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URANIUM DEPOSITS IN GASPÉ, NEW BRUNSWICK, AND NOVA SCOTIA

By

G. A. Gross

OTTAWA
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CONTENTS

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INTRODUCTION

As a result of widespread interest in prospecting for uranium during the last few years, several uranium occurrences were found in the Gaspé region of Quebec, in New Brunswick, and in Nova Scotia. Some of these occurrences were explored fairly extensively but under present conditions none of them was proved to be of commercial interest. Several different types of uranium deposits were found, and some are of particular geological interest. All known occurrences were studied by the writer during the 1956 field season to provide a more complete understanding of the uranium possibilities in this part of Canada.

The writer was fortunate in being able to draw on information provided the Atomic Energy Control Board and filed with the Geological Survey of Canada. The release of this information for publication by the discoverers and property owners is gratefully acknowledged. Assistance by officers of the Quebec Department of Mines, the New Brunswick Department of Lands and Mines, and the Nova Scotia Department of Mines was much appreciated. The writer is especially indebted to property owners, company officials and consulting geologists in the region who supplied information and gave the writer their full cooperation in the field. Complex mineral separations were made by H. R. Steacy of the Radioactivity Laboratory, Geological Survey of Canada.

The topography in most of the region is characterized by high flat-topped plateaux over the more resistant rocks, and broad lowlands with very little relief over the less resistant rocks (Alcock 1947, p. 98)[1]. The flat-plateau tops are thought to be old erosion surfaces or peneplains that have been uplifted and subjected to several cycles of erosion in the past (Alcock 1949, p. 49). The plateaux are incised by deep, steep-walled valleys and the topography over the higher ground is rugged.

There is abundant evidence of recent glaciation. Raised beaches in many parts of the region are believed to have been elevated through large-scale uplift and warping of the earth's crust after the load of ice had melted. Glacial deposits several feet thick are distributed over much of the region and these deposits of unconsolidated material are a decided impediment to surface prospecting and a hindrance to geological study.

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[1] Dates, etc., in parentheses refer to references at the end of this paper.

GENERAL GEOLOGY

Uranium occurrences have been found at widely distributed places in the Appalachian region of Eastern Canada and the geological setting is different for nearly every deposit.

Much of the Appalachian region is underlain by highly deformed Palaeozoic sedimentary and meta-sedimentary rocks. The prominent structural trend is northeast and the deformation is related to two main periods of mountain building which took place at the close of the Ordovician and, later, during the Devonian. Granite was intruded in the Arisaig area of Nova Scotia probably towards the end of the Ordovician, but most of the large masses of granite were emplaced during the Devonian.

Gaspé peninsula and the northwest half of New Brunswick are underlain by tightly folded Palaeozoic sedimentary and volcanic rocks, most of which range in age from Ordovician to Devonian. Local areas at the east end of Gaspé Peninsula and along the shores of Chaleur Bay are underlain by less deformed Carboniferous sedimentary rocks. Small masses of ultrabasic rock, which are extensively altered to serpentine, form hills in the central northeast part of Gaspé and occur in northern New Brunswick. Small intrusive masses of granite and related rock types, believed to be Devonian in age, occur in central Gaspé and in the area immediately south of Chaleur Bay. Larger granite masses occur in a broad highland belt about 30 miles wide that extends southwest from Bathurst, New Brunswick, to the border of the State of Maine.

The central and southern parts of New Brunswick and the adjacent northwest part of Nova Scotia as far east as New Glasgow is underlain by Carboniferous rocks, which include sandstone, shale, limestone, and gypsum, and acid volcanic rocks of the Windsor group and thick sections of later sandstone, shale and conglomerate. These rocks form a large syncline in central New Brunswick which plunges at a low angle to the northeast. To the east these rocks are more highly deformed in local areas but the major folds plunge northeast.

Precambrian and early Palaeozoic meta-sedimentary and volcanic rocks form a complex structural belt along the north shore of the Bay of Fundy in southern New Brunswick. This belt of rocks is intruded by granite, some of which may be Precambrian, but most of which is Devonian.

The Cobequid complex, consisting mainly of Palaeozoic sedimentary and volcanic rocks cut by granitic intrusions, extends through the northern part of Colchester county, Nova Scotia. The upland formed by the Cobequid complex is flanked on the south by a narrow band of Pennsylvanian sedimentary rocks overlain by

Triassic sandstone, conglomerate, and shale, as well as igneous rocks, mainly basalt and diabase, which are probably also Triassic in age. The Triassic rocks are exposed around Minas Basin and extend southwest under Annapolis Valley and the southwest coastal area of Nova Scotia.

The south half of Nova Scotia is underlain by tightly folded argillite, quartzite, and various meta-sedimentary rocks of the Meguma group which has for many years been considered to be Precambrian but which may well be Lower Palaeozoic. Large areas throughout the central part of the province are underlain by Devonian granite, which in a few places is cut by later basic intrusives.

A band of Carboniferous rocks 10 to 20 miles wide extends northeast from Minas Basin to beyond Canso Strait where it divides into several structural units in Cape Breton. A highly complex group of rocks, which consist of early Palaeozoic sedimentary and volcanic rocks and some granite, extends north from this belt through the central part of Cape George peninsula, west of Antigonish.

Most of the highland areas of Cape Breton are underlain by granite, gabbro, and metamorphosed sedimentary rocks of Precambrian or early Palaeozoic age.

Isolated basins of Carboniferous sedimentary rocks occur in the southern part of Cape Breton, at several places along the coast, especially in the northeast, and in the Sydney and Glace Bay areas where extensive coal beds occur.

The geology in most of the Appalachian region is very complex in detail and conditions are favourable for the occurrence of a great variety of mineral deposits. Extensive deposits of coal, gypsum, barite, and salt have been of greatest economic interest in the past but considerable quantities of gold, copper, iron, lead, zinc and manganese have also been produced. More recently large copper sulphide deposits have been brought into production at Murdochville in the Gaspé Peninsula, and large reserves of zinc, lead, and copper sulphide ore have been demonstrated in the Bathurst area of New Brunswick. Important low grade manganese deposits in New Brunswick are under development. The output of gypsum, barite, and salt from Nova Scotia has been increased greatly in the last few years.

The use of new and improved exploration methods in the past decade has been an important factor in demonstrating the extensive mineral potential in this region. The uranium deposits described in this report are newly found occurrences although some of the radioactive material is found on old properties or prospects that were previously worked for other minerals.

Further information on the general geology of this region may be obtained from the Geological Map of the Maritime Provinces (Map 910A); from Geological Maps of Southern Quebec (Maps 704A and 705A); and from "Geology and Economic Minerals of Canada", Economic Geology Series No. 1; all published by the Geological Survey of Canada.

URANIUM DEPOSITS

TYPES OF DEPOSITS

The uranium occurrences in the Appalachian region, as well as a few thorium occurrences, are of particular geological interest because they represent many distinctly different types of deposits. Some of these types are better known or of more economic importance in other parts of Canada or in other countries and, therefore, a few notes on certain occurrences elsewhere are included below. The types known in the region under discussion comprise:

1. Pegmatite dykes

2. High temperature quartz veins and greisen in granite

3. Veins containing galena and pitchblende

4. Radioactive minerals associated with purple fluorite in shear and breccia zones in rhyolite and volcanic breccia

5. Uranium bearing hydrocarbon or mixtures of uranium oxide and hydrocarbon in small nodules or veinlets in felsite dykes

6. Radioactive hydrocarbon in fault zones

7. Radioactive minerals associated with fossil carbon, chalcocite, pyrite, hematite or malachite in sedimentary rocks

Pegmatite dykes (1) are associated with Ordovician and Devonian granite in the region and most dykes of any appreciable size are zoned. The radioactive minerals identified from pegmatites in this region are cyrtolite, a uranium and thorium bearing variety of zircon; uranothorite, a thorium orthosilicate with variable amounts of U_3O_8; gummite; monazite; and other rare-earth minerals containing only slight amounts of uranium or thorium. Many other radioactive minerals are probably present in these dykes, but are unrecognized and less abundant. Because of the sparse and erratic distribution of the radioactive minerals in pegmatite dykes in general, they have rarely proved to be commercial sources of uranium although a few exceptional ones have recently been developed successfully in Ontario. The fact that the various minerals in the pegmatites of the Maritime Provinces tend to be concentrated in zones is a significant factor in their evaluation.

The association of radioactive minerals with cassiterite and tungsten minerals in high temperature quartz veins and in replacement masses of muscovite and quartz (greisen) in granite (2) is a less common type of occurrence. Quartz veins and lodes of this type generally occur near the contacts of granite masses and thermally metamorphosed country rock. Secondary uranium minerals such as torbernite, meta-torbernite, autunite, or uranophane are associated with white mica and quartz in later fracture or shear zones that cut the quartz veins. This type of mineralization has been reported from two areas in the United States, one near Spokane, Washington, and one near Austin, Nevada (Thurlow, 1956) where the concentration of autunite and torbernite follows mineralized fracture zones that resemble dykes in both the intrusive rocks and metamorphosed sedimentary rocks. Somewhat similar types of deposits in Devon and Cornwall in England (Davidson 1956, pp. 204-206) show mineral zoning with pitchblende associated mainly with copper sulphide minerals, and, as the lodes pass into the granite where tin and tungsten are more abundant, less uranium is found. It is interesting to note that meta-torbernite occurs near the surface in veins in contact zones at St. Stephen in Cornwall but that pitchblende occurs at depth.

Many sulphide deposits (3) in other parts of Canada and in other countries contain variable amounts of pitchblende. In the Appalachian region pitchblende occurs in a vein of argentiferous galena and sphalerite. The vein consists of a fracture filled with very small amounts of calcite and quartz gangue. Sericite and chlorite are present in the wall-rock adjacent to the vein. The pitchblende replaces galena and it may represent a separate, late stage of mineralization.

Radioactive minerals associated with purple fluorite in shear and breccia zones in rhyolitic lava and volcanic breccia (4) occur in the Harvey formation of the Windsor group in New Brunswick. This appears to be a separate type of occurrence in which gaseous emanations during a late stage of the regional volcanic activity penetrated the lava and breccia along structural breaks and deposited fluorite, pyrite, and radioactive minerals. Deposits in British Columbia, somewhat similar in type to these (Joubin and James, 1956, pp. 59-60) are being prepared for production of uranium.

Another type of uranium occurrence has been found in New Brunswick, southwest of Chaleur Bay, where small nodules or veins of radioactive hydrocarbon occur along the borders of felsite dykes in black carboniferous slate and argillite (5). Very finely disseminated pitchblende or uraninite has been identified in the more highly radioactive hydrocarbon but in other specimens the mode of occurrence of the uranium could not be determined. It may be present in these specimens either as a complex uranium hydrocarbon compound or as discrete grains of uranium minerals that are too fine grained to be detected by normal laboratory methods. Felsite dykes that show more than background radioactivity are believed to be the source of the uranium in the hydrocarbon veins and nodules. The hydrocarbon was probably derived from the black slate during the cooling of the dykes.

Radioactive hydrocarbon is also found in the Hampton area of New Brunswick, in a fault zone that forms the contact between sedimentary rocks of the Kennebecasis group and early Palaeozoic volcanic and sedimentary rocks (6). The hydrocarbon in this deposit was probably derived from petroleum that migrated into the fault zone from beds of the Albert formation, a part of the Kennebecasis group.

There are several occurrences of radioactive minerals in Carboniferous sandstone in the Appalachian region (7). In one type of occurrence uranium is associated with chalcocite, pyrite, and malachite that replace the carbon and coal-like material of fossil wood fragments or "trash". Much of the pyrite is very fine grained and is cut by veinlets of later chalcocite. The chalcocite is distributed in carbonaceous seams along bedding planes or in joints in the sandstone, or forms intricate networks in the wood, following its fibrous structures. The uranium is concentrated mainly in the carbonaceous material and it is not known whether it is present in a finely disseminated mineral or dispersed in the ionic state. Many of the copper and carbon occurrences of the region show no indications of radioactivity, some are very weakly radioactive, and only a few have a uranium content approaching ore grade. The copper and uranium in these deposits are believed to have been precipitated from circulating ground water. The radioactive occurrences of this type found to date in the Appalachian region are all small; some consist of less than a cubic foot of material, but other occurrences have supplied small tonnages of copper ore.

Pitchblende associated with earthy hematite has been found in Pennsylvanian arkosic sandstone in the Appalachian region (7). The hematite is present in thin seams along the bedding planes of the sandstone and forms a part of the cementing material around the sand grains. Pitchblende in very finely divided grains is apparently present in the hematite and around the sand grains. Evidence of fossil wood and organic debris, now largely hematitized, suggests that the pitchblende may have been precipitated by carbon in the sedimentary rock. There may be no direct genetic relationship between the pitchblende and hematite because most of the hematite found in the area is not radioactive. The occurrences of this type examined to date in the region are very small and their origin is not fully understood.

DESCRIPTION OF DEPOSITS

Quebec

Cross Point

The uranium occurrence near Cross Point was one of the first discoveries of radioactive material in the New Brunswick-Gaspé area. The lead-zinc vein, in which the radioactive material occurs, was discovered in 1912 when ballast was being removed from the outcrop. Radioactive material was first detected in 1949 by N.E. Nelson, of Wright Hargreaves Mines Limited, while he was examining specimens from the Cross Point area sent to him by a prospector. The deposit is on a property owned by W.B. Busteed in Mann township, Bonaventure county, Quebec. The occurrence is 11.7 miles east of the village of Matapedia and is on the west bank of a creek on the west side of a wagon road about 1/2 mile north of Highway No. 6. The deposit and early exploration, which included four drill-holes put down by J.C. Beidelman of Federal Zinc and Lead Company of Montreal, are described by Alcock (1930). Gulf Development Company excavated a large trench on the vein in 1936 and is reported (Quebec Department of Mines, 1936) to have shipped about 20 tons of picked ore to Belgium, which assayed 37 per cent lead and 3 ounces of silver per ton, and some zinc. Interest was revived in 1949 after uranium was discovered on the property and four samples, sent to the Geological Survey and to the Mines Branch by Nelson, showed 0.64, 0.32 and 0.25 per cent U_3O_8 equivalent and 0.16 per cent U_3O_8 chemical.

Exploration of the property was continued after Dudley Dimock of Campbellton, New Brunswick, made a financial arrangement with Busteed. This work included clearing off the vein, bulldozing across the creek in search of the eastern extension of the vein, an electromagnetic survey completed in 1954, and diamond drilling in 1955. This drilling consisted of six holes totalling 2,103 feet. Several conductor zones were indicated by the electromagnetic survey, two of which were probed by drill-holes but no mineral zones of interest were found.

The host rock in which the vein occurs is a highly jointed, dark grey, massive, porphyritic volcanic flow or sill classed as Lower Devonian in age. About 20 per cent of the rock consists of 2 to 3 mm. euhedral phenocrysts of plagioclase with random orientation, set in a highly altered felted groundmass of feldspar microlites, chlorite, white mica, fine-grained quartz, carbonate, leucoxene, and iron oxides. Numerous shear planes which strike northeast and dip steeply south cut the massive rock, and glossy brown slickensides on these planes plunge 45 to 70 degrees to the southwest. On most slickensides the movement indicated is 'south side up', with thrusting to the northeast. Pink to white calcite which coats most of these shear planes is sheared and was evidently emplaced along fractures before the final shearing and structural adjustment took place.

The vein consists of a fracture filling that averages about 8 inches in width and is intermittently exposed for a length of 35 feet. The main vein is somewhat sinuous in attitude and strikes north 35 to 40 degrees east and dips steeply to the southeast. The walls of the vein are clean and well defined for the most part, but minor stringers and veinlets less than 1/2 inch wide here and there extend a few inches into the wall-rock. In the central part of the exposure the vein breaks up in a breccia zone 3 to 4 feet long and minor replacement of the wall-rock by the sulphide minerals is evident.

Fine-grained galena is the principal sulphide mineral present, with lesser amounts of sphalerite, pyrite, and chalcopyrite. Pink to white calcite predominates over quartz in the gangue minerals. It is evident from laboratory investigations that very fine-grained pitchblende and galena form an intimate mixture in which pitchblende replaces galena. A few late fractures in the vein have a yellow radioactive coating which was identified by x-ray methods to be kasolite, a hydrated lead uranium silicate, and a complex mixture of other secondary uranium minerals. The strongest radioactivity is localized where the main vein is cut by fractures and weak shear zones that strike north 75 degrees west and dip vertically. The vein narrows and apparently pinches out to the southwest. At the other end of the exposure, 35 feet to the northeast, the vein is about 10 inches wide.

Wall-rock alteration along the vein is rather spotty and is particularly conspicuous for a width of 2 feet along the hanging-wall at the northeast end and at several places along the foot-wall. The porphyritic wall-rock is altered to light buff or grey and is softer and more friable than the unaltered rock. White mica, chlorite, and carbonate are extensively developed. Zones of altered wall-rock are found adjacent to areas in the vein that show high radioactivity, and many of these altered zones are weakly radioactive. Pink to red calcite forms a thin selvage along the walls of the vein in many places.

At the southwest end of the showing, fairly strong shear planes that strike east to southeast and dip from 40 to 60 degrees south contain fine-grained galena. Four to five times background count on a Geiger counter was indicated over some of the galena in these shear planes.

Five anomalous zones were indicated on the property by the electromagnetic survey, all of which trend northeast. Two of these zones were tested by diamond drilling in 1955. Two holes directed below the surface showing did not intersect the vein, and deeper holes begun 200 feet and 550 feet northeast of the showing passed through the anomalous zone but did not intersect mineralized rock. Another anomalous zone about 1,300 feet northwest of the showing was probed by one drill-hole without favourable results.

About 200 feet east of the main showing on the east bank of the creek, highly altered and friable porphyritic rock exposed for 15 to 20 feet bears traces of lead and zinc. Towards the south end of this trench a fault zone marked by a breccia zone 2 to 3 feet wide strikes west and dips steeply to the south.

Chip samples taken by the writer along four sections across the vein gave the following results by the equilibrium method:

Section No.	Location	Sample Location	Width Sampled	Per Cent U_3O_8
1	15 ft. northeast from southwest end of vein	across vein	12 inches	0.075
2	7.5 ft. northeast of section one	across vein	18 inches	0.067
3	15 ft. northeast of section one	across vein	24 inches	0.63
3	15 ft. northeast of section one	wall-rock north of vein	24 inches	0.36
4	20 ft. northeast of section one	across vein	18 inches	0.038
4	20 ft. northeast of section one	wall-rock north of vein	36 inches	0.40

A 500-pound sample from this property taken by W.B. Busteed and assayed by the Mines Branch showed 0.13 per cent U_3O_8 (chemical); 3.49 per cent molybdenum; 9.80 ounces of silver per ton; traces of gold; and a high percentage of lead and zinc.

A picked sample taken by A.H. Lang showed 0.12 per cent U_3O_8 equivalent (Lang, 1952).

New Brunswick

Atholville

This occurrence is on the south shore of Chaleur Bay at the east end of the W.H. Miller Lumber Company yard in Atholville, New Brunswick. Several diamond drill-holes were put down on the showing in 1954 by M.J. Boylen, Engineering Offices Limited, of Bathurst, New Brunswick.

The contact between a quartz-feldspar porphyry dyke or sill and black slate is exposed near the top of an 8-foot cliff at the east end of the exposure. The quartz-feldspar porphyry is finer grained near this contact and the slate is metamorphosed for about 1 inch along the contact, forming a hard dense black massive rock. The slate strikes west and dips south at a low angle and the strike of the porphyry contact is roughly parallel with the strike of the slate. Radioactivity was detected in the porphyry along the contact at the east end of the cliff and two to three times background count on a Geiger counter was registered over half-inch pyrite nodules in the porphyry at the west end of the outcrop.

Black brittle pitchy-looking material is finely disseminated in the quartz-feldspar porphyry within 1 inch of the contact. Megascopically, this material appears to form a web-like replacement structure in the porphyry or else occurs as very fine discrete particles.

Specimens collected by the writer from this showing were examined at the Geological Survey laboratories. An x-ray diffraction photograph of this carbonaceous matter separated as a float product in liquid of 1.8 specific gravity indicated that quartz, kaolin, and calcite were present as impurities but no lines from uranium oxide were detected. The float product nonetheless showed a radioactivity of 2.3 per cent U_3O_8 equivalent and on ignition yielded 21.3 per cent ash. The ash was reported to be light brown and a fluoride bead test gave a strong positive indication of uranium. Spectrographic analyses of this ash confirmed the presence of uranium but no thorium was detected.

A sample taken by the writer consisting of fragments of both quartz-feldspar porphyry and metamorphosed slate from the contact zone showed 0.04 per cent U_3O_8 by the equilibrium method.

Coxs Brook

This occurrence, at the mouth of Coxs Brook on the Upsalquitch River, 1.6 miles east of the bridge at Robinsonville in Restigouche county, New Brunswick, was reported in 1953 by C. T. Ritchie of Toronto. In 1954, M. J. Boylen, Engineering Offices Limited, Bathurst, New Brunswick, optioned the property and drilled a number of short holes to test two felsite dykes.

The radioactive material occurs in a very fine-grained light pinkish grey felsite dyke which cuts dark grey to black slate and slaty argillite of Upper Ordovician age (Alcock, 1941). The regional structure consists of a large syncline of Palaeozoic rocks which plunges northeast. Several granite and feldspar porphyry masses, a mile or more across, as well as numerous smaller intrusive masses, are emplaced along the axis of this syncline between Robinsonville and Glencoe to the northeast. The felsite dyke at the mouth of Coxs Brook, in which the radioactive material is found, is near the axis of this fold and the showing is less than 1/2 mile south of a granite mass.

The country rock exposed for several hundred feet along the road-cut at the showing consists of medium grey, fine-grained, limy argillite in beds 1/2 to 1 foot thick, interbedded with black thin-banded slate. In general the sedimentary rocks strike north 10 degrees east and dip from low angles to about 30 degrees south. Small-scale folding is present locally and several minor faults east of the felsite dyke strike north 70 degrees east and dip steeply south. Results from drilling indicate that the felsite dyke has been offset by this faulting, the eastern block having dropped about 20 feet with respect to the western block.

The eastern part of the felsite dyke is 12 to 15 feet wide. It strikes north and dips steeply west. The dyke is very fine grained, light pink and weathers to a light buff or white mass of softer clay-like material. Pink flow lines are visible in the western border zone, adjacent to a 6-inch gouge or breccia zone along this contact. Parts of the dyke are exposed along strike for 50 feet, the south end being covered by overburden and the north end by road fill.

A Geiger counter showed two to three times normal background count over the full width of the dyke in a trench on the south side of the road. The showing was examined by I. C. Brown of the Geological Survey when the trenches were free of debris and he observed that radioactive material was present in irregular veinlets 1/8 to 1/2 inch wide and in disseminated specks and streaks along narrow fractures in the dyke.

The dyke along these fractures and veinlets is soft and altered, probably kaolinized. Fragments of the black material examined at the Geological Survey laboratories consisted of a mixture of hydrocarbon and uraninite or pitchblende. The uranium oxide is very finely disseminated in the hydrocarbon and it gave an x-ray diffraction pattern similar to that of pitchblende.

A grab sample reported to be from this showing taken by Ritchie and assayed at the Geological Survey laboratories showed 2.48 per cent U_3O_8 equivalent, and chip samples taken by M. J. Boylen, Engineering Offices Limited were reported to contain 0.21 and 0.05 per cent U_3O_8.

Hampton

Radioactive material was discovered in 1953 in a vein of hydrocarbon in the Hampton-Norton district, Kings county, New Brunswick. The vein is exposed near an old mine shaft where an attempt was made in the early part of this century to mine the hydrocarbon for fuel. In 1915 R.A.A. Johnston (1915) mentioned a deposit of hydrocarbon near Norton, Kings county, which is believed to be the same deposit as that described here. The deposit is 3 1/2 miles northwest of Hampton Station and about 1/2 mile north of Highway No. 2, at the end of a tractor road that follows the north bank of a brook.

The property was staked in 1953 by R. B. Hunziker of Newcastle Bridge, New Brunswick. Kingston Uranium Limited, headed by D. W. Britten of Saint John, New Brunswick, was formed to explore the property. A geophysical survey using a resistivity method was completed but failed to outline the vein. A diamond-drill program consisting of seven holes totalling 1,412 feet was completed early in 1954, but none of the core showed more than 0.03 per cent U_3O_8 (chemical).

The vein of hydrocarbon occurs in or near a major fault that strikes northeast and has been traced for 20 miles (Alcock, 1946). Precambrian or early Palaeozoic acid and basic volcanic rocks underlie the area on the northwest side of the fault but Palaeozoic rocks including grey to red conglomerate, sandstone and shale of the Kennebecasis group underlie the area southeast of it. In the vicinity of the radioactive occurrence the fault passes through rocks of the Kennebecasis group and a band of sedimentary rocks 500 feet wide and 1/2 mile long is present on the northwest side of the fault. The sedimentary rocks exposed on the Hampton prospect consist mainly of grey shale, beds of argillite containing numerous grit-size fragments of quartz and feldspar, lenses of conglomerate, black shale, and grey dolomite.

The vein is exposed at the base of the southeast side of a steep hill several hundred feet high. The zone of strongest shearing, which strikes north 10 degrees east and dips steeply to the east, is 15 to 20 feet wide. Jet black, brittle hydrocarbon having a conchoidal fracture is present in this shear zone over a width of 12 to 15 feet. Lenses up to 3 feet wide appear to be composed of nearly pure hydrocarbon but throughout much of the zone the rock has been partly replaced by hydrocarbon and altered to a black fissile slaty material. At the west side of the shear zone a band of hydrocarbon about 2 feet wide and exposed for 10 feet to the northwest appears to follow a subsidiary structure that strikes north 40 degrees west and dips vertically. Dark slate, conglomerate, and lenses of massive dolomite outcrop on the side of the hill immediately southwest of the vein. Numerous thin pink to white calcite veins form a network cutting the vein zone.

The radioactive material is confined to the zone that bears hydrocarbon and the strongest radioactivity is in the lenses of nearly pure hydrocarbon. Chip samples were taken by the writer in a trench across the vein of black slaty hydrocarbon 10 feet north of the main exposure. These samples showed 0.049, 0.053, and 0.024 per cent U_3O_8 by the equilibrium method, for widths of 3, 2, and 2 feet respectively.

About 80 feet southwest of the main exposure another shear zone is exposed on the side of the hill. This zone strikes north 30 degrees east and dips 85 degrees southeast. Hydrocarbon is present over a width of 12 feet but is most abundant in a band 5 feet wide. A chip sample 3 feet long taken by the writer over the most highly radioactive part of this structure showed 0.04 per cent U_3O_8 by the equilibrium method. The mine shaft was sunk at the junction of the main shear zone and this subsidiary zone.

The main vein of hydrocarbon is exposed in the creek bed about 260 feet north of the first outcrop described. Knobs of black material rich in hydrocarbon are found over a width of 12 feet and a Geiger counter there showed four to five times background count.

Five of the seven diamond drill-holes, which plunge 50 to 51 degrees west on a bearing of north 80 degrees west, were directed to intersect the main shear zone. These holes cut the vein over a length of 425 feet and to a vertical depth of 250 feet. The drill-cores indicate that the vein zone varies in width from 18 to 32 feet and the highest assay obtained from the core was reported to have indicated 0.03 per cent U_3O_8 (chemical).

The hydrocarbon in this fault zone probably originated from petroleum that was once present in the Albert formation, a part of the Kennebecasis group. The source of the uranium is not known but it may have been leached from the sedimentary rocks by ground water and precipitated by the carbon in the vein. Some of the rhyolitic and porphyritic acid volcanic rocks in the Kingston group to the west of the fault give up to twice background count on a Geiger counter, suggesting that uranium may have been leached from rocks of this group and precipitated in the fault zone.

Harvey

Radioactive material was discovered in the Harvey Station area of York county, New Brunswick, by H.H. Huestis in 1954. During the staking rush that followed this discovery more than 180 claims were recorded, which covered a complex band of rhyolite flows and volcanic breccia referred to as the Harvey formation.

Exploration carried out by Technical Mine Consultants Limited in 1954 included geological mapping and a diamond-drill program at the York Mills prospect, consisting of four holes with a total footage of 1,963 feet. The property was taken over by New Brunswick Uranium Metals and Mining Limited early in 1956 and reduced in size to 54 claims. Rio Canadian Exploration Limited acquired control of the property later in 1956 and further reduced the number of claims.

The uranium prospects described here occur in a band of rocks composed of rhyolite flows, rhyolite breccia, tuff, and agglomerate, included in the Windsor group of Mississippian age on the Geological Map of the Maritime Provinces, number 910A, published by the Geological Survey of Canada. The Harvey formation is about 1/2 mile wide, and extends northeast for 12 miles from the vicinity of York Mills to beyond the village of Harvey Station and Harvey Mountain. The volcanic rocks of the Harvey formation are believed to lie unconformably above pre-Carboniferous black slate, argillite and greywacke and are overlain by red shale, conglomerate, and sandstone of the Windsor group. The Harvey formation forms the lower part of the northwest limb of a large syncline plunging northeast. Volcanic rocks have not been found in the Windsor group near the axis of the syncline but a large prominent band is exposed in the Windsor group on the southeast limb of this structure.

York Mills Prospect

York Mills is about 8 miles southwest of Harvey Station and the uranium prospect is on the east bank of the river southwest of the woollen mill. More than 100 feet of stripping and trenching has been done. The radioactive material occurs in a shear zone that passes through light grey to blotchy purple-red rhyolite and rhyolite tuff. The shear zone is about 15 feet wide, strikes northeast and dips 70 degrees southeast. Chip samples, each 3 feet in length, taken by the writer across the shear zone in the southwest cross trench, assayed 0.020 to 0.036 per cent U_3O_8 equivalent for a total width of 12 feet, and 0.01 per cent U_3O_8 equivalent for an additional width of 9 feet. Geiger counter readings over the trenches to the northeast suggest that the radioactive zone may not extend for more than 20 feet northeast from the section sampled. It is possible, however, that the shear zone diverges to the north from the trench, which runs north 60 degrees east, and that the strongest radioactive zone is not exposed. A fracture zone is exposed on the strike of the main shear zone in a trench 106 feet northeast of the section sampled, where above normal background counts were detected for a width of 25 feet. A 3-foot chip sample from this trench taken by the writer assayed 0.006 per cent U_3O_8 equivalent. Southwest of the first-mentioned trench, along a line perpendicular to the section sampled, high Geiger counter readings were obtained for 25 feet even above the overburden, thus suggesting that the radioactive zone extends to the southwest.

Results of diamond drilling suggest that radioactive material may be distributed along this shear zone for a length of 350 feet. The highest assay reported from drill-cores was 0.08 per cent U_3O_8, but most of the drill-core from this zone showed less than 0.05 per cent U_3O_8. Another, roughly parallel, radioactive zone may exist about 100 feet to the north, but none of the core from there was reported to show more than 0.04 per cent U_3O_8. Several drill-core sections were reported to contain 0.14 per cent U_3O_8 over narrow widths and several other intersections gave up to 0.04 per cent U_3O_8 but these appear to be from small, isolated, and unrelated occurrences.

The rhyolite tuff exposed in the trenches is altered and considerable white clay-like material and minor amounts of brown limonite are present. Small cavities and vugs, 3 to 4 mm. in size, are lined with buff coloured clay. Deep red to purple patches of stain or alteration are common but they do not seem to bear any special relationship to the radioactive material. Dark purple to black, fine-grained fluorite with a dull to earthy lustre is distributed on fracture planes, in cavities, and as minor replacement masses.

Uranospinite was identified in this material at the Geological Survey laboratories and fine scaly material was tentatively identified as a mixture of uranospinite and saleite. Uranospinite is a hydrous arsenate of calcium and uranium which is lemon-yellow and fluoresces a bright yellowish green under the ultraviolet lamp. Uranospinite occurs as small randomly oriented grains, as scaly aggregates, and occasionally as minute tabular crystals in the kaolin-fluorite masses. Saleite is a hydrated magnesium uranium phosphate that shows a lemon-yellow colour under the ultraviolet lamp. No primary radioactive minerals were recognized.

Another occurrence of radioactive material is exposed at York Mills, northwest of the junction of the mill-race and the river channel. About 30 feet of trenching in green volcanic breccia has exposed a fracture that strikes north 20 degrees east and dips 75 degrees south. The volcanic breccia is silicified along this fracture and calcite, blue-black fluorite and clay minerals or zeolite minerals have been introduced. A number of deep orange-red patches of stained rock up to a foot across, associated with minerals along the fracture, give several times background count on a Geiger counter.

Manners Sutton Prospect

This prospect is about 3 miles south of Harvey Station and is on the east edge of a steep wooded slope about 1 1/4 miles northwest of Manners Sutton corner on Highway No. 3.

A zone in light pink, thin-banded rhyolite has been exposed intermittently by stripping and trenching for a length of 300 feet. At the east end of the prospect the best developed structure is a narrow fault zone, 2 to 3 inches wide, with light green gouge and breccia that can be traced for 130 feet. This fault strikes north 75 degrees east and dips vertically or steeply to the west. Subsidiary faults, shear zones, or fractures are developed along this fault. The rhyolite is brecciated at a few places along the fault and blue fluorite is present as a matrix in the breccia or as fracture fillings. Radioactive material appears to be directly associated with fluorite in only a few places. Patches of brown stain with fine-grained white micaceous alteration are present adjacent to the faults or shear zones.

Twice background count with a Geiger counter was recorded over most of the rhyolite adjacent to the structure zone and higher counts were indicated over the faults and subsidiary structures. At the east end of the prospect, a chip sample, 2.5 feet long, taken by the writer across the fault zone and sheared rhyolite where the highest radioactivity was indicated, showed 0.031 per cent U_3O_8 equivalent. Chip samples were taken across the structure zone at a point 105 feet west of the above-mentioned sample location. The best sample taken there showed 0.024 per cent U_3O_8 equivalent over a width of 1.5 feet. The radioactive material is unevenly distributed, and strong indications of radioactivity are more often found adjacent to fault or shear zones than within them.

At the west end of the prospect area several narrow fault zones that strike east to northeast cut thin banded rhyolite. Patches of deep red stain are conspicuous along these faults but radioactivity was detected in only one of them, where a 1-foot chip sample taken by the writer showed 0.049 per cent U_3O_8 equivalent.

Other Occurrences

Geiger counter readings up to four times background count were recorded over an area 100 feet long and 50 feet wide about 500 feet southwest of the railway crossing in Harvey Station. The strongest radioactivity is associated with patches of red stain for a distance of 10 feet along a fracture in rhyolite that strikes north 15 degrees and dips 80 degrees east.

Mr. H.H. Huestis submitted a sample to the Geological Survey that showed 0.027 per cent U_3O_8 equivalent, which was reported to be from an outcrop on Highway No. 3 about 1 mile northeast of Harvey Station.

Low indications of radioactivity were found by the writer at many places in the Harvey formation. In most places radioactivity is associated with minor structural breaks where the volcanic rocks are altered to clay minerals, soft green platy minerals, or fine-grained white mica, and quartz, fluorite, pyrite or hematite have been introduced.

Shippigan Island

The occurrence of uranium in Pennsylvanian sandstone on Shippigan Island, New Brunswick, represents a type of deposit that is rarely found in Canada. A large number of claims were staked in the area in 1954 by J.W. McCarthy and by M.J. Boylen, Engineering Offices Limited. Exploration by this company included some detailed mapping and a scintillometer survey on the sea floor opposite Chaisson village. Several water wells in the area also were probed with a scintillometer. The prospect area is now covered by claims held by Charles McAllister and J.W. McCarthy of Bathurst, New Brunswick.

Shippigan Island and the mainland nearby is a low, almost featureless, plain with less than 40 feet of elevation. Much of the island is covered by swamp and thick deposits of peat. Outcrops are found only along the coast, where flat-lying sandstone is exposed in vertical sections up to 30 feet high. The area is underlain by buff to reddish brown medium-grained arkosic sandstone with lesser amounts of fine silty material, thin bands of conglomerate, and a few lenses of mottled red and grey nodular argillaceous limestone. The sandstone beds vary in thickness from 2 to 10 inches and crossbedding is present in a few places. The sandstone along the cliff at Chaisson is highly jointed and at many places the joints are spaced from 2 to 4 inches apart. Two main sets of joints occur; one set strikes north 65 degrees west and dips vertically, and the other strikes north 25 degrees east and dips vertically. Sandstone beds exposed at the base of the cliff northeast of Chaisson village are folded and distorted. Some of the folds have 3 to 4 feet of closure in 50 feet and a few sharper flexures and minor faults are developed. The folds plunge north at low angles.

Fossil plant stems or leaves occur in the finer grained facies of the sandstone. Larger fossil sticks or logs, now changed to coal or carbonaceous material, are common, and pyrite, chalcopyrite or malachite are associated with some of them. A few fossil logs up to 6 inches in diameter are completely silicified and form black or dark red porous agate in which traces of the wood structures are discernible. One-inch veins or stringers of hematite and manganese oxide are present in many places along bedding planes or joint planes in the sandstone.

Twelve miles west of Shippigan and 3 miles south of Caraquet a diabase dyke, exposed in a 10-foot vertical shaft, cuts the flat-lying sandstone of the area.

The radioactive deposit is about 3 miles southeast of the ferry dock at Savoy Landing and about 800 feet northeast of a point where the road turns sharply northeast, about 100 yards from the seashore. The outcrop of sandstone in which the radioactive material occurs is exposed only at low tide and then after a period of storm or southeast wind, when the beach gravel and sand have been washed off the bedrock.

The sandstone outcrop exposed under these conditions is about 300 feet long and 30 to 40 feet wide. The beds of buff to reddish brown, medium-grained arkosic sandstone are about 2 inches thick and nearly flat-lying. Within an area 20 feet by 20 feet in size, at the southwest end of the outcrop, several patches of sandstone less than 1 foot wide are stained darker red and stand out with slight relief on the rock surface. The radioactivity is confined to these red patches and is limited in extent, as two of the radioactive stained patches were removed in slabs of rock 2 inches thick and no radioactivity was detected in the underlying beds. Thin bands of hematite parallel with the sandstone beds occur in some of these coloured patches and hematite cement is predominant in the sandstone adjacent to them. The strongest radioactivity was detected over the impression of a fossil stem, 3 inches wide and 3 feet long, coated with hematite and a very small amount of carbon.

One spot of red radioactive sandstone occurs 200 feet northeast of this area. Most of the radioactive spots are near the intersections of joints which belong to the two main sets mentioned above and it may be significant that the joints are not as closely spaced where the radioactivity is found.

A small amount of radioactive material was concentrated with difficulty at the Geological Survey laboratories and the x-ray diffraction patterns showed that uranium oxide, either uraninite or pitchblende, in finely disseminated form, is associated with hematite. Autoradiographs indicate that radioactive material is restricted to the hematitic areas but the disseminated particles are too small to be separated by ordinary laboratory methods. No thorium was detected in this material by x-ray fluorescence analyses. A few very small scarlet crystals of barite, identified by x-ray methods, occur in the interstices and cavities between sand grains in the parts of the rock where radioactivity is detectable.

The grade of material on this showing ranges from 0.25 to 1.47 per cent U_3O_8 equivalent according to assays of material submitted to the Geological Survey by Stockwell and McCarthy.

Nova Scotia

Black Brook and Vicinity

Radioactive material associated with copper minerals and black fossil plant debris or coal has been found at a number of places south of Northumberland Strait. Many copper occurrences are shown on Maps 59 (Fletcher, 1905) and 62 (Fletcher, 1905a), of Colchester and Pictou counties and of Cumberland and Colchester counties, respectively, and on the geological map of Malagash Peninsula, Cumberland county, (Hayes, 1920) published by the Geological Survey of Canada. Small quantities of copper were mined in this area in the early part of the century. Much of the area is in the holdings called the 'Dawmac and King Copper closures' held by Dawmac Mining and Oils Limited and the King Copper Mining Corporation, both of Montreal, and nine copper deposits were examined there by Kennco Explorations, (Canada) Ltd., Eastern Division, during 1955. A thorough study of this area by Kennco Explorations was undertaken to investigate the down-dip extensions of the grey sandy beds, which contain copper minerals and limonitic specks, and also to investigate the extent of the uraniferous carbonaceous material associated with these limonitic specks and copper minerals. This study included 2,857 feet of diamond drilling, self-potential surveys, both airborne and surface scintillometer surveys, and geochemical surveys. Dr. J.J. Brummer of the Kennco company sent samples of radioactive material from the Black Brook prospect to the Geological Survey in 1955, and weak indications of radioactivity have been found at several other places in the area.

In the northern part of the area rocks of the Windsor group are exposed along the axis of a large anticline that strikes east to northeast and extends through the central part of Malagash Peninsula. South of Malagash Peninsula, between the axial area of this anticline and the Cobequid complex of volcanic, sedimentary and granitic rocks, 5 to 8 miles to the south, lies a large syncline of Pennsylvanian and Carboniferous rocks which plunge northeast at a low angle. The rocks in this syncline, which consist of grey to buff sandstone, red and grey shale, and conglomerate, were deposited in shallow water. Black fossil stems, wood fragments, logs, and organic "trash", which have been changed to jet black, brittle carbon, appear to be restricted to the grey sediments, particularly to the gritty sandstone, crossbedded sandstone, and grey shale in this syncline and in the rocks of the north flank of the Malagash anticline.

Small amounts of pyrite, chalcocite, and malachite accompany the carbon deposits in the sandstone. In places the carbon is partly replaced by very fine-grained pyrite, and chalcocite appears to be later than the pyrite. The chalcocite is distributed along fractures, bedding planes and fossil fibres in the woody debris. The malachite is formed by oxidation of chalcocite. It was not possible to enter the old mine workings to examine the deposits in detail, but most of the copper occurrences appear to be small and localized near the carbonaceous material. The strongest indications of radioactivity were found near copper minerals but greater than background counts were also found at a few places over carbon and pyrite occurrences.

The Black Brook prospect is on the north bank of Black Brook about 1 1/2 miles upstream from where it flows into the Waugh River. Several tons of copper 'ore' on the dumps at the old mine give weak indications of radioactivity and selected fragments of the most highly radioactive material collected by the writer showed 0.16 per cent U_3O_8 equivalent. Specimens from this prospect sent to the Geological Survey by J. J. Brummer showed 0.047 and 0.071 per cent U_3O_8 equivalent. Laboratory work done by the Geological Survey showed that the radioactivity is due to uranium which is distributed mainly in the carbonaceous material. It was not possible to identify any specific uranium minerals in this material and it is very likely that uranium oxide is dispersed in the carbon in very minute particles, or it may be present in the ionic state. Special radiometric tests indicated that this material is out of radioactive equilibrium, because beta activity indicated 0.071 per cent U_3O_8 equivalent whereas gamma activity indicated only 0.040 per cent U_3O_8 equivalent. Brummer noted that most of the values for radioactive material in the general area range from 0.023 to 0.042 per cent U_3O_8 equivalent over widths measured in inches.

Weak indications of radioactivity were found by the writer at several copper occurrences in the area which can only be mentioned briefly, as follows:

The location of an old copper mine is shown on Geological Survey Map 59 (Fletcher, 1905), on the French River about 1/4 mile north of Oliver post office. Weak indications of radioactivity were found over the trenches and mine dumps on the west bank of the river and over carbon deposits on the west bank of the river just north of the mine.

One sample reported by Brummer from Woodlock Brook (McCullough Prospect), 1 1/2 miles southeast of Tatamagouche, south of Highway No. 11, on the bank of Woodlock Brook, showed 0.051 per cent U_3O_8 equivalent.

Radioactivity was detected at an old mine situated about 1/2 mile south of Oliver post office on French River.

On Malagash Peninsula, greater than background counts were obtained on a Geiger counter near Malagash Centre and 1/4 mile east of Gravois Point.

One mile south of Lower Wentworth, on the east bank of Wallace River, carbon fragments collected near a copper prospect showed weak radioactivity.

No radioactive material was found at the site of the Palmer Mine, but material on the dumps at the Wentworth Copper reduction works reported to be from the Palmer Mine is weakly radioactive. Samples from these dumps taken by Brummer are reported to contain from 0.035 to 0.016 per cent U_3O_8 equivalent.

A sample of carbon and pyrite collected by the writer from Block House Point, just west of Tatamagouche, showed 0.011 per cent U_3O_8 equivalent. Brummer reported one sample from this area which showed 0.051 per cent U_3O_8 equivalent.

Georgeville

Pegmatite dykes containing radioactive minerals occur in granite and sedimentary rocks west of the village of Georgeville in Antigonish county. Mr. John R. Bridger sent a sample of radioactive material to the Geological Survey in 1953 which was reported to be from a pegmatite dyke exposed on the seashore west of Georgeville. The area is held under concession by Eastern-Northern Exploration Limited and the largest pegmatite dyke was examined for this company by McPhar Geophysics Limited.

The oldest rocks exposed along the northwest coast of Cape George are tightly folded Lower Ordovician dark slate, argillite, and acid and basic volcanic rocks of the Brown Mountain group. About 1 1/2 miles southwest of Georgeville the sedimentary rocks are intruded by massive medium-grained to fine-grained grey diorite. The largest pegmatite dyke of interest in the area occurs in light pink alaskite granite exposed along the coast for 1/2 mile. The bulk of the granite has hypidiomorphic texture, is medium to coarse in grain (5 to 7 mm.), and consists of 70 per cent pink feldspar, and 25 per cent dusty white quartz, with minor amounts of white mica, chlorite, pyrite, and chalcopyrite. Patches of coarse-grained, pegmatitic granite up to 4 feet in length occur at numerous places in the granite mass. A few of these pegmatitic patches contain up to 10 per cent green microcline associated with pyrite, chalcopyrite, and a radioactive mineral believed to be cyrtolite. Fine grains of this mineral are sparsely distributed in the granite. The granite intrudes the sedimentary rocks and both the granite and sedimentary rocks are cut by diabase dykes.

The largest pegmatite dyke is exposed at low tide on the seashore about 1/2 mile northwest of the church at Georgeville and about 1,200 feet southwest of the mouth of McInnis Brook. This dyke, in alaskite granite, appears to be pod-like in shape and is elongated to the northwest on a bearing north 60 degrees west. The dyke, which does not appear to be more than 20 feet long and 3 feet wide, grades into granite along its borders and dips 20 degrees south. The outer zone of this pegmatite consists of pink feldspar and quartz, which increase in grain size toward the centre of the pod. The central zone, although crudely defined, is about 1 foot wide and consists of an intergrowth of pink to white feldspar, quartz, muscovite, and about 10 per cent green microcline, present in crystals up to 6 inches in length. Small amounts of partly altered hornblende and green mafic material, pyrite, and chalcopyrite are associated with the central zone.

The radioactive material is distributed mainly in the central zone of the dyke and consists of cyrtolite in blocky crystals that range in size from 1 inch to less than 1 millimetre, and minor amounts of uranothorite. Cyrtolite, a mineral which is common in Canadian pegmatites, is a variety of zircon that contains thorium, uranium, and rare earths. Uranothorite is a thorium silicate that contains uranium. A specimen of cyrtolite from this dyke showed 2.5 per cent U_3O_8 equivalent.

A composite sample of the radioactive zone in this dyke consisting of three channel samples, each 1 foot long, was taken by the writer. One channel was cut across the central part of the dyke, one was cut 5 feet to the northwest, and the third was cut 5 feet to the southeast. This composite sample assayed 0.22 per cent U_3O_8 equivalent. Two samples, reported to be from this dyke, were submitted by A.S. Bryson of Eastern-Northern Exploration Limited and assayed by the Mines Branch. One of these samples showed 0.21 per cent U_3O_8 (chemical) and 0.14 per cent ThO_2 (chemical). The other showed 0.013 per cent U_3O_8 (chemical) and 0.03 per cent ThO_2 (chemical).

Other pegmatitic material in the granite mass gave weak indications of radioactivity but no appreciable concentration was discovered.

A second small pegmatite dyke containing radioactive material is exposed on the shore about 1,800 feet northeast of the dyke just described. This dyke, which is 1 inch to 1 1/2 inches wide, strikes north 85 degrees east and dips steeply north, consists of medium- to coarse (5 mm.)- grained quartz, pink and green feldspar, greenish yellow muscovite, and numerous 2 to 4 mm. black crystals thought to be cyrtolite. The dyke cuts dark argillaceous sedimentary rocks and is exposed for a length of 50 feet. At the northeast end of the exposure the dyke is offset by several small faults with 1 foot to 2 feet of left-hand displacement on each fault. One hand specimen taken by the writer, which included the full width of the dyke, showed 0.039 per cent U_3O_8 equivalent, and Geiger counter readings suggest that this specimen is typical of the dyke as a whole.

New Ross

An occurrence of gummite and monazite in pegmatite near Lake Ramsay (in Lunenburg county) was reported by Johnston (1915, pp. 112, 161) and radioactive mineral occurrences in pegmatite dykes are indicated on maps of this area published as early as 1924 by the Geological Survey of Canada (Faribault, 1924 and 1931). Considerable prospecting and exploration of pegmatite dykes and quartz veins were done in this area in the early part of this century but no major economic deposits were discovered. The Turner Tin Prospect, one of several in the New Ross area, was discovered in 1906 and some work was done to evaluate the tin-bearing veins (Douglas, 1941). Samples of radioactive material from the Turner Tin Prospect were received by the Geological Survey of Canada from A.C. Mosher in 1949 and from M.G. Goudge of the Nova Scotia Department of Mines in 1950. The area is held under concession by Eastern-Northern Exploration Limited. The Turner Tin Prospect was described by Douglas (1941) in some detail and the following deals mainly with the recently discovered radioactive occurrences.

The greater part of the area is underlain by pink, medium-grained, muscovite and biotite granite. A lens-shaped band of fine-grained quartzite, slate, and dark schist, up to 2 miles in width, extends northeast from Harris Lake, 2 miles north of New Ross, through Wallaback Lake, and east from Wallaback Lake for 8 miles. A geological map, New Ross Sheet No. 86, indicates that the area south of this band of sedimentary rocks is underlain by muscovite granite and that the area north of it is underlain by biotite granite. The relationship between these two granite masses is not well defined. Pegmatite dykes and high-temperature quartz veins containing tin, molybdenum, tungsten, lithium, fluorite, and rare-earth or radioactive minerals occur in the area mapped as muscovite granite and in the band of sedimentary rocks. Manganese deposits occur 1 1/2 miles north of Wallaback Lake in the area mapped as biotite granite.

The Turner Tin Prospect is about 3 miles north of New Ross, and the veins are exposed near a sawmill on the west side of Mill Road between Harris and Camp Lake. Four veins are exposed on the property, three of which consist of coarse granular quartz, muscovite, feldspar, cassiterite and other accessory minerals, whereas the fourth is a quartz-porphyry dyke with the above-mentioned mineral assemblage developed in a few places along its borders. The Discovery vein, lying about 300 feet northeast of the sawmill, is of principal interest as in it most of the radioactive minerals have been found. It is exposed in a trench about 240 feet long and strikes north to north 10 degrees west and dips vertically. The mineralization appears to have followed a shear zone in the granite. The main vein is 1 foot to 2 feet wide, with numerous subsidiary quartz veins, striking north 35 to 45 degrees west, which apparently represent replacement veins along subsidiary shear planes. As a result of this replacement the Discovery vein consists of a zone 4 to 5 feet wide. The radioactive minerals occur in later fractures and shear zones that cut the quartz veins, and in altered red-stained granite adjacent to the shear zones. These later fractures and shear zones are marked by bands of dark mylonitized vein material 1 inch to 2 inches wide that consist of quartz, platy silicate minerals, pyrite, chalcopyrite, and radioactive minerals. South of the collar of the most northerly shaft on the Discovery vein a gouge zone cuts the main quartz vein and extends 10 feet south before dying out in the vein. It diverges from the vein to the northwest and appears at the northwest corner of the shaft where it strikes north 40 degrees west. This gouge zone is radioactive for a length of 20 feet. Three chip samples taken by the writer across this zone, on a section 4 1/2 feet south of the north shaft, showed 0.030 per cent U_3O_8 equivalent over a width of 18 inches, and 0.069 and 0.13 per cent U_3O_8, by the equilibrium method, over widths of 12 inches and 18 inches respectively. Thirty feet south of this section another shear or gouge zone, parallel with the main vein, is radioactive for a length of 10 feet. Chip samples taken by the writer on a section across this zone showed 0.006, 0.041 and 0.013 per cent U_3O_8 equivalent over widths of 18, 12, and 12 inches respectively. About 140 feet south of the north shaft a fractured part of the vein 5 feet wide and 10 feet long gave Geiger counter readings of two to three times background count. Samples reported to be from the Discovery vein, submitted by Goudge, showed 1.2, 0.22, 0.42, 0.24 and 0.096 per cent U_3O_8 equivalent, and a sample reported to be from the Turner Tin Prospect, taken by Mosher, assayed 0.16 per cent U_3O_8 equivalent. Radioactive material from this vein has been tentatively identified by the Geological Survey as torbernite or meta-torbernite.

About 100 feet east of the sawmill on the south side of the brook, a shear zone 15 feet east of the Elephant vein is weakly radioactive for a distance of 10 feet.

Weak indications of radioactivity were also found at the Turner vein 360 feet west of the sawmill.

Selected specimens from the dumps at the New Russell Molybdenite Mine were found to be weakly radioactive.

Radioactivity was also detected at a few places in pegmatite dykes at the Wallaback Lake Tin Prospect.

CONCLUSIONS

None of the radioactive deposits examined in the Appalachian region to date appears large enough to be mineable under present economic conditions. A large number of the occurrences are low grade but a great variety of different types of deposits have been discovered. Deposits similar in type to some of the occurrences found in this region are mined in other parts of the world. In most cases the conditions that led to small concentrations of uranium at a number of widely distributed places in this region could have been effective in developing deposits of commercial size. Deposits have been found that appear to be directly related to granite or other acid intrusive rocks and all signs of mineralization related to these rock masses should be carefully checked for radioactivity in any future prospecting. Occurrences of uranium with fluorite in rhyolitic volcanic rocks are of special interest. Several additional base metal, fluorite, and placer gold deposits in various parts of the region were tested with a Geiger counter with negative results but because of the limited time available all such deposits could not be examined. All carbon and hydrocarbon deposits should be checked for radioactivity in any further prospecting. It is possible that small deposits of fair to average uranium content could be profitably worked in this region, where transportation facilities are relatively well developed, if the demand for uranium increases in the future.

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