URANINITE FROM LAC PIED DES MONTS, SAGUENAY DISTRICT, QUEBEC

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In 1893 or 1894 J. Obalski, then inspector of mines for Quebec collected a crystal of uraninite from a pegmatite dike worked for muscovite on the north side of Lac Pied des Monts, de Sales township, Charlevoix county, about 18 miles northeast of Murray Bay. This is the easternmost occurrence of uraninite in Canada. Obalski described the crystal about ten years later in the *Journal of the Canadian Mining Institute*, vol. VII, pp. 245–256, 1904. In 1915 the crystal was bought by the Department of Physics of McGill University. Dean A. S. Eve, Director of the Department of Physics, has kindly allowed the writers to describe the crystal and to saw 4-1/2 grams from it for analysis.

Fig. 1. Uraninite crystal, Pied des Monts, Quebec. (Natural size.)

The crystal, which is about two inches in diameter, is part of a dodecahedron with six faces developed (Fig. 1). The faces show a coating of deep orange to brown gummite, which forms a covering about 1 mm. thick on the parts of the faces near the ends of the cube axes. About two grams of quartz adhered to one end of the crystal; this was removed and a thin coating of gummite and uran-

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ophane found beneath it. The fractured surfaces of the crystal are free from visible alteration products.

The crystal weighed 375 grams when found, and the density of the crystal, including alteration products and quartz, was determined as 8.43 by B. J. Harrington.

Mineragraphic Examination

The side of the saw-cut opposite to the part analyzed was polished and examined with the reflecting microscope by Osborne. The surface is almost entirely of uraninite, but shows one very narrow series of anastomosing veinlets of an alteration product. Fig. 2 shows the microscope field that contains the most alteration product.

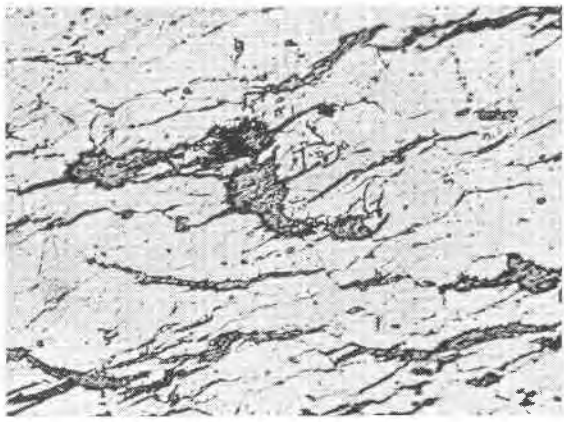

Fig. 2. Veinlets of uranophane cutting uraninite. (×90). Pied des Monts uraninite crystal.

The alteration product was determined as uranophane by etch reactions and comparison with uranophane associated with gummite and uraninite from Mitchell county, N.C. Under the reflecting microscope the uranophane has a blue-green colour against uraninite, gummite is reddish. The internal reflection of uranophane seen with crossed nicols is sulphur yellow, of gummite orange. The etching behaviour of the minerals shown toward the standard etching reagent is given in the table.

	Uranophane	Gummite
HNO_3	No colour change, surface becomes pitted.	Similar reaction but slower.
HCl	Surface becomes pitted, fumes tarnish pale green, rubs clean.	Surface pitted

KCN	Negative	Negative
$HgCl_2$	Slight pitting	Negative
$FeCl_3$	Slow reaction, fumes tarnish pale brown, slight pitting.	Very slight reaction
KOH	Negative	Negative

The uranophane in the larger areas is feebly anisotropic.

In the course of the tests the behaviour of the uraninite itself was checked. It is negative to all reagents except $FeCl_3$. Murdoch, Davy and Farnham[2] and Short[3] list a slight reaction with this reagent: the surface turns brown and rubs gray. According to Schneiderhöhn and Ramdohr[4] the reaction is negative. This specimen turns brown with the separation of minute acicular crystals in the reagent, and the surface rubs brown.

Analysis

The material used for analysis was a 4-1/2 gram fragment showing no colored alteration products when examined under the binocular microscope. Though black, it lacked the steely colour and almost metallic lustre of the best-preserved uraninites which also have a slightly greater specific gravity and hardness. Nevertheless, judging from past experience, the alteration is not sufficient to cause any serious error in the lead ratio. Owing to the small amount of material available and its apparently good quality no attempt was made to separate a concentrate of maximum density. An analysis on samples of 2 grams yielded the following results:

Uraninite, Lake Pied des Monts, Que.
Analyst—H. V. Ellsworth

PbO[1]	11.69
(Pb=10.84)	
U_3O_8	86.16
(U=73.08)	
ThO_2	0.10

[1] Pb=206
Spec. Grav.=8.958 at 18.53°C.

$$\frac{Pb}{U+0.36\ Th}=0.148$$

[2] Davy and Farnham, The Microscopic examination of ore minerals, 1920.

[3] Short, M. N., Microscopic determination of ore minerals; *U. S. Geol. Surv. Bull.* **825**, p. 102, 1931.

[4] Schneiderhöhn and Ramdohr, Lehrbuch der Erzmikroskopie, 1931, p. 521.

(Th=0.088)	
$(Ce, La, Di)_2O_3$	0.06
$(Yt, Er)_2O_3$	0.73
Fe_2O_3, Al_2O_3	0.35
MnO	0.14
CaO	0.35
MgO	0.06
SiO_2	0.21

This uraninite contains the lowest percentage of thorium and rare earths of any so far examined by Ellsworth. The amount of thorium found is so small that it has no appreciable effect on the lead ratio, as the uranium equivalent is no greater than the probable analytical error of the uranium determination. It is interesting to note that the lead ratio for this low-thorium uraninite is in fairly close agreement with the ratios (0.15 to 0.16), from the best preserved uraninites of the Grenville area of Ontario and Quebec, which contain from 1 per cent to as much as 11 per cent ThO_2, whereas uraninite from the Huron claim in south east Manitoba carrying 14 per cent ThO_2 yields a lead ratio of 0.26.

In dissolving the uraninite a slight brownish colouration of the solution, apparently due to carbon or hydrocarbon, was noticed. This is interesting in connexion with Obalski's statement (*loc. cit.*) that he also found in the same deposit with the uraninite "a carbonaceous material burning quite easily and leaving ashes containing oxide of uranium" which evidently was a variety of thucholite.

Geological Occurrence

The dike from which the uraninite was obtained is about half way up the high hill on the north side of the lake. It is 15 to 20 feet thick and can be traced for 200 feet along the hillside cutting hornblendic gneiss. The chief constituents of the dike are pink microcline, white albite, and white quartz with much biotite[5] and somewhat less muscovite, all more or less mixed and with no large segregations of either quartz or feldspar. The structure is coarse granitoid to graphic. Mica books are as much as a foot in diameter, and intergrowths of biotite and muscovite occur. Red

[5] Some of the biotite from this mine carries unusually perfect pleochroic haloes which have been very thoroughly studied by D. E. Kerr-Lawson (*University of Toronto Studies, Contributions to Canadian Mineralogy*, **1927, 1928**).

garnets are plentiful and occasional fragments are almost of gem quality. A few small dark zircon crystals, very fresh and bright, may be seen, and some very small monazite crystals have been found. No traces of uraninite or thucholite can be seen at present.[6]

Lac Pied des Monts is on the northwestern corner of the St. Urbain area mapped by Mawdsley.[7] In that area Mawdsley found only a few dikes of pegmatite and these are younger than the anorthosite. In mapping an area east of this Faessler[8] found a coarse-grained pink granite to have a widespread development. He believes that this is the same age as the Roberval granite named by Dresser[9] from its occurrence near Roberval. Osborne, mapping near Chicoutimi along the Saguenay, found that the dikes older than the anorthosite have taken on an augen structure due to shearing. A few dikes, rather syenitic in composition, appear to be related to the anorthosite and to have escaped shearing, as also did granite pegmatite dikes belonging to the Roberval granite. These observations suggest that the dike containing the uraninite is younger than the anorthosite and probably satellitic to the Roberval, the only granite in this area known to be younger than the anorthosite, for a dike that has yielded 20 tons of commercial muscovite cannot have been sheared to a great extent. Dikes similar to the one mentioned here are abundant in the area east of the Saguenay, where Faessler notes the widespread development of the Roberval granite, suggesting a genetic relationship between the two.

[6] *Geol. Surv. Can., Econ. Geol. Series,* No. **11,** 1932.

[7] Mawdsley, J. B., *Geol. Surv. Can., Mem.* **152,** 1927.

[8] Faessler, Carl, Geological Explorations of the North Shore Tadoussac to Escoumains; *Quebec Bur. of Mines, Ann. Rept.* **1929,** p. 81, 1930.

[9] Dresser, J. A., Part of the district of Lake St. John, Quebec, *Geol. Surv. Can., Mem.* **92,** p. 26, 1916.