

TODDITE—A NEW URANIUM MINERAL FROM  
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Within the last two or three years quite a number of pegmatite dikes in the Sudbury area have been more or less opened up in attempts to produce commercial feldspar. Certain of these efforts have met with fair success but in many cases the dikes appear to be not well adapted to the profitable extraction of feldspar. This area constitutes the present north western frontier of the feldspar mining industry in Canada and is particularly interesting because, aside from being more or less virgin ground for the occurrence of pegmatite minerals, the age of the rocks themselves is a subject of controversy. The older view, still held by many geologists is that they are identical in age with the supposedly pre-Huronian Laurentian-Grenville complex to the south east, while more recently Collins and Quirke have assigned them to the Huronian. The occurrence of uranium and thorium minerals in these rocks is therefore of special interest, leading us to hope that eventually their true age relationships may be accurately fixed by the radioactive disintegration method.

The mineral here described was found by the writer last summer in a pegmatite dike in the north west corner of lot 4, conc. 3, Dill township, Sudbury district. An opening had been made in the dike from which one carload of feldspar was shipped.

The dike is 30 to 40 feet wide and is exposed for a length of 100 feet cutting biotite-garnet-gneiss. It consists of the usual association of pale pink microcline in crystals not usually over one foot in diameter, white quartz, some badly cracked muscovite in thin plates and "books" up to 4 x 6 inches in diameter, a little decomposed biotite in very thin plates, a little smoky quartz, and a few garnets. There is little if any albite or other plagioclase feldspar visible. Columbite occurs sparingly in crystals and grains usually not over one quarter inch in diameter and is readily distinguished from the uranium minerals also present by the fact that it does not cause fracturing in the surrounding feldspar or quartz. Probably two or more different radioactive minerals occur. These do not exhibit definite crystal boundaries but usually take the form of small, rounded, elongated masses one to three inches in length, which cause well marked radial fracturing in the enclosing rock. For instance the mass of toddite, about  $1\frac{1}{4} \times \frac{1}{2}$

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inch which furnished the material for the analysis, gave rise to fractures 5 inches long in the quartz and feldspar matrix. This specimen was selected for analysis because it appeared to be the least altered of the various individuals collected. Although there was an outer zone perhaps 1 to 2 millimeters thick next the matrix which by its duller lustre gave evidence of alteration, the inner portion was bright and lustrous and apparently very well preserved. On breaking up the mass after removing the outer altered material it appeared under the microscope to be perfectly uniform and homogeneous. The color is pitch-black, lustre submetallic, brilliant, fracture subconchoidal, very brittle. Cleavage none, hardness 6.5, powder brownish gray. The finely crushed powder is almost opaque under the microscope, even with arc light illumination, but very thin grains transmit some light, showing a dark brown color and isotropic character.

Analysis of the mineral yielded the following results:

	Percent	Mol. Wt.	Bases	Acids
PbO.....	0.44	222	0.0020	
(Pb=0.41)				
UO <sub>2</sub> .....	8.71	270.2	0.0322	
UO <sub>3</sub> .....	2.37	286.2	0.0083	
(U=9.65=11.38 U <sub>3</sub> O <sub>8</sub> )				
ThO <sub>2</sub> .....	0.47	264	0.0018	
(Th=0.41×0.38=0.15 U equivalent)				
(Ce, La, Di) <sub>2</sub> O <sub>3</sub> .....	0.76	330	0.0023	
(Yt, Er) <sub>2</sub> O <sub>3</sub> .....	3.42	230	0.0149	
FeO.....	4.38	72	0.0608	
Fe <sub>2</sub> O <sub>3</sub> .....	4.68	159.7	0.0293	
MnO.....	2.62	70.9	0.0369	
Al <sub>2</sub> O <sub>3</sub> .....	0.04	102.2	0.0004	
BeO.....	0.47	25.1	0.0188	
CaO.....	2.02	56	0.0361	
MgO.....	0.22	40.3	0.0054	
ZrO <sub>2</sub> .....	0.06	122.6		0.0005
SnO <sub>2</sub> .....	0.53	150.7		0.0035
TiO <sub>2</sub> .....	0.85	80.1		0.0106
Ta <sub>2</sub> O <sub>5</sub> .....	8.97	443		0.0202
Cb <sub>2</sub> O <sub>5</sub> .....	53.73	266.2		0.2018
SiO <sub>2</sub> .....	1.77	60.3		0.0293
F.....	Not detected		0.2492	_____
H <sub>2</sub> O-110°.....	0.35			0.2659
H <sub>2</sub> O+110°.....	3.59	18	0.2000	
Hydrocarbons.....	Trace			
Loss on ignition.....	(3.42)			
		100.45		

Sp. Gr.=5.041 at 19.80°C.

Pb/U+0.38 Th=0.042=300 million years.

From the analysis it is evident that the mineral conforms in a general way to the columbite formula and may be considered as columbite in which some manganese and iron is replaced by uranium, which is present in sufficiently important amount to justify making it a new species.

The age of the mineral was determined as about 300 million years which is very much lower than that of the Ontario uraninites (1100–1200 million) but this result is not conclusive, as, in the writer's experience minerals of this sort often give very much lower age results than they should, due doubtless to the leaching or replacement of part of the lead.

That the material analyzed can be a mixture or intergrowth appears highly improbable. The microscopic examinations revealed no evidence of a lack of homogeneity. Nevertheless because of the opaque character of the mineral the possibility that it might be an intergrowth or mixture of columbite and uraninite was considered though no uraninite was found in the dike. If this were the case treatment with nitric acid would remove the uraninite, a test which was applied with negative results.

The name Toddite is proposed for this mineral in honor of E. W. Todd of the Ontario Department of Mines who has contributed so much to our knowledge of Canadian radioactive minerals.

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#### NOTES ON THE MINERAL LOCALITIES OF RHODE ISLAND. I. PROVIDENCE COUNTY

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A recent survey of the minerals of the state of Rhode Island which are included in the museum collections of the Department of Geology of Brown University and of Roger Williams Park of Providence, together with a careful study in the field by the authors and others have revealed the presence of at least sixty species of minerals from forty-five localities. A brief discussion of the chief mineral localities and occurrences in Providence County<sup>1</sup> is here recorded.

<sup>1</sup> A paper is being prepared by the authors on the remaining localities.