0.01

The lattice constants of hydroxylapatite and 100 per cent strontium hydroxylapatite (Klement, 1939) are given below to show the magnitude of change in lattice constants when the calcium is completely replaced:

	a_0 (*in Å units*)	c_0 (*in Å units*)
Hydroxylapatite	9.42[2]	6.94[2]
Strontium hydroxylapatite	9.76[2]	7.21[2]

The specific gravity of strontian fluorapatite, calculated from the above parameters, is 3.34. This is larger than the specific gravity of calcium fluorapatite, but it is appreciably smaller than that of pure strontium hydroxylapatite (sp.gr. $=4.17$) calculated from its lattice parameters (Klement, 1939).

The differences between the lattice constants of fluorapatite and strontian fluorapatite, though small, are greater than the error of measurement and therefore real, and they could be used to distinguish between the two. However, the high specific gravity of strontian apatite is probably the best property for its identification.

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[2] Recalculated to Å units from the formula 1 Å $=1.00202$ kX.