

## ADDITIONAL DATA ON BARYLITE FROM SEAL LAKE, LABRADOR

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## INTRODUCTION

A paper describing the occurrence of barylite at Seal Lake, Labrador, by Heinrich and Deane (1962) appears as the preceding paper in this issue. Since late in 1960 the beryllium-bearing rock from this area has also been under investigation at the Mines Branch of the Department of Mines and Technical Surveys, Ottawa, Canada. One of the authors of this paper (E.H.N.) is currently engaged in investigating the mineralogy of the rock and, as part of this program, has developed a staining method for barylite. The second author (D.J.C.) has made a complete chemical analysis of the barylite. Since this information supplements the work of Heinrich and Deane, it was decided to publish both accounts together. Dr. Heinrich kindly provided a draft copy of his paper (with Deane) and agreed to postpone its publication until the completion of our paper.

The barylite was concentrated from Sample No. TR-16, one of a number of samples provided by R. A. Dujardin of Rio Tinto Canadian Exploration Limited. This particular sample was selected in preference to the others because of its relatively high proportion of barylite. The sample, a part of which is shown in thin section in Fig. 1, appears to correspond to the "vein barylite" described by Heinrich and Deane. The refractive indices, cleavage, and  $x$ -ray powder diffraction pattern of the analyzed barylite conform to those given by Heinrich and Deane, so that there is no doubt as to the identity of the mineral described in these two papers.

Since Heinrich and Deane have given a preliminary description of the mineralogy of the deposit, and since our own mineralogical study has not yet been completed, there would be little value in presenting the results of our preliminary work on the minerals other than barylite. However, it might be mentioned that, with regard to the presence of other beryllium minerals suggested by Heinrich and Deane, eudidymite has been isolated during our studies and has been positively identified by its  $x$ -ray powder diffraction pattern and optical properties.

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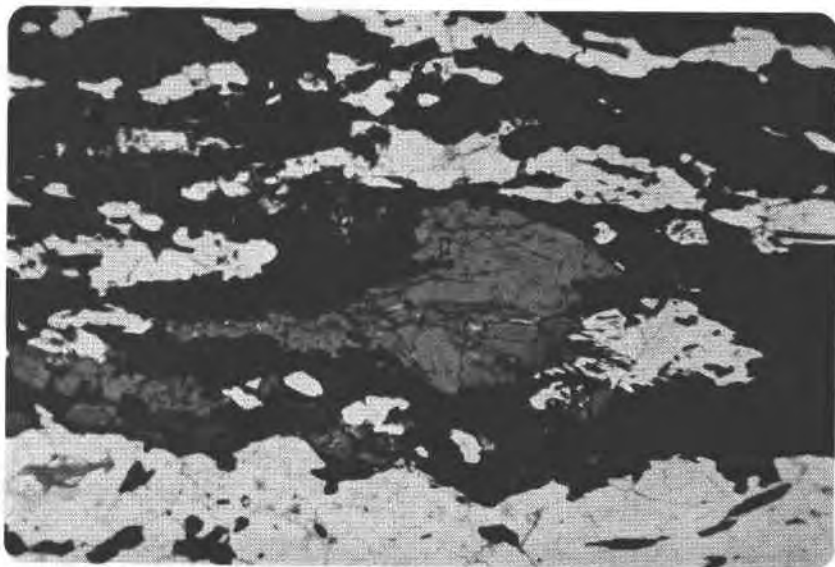


FIG. 1. Color photomicrograph of thin section stained with potassium rhizonate. Feldspar is white; amphibole is black; barylite is stained brick-red. Photograph by J. A. Soles, Mines Branch. Ultropak illumination. Magnification 40X.

#### CHEMICAL ANALYSIS

The barylite was concentrated from sample No. TR-16 by pulverizing and centrifuging repeatedly in Clerici solution diluted to a specific gravity of 3.90, which is slightly below that of the barylite. The lighter minerals, principally quartz, floated in this liquid, leaving a heavy concentrate consisting of nearly pure barylite.

The analyzed barylite is light pink in color, in contrast to the white or colorless barylite in most of the other samples. Nevertheless, both the pink and white materials have the same  $x$ -ray powder patterns and optical properties, the pink color probably being due to the presence of a minor constituent, possibly iron. The pink barylite was analyzed in preference to the white because sample No. TR-16 contained a much higher proportion of barylite than any of the other samples studied and consequently was more amenable to concentration.

The chemical analysis of the barylite is shown in Table 1. When this analysis is compared with the theoretical composition of pure barylite ( $\text{BaBe}_2\text{Si}_2\text{O}_7$ ) it is seen that the analyzed sample contains a small excess of  $\text{SiO}_2$  and a deficiency of  $\text{BeO}$  and  $\text{BaO}$ . This can be explained by the presence of about 2 per cent quartz in the analyzed barylite.

The analysis recalculated to molecular proportions is shown in Table 2.

TABLE 1. CHEMICAL ANALYSIS OF BARYLITE

	Barylite, Seal Lake, Labrador	BaBe <sub>2</sub> Si <sub>2</sub> O <sub>7</sub> (Calc.)
BeO	15.00%	15.46%
BaO	46.12	47.40
SiO <sub>2</sub>	38.52	37.14
Fe <sub>2</sub> O <sub>3</sub>	0.08	—
Al <sub>2</sub> O <sub>3</sub>	0.04	—
CaO <sup>1</sup>	0.15	—
H <sub>2</sub> O	0.11	—
	100.02	100.00

<sup>1</sup> Includes minor amount MgO.

This also shows the deficiency of BeO and BaO and the excess of SiO<sub>2</sub> with respect to pure BaBe<sub>2</sub>Si<sub>2</sub>O<sub>7</sub>. However, the mole BeO:BaO ratio is 1.93:0.97 = 2:1, which corresponds to that of pure barylite.

The specific gravity of the barylite calculated from the above analysis, accepting Smith's (1956) values for the unit cell parameters and assuming 4 formula weights per unit cell, is 3.98. This is in good agreement with the measured value of 3.96, determined by pycnometer. The calculated specific gravity of pure barylite is 4.00.

#### STAINING METHOD

Since it is very difficult to distinguish barylite from the other white minerals in the rock, an attempt was made to find a suitable diagnostic stain for barylite. A number of reagents were investigated, particularly

TABLE 2. MOLECULAR PROPORTIONS IN BARYLITE

Oxide	Analyzed Wt. %	Mol. Wt.	Mol. Props.	Mol. Props. × 3.2233 <sup>1</sup>	Theoretical BaBe <sub>2</sub> Si <sub>2</sub> O <sub>7</sub>
BeO	15.00	25.01	0.5998	1.93	2.00
BaO	46.12	153.36	0.3007	0.97	1.00
SiO <sub>2</sub>	38.52	60.09	0.6410	2.07	2.00
Fe <sub>2</sub> O <sub>3</sub>	0.08	159.70	0.0005	0.01	—
Al <sub>2</sub> O <sub>3</sub>	0.04	101.96	0.0004		
CaO	0.15	56.08	0.0027		
H <sub>2</sub> O	0.11	18.02	0.0061	0.02	—
	100.02		1.5512	5.00	5.00

<sup>1</sup> This factor brings the total mol. props. to 5.00.

those likely to be specific for beryllium or barium. The most successful reagents were found to be sodium rhodizonate and potassium rhodizonate, both of which react with barium. The use of sodium rhodizonate as a spot test for barium has been described by Feigl and Suter (1942) and Feigl (1958). In staining barylite, the potassium rhodizonate was found to be equally as effective as the corresponding sodium salt.

The staining method involves a two-step procedure—etching followed by staining. The details are as follows:

### *Reagents*

*Etching Reagent:* Concentrated hydrofluoric acid (HF), 48% solution.

*Staining Reagent:* 0.2% aqueous solution of sodium rhodizonate or potassium rhodizonate. The solution of either salt is prepared with cold water shortly before use, as it deteriorates rather rapidly. In practice, a solution prepared in the morning may be used for the remainder of the day, but is ineffective the following day.

### *Procedure*

*Rock slabs and thin sections:* Suspend sample over hot fuming HF for 1 minute; rinse with water; immerse in staining solution for 2 to 5 minutes; rinse with water; dry, if necessary, but without heating.

*Crushed samples:* Immerse the sample in cold HF in a platinum or "Teflon" crucible for 1 to 5 minutes, depending on particle size (excessive etching will decompose finely pulverized barylite completely); decant HF and rinse with water; apply a staining solution for 2 to 5 minutes; decant and rinse with water; dry, if necessary, but without heating.

*Results.* If the above procedure is followed, the barylite is selectively stained to a brick-red color. The contacts between the barylite grains and the other minerals are sharply defined, and there is no appreciable tendency for the color to run (Fig. 1). At room temperature the color persists for a long time, although over a period of months it becomes somewhat lighter in shade. In stained sections examined after six months, the color was found to have changed from its original bright brick red to a reddish-orange shade. Heating, even to relatively moderate temperatures, causes the stain to change to a dark chocolate-brown, so that heating should be avoided when drying the stained sample.

Some grains of barylite stain more deeply than others, even within the same sample (Fig. 1). This is apparently due to variations in the degree of attack by the hydrofluoric acid, which, in turn, appears to depend on such factors as surface preparation, degree of fracturing or cleavage, and crystallographic orientation.

In general, since the staining reaction depends on the presence of

barium ions, other barium-bearing minerals, if present, might also be expected to be stained. The staining procedure was tried on barite, one of the most common barium minerals. It resisted staining, however, because of its insolubility in HF.

With respect to interference by other elements, Feigl (1958, p. 216) notes that "the rhodizonate test is recommended only for the detection of barium . . . when bivalent heavy metals are known to be absent." Feigl and Suter (1942), in their investigations of the effects of sodium rhodizonate on a number of elements, showed that in a neutral solution both barium and strontium react to form a red-brown color, and that a few other ions (mercury, cadmium, bismuth and copper) produce other shades of red. Dr. A. A. Levinson of Gulf Research and Development Company, formerly with the Texas Division of the Dow Chemical Company, drew our attention to a paper by Poluektov (1959) who reported that in a weakly acid medium the rare earth elements react with potassium and sodium rhodizonates to form a red-violet color. Therefore, in applying this staining method to barylite the possibility of these interferences must be considered.

In the Seal Lake beryllium-bearing assemblage, however, the only mineral, other than barylite, affected by the stain appears to be a metamict rare-earth mineral that has not yet been fully identified. It changes from its original tan color to a darker brown, a color that is quite distinct from that of the stained barylite. The barylite appears to be the only mineral in the assemblage that produces the characteristic brick-red stain when the described procedure is followed. It may be concluded, therefore, that the barylite in the Seal Lake mineral assemblage is selectively stained by this procedure.

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