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Uranium and Thorium Deposits at the Base of the Huronian System in the District of Sudbury

By
JAS. E. THOMSON

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BY

Jas. E. Thomson[1]

ABSTRACT

Nineteen occurrences of radioactive conglomerate are described. These are similar lithologically to the uraniferous ores of the Blind River–Elliot Lake area and lie at the same stratigraphic horizon. Most of the deposits are greatly deformed. None are of sufficient size and grade to be mineable under 1958–59 marketing conditions for radioactive minerals.

The deposits are distributed at irregular intervals over a distance of about 150 miles, at or near the base of the Huronian system from the Agnew Lake area to Lake Timagami. They lie with great angular and erosional unconformity upon a variety of Pre-Huronian formations. The regional distribution of the radioactive conglomerates provides a valuable guide to the location and correlation of Huronian strata in those parts of the district that are complexly deformed. The data indicate that the original Huronian basin extended around the north side of the Sudbury Basin, but there is no indication of it on the south side of the Sudbury structure.

Field and laboratory evidence show that the radioactive deposits are essentially of sedimentary origin; slight local regeneration of radioactive minerals occurred.

INTRODUCTION

This report is a compilation of all available information on uranium and thorium deposits of the conglomeratic type found in the District of Sudbury during 1953–58. The discovery of important uranium deposits in radioactive conglomerate at the base of the Huronian system in the Blind River–Elliot Lake area in 1953 led to widespread exploration at the same stratigraphic horizon. This search resulted in the discovery of similar radioactive conglomerates at intervals eastward from Blind River through the Agnew Lake area, northward and eastward around the outside of the Sudbury Basin in the vicinity of Milnet and Lake Wanapitei, and as far eastward as Lake Timagami. The development work revealed that all of these are non-commercial deposits under 1958–59 marketing conditions for radioactive minerals. Nevertheless, a great deal of valuable geological information was obtained during the exploration work, and it is thought advisable to assemble this while it is still available.

The regional distribution of the radioactive conglomerate provides a valuable guide to the location of the base of the Huronian system in the Sudbury region. This, in turn, will show the extent of the original "Huronian" sedimentation across northern Ontario, which has been the subject of much controversy throughout the Sudbury region.[2] Wherever exact information is available these unique

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[1]Assistant Provincial Geologist, Ontario Department of Mines.

[2]Jas. E. Thomson, "The Questionable Proterozoic Rocks of the Sudbury-Espanola Area," *The Proterozoic in Canada,* Royal Soc. of Can., Special Publications No. 2, Univ. of Toronto Press, 1957, pp. 48–53.

conglomerates are found to occur at the same stratigraphic horizon. This is immediately above the great unconformity that separates the Early and Late Precambrian (Archean and Proterozoic). They are thus regarded as the most reliable horizon markers in those parts of the Sudbury region where the structure is extremely complex, and the stratigraphy is correspondingly difficult to establish. The distribution of the radioactive conglomerate also aids in the correlation of the Huronian in the Elliot Lake basin with that of the great basin extending northeast from Lake Wanapitei. Because the quartz-pebble conglomerates at the base of the Mississagi formation are the host rocks of the Blind River uranium deposits they constitute one of the most important stratigraphic horizons in the Precambrian of Ontario from an economic viewpoint. It is thus essential that the stratigraphy of the Mississagi formation be studied in detail, and that the radioactive conglomerates be traced as far as possible.

Scope of Report

The field work for this report was carried out in the summer of 1958. The author visited most of the uranium occurrences described herein, and, as far as possible, obtained the development records from the various companies that had carried on development work. Much of this information had been filed with the Ontario Department of Mines for assessment purposes, but in all cases it was necessary to apply to the mining companies for data on the final results of operations. In a few cases it was not possible to get complete information on developments.

In addition to examining the mineral deposits, the author examined the unconformity, structure, and stratigraphy of the lower part of the Huronian sequence at intervals from Agnew Lake to Pardo township (see Chart A, in map case). This would be an over-all distance of over 150 miles along the base of the Huronian if it were continuously exposed. However, there are very extensive gaps where the Huronian rocks have been removed by erosion or cut out by faulting. The main localities visited are in the vicinity of Agnew Lake, Cartier, Milnet, Lake Wanapitei, Ashigami Lake and Pardo township. Because of the limited time available in some of these areas, much of the geological work was of a preliminary character, and is subject to revision if, and when, more detailed surveys are made.

Acknowledgments

The author is indebted to a great many companies and individuals for assistance in the preparation of this report. Those who were approached gave all possible assistance, and their aid is gratefully acknowledged. The companies that provided information are mentioned in the section of this report that deals with the description of properties. In addition, A. H. Lang, chief, Mineral Deposits Division, Geological Survey of Canada, provided access to the files of radioactive occurrences reported to the Atomic Energy Control Board by discoverers and companies as required by government regulations.

The author was ably assisted in the field by K. D. Card. Mr. Card also made a mineralogical study of samples of the radioactive deposits, at Queen's University. The results of his study are incorporated in this report. Assays and mineralogical studies of samples were made by the Provincial Assay Office.

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GENERAL GEOLOGY

Summary

The general geology of the area is shown in Chart A (map case). In the vicinity of most of the radioactive deposits, the general geological relationships are rather similar, although the details may be very different. A Pre-Huronian basement complex, consisting of volcanic, sedimentary, and granitic rocks, is overlain with great unconformity by a sedimentary group of Huronian age. The base of the Huronian system consists of radioactive quartz-pebble conglomerate with quartzite or argillite interbeds. This grades upwards into quartzite and arkose by diminution of the number of conglomerate interbeds. The conglomerate-argillite-quartzite sequence constitutes the Mississagi formation. Regardless of its regional location, the Mississagi formation is generally similar lithologically to the same formation in the Elliot Lake trough of the Algoma uranium district. The quartz-pebble conglomerate occurs only at intervals along the base of the Huronian, apparently at places where streams were depositing this unique type of detrital sediment in the Huronian basin. In the Algoma uranium districts, where the Huronian strata are only gently deformed, the Mississagi formation is covered by the Bruce, Espanola, Serpent and Gowganda formations. Going eastward towards the Agnew Lake area, the Huronian rocks become greatly deformed, and the stratigraphy is accordingly much more difficult to unravel. This great deformation continues eastward through the Sudbury country as far as Lake Wanapitei. Eastward from the Lake Wanapitei area the Huronian strata are only gently folded, except near faults and intrusions. Despite the deformation, the lower part of the Huronian sequence (Bruce series of Collins[1]) can be recognized in the Agnes Lake, Cartier, Milnet, and Lake Wanapitei areas. However, the Bruce group becomes noticeably thinner to the east, until at Pardo and Turner townships, and at Lake Timagami, only thin scattered patches of the Mississagi formation remain. In the eastern localities, the Mississagi formation is overlain directly by the Gowganda formation. It is not known to what extent the eastward thinning of the Mississagi is due to decreased sedimentation or to erosion prior to the deposition of the Gowganda formation. In some localities there is a suggestion that the Gowganda formation lies unconformably on the Mississagi formation, but the evidence is nowhere very definite.

It is important to note that the typical Huronian rocks are not found south of the Sudbury Basin. The great unconformity, the radioactive quartz-pebble conglomerate, and the Bruce-type lithological units are not found around the south side of the Sudbury Basin between Lake Wanapitei and Drury township. At Lake Wanapitei the Huronian rocks lie unconformably on the older Pre-Huronian sequence of volcanic, sedimentary, and granitic rocks found southeast of Sudbury. At the southwest end of the Sudbury Basin some typical Huronian stratigraphy is found in an area of great structural complexity. Further detailed geological studies are necessary in this vicinity before the structure, stratigraphy, and correlation can be solved. In Chart A the author has arbitrarily carried the Huronian formations as far south and east of Agnew Lake as is indicated by the distribution of radioactive conglomerates. Additional detailed studies are planned in this area by the Geological Branch of the Ontario Department of Mines.

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[1]W. H. Collins, *North Shore of Lake Huron,* Geol. Surv. Can., Memoir No. 143, 1925, p. 29.

The sedimentary rocks of Huronian age are intruded by masses of gabbro and diabase. No granite intrusives are found to cut the Huronian formations anywhere except in the Agnew Lake area, where small granitic bodies appear to intrude the Bruce group. The Killarnean metamorphic complex, located south of Sudbury, is later than the basic intrusives that invade the Huronian strata, so it must be post-Huronian in age.

The stratigraphic succession and nomenclature used in this report are as follows:

TABLE OF FORMATIONS

PRECAMBRIAN	
POST-HURONIAN SYSTEM:	
BASIC INTRUSIVES	Olivine diabase dikes.
KILLARNEAN	Metamorphic complex.
BASIC INTRUSIVES	Gabbro, diorite (including Nipissing diabase). Sudbury nickel irruptive.
HURONIAN SYSTEM:	
COBALT GROUP[1]	Lorrain formation. Gowganda formation.
BRUCE GROUP[1]	Serpent formation. Espanola formation. Bruce formation. Mississagi formation.
Great Unconformity	
PRE-HURONIAN SYSTEM:	
ACID INTRUSIVES.	Granitic complex.
SEDIMENTARY GROUP[1] (including "Timiskaming" and "Sudbury" series)	Chelmsford formation. McKim formation. Ramsey Lake formation. Wanapitei formation.
VOLCANIC GROUP (including "Keewatin" series)	Onaping formation. Stobie formation.

Pre-Huronian System

A basement complex, consisting of rocks that lie beneath the great unconformity at the base of the Huronian system is found at intervals across the region under consideration from the Blind River area to Lake Timagami. These rocks consist of volcanics, sediments, and intrusives distributed in various combinations.

The volcanic assemblage contains altered lava flows of andesitic to basaltic composition, rhyolite, pyroclastics, and iron formation. In some localities sedimentary rocks, such as quartzite or conglomerate, are interbedded with the volcanic rocks. All are greatly deformed and metamorphosed. The main areas where volcanic rocks lie immediately beneath the cover of Huronian strata are at Lake Timagami, northwest of Lake Wanapitei, north of Cartier in the Lake Geneva area, and in the Agnew Lake area. The volcanic assemblage has been

[1]Geological formations formerly listed collectively as series are here referred to as groups, in conformity with the interim recommendations of the Precambrian Committee of the American Commission on Stratigraphic Nomenclature, November, 1958.

assigned to the Keewatin period on some geological maps; on others it has been given specific names such as Stobie formation or the volcanic group in Baldwin township.

Belts of pre-Huronian sedimentary rocks, which are generally devoid of intermingled volcanics, are found south of Lake Wanapitei, south of the city of Sudbury, and in Pardo and Vogt townships. These were named the Sudbury series by Coleman.[1]

The rocks consist chiefly of quartzite and greywacke with lesser amounts of conglomerate and limestone. These strata may be lithologically similar to certain formations in the Huronian system. Therefore, age correlations of steeply folded sedimentary formations are extremely uncertain when based only on lithological characteristics, and can generally be established only by locating the great unconformity. In some cases a unique marker horizon may be used for age correlation, for example, iron formation is found only in the Pre-Huronian complex whereas radioactive quartz-pebble conglomerate is found only at the base of the Huronian sequence. The Pre-Huronian sedimentary strata are deformed and metamorphosed in a similar way to the volcanic rocks.

Both volcanic and sedimentary assemblages are intruded by granitic rocks, and this is generally a criterion by which Pre-Huronian sedimentary formations are distinguished from Huronian formations. However, this criterion does not necessarily apply in the Agnew Lake area where there is evidence of post-Huronian granite. In some areas the Huronian strata lie directly on granitic rocks. Such relationships are described in the section of this report that deals with the great unconformity.

On Map No. 155A, third edition (Lake Huron Sheet), of the Geological Survey of Canada much of the granitic complex lying west of the Sudbury Basin, and generally referred to as the Birch Lake granite, has been assigned to the Killarnean period rather than to the Pre-Huronian as shown in Chart A. The author's reasons for assigning a Pre-Huronian age to the Birch Lake granite are as follows:

1. Whenever contact relationships with Huronian rocks were found by the author, the Huronian strata lay unconformably on the Birch Lake granite.

2. Basic intrusives (Nipissing diabase and gabbro) cut the Birch Lake granite. These basic intrusives are traced at intervals to the Grenville Front where they are metamorphosed in the Killarnean complex. This means that the Birch Lake granite is much older than the Killarnean.

3. The Birch Lake batholith is largely a massive homogeneous granite in marked contrast to the Killarnean metamorphic complex, which is extremely heterogenous and shows little true granite.

4. Isotopic dating of the Birch Lake granite gives ages of 1,800–1,900 million years compared with ages of 1,000–1,100 million years for the Killarnean complex.[2]

Huronian System

The Huronian stratigraphy as established by Collins[3] and his associates is followed throughout this report as closely as possible. With increasing distance from the type locality of the formations at Bruce Mines, facies changes and

[1] A. P. Coleman, *The Nickel Industry*, Mines Branch, Can. Dept. Mines, No. 170, 1913, p. 6.

[2] "Variations in Isotopic Abundances of Strontium, Calcium, and Argon and Related Topics," Dept. of Geol. and Geophysics, Massachussetts Inst. of Tech., Cambridge, Mass., March 1, 1958, p. 56.

[3] W. H. Collins, *op. cit.*

structural disturbances make lithological correlations with the type locality increasingly difficult. In places, a rather arbitrary stratigraphic sequence has been set up by the different geologists in charge of investigations. For example, in some localities, any limestone band, no matter how insignificant, has been assigned to the Espanola formation, thus automatically fixing the unit lying stratigraphically above it as Serpent formation, and that below as Bruce or Mississagi depending upon the lithology. The assumption that all the limestones in the Huronian basins were deposited contemporaneously is probably no more justified than a similar assumption for all the quartzites or conglomerates. However, the matter of regional stratigraphical correlation is beyond the scope of this report. In a rapid survey of a large area, the author could do little in the way of revision of the geology and generally accepted the previous interpretation. Recent detailed study of the stratigraphy in the Algoma uranium district[1] has led to the formal redefinition of some of the stratigraphic units. This may eventually be necessary in the area under discussion.

BRUCE GROUP

Mississagi Formation

This forms the strata lying immediately above the basement complex. It consists of bedded clastic rocks, mainly quartzite, with interbeds of feldspathic quartzite, arkose, grit, argillite, and conglomerate. Members are discontinuous and vary greatly in thickness. Argillitic partings between quartzite beds are common; cross-bedding is often present in the finer-grained clastics. In some places a basal conglomerate is present. The boulders and pebbles may represent a variety of rock types, with the largest proportion from the immediate basement. In a few places argillite rests directly on the basement; at others a thin regolith derived from the weathering of a land surface may be found in a transition zone between basement rocks and Huronian strata. The areas of greatest economic interest are where quartz-pebble conglomerate lies on, or near, the basement rocks. Although usually concentrated within a hundred feet of the basement, interbeds of this conglomerate may occur in the quartzite for hundreds of feet above it.

The radioactive quartz-pebble conglomerates vary considerably in lateral extent and thickness but are so remarkably uniform in lithological characteristics that they may be easily recognized at intervals for hundreds of miles along the margin of the great Huronian basin. They consist essentially of white quartz pebbles and darker coloured chert pebbles, ½ inch–4 inches in diameter, embedded in an arkosic matrix, which generally shows some sulphide mineralization. Decomposition of the sulphides gives the matrix a slightly rusty appearance on the weathered surface, and makes the white pebbles stand out in sharp contrast. Although over 90 percent of the pebbles in the conglomerate are of the quartzose type, a pebble or boulder of granite, rhyolite, or bedded sediment may rarely be seen. It is essentially an oligomictic type of conglomerate in which the pebbles are well sorted and well rounded. The pebbles generally occupy a greater proportion of rock space than the matrix. This pebble conglomerate is the host rock of the uranium and thorium mineralization and is described again in the section of this report dealing with economic geology.

The thickness of the Mississagi formation often cannot be accurately measured because of deformation, intrusion, lack of exposures, or lack of detailed

[1]S. M. Roscoe, *Geology and Uranium Deposits, Quirke Lake–Elliot Lake, Blind River Area, Ontario*, Geol. Surv. Can., Paper 56–7, 1957.

mapping. It is noticeable, however, that it is very thin at the east end of the area shown on Chart A and becomes thicker to the westward.

Bruce, Espanola, and Serpent Formations

A polymictic conglomerate, correlated with the Bruce formation, overlies the Mississagi formation in the Agnew Lake area, Ermatinger township, and in the Lake Wanapitei area. It is a boulder conglomerate containing rounded to subangular boulders of granite, gneiss, rhyolite, greenstone, and other rocks. The Espanola formation is characteristically a bedded limestone. This unit is best developed in Parkin township but is also found in several other Huronian areas. It is readily deformed, and the bedding is commonly crenulated. The Espanola formation is overlain by the Serpent quartzite in the Agnew Lake and Geneva Lake areas, and in Hart and Parkin townships.

COBALT GROUP

Gowganda Formation

The Gowganda formation is a heterogeneous assemblage of interbedded conglomerate, greywacke, quartzite, and thinly bedded argillite. In some areas it appears to lie conformably on the Bruce group, whereas in other places there is a suggestion that the relationship is unconformable. In the Huronian basin northeast of Lake Wanapitei, a coarse boulder conglomerate of the Gowganda formation lies directly on the Pre-Huronian basement. In Hutton township the conglomerate contains boulders up to 4 by 2 feet in dimensions and of a great variety of rock types; some of these are similar lithologically to the Mississagi or Serpent quartzite, suggesting an erosional unconformity at the base of the Gowganda formation. Collins[1] found good evidence of an unconformity between the Bruce and Cobalt groups north of Lake Huron, and this probably extended through the entire Huronian basin.

Lorrain Formation

This is a rather pure, white quartzite that lies stratigraphically above the Gowganda formation. Certain horizons in it are characterized by thin beds of small rounded quartz and jasper pebbles. A considerable area of the Lorrain formation occurs in the Lake Geneva area north of Cartier, and in the Huronian basin extending north and east of Lake Wanapitei.

Post-Huronian System

Basic Intrusives

Sills, dikes, and irregularly-shaped bodies of diabase, gabbro, and diorite intrude the Huronian and Pre-Huronian formations throughout the area under discussion. This is the so-called Nipissing diabase or Sudbury gabbro. Sometimes the basic intrusives will follow the base of the Huronian for some distance, or they will angle across the Huronian–Pre-Huronian boundary and cut out the stratigraphic horizon at which the radioactive conglomerates might appear. Breccias are frequently associated with these intrusions especially along the contacts. The gabbros are cut by olivine diabase dikes and are metamorphosed in the Killarnean metamorphic complex southeast of Sudbury.

[1]W. H. Collins, *North Shore of Lake Huron*, Geol. Surv. Can., Memoir No. 143, 1925, pp. 71–73.

Killarnean Metamorphic Complex

The geology of the Killarnean metamorphic complex, shown in the south-eastern corner of the sketch map (Chart A), is beyond the scope of this report. It is described elsewhere.[1]

STRUCTURAL GEOLOGY

Great Unconformity

The location of the great unconformity at the base of the Huronian system has always been a great problem in parts of the region extending along the north shore of Lake Huron and eastward through Sudbury. The discovery and development of radioactive quartz-pebble conglomerates along the margin of the Huronian basin at intervals for great distances has produced much new information about the nature and location of this unconformity. Going eastward from the Blind River area, where it is well established, the unconformity is now recognized in the Agnew Lake area, in Ermatinger township, the Lake Geneva area, Creelman, Hutton, and Parkin townships, the Wanapitei Lake area, and Pardo and Vogt townships. This great unconformity has been previously described in such mining areas as Cobalt, Larder Lake, Gowganda, and Matachewan. It is significant that the unconformity and scattered radioactive conglomerates extend around the north side of the Sudbury Basin but have not been found around the south side of that structure. It would appear that the original Huronian basin was continuous in an east-west direction from Lake Superior to the Quebec boundary, but its southern margin is more difficult to establish because of the great deformation involved in the Sudbury-Espanola area. The nature of the unconformity is disclosed by three main types of evidence: (1) a residual soil or regolith on the pre-Huronian land surface; (2) a basal conglomerate containing boulders of basement rocks; and (3) an angular discordance between basement and Huronian strata.

In the Blind River area the residual deposits on the Pre-Huronian surface have been well described.[2] Similar residual deposits are found in the District of Sudbury. Where the Mississagi formation lies directly on granite, as in Ermatinger and Maclennan townships, a narrow transition zone, developed by the weathering of the granite, separates recognizable rocks. However, when the Huronian strata lie on volcanic rocks the residual soil may be bouldery, resulting in a basal conglomerate with abundant boulders of basement volcanics, or under different conditions, a residual clay may be reworked and consolidated to form a bedded argillite. In concession V, Baldwin township, Agnew Lake area,[3] the basal Huronian strata lie on volcanic rocks; a basal conglomerate with volcanic boulders occurs beneath the radioactive quartz-pebble conglomerate. In lot 12, concession IV, Parkin township, thinly bedded argillite occurs at the base of the Huronian adjacent to volcanic rocks. At the old Skead gold mine, located east of Skead village in the Wanapitei Lake area, a basal Huronian argillite lies on

[1] T. T. Quirke and W. H. Collins, *The Disappearance of the Huronian*, Geol. Surv. Can., Memoir No. 160, 1930.
T. C. Phemister, Ont. Dept. Mines (In preparation).
[2] W. H. Collins, *op. cit.*, pp. 38, 39.
S. M. Roscoe, *op. cit.*, pp. 4, 5.
S. W. Holmes, *Structural Geology of Canadian Ore Deposits*, Can. Inst. Min. Met., Congress Volume, Vol. II, 1957, p. 326.
[3] Map No. 1952-1, *Township of Baldwin, District of Sudbury, Ontario*, Scale, 1 inch to 1,000 feet. (To accompany Ont. Dept. Mines, Vol. LXI, 1952, pt. 4.)

Pre-Huronian quartzite and conglomerate with great angular unconformity. The basement sediments are noticeably leached and rusty in outcrops at the unconformity. The mine workings follow the unconformity, and the rock dump is largely of carbonatized and silicified sediments from the old regolith. Farther eastward, in Scadding township, the Mississagi quartzite lies on Pre-Huronian limestone, and the basal quartzite member is full of carbonate crystals, probably derived from the weathering of the underlying limestone with subsequent remobilization. In the Wanapitei Lake area a noticeable feature of the unconformity is that the base of the Huronian lies on the eroded surface of a variety of older rock types, including quartzite, conglomerate, greywacke, limestone, granite, and basic volcanics.

The angular unconformity between the Huronian and Pre-Huronian strata is very pronounced at the east end of the area under discussion but is not so readily apparent in the Agnew Lake country at the west end. As shown in Figure 10, a right-angled unconformity between Pre-Huronian sediments and the basal Huronian quartz-pebble conglomerate occurs in Vogt township. Approximately the same degree of angular unconformity is found in Pardo township, as indicated in Chart H. This unconformity has been described by Bruce.[1] The unconformity is similar to that found at the base of the Huronian at Cobalt,[2] and Larder Lake.[3]

From Pardo township southwest to the Ashigami Lake area, the unconformity has not been seen, although a detailed search could probably locate it in Janes township. For a considerable distance along the Canadian National railway east of Crerar station the base of the Huronian is cut out by faulting. Near the south end of lot 8, concession III, Scadding township, the basal beds of the Mississagi quartzite strike N.45°–60°W. and dip 25°NE.[4] These lie on limestone beds that strike N.20°E. and dip 65°SE. A marked angular unconformity is suggested here. On the east side of Outlet Bay on Wanapitei Lake, there is evidence of a right-angled unconformity between flat-dipping, east-west-striking quartzite beds at the base of the Mississagi formation and a north-south-trending band of limestone.

The great unconformity at the base of the Mississagi formation near Skead village and in Massey Bay on Lake Wanapitei is described in detail elsewhere[5] and was first recognized by Quirke.[6] At these localities gently dipping Mississagi beds lie with great angular unconformity on steeply dipping Pre-Huronian sediments of the Sudbury series.

The author found good evidence of a great angular unconformity in Parkin and Hutton townships. Near the south boundary of lots 11 and 12, concession IV, Parkin township, the basement rocks consist of rhyolite and rhyolitic tuffs, interbedded with andesitic flows. These strike N.35°W., whereas the bedded quartzite and argillite at the base of the Huronian strike about east-west. At

[1] E. L. Bruce, *Geology of the Townships of Janes, McNish, Pardo and Dana*, Ont. Dept. Mines, Vol. XLI, 1932, pt. 4, pp. 13–15.

[2] Cyril W. Knight, *Cobalt and South Lorrain Areas*, Ont. Dept. Mines, Vol. XXXI, 1922, pt. 2, p. 32.

[3] Jas. E. Thomson, *Geology of McGarry and McVittie Townships, Larder Lake Area*, Ont. Dept. Mines, Vol. L, 1941, pt. 7, p. 28.

[4] See Map No. 48m, *Ashigami Lake Area, District of Sudbury, Ontario.* Scale, 1 inch to ½ mile. (To accompany Ont. Dept. Mines, Vol. XLVIII, 1939, pt. 10.)

[5] Jas. E. Thomson, *Geology of Maclennan and Scadding Townships*, Ont. Dept. Mines. (In preparation.)

[6] T. T. Quirke, "Wanapitei Lake Map-Area," *Summary Report*, Part D, Geol. Surv. Can., 1921, p. 39.

one place near the south boundary of lot 12 the author found the exposed contact and could measure a 50-degree angle of discordance in strike between the interbedded rhyolite and andesite and the basal argillite of the Mississagi formation. Near the north boundary of lot 2, concession III, Hutton township, a similar discordance of 40 degrees in strike was found near the contact. Near the north boundary of lot 4, concession III, Hutton township, radioactive conglomerate at the base of the Huronian lies on a very irregular erosion surface; here, the basement rocks consist of a greenstone-granite complex, and the conglomerate covers several contacts. Throughout Parkin and Hutton townships the Huronian formations have been folded into a near-vertical position so that the beds dip almost as steeply as those in the Pre-Huronian formations, so only a discordance in strike can be recognized.

In Creelman township, the Geneva Lake area, and the northern part of the Agnew Lake area the Pre-Huronian basement consists of granitic rocks, and so an angular discordance in strike is scarcely ever found. However, on the property of Alcourt Mines, Ermatinger township, the basal beds of the Mississagi formation lie across an eroded basic dike in the granite at a high angle (see Chart B).

A detailed geological survey of Baldwin township, published in 1952, failed to locate an angular unconformity between volcanic rocks of the basement type and sedimentary rocks of the Huronian type.[1] In 1953, uranium deposits of the Blind River type were found throughout the Agnew Lake area, which has been explored and restudied. The widespread occurrence of radioactive conglomerate at, or near, the contact of the volcanic group provides definite evidence that this is the base of the Huronian, and the stratigraphic succession above the radioactive conglomerates north of Agnew Lake is identical with that of the Quirke Lake trough. The main difference between the Blind River area and parts of the Agnew Lake area is the great amount of deformation in the latter. This may account for the difficulty in recognizing an angular unconfoımity although the evidence of an erosional unconformity similar to that at Blind River is quite satisfactory. Recent detailed restudy of Porter and parts of Baldwin townships by R. M. Ginn,[2] geologist for the Ontario Department of Mines, has shown evidence of some angular unconformity between the older volcanic-sedimentary sequence and the Huronian quartz-pebble conglomerate. So much post-Huronian deformation has occurred in the Lake Agnew country that it is difficult to trace Huronian and Pre-Huronian formations for long distances with any degree of certainty. The problem is greatly complicated by the fact that, east of the Agnew Lake area and south of the Sudbury Basin, no great unconformity or radioactive conglomerate has ever been found anywhere from the lowest volcanic formation up through the entire sedimentary succession.[3] Pre-Huronian and Huronian sedimentary formations are known to occur in many localities between Blind River and the Quebec boundary. Where the Huronian basin is gently deformed, the distinction between Huronian and Pre-Huronian rocks can easily be made, but when Huronian formations become as greatly deformed as the Pre-Huronian basement, and lithologically similar formations are found in both age groups, it becomes essential to locate the unconformity, or some unique formation such as

[1]Jas. E. Thomson, *Geology of Baldwin Township*, Ont. Dept. Mines, Vol. LXI, 1952, pt. 4, pp. 15–18.

[2]Personal communication.

[3]Jas. E. Thomson, "The Questionable Proterozoic Rocks of the Sudbury-Espanola Area," *The Proterozoic in Canada*, Royal Soc. of Can., Special Publications, No. 2, Univ. of Toronto Press, 1957, pp. 48–53.

the radioactive conglomerate, before an age correlation is possible. Detailed studies of the great sedimentary belt are being continued, and the problems of stratigraphy and correlation may eventually be solved.

In summary, it can be said that there is a great angular and erosional unconformity between the Pre-Huronian and Huronian systems. Wherever exact information is available, and radioactive quartz-pebble conglomerates are found, they lie at, or near, the base of the Huronian system. These provide a reliable marker horizon in those areas where great deformation has tended to obliterate or mask the unconformity.

Folding

Collins[1] first noticed, in the Onaping map area, a general increase in the degree of folding of the Huronian strata towards the southwest. Reconnaissance surveys by the author along the roads north of Lake Wanapitei indicate that the steepening of the beds begins about a mile east of the Upper Wanapitei River in Aylmer township. Here, the beds strike northwest about parallel to the general trend of the river and dip northeast. The steepening increases from 40 to 70 degrees towards the river, which is the locus of a regional fault. This compares with general dips of about 15 degrees on Chiniguchi Lake in Telfer township, where the beds are relatively undisturbed. Southwest of the Upper Wanapitei River the beds dip vertically and face northeasterly all the way to the contact with the Pre-Huronian volcanics near the northwest shore of Lake Wanapitei.

Throughout Parkin township the Huronian and Pre-Huronian formations are folded into an almost vertical position.[2] In places the basal beds of the Huronian are even slightly overturned. In 1956 the author obtained a geological section through the Jonsmith (Milnet) mine in the north half of lot 5, concession II. This shows that, to a depth of about 1,500 feet, the Huronian formations dip about 80°SW. and face northeast, so that they are overturned. Local faulting and intrusions in the mine workings may have some local effects on dips, but similar overturning by as much as 30 degrees was found at the unconformity in lot 12, concession III, where no intrusives or faulting are found. A traverse along a logging road, from the Jonsmith mine northeast to the Upper Wanapitei River, shows dips of 70–80 degrees everywhere in the Huronian formations.

In Hutton township the Huronian beds are consistently folded to an almost vertical position. Along the Canadian Pacific railway, about 2½ miles north of Cartier station, the beds are overturned to the south within a few hundred feet of the unconformity at the base of the Huronian, and all Huronian formations in the Lake Geneva area are complexly deformed.[3] The Huronian strata in Hart and Ermatinger townships and in the Agnew Lake area are also steeply folded in most localities. The complex structures in Baldwin township have been studied in detail by the author,[4] and those of Porter, Nairn, and Lorne townships by Ginn.[5] In the Quirke Lake–Elliot Lake trough the Huronian strata are only gently deformed, and the folding is comparable to that throughout most of the great Huronian basin extending from Lake Wanapitei to the Quebec boundary.

[1] W. H. Collins, *Onaping Map-Area*, Geol. Surv. Can., Memoir No. 95, 1917, p. 78.

[2] Map No. 41e, *Moose Mountain–Wanapitei Area, District of Sudbury, Ontario*, Scale, 1 inch to ¾ mile. (To accompany Ont. Dept. Mines, Vol. XLI, 1932, pt. 4.)

[3] F. F. Osborne, *The Cartier-Stralak Area, District of Sudbury*, Ont. Dept. Mines, Vol. XXXVIII, 1929, pt. 7, pp. 54–55.

[4] Jas. E. Thomson, *Geology of Baldwin Township*, Ont. Dept. Mines, Vol. LXI, 1952, pt. 4.

[5] R. M. Ginn, *Geology of Porter Township*, Ont. Dept. Mines. (In preparation.)

R. M. Ginn, *Geology of Nairn and Lorne Townships*, Ont. Dept. of Mines. (In preparation.)

It would appear that extreme deformation of the original Huronian basin was concentrated in a great arc around the northeast, north, and west sides of the Sudbury Basin. In all cases the faulting and folding parallels the arc, and the thrust appears to be towards the margin of the basin. Inasmuch as Huronian strata do not occur in the Sudbury Basin it was probably a highland, and underwent erosion in Huronian time. Such a concept is tentative, and elaboration on the subject is deferred until further studies of post-Huronian tectonics in the region are completed.

Faulting

Detailed geological studies in various parts of the area under discussion during the last decade have revealed several major faults and many minor displacements. Most of the faults that have been found are described elsewhere, and it is beyond the scope of this report to discuss them. The major structures located up to 1958 are shown diagrammatically in Chart A. Studies of the tectonics of the district are being continued, and revisions of the fault pattern will undoubtedly be made as new information is accumulated.

The Upper Wanapitei fault and Milnet fault are structures appearing on a government geological map for the first time in Chart A. Both are well-defined topographic lineaments that can be followed for long distances. New information on these structures was obtained by the author in 1958 and is recorded here.

The Upper Wanapitei fault follows the Upper Wanapitei River. Its continuation southeast of Wanapitei Lake would follow a well-defined lineament extending through Ashigami Lake to the Grenville Front. Details of this part of the structure will appear in a forthcoming report. The most obvious feature of the Upper Wanapitei fault north of Lake Wanapitei is that it is a thrust fault that reproduces part of the sequence of Pre-Huronian and Huronian formations on its northeast side. This is well displayed on the northwest side of Lake Wanapitei, where there is a section from Pre-Huronian granite and greenstone through the Mississagi, Bruce, Espanola, Gowganda, and Lorrain formations west of the Upper Wanapitei River. Traverses by the author indicated that the Lorrain quartzite is not folded into a syncline west of the Upper Wanapitei River, as shown in the cross-section by Quirke,[1] but faces northeast across its full width. The Gowganda and Lorrain formations are repeated northeast of the Upper Wanapitei River; farther upstream, in Fraleck township, the Pre-Huronian rocks reappear at the base of the Huronian on the east side of the fault. Furthermore, in Fraleck township, air photographs, checked by ground traverses by the author, show that the beds of the Lorrain quartzite on the west side of the river, north of Fraleck Lake, strike at about right-angles to the beds of the Gowganda formation on the east side of the river.

The Milnet fault follows the valley of the Vermilion River north of Milnet station on the Canadian National railway. It was recognized by Kindle.[2] The right-angled divergence in strike of the beds on opposite sides of the river is very apparent along the railway about 2 miles north of Milnet station. The Mississagi formation continues along the northeast side of the Vermilion River at least to Anstice station in Creelman township. It thus transgresses the strike of the Mississagi, Gowganda, and Serpent formations on the opposite side of the river.

[1]T. T. Quirke, "Wanapitei Lake Map-area," *Summary Report 1921*, Part D, Geol. Surv. Can., 1922. (With Map No. 1948, *Wanapitei Lake Area, Sudbury district.* Scale, 1 inch to 1 mile.)

[2]L. F. Kindle, *Moose Mountain–Wanapitei Area*, Ont. Dept. Mines, Vol. XLI, 1932, pt. 4, p. 35.

ECONOMIC GEOLOGY

General Character of Uranium and Thorium Deposits

This report deals only with the deposits of uranium and thorium that occur in conglomerate and associated sedimentary rocks in the District of Sudbury and eastward as far as Lake Timagami. These deposits are similar in lithology, stratigraphy, and mineralogy to the uranium ores of the Blind River camp and are believed to lie along the shore line of the eastern extension of the same Huronian basin. However, the radioactive conglomerate beds in most of the area under discussion are greatly deformed; consequently the distribution of values is generally more erratic than in the Blind River mines. None of the properties have reached the production stage, and all the mineralized bodies are too small or too low in grade to be profitably mined under 1958–59 marketing conditions for uranium and thorium minerals. Development on all the showings has been confined to surface work and diamond-drilling. The largest deposit found to date is in Hyman township, and is owned by Canadian Thorium Corporation Limited. The company's engineer has estimated that drilling indicated 750,000 tons averaging 0.095 percent U_3O_8 and 0.30–0.35 percent ThO_2.

The radioactive quartz-pebble conglomerate is almost always found at, or near, the base of the Mississagi formation, which lies unconformably on a basement complex. An apparent exception to this rule is found in the case of two uranium occurrences in Hyman township, which do not show this exact relationship on company plans, but these deposits are in an area of intense deformation where geological interpretation is difficult. The conglomerate beds are usually concentrated within 100 feet of the basement, but narrow interbeds of the conglomerate may be interbedded with quartzite for hundreds of feet above the main reef. These conglomerates do not extend uniformly across the country at this stratigraphic horizon but rather are concentrated in certain localities. Probably this distribution is related to a deltaic environment in those localities where rivers were entering the Huronian sea. The detailed stratigraphy of the radioactive beds is quite variable, and interlensing of conglomerate, grit, quartzite, and argillite beds may occur; any or all of such beds may contain radioactive minerals in varying amounts.

Quartz-pebble conglomerate is the commonest host rock of uranium and thorium. The conglomerate contains well-rounded to subangular pebbles, mainly of quartz and chert, in a gritty matrix with varying amounts of pyrite. Generally the pebbles range from ¼ to 3 inches in diameter, but occasionally boulders up to 6 inches in diameter may be found. The sorting is good, and pebbles predominate slightly over matrix in percentage of rock volume. On weathered surfaces of the conglomerate, the oxidation of the pyrite in the matrix produces a rusty colour, which contrasts with the white pebbles or adjacent quartzite. In certain areas the conglomerate is strongly sheared, and the ratio of length to thickness of pebbles may be as much as 6:1. In such cases it may be difficult to recognize the rock as a conglomerate in hand samples or drill core, but it is readily detected on a good rock exposure.

The width of uranium-bearing beds or reefs varies greatly; these may alternate with relatively barren beds in such a way that only detailed sampling and assaying could indicate thicknesses of commercial or near-commercial grade. Grades of 0.05–0.10 percent U_3O_8 are generally confined to widths of 5 feet or less, and rarely up to 12 feet, but an average grade of 0.01–0.03 percent U_3O_8 may occur over widths up to 70 feet.

Mineralogy

The mineralogy of the radioactive conglomerates and associated rocks is probably similar to that of the Blind River mining district, but only a limited amount of laboratory work has been done on the minerals from the area under discussion. Uraninite, uranothorite, monazite, "brannerite," and thucholite have been found in the conglomerate at a few places, and small patches and stringers of pitchblende have been reported in sheared pebble conglomerates of the Lake Agnew area. Cyrtolite, ilmenite, titanite, magnetite, tourmaline, chromite, zircon, garnet, and apatite are revealed by microscopic examination of the matrix of the conglomerate. Autoradiographs indicate that the radioactive minerals are in the matrix of the conglomerate and often associated with pyrite. Quartz, feldspar, biotite, sericite, and chlorite are also common in the matrix.

K. D. Card, the author's field assistant, made a mineralogical study of the radioactive conglomerates from the different localities described in this report and has described the radioactive minerals as follows:[1]

> Uraninite occurs in the form of small (0.05–0.1 mm.) rounded to angular, fractured grains which often show a cubic habit. It is generally concentrated with other heavy minerals and with pyrite in thin seams and in the matrix as rims on quartz pebbles.
>
> Uraninite appears to be a primary detrital mineral, as is evidenced by its close association with normal detrital minerals such as zircon and by the rounded nature of some of the grains.
>
> A mineral which is called brannerite here, due to its similarity to the so-called brannerite of the Blind River ores, was noted in several samples. It occurs as small (0.01–0.5 mm.) highly altered grains in the matrix where they are closely associated with pyrite, uraninite, zircon, and ilmenite. In polished section, brannerite grains are seen to be a mixture of two constituents, one of which is light grey and highly reflective, and another which is darker grey and less reflective. It is probable that this material is a two-phase mixture of uraninite and a titanium mineral such as rutile.
>
> Thucholite was found in one sample from the property of Jellicoe Mines (1939) Limited in Baldwin township. It occurs as small (0.02 mm.) rounded grains associated with pyrite and uraninite. Thucholite replaces uraninite and has probably formed by the alteration of this mineral.

On the L. Leslie property in Creelman township, uranium values up to 0.49 percent U_3O_8 are obtained from hand samples of bedded argillite, which occurs at interbeds in quartz-pebble conglomerate. Autoradiographs show that the radioactivity occurs in parallel narrow layers that correspond with the bedding planes. Mr. Card found on microscopic examination that the darker coloured portions of the beds contain detrital minerals such as zircon, apatite, tourmaline, monazite, sphene, ilmenite, magnetite, and uraninite (see lower photograph, page 16). Ilmenite is concentrated with uraninite in thin seams near the bottom of the beds. Uraninite occurs as small (0.05 mm.) grains, many of which are well rounded and undoubtedly of clastic origin. (See upper photograph, page 17.)

The ratio of uranium to thorium in the conglomerate is extremely variable, even within a single drill hole. This point is discussed in the description of the property of Canadian Thorium Corporation on page 23 of this report. No accurate appraisal of the over-all uranium-thorium ratio in any deposit will be made until such a time as there is an economic incentive to develop thorium deposits, and then the necessary number of thorium assays will be made. The most accurate information available to date comes from the work on the deposit of Canadian Thorium Corporation, where the ratio of thorium to uranium is stated to be about 3:1. A few uranium and thorium assays from the showings of Noranda Mines, L. Leslie, Fano Uranium Mines, Dominion Gulf Company, and Alford Explorations are listed in the description of properties; in most cases the amount of uranium present exceeds that of thorium.

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[1] K. D. Card, B.Sc. thesis, Queen's University, 1959.

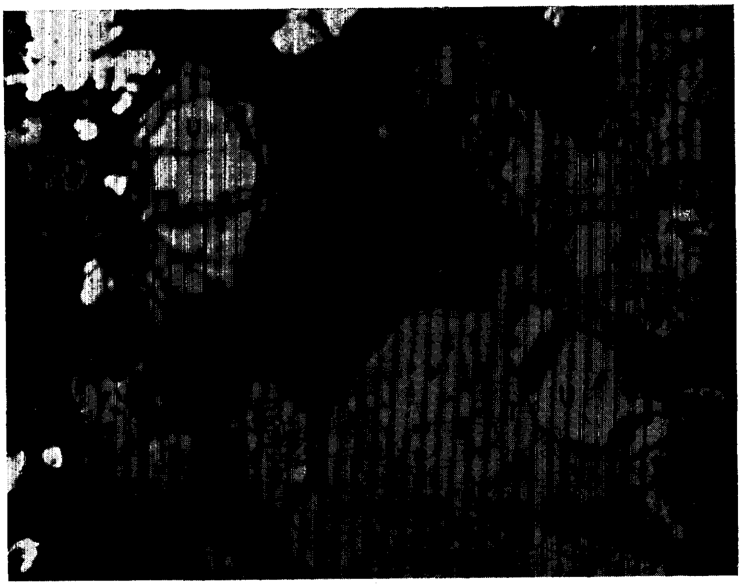
Photos by K. D. Card

Photomicrograph of thin section of uraniferous quartz-pebble conglomerate, Jellicoe Mines (1939) Limited, Baldwin township. Note the pyrite (black) between quartz grains (white). (× 3.2.)

Photomicrograph of a thin section of uraniferous bedded argillite, Leslie property, Creelman township. (×3.2.)

Photos by K. D. Card

Photomicrograph of uraniferous bedded argillite, Leslie property, Creelman township, showing rounded grains of detrital uraninite (U). The light-coloured mineral is ilmenite (I). (× 800.)



Photomicrograph showing thucholite (T) replacing uraninite (U) in quartz-pebble conglomerate, Jellicoe Mines (1939) Limited, Baldwin township. (× 140.)

An interesting and unusual feature of the property of Prosco Limited in Vogt township is the association of gold with uranium in quartz-pebble conglomerates.

Genesis

The field evidence strongly favours a sedimentary origin of the uranium mineralization. The placer theory as proposed by Holmes[1] for the Blind River camp appears to be the most logical explanation of the genesis of this type of deposit. It is true that on rare occasions tiny patches and stringers of pitchblende occur in highly deformed radioactive conglomerate, and these are undoubtedly of

Photo of autoradiograph of uraniferous bedded argillite, Leslie property, Creelman township. Radioactivity, indicated by light colour, is concentrated along bedding planes. This and lower photo, page 16, are from the specimen but do not exactly match. (X 2.)

hydrothermal origin. Such occurrences could readily be explained by regeneration of uranium-bearing minerals in the pebble conglomerate, and have little bearing on the general problem of genesis.

The uranium mineralization is restricted to the pebble conglomerate and associated beds at the same general stratigraphic horizon at intervals over hundreds of miles along the margin of the original Huronian basin. In detail, the restriction of values to reefs, beds, and related sedimentary phenomena is so striking and so uniform that no process other than a sedimentary accumulation of radioactive minerals is reasonable. The deposits have all the geological features of syngenetic deposits and none of the common characteristics of hydrothermal deposits. A process whereby detrital sediment was transported by water into a deltaic or estuarine environment and constantly reworked could readily account for the features of sedimentation in the host rock and the uranium and thorium concentration within it. Where high-grade uranium-mineralization is associated with well-bedded argillite interbeds in the conglomerate, the primary rhythmic alternation of heavy detrital minerals, including uraninite, with quartz and feld-

[1]S. W. Holmes, *Structural Geology of Canadian Ore Deposits*, Can. Inst. Min. Met., Congress Volume, Vol. II, 1957, pp. 337–39.

spar grains is just as pronounced as that of iron-bearing minerals and silica in a bedded iron formation. Microscopic examination also reveals evidence of detrital uraninite in the quartz-pebble conglomerates. When all the evidence is considered, the only reasonable conclusion is that the uranium and thorium mineralization is of sedimentary origin. In other words, these are syngenetic mineral deposits.

Considerations in Future Exploration

If it should become desirable to supplement the huge reserves of uranium ore of the Blind River mining camp, a further search for uranium and thorium ores would undoubtedly be made in the District of Sudbury. The experience gained to date shows that the uniformity of uranium distribution that is so characteristic of the Blind River deposits could scarcely be expected where the host rocks are so highly deformed as in most parts of the Sudbury district. On the other hand, there is the remote possibility that a small high-grade vein type of deposit could have been regenerated in the deformed radioactive conglomerates and could be profitably exploited. Another interesting speculation would be the finding of a mineable deposit of gold- and uranium-bearing conglomerate of the type found at Prosco (Aubay) Mines in Vogt township. Such an occurrence on a much larger scale would have intriguing possibilities because of the geological similarity to the gold and uranium conglomeratic ores in the Rand in South Africa. Some speculators may consider the potentialities at the base of the large Huronian basin extending north and east from Lake Wanapitei and wonder what lies beneath the cover of the Gowganda and Lorrain formations, especially when occurrences of uranium are found at a few places around the exposed margin of the basin.

DESCRIPTION OF PROPERTIES

Throughout this report the method adopted for giving the kind of assays made on samples is similar to that used by Lang.[1] To conserve space, a short way of reporting the results of chemical analysis and radiometric tests has been devised. For example, 0.11 percent U_3O_8 (C) means uranium oxide determined by chemical analysis, whereas 0.11 percent U_3O_8 (R) stands for 0.11 percent U_3O_8 equivalent determined by radiometric test. Where neither (C) nor (R) are shown this indicates that the kind of assay made is unknown to the author. An ordinary radiometric test gives a close approximation of the total amount of uranium or thorium oxide, or both, in a sample, but it does not distinguish between uranium and thorium.

The descriptions of properties are taken from the best available information and are believed to be authentic, but the author does not assume responsibility for information supplied by others. The properties are listed in alphabetical order according to name. For their general location the reader is referred to Chart A.

Alanen and Maki Claims

In 1958, William Alanen, of Worthington, held a group of 14 claims in Drury township. These consisted of most of lot 6, concession IV, all of the south half of lot 6, concession V, and three claims at the north end of lots 7 and 8, concession IV. Uranium discoveries were made on claims S.98185 and S.98186 (SE. and

[1] A. H. Lang, *Canadian Deposits of Uranium and Thorium*, Geol. Surv. Can., Econ. Geol. Series No. 16, 1952, p. 8.

SW. ¼, S.½ lot 6, con. IV). Mr. Alanen and E. Maki also held 13 claims in lots 9–11, concession IV, Drury township, and reported that uranium occurrences had been found on these claims. The author visited only the showings on claims S.98185 and S.98186 with Mr. Alanen in 1958. Very little exploration for uranium had been done at the time of the examination. There are also copper showings in these properties.

The geology in the vicinity of the uranium occurrences is shown on Maps Nos. 291A and 292A of the Geological Survey of Canada. A band of greatly deformed Mississagi formation extends across the properties, and beds of radioactive rock have been found in places along it. Near the east boundary of claim S.98185 there is a large bare outcrop of greatly deformed quartzite, argillite, arkose, and pebble conglomerate. The beds of quartz-pebble conglomerate are radioactive but are so contorted, sheared and faulted that they have little continuity. In places the quartz pebbles are so elongated by deformation that they can scarcely be recognized. The Creighton fault, a strong regional structure, is probably located near these showings and would be responsible for the great local deformation. The matrix of the conglomerate beds contains traces of sulphides. The beds are narrow and occur at a number of different stratigraphic horizons.

Small test-pits have been opened at two places about 100 feet apart. A grab sample taken from the discovery pit by Mr. Alanen assayed 0.61 percent U_3O_8 (C) and 0.30 percent ThO_2 (C). A representative sample was taken by the author from a conglomerate bed, 1.5 feet wide, at this pit. It assayed 0.38 percent U_3O_8 (C) and 0.10 percent ThO_2 (C). A grab sample of sheared radioactive conglomerate from the second pit assayed 0.05 percent U_3O_8 (R).

Several hundred feet to the west of the test-pits, there is a small exposure of sheared pebble conglomerate, which is strongly radioactive across a width of 10 feet. It had not been blasted open at the time of the author's visit, so no samples could be obtained.

Alcourt Mines Limited

In 1957, Alcourt Mines Limited held 19 claims in the north-central part of Ermatinger township. The property covered parts of lots 5–8, concessions V and VI. A uranium discovery was made on claim S.104216 (approximately SW.¼, N.½ lot 6, con. IV). A small amount of surface work was done, and one hole was drilled beneath the discovery outcrop; four additional holes were drilled in 1959. The showing is reached by way of the Pumphouse Creek road, which extends westerly from highway No. 544. About 3 miles west of the highway a bush road runs southward about 1 mile to the discovery showing.

Information on the property was obtained from a report by J. G. Willars, company engineer, dated October 22, 1957. The author examined the showing in 1958.

GENERAL GEOLOGY

The geology of the area and detailed geology at the discovery are shown in Chart B. A basin-shaped erosion remnant of deformed Huronian sedimentary rocks lies unconformably on the granite basement complex. Immediately above the unconformity there are outcrops of the Mississagi formation. The Mississagi rocks consist of quartzite and arkosic beds with argillite partings and scattered thin interbeds of quartz-pebble conglomerate. The beds dip steeply to the northwest, and face in the same direction. The unconformity is exposed at a few places and is marked by a 3-foot transition zone between massive local arkose and massive pink granite. At one point a basic dike, 15 feet wide, cuts the granite, but is sharply truncated at the unconformity as shown on Chart B.

URANIUM OCCURRENCE

The Mississagi formation is locally radioactive near the granite contact. On claim S.104216 some rock was blasted from the outcrop at the places where the strongest radioactivity was found. The radioactive rock is mostly quartzite and arkose, with scattered pebbles and traces of pyrite. The radioactivity is spottily distributed throughout the discovery area. Uranium values on claim S.104216 are stated in the report by Mr. Willars as follows:

Three grab samples taken from three of the pits assayed 0.027, 0.027. and 0.038 percent U_3O_8. Three samples of the drill core assayed as follows:

Sample	Width	U_3O_8
feet	feet	percent
81.0– 82.0	1.0	0.044
100.0–103.5	3.5	0.042
108.5–110.5	2.0	0.032

These assay results were derived by chemical analyses.

A selected grab sample taken by the author from the discovery outcrop above the drill hole assayed 0.03 percent U_3O_8 (R).

In 1959, hole No. 1 was deepened to the granite contact, and four additional holes were drilled nearby. The Company reported that all assays in these holes were lower in U_3O_8 content than the results listed above.

Alford Explorations Limited

This company was formed to consolidate the claim holdings of various individuals and organizations, in lots 9–12, concessions IV and V, Drury township. Base metal and uranium occurrences on the property have been investigated in recent years by Sagamore Exploration Limited and Cody-Reco Mines Limited. This report deals only with the uranium occurrences and is based on a short trip to the property, under the guidance of William Alanen of Worthington in 1958. At that time exploration of the uranium mineralization had not been great. The property is reached by way of a bush road, which extends northward from the motor road leading to High Falls power plant on Agnew Lake.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. A band of conglomerate, arkose, and quartzite of the Mississagi formation extends across the property; certain beds in these sediments exhibit radioactivity. The sedimentary rocks are greatly deformed, and dip about vertically. They have been injected more or less concordantly by gabbro bodies (Nipissing diabase). The Mississagi formation is bounded on the north by pink granite and pegmatite. The contact between granite and radioactive sediments is drift covered over a width of 50 feet at the point where it was crossed by the author. Strong shearing is in evidence and may indicate a fault contact.

Prospecting with a scintillometer has indicated that certain beds of quartz-pebble conglomerate and quartzite are noticeably radioactive, and some of these localities have been opened by small test-pits and rock trenches. Few of the radioactive horizons have been traced for any distance along strike. The radioactive beds shown to the author ranged from 2 to 20 feet in width and are probably all at different stratigraphic horizons. Although greatly sheared, the quartz-pebble conglomerate is similar lithologically to the radioactive conglomerate of the Blind River–Elliot Lake camp.

URANIUM OCCURRENCES

On claim S.1011356 (NW.¼, N.½ lot 11, con. IV) interbedded quartz-pebble conglomerate, arkose, and quartzite are exposed. Immediately north of the campsite a test-pit was sunk on a bed of radioactive conglomerate 2 feet wide. A selected sample of this material, taken by the author, assayed 0.24 percent U_3O_8 (C) and 0.30 percent ThO_2 (C). A hole (No. 6, 1958) drilled beneath the showing, under the supervision of R. I. Benner, consulting geologist, cut three beds of radioactive conglomerate, each 2½ feet wide, but assay results of samples taken are not known by the author.

On claim S.101134 (NE.¼, N.½ lot 11, con. IV) a rock trench was opened across 20 feet of radioactive sediments. A grab sample of selected radioactive rock, taken by the author, assayed 0.02 percent U_3O_8 (R). On claim S.101348 (NE.¼, S. ½ lot 12, con. IV) a bed of sheared radioactive conglomerate is located 90 feet south of the granite contact; it is exposed over a width of 10 feet, but is drift covered along strike. A selected grab sample of this conglomerate assayed 0.11 percent U_3O_8 (C) and 0.05 percent ThO_2 (C). A sample from a narrow parallel conglomerate bed a few feet to the north assayed 0.02 percent U_3O_8 (R).

Canadian Thorium Corporation Limited

In September, 1956, Canadian Thorium Corporation Limited took over the uranium-thorium property of New Thurbois Mines Limited in Hyman township. In 1955, New Thurbois Mines Limited owned a group of 72 contiguous claims, about 2,800 acres. These covered a strip across lots 1–12, concession V, and lots 4–6, concession VI (before annulment of these subdivisions), in the northern part of Hyman township. The property lies about 4 miles north of Agnew Lake, and is reached from there by a bush road accessible by a jeep. The claims were developed by surface work and about 36,000 feet of diamond-drilling.

The following report is based on records of New Thurbois Mines Limited, especially on a summary report by L. G. Phelan, company engineer, dated November 21, 1955. The author visited the property briefly in 1959, when a detailed resurvey of the geology of Hyman township was commenced by the Geological Branch of the Ontario Department of Mines. This resurvey will probably lead to considerable revision of the geology as stated below and as shown in Chart C.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. Chart C shows diagrammatically the geology in the vicinity of the radioactive deposits. Heavy overburden covers most of the bedrock in the vicinity of the Nos. 2 and 3 zones, and accurate geological relationships are difficult to obtain. The radioactive minerals are found in quartz-pebble conglomerate, which is interbedded with sericitic quartzite and argillite; these are correlated with the Mississagi formation of Huronian age. The sedimentary rocks are bounded on the north by a granitic complex. Small masses of basic intrusives cut all other rocks.

The sedimentary rocks underlie most of the property. They strike northeast to east and have a very steep dip. It is thought by company geologists that they are closely folded into a syncline, the axis of which bisects the argillitic member. In the embayment of sediments in the granite (No. 3 zone, Chart C) the sericitic quartzite is reported to be repeated by folding and possibly by faulting.

Preliminary geological investigation of the property by geologists of the Ontario Department of Mines in 1959 revealed great structural complexity. The granite-sedimentary contacts appear to be largely faulted.

URANIUM-THORIUM DEPOSITS

These have been described by L. G. Phelan as follows:

Extensive uranium-thorium deposits have been found in the pebble conglomerate beds within the sericitic quartzite. The ore is very similar to that found in the Blind River area a few miles to the west. The pebble beds are composed principally of quartzite pebbles in a quartz-sericite matrix with varying amounts of pyrite and pyrrhotite. Uranothorite, monazite, and uraninite have been identified as at least some of the uranium- and thorium-bearing minerals.

In the Nos. 2 and 3 zones described below there is a main ore-bearing conglomerate horizon, continuous but of varying width and grade. This horizon is flanked by two or more parallel conglomerates, which are lenticular in habit, reappearing at irregular intervals in more or less the same stratigraphic position. In both the main and flanking conglomerates the walls are indefinite, there is a central higher grade core, which grades outward into barren and more or less pebble-free quartzite.

Fairly accurate indications of the uranium grade are available. Thorium assays have been obtained, but no grade calculations have yet been made. Combined grade calculations will be difficult until such time as a price can be placed on the thorium, because the uranium-thorium ratio is extremely variable, and the high-uranium sections are not necessarily the high-thorium sections. It is quite possible to assay two adjoining and strongly radioactive sections of drill core and obtain from one an assay of 0.15 percent U_3O_8 with 0.05 percent ThO_2, while the other assays 0.03 U_3O_8 with 0.5 percent ThO_2.

As an over-all arithmetic average of the uranium-rich sections, the thorium-uranium ratio is from 3:1 to 4:1. Grades and tonnages quoted below cover only the uranium-rich sections. If thorium-rich sections are to be included in ore calculations, then the tonnages can probably be increased by a factor of two or more.

Drilling to date indicates approximately 750,000 tons of uranium ore carrying 0.095 percent U_3O_8, with a thorium content averaging about 0.3 to 0.35 percent ThO_2. This is found in the zones described in detail below.

No. 2 Zone

This zone occurs in the coarse sericitic quartzite on the south limb of the main syncline. It has been traced by diamond-drill for a length of over 3,150 feet: it is cut off to the west by a fault and appears to be lensing out eastward.

Scattered values are obtained in all conglomerate beds, but the only one consistent enough to be included in the following calculations is the central bed.

Two tiers of holes have been drilled, cutting the zone at 100- and 300-foot depths, and one hole has cut the zone at 500 feet. The over-all average grade is 0.079 percent U_3O_8 over a 5-foot width. There are indicated 1,325 tons per vertical foot.

Within the 3,150-foot length there are four higher grade shoots separated by low grade zones. These shoots rake downward to the east at an average angle of 35°. These shoots contain 900 tons per vertical foot with a grade of 0.09 percent U_3O_8. The thorium content of the shoots is about 0.3 percent ThO_2.

No appreciable change in character or grade was noted at depth. The nearest known granite is 800 feet to the north. There is good reason to expect that the values will persist down dip for an indefinite distance.

No. 3 Zone

The No. 3 zone is found on the north limb of the syncline, in the embayment and immediately south of the granite. There are three sections. The B and C sections are merely two parts of the same zone separated by a fault. The A section, north of B, is believed to be a repetition of the same bed, on the north limb of an anticlinal fold.

The structure in the rocks adjoining the granite is very complex and has not been completely worked out. Among other complications there is a more or less flat thrust fault which has displaced both greywacke and granite so that these cap a portion of the No. 3 zone. Only deep drilling detected much of the ore.

3A Section

This section lies entirely within the granite embayment. It has a length of approximately 650 feet, is cut off to east and west, and presumably at depth by granite. It is known to extend to a depth of at least 400 feet in the centre of the section.

There are three parallel conglomerate beds, the central one carrying consistent values for the full length of the section, and the southerly bed consistent for a length of 300 feet. From limited drilling these aggregate 560 tons per vertical foot grading 0.106 percent U_3O_8. Thorium content is estimated to be 0.4 percent ThO_2.

3B Section

This section is 1,200 feet long. It is cut off to the west by granite and to the east by a fault.

The eastern portion is capped by overthrust granite and greywacke.

Granite is quite shallow to the west (300–400 feet) but has not been intersected at depth to the east. Values occur in two and sometimes three parallel conglomerate beds. There has been insufficient drilling to arrive at any ore estimates. Values are erratic, ranging from 0.096 percent U_3O_8/39.0 feet through 0.35 percent U_3O_8/2 feet to 0.05 percent U_3O_8/7.0 feet. There is a similar variation in thorium values.

3C Section

This section also is only partially outlined and is complicated by a granite overthrust and cross-faulting. It has been traced for a length of 1,000 feet and a depth of 400 feet. It is cut off to the west by faulting and may be open eastward. So far as is known it is not cut off at depth by granite.

Again there is insufficient information available to make tonnage calculations. Three parallel conglomerate beds carry values. Widths and grades are erratic; e.g. 0.097 percent U_3O_8/26.0 feet, 0.09 percent/2.7. feet, 0.07 percent/13.0 feet, 0.101 percent/7.3 feet.

No. 1 Zone

This zone occurs in quartzites south of the No. 2 zone and apparently is a distinct horizon. It is characterized by high but spotty copper values. Little work has been done on this zone. Uranium values appear to be erratic and low.

Summary

To 400-foot depth, the No. 2 and 3A zones are estimated to contain 625,000 tons grading 0.095 percent U_3O_8. Assuming a minimum amount from 3B and 3C zones, there is indicated some 750,000 tons.

Chemical Research Corporation (Canada) Limited

In 1954, this company held 159 claims, covering about 5,900 acres, in the southeastern part of Porter township and the southwestern part of Hyman township, north of Agnew Lake. The property was explored by geological mapping and surface work. A number of radioactive occurrences were found, but no body of commercial importance was located, and most of the claims were dropped.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. The township of Porter was remapped in detail in 1956–57 by R. M. Ginn for the Ontario Department of Mines. The new survey revealed that the radioactive deposits in the southeastern part of Porter township lie near an older group of volcanics, sedimentary, and metamorphic rocks in a younger sedimentary group of Huronian age, with quartz-pebble conglomerate at, or near, the base and interbedded with quartzite. All the rock types are greatly deformed.

URANIUM OCCURRENCES

Radioactive quartz-pebble conglomerate occurs adjacent to the volcanic complex near the south end of lot 1, concession II, and in the southeast quarter of the north half of lot 1, concession I, but no information is available on the grade or size of the showings.

The main showing was found near the shore of Agnew Lake in the southeast quarter of the south half of lot 2, concession I. A ridge of quartzite and quartz-pebble conglomerate, much contorted and faulted, is exposed. The bed of radioactive quartz-pebble conglomerate is 8–12 feet wide, and was trenched and sampled by the company at intervals for 240 feet in a direction N.55°E. In trench No. 1 an average of 0.29 percent U_3O_8 (C) was obtained over a width of 12 feet. In trench No. 2, an 8-foot width assayed 0.25 percent U_3O_8 (C). In trench No. 3, a 4-foot width assayed 0.08 percent U_3O_8 (C). In other trenches the assays ranged from 0.01 to 0.06 percent U_3O_8.

Some assays disclosed that thorium is present with the uranium but in smaller quantities.

Dominion Gulf Company

1. SHAKESPEARE TOWNSHIP

In 1953-54, this company held 28 mining claims in a group, the centre of which is lot 5, concession V, Shakespeare township. The claims were on the south, west, and east shores of Agnew Lake. Discoveries of radioactive minerals were first made along the south shore of the lake. The property was developed by surface work, rock trenching, detailed geological and geophysical surveys, and three diamond-drill holes. No uranium mineralization of economic interest was found.

The information given below is largely based on a report for the company by J. A. La Rocque, dated September 30, 1954. The author has not seen the showings.

General Geology

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. Sedimentary rocks typical of the Mississagi formation are found around the shore of Agnew Lake. Adjacent to these are areas of granite. The sedimentary rocks consist chiefly of quartzite, with local interbeds of quartz-pebble conglomerate. These trend east-westerly and dip north at angles of 30–70 degrees. The sediments are intruded by large and small bodies of diabase, diorite, and gabbro, and are often much deformed and metamorphosed.

Uranium Occurrences

Five zones of radioactivity were located in the Mississagi formation, and four of these occur in quartz-pebble conglomerate beds associated with the quartzite. Weak sulphide mineralization accompanies the uranium values. Zones A and B were found on claims S.71461 and S.71462 (lot 4, con. V) on the south shore of Agnew Lake. Here, a bed of conglomerate, 8 inches wide, and exposed intermittently for 150 feet, gave assays as high as 0.054 percent U_3O_8 and 0.09 percent ThO_2 (R). Another bed, 2 feet wide, and traced for 200 feet, gave assays up to 0.056 percent U_3O_8 (R).

Zone C is in the north half of lot 6, concession V; zones D and E are in small patches of sediments south of Agnew Lake. An assay of 0.03 percent U_3O_8 and 0.05 percent ThO_2 was obtained from pebble conglomerate in the southeast corner of lot 4, concession VI.

2. MAY TOWNSHIP

In 1954, Dominion Gulf Company did some exploration on claim S.72565 (NE.¼, S.½ lot 2, con. VI) in May township. Three drill holes were put down to explore a uranium occurrence. The drilling records show that the country rock is quartzite and greywacke, greatly deformed and sheared. This is correlated with the Mississagi formation on Map No. 291A. There was much core lost, and a great deal of vein quartz was intersected. The drill holes are located close to the probable western extension of the Worthington fault from Baldwin and Shakespeare townships, and it is quite possible they intersected this fault zone.

About 530 feet south of the northwest corner of this claim, a 6-inch rusty band in quartzite is radioactive. The exposure is small. Assays of 0.07, 0.06, and 0.13 percent U_3O_8 (R) were recorded from this place.

3. BALDWIN TOWNSHIP

In 1954, Dominion Gulf Company reported the discovery of a small uranium showing in lot 3, concession V, Baldwin township, about 1,000 feet west and 400 feet south of the Forestry lookout tower.[1] A narrow radioactive quartzite band was traced at intervals for about 2,000 feet. Assays recorded from this occurrence are 0.12 (R), and 0.04 (C) percent U_3O_8.

Doyon-MacLeod-MacIntosh Property

In 1955, Paul Doyon, E. C. MacLeod, J. M. MacIntosh, and associates, Room 906, 357 Bay Street, Toronto, did some work on a uranium showing in lot 8, concession V, Hutton township. Three short holes were drilled.

The geology of the area is shown on Map No. 41e of the Ontario Department of Mines. Quartz-pebble conglomerate and quartzite lie on granitic rocks. Radioactivity in the conglomerate is quite high in places. Two surface samples taken by D. H. James, geologist, assayed 0.03 and 0.01 percent U_3O_8. Intersections are reported in each of the drill holes giving values of 0.04 percent U_3O_8 in 8 feet of core, 0.08 percent U_3O_8 in 8 feet of core, and 0.07 percent U_3O_8 in 8 feet of core.

Dyno Mines Limited

In 1954, this company held a large block of mining claims in the northeast corner of Roberts township. The claims were mapped in detail by L. R. Simard and F. C. Knight, mining consultants, and following information is taken from their report, dated November 18, 1954.

The rocks on the property are predominantly greywacke, quartzite, and conglomerate. The beds dip at 14–33 degrees. Some weak to moderate radioactivity was observed in the conglomerate and adjacent quartzite on claims S.102478 and S.102474. These occurrences are on the east side of the Vermilion River, about 70 and 100 chains south of the north boundary of Roberts township.

Elmridge Mines Limited

In 1954, Elmridge Mines Limited held a group of 18 claims in the northeastern part of Roberts township, between the Vermilion River and Roberts Lake. The claims were mapped in detail by L. R. Simard and F. C. Knight, mining consultants, and the following information is taken from their report, dated December 31, 1954.

Slightly radioactive conglomerate is exposed for about 1,000 feet in a railway rock cut on the Canadian National railway close to the west side of the Vermilion River, on claims S.64847 and S.64844. This is about 1 mile south along the rail-

[1]See Map No. 1952–1, *Township of Baldwin, District of Sudbury, Ontario,* Scale, 1 inch to 1,000 feet. (To accompany Ont. Dept. Mines, Vol. LXI, 1952, pt. 4.)

way, from the north boundary of Roberts township. The conglomerate band is about 50 feet thick and is mineralized with pyrite and pyrrhotite. The entire mass registers about three times normal background on a geiger counter. It is at the northeast boundary of a body of rock, mapped as arkose but classified as granite on Map No. 179A (Onaping sheet) of the Geological Survey of Canada. A similar type of conglomerate occurs west of Roberts Lake, on claims S.103446, and S.103447, and south of a small pond on claim S.103427.

Fano Uranium Mines Limited

Fano Uranium Mines Limited did surface exploration on a band of radioactive conglomerate in Hutton township in 1955. Late in the year the company was absorbed by Fano Mining and Exploration Inc.

The company optioned a group of 19 claims lying west of the Canadian National railway, in lots 3–6, concessions III and IV, Hutton township. Geological and geophysical surveys were made, some test-pits were sunk, and three drill holes, totalling 2,463 feet, were put down. Scattered uranium mineralization was found, but nothing of economic interest was indicated, and the claims were dropped.

The information given below is based on incomplete company records and the result of a short visit to part of the property by the author in 1958.

GENERAL GEOLOGY

The general geology of the area is indicated on Map No. 41e of the Ontario Department of Mines, published in 1932. A band of radioactive quartz-pebble conglomerate extends southwesterly from the Canadian National railway to the west side of lot 5, through the southern part of concession IV, and the northern part of concession III. The conglomerate lies with great unconformity on the basement complex of granite, gneiss, pegmatite, and metavolcanic and metasedimentary rocks. Gabbro dikes with associated breccias intrude the basement rocks, and breccia occurs locally along the unconformity and in the sedimentary rocks.

The radioactive conglomerate is packed with rounded to sub-angular pebbles of quartz and chert, most of which are under 2 inches in diameter. A few boulders and pebbles of granite, rhyolite, and argillite also occur. The matrix is a feldspathic arkose with disseminated pyrite. Interbeds of argillite and quartzite strike N.50°–80°E. and dip from 65°NW. to 70°SE. The beds face northwest, and most of the radioactive sedimentary rocks are overturned. Strong local deformation of beds may be seen; quartz stockworks occur in the conglomerate exposed on the railway line near the Vermilion River fault.

The thickness of the radioactive conglomerate band is difficult to estimate because of the varying thickness of quartzite and arkosic interbeds and the great amount of deformation. Quartz-pebble conglomerate is the predominant member of the Mississagi formation for 750–1,000 feet above the unconformity. At the west end of the property there is a thickness of about 500 feet of quartzite above the conglomerate, followed by the Gowganda conglomerate. The conglomerate-quartzite contact lies along an escarpment where reddish alteration, quartz veining, and great local deformation of beds suggests that strike faulting may occur. However, along the railway the quartzite member is missing, and the radioactive conglomerate is found in sharp contact with the Gowganda conglomerate. The latter contains unsorted, angular blocks and boulders up to 3½ feet in length; some of these are argillite and quartzite, similar lithologically to the underlying Mississagi rocks.

The radioactive conglomerate and overlying quartzite are lithologically similar and stratigraphically equivalent to the Mississagi formation of the Blind River–Elliot Lake area. Field relationships suggest that the Gowganda formation may lie unconformably above the Mississagi formation, but the possibility of a faulted contact, and the great local deformation of all Huronian strata in Hutton township, weakens the reliability of the evidence.

URANIUM OCCURRENCES

Most of the quartz-pebble conglomerate is slightly radioactive and produces a noticeable geiger count. Surface outcrops of the conglomerate are slightly rusty and of similar appearance to surface exposures of the radioactive conglomerate in the Blind River mining camp. Small test-pits have been sunk where a geiger survey indicated strong radioactivity. The distribution of the test-pits would suggest that appreciable uranium mineralization is spotty and restricted to a few places.

The author could locate only part of the company's records, and no information was obtained on the results of drilling operations. The available results of sampling radioactive conglomerate are listed below. Samples 1–5 were taken by R. J. Cook, consulting geologist for the company in 1955, and are presumably grab samples from test-pit areas, but their exact location is unknown to the author; analysis of samples 3–5 were made at the assay office of Pronto Uranium Mines Limited. Samples 6–9 are grab samples taken by the author of the most radioactive rock found on a short visit to the property; the analyses are radiometric. Samples 6–8 were taken from conglomerates near the railway, and sample No. 9 from the west end of the conglomerate band near the drill holes.

Sample No.	U_3O_8	ThO_2
	percent	percent
1	0.15	No assay
2	0.02	No assay
3	0.19	0.14
4	0.21	0.08
5	0.17	Nil
6	0.02	No assay
7	0.006	No assay
8	0.02	No assay
9	0.01	No assay

Harrison Minerals Limited

In 1957, Harrison Minerals Limited held a group of 19 claims in the southeast quadrant of Turner township. These were a consolidation of ground formerly held by Harrison-Hibbert Mines Limited and Normingo Mines Limited. A uranium discovery was made in 1954, about ½ mile south of Bull Lake, on the property of Normingo Mines. Bull Lake lies about 46 air miles northeast of the city of Sudbury, and is serviced by aircraft from Sudbury, New Liskeard, or Timagami. Exploration consisted of surface work, detailed geological mapping, geiger counter surveys, and nine drill holes. Uranium mineralization of economic importance was not found, and the claims were allowed to lapse.

Information given here is taken from the records of the company. The author has not visited the property.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 179A (Onaping Sheet) of the Geological Survey of Canada, published in 1915. Details of the geology in the vicinity of the uranium discovery are shown on Chart D. The basement rocks, consisting of greatly deformed lavas, pyroclastics, iron formation, granite, and gneiss, are overlain with great unconformity by relatively undeformed sedimentary rocks of the Huronian system. Basic intrusives cut the Huronian and Pre-Huronian rocks.

Quartz-pebble conglomerate lies directly on the basement rocks. It consists of well-rounded, well-sorted pebbles of white quartz, quartzite, greywacke, and rarely, red or green jasper. The pebbles are 1–3 inches in diameter. The conglomerate is interbedded with argillite, quartzite, and greywacke. A variety of the conglomerate is locally called microconglomerate, and consists of beds of small angular quartz pebbles. The conglomerate is exposed at intervals over a length of almost 2 miles, and is approximately 30 feet in thickness. Pyritization is widespread throughout the whole formation but is concentrated in the conglomerate beds. The conglomerate is locally radioactive, with a range of three to ten times background indicated by geiger counter surveys. It is lithologically similar to the ore-bearing conglomerate of the Blind River–Elliot Lake camp and occurs at the stratigraphic horizon of the Mississagi formation. It appears that the Mississagi-like formation is overlain by Gowganda and Lorrain formations, but exact relationships are indefinite because of the scarcity of outcrops. All the Huronian strata are very gently folded, with dips averaging 10–15 degrees to the east or northeast.

URANIUM OCCURRENCES

The geiger survey indicated eight distinct radioactive anomalies, but investigation proved that all were low-grade uranium occurrences. The highest assay obtained was at the discovery on claim No. 77112 where 0.27 percent U_3O_8 was obtained across 7 feet in a surface pit. As shown by the section in Chart D, four drill holes intersected the radioactive microconglomerate bed, but uranium content was much lower than on surface. Two shallow holes were drilled in the radioactive conglomerate exposed on claims Nos. 77110, and 77111, where geiger counts up to five times background were obtained. Holes Nos. 2 and 3 cut 12 and 14 feet of mineralized conglomerate, but assay results are not available. A few chemical tests of radioactive samples indicated a minor amount of thorium and a rather high content of zirconium.

Jellicoe Mines (1939) Limited

In 1955, the company held a group of mining claims in the north-central part of Baldwin township. Exploration was concentrated on a uranium discovery in the north half of lot 7, concession V. A total of 27 holes were drilled on the band of radioactive rocks, but no body of commercial importance was outlined, and the property was dropped. Copper was also encountered in a hole drilled to the east of the uranium showing.

Information on the property was obtained from company records and a brief visit by the author in 1958.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 1952-1 (Township of Baldwin) of the Ontario Department of Mines, and details of the main uranium discovery are shown in Chart E. In the north half of lot 7, concession V, amygdaloidal basaltic lava is overlain by a basal conglomerate, followed by a 50-foot band of quartzite, a bed of radioactive quartz-pebble conglomerate, and an upper band of quartzite with local narrow interbeds of radioactive quartz-pebble conglomerate. The formations strike east and dip 45°–70°N. Eastward the formations swing around towards the south.

The basal conglomerate contains an abundance of boulders of the underlying lava. It has an arkosic matrix that has been largely replaced by garnet crystals. Although no angular unconformity is found, this basal conglomerate may be the equivalent of the regolith that occurs at the base of the Huronian system in the Blind River area. The radioactive quartz-pebble conglomerate is also identical in appearance to that which forms the bulk of the ore in the uranium-producing camp. Quartz-pebbles up to 4 inches in length occur in this conglomerate, and disseminated pyrite is found in the matrix. This conglomerate is often quite strongly radioactive when tested with a geiger counter. The sedimentary rocks are similar lithologically to the Mississagi formation of the Blind River camp and occupy the same stratigraphic horizon at the base of the Huronian system. However, in Baldwin township the Mississagi formation is greatly deformed.

URANIUM OCCURRENCES

The author was unable to locate a complete record of uranium assay results from the property. The available company geological maps and drilling records show that the radioactive conglomerate was traced at least 3,400 feet along the strike. Results of some samples taken from rock trenches are shown in Chart E, and range from traces up to 0.52 percent U_3O_8; widths range from 1.5 to 7 feet. Numerous narrow beds of radioactive conglomerate and quartzite lie above the main horizon. For example, in drill hole No. 3, eight intersections ranging from 1 to 1½ feet gave assays of 0.03 to 0.11 percent U_3O_8 throughout a core length of 95 feet in the quartzite lying immediately above the main conglomerate bed. In drill hole No. 20, fourteen intersections in this quartzite horizon gave assays from 0.01 to 0.08 percent U_3O_8 over core lengths of 1 to 3½ feet and distributed throughout a total core length of 123 feet. Disseminated visible pitchblende was found at one place in sheared pebble conglomerate.

L. Leslie Property

In 1957, L. Leslie, of Anstice, held 23 claims within lots 10–12, concessions II–IV, Creelman township. These extend along the Canadian National railway from mileage 18 to mileage 20.5, north of Capreol. Three discoveries of radioactive rock were made by Mr. Leslie. The property was optioned to MacLeod-Cockshutt Gold Mines Limited in 1954, and 14 holes, totalling 3,591 feet, were drilled. The property was dropped, and again optioned by Rio Canadian Exploration Limited in 1957. The company made a detailed geological survey, after which the property was allowed to lapse.

The following report is based on a brief examination of the showings by the author in 1958, under the guidance of Mr. Leslie, and the maps and records of the property supplied by Rio Canadian Exploration Limited.

GENERAL GEOLOGY

The general geology in the vicinity of the uranium discoveries is shown in Chart F. The regional geology is partly covered by Map No. 179A (Onaping Sheet) of the Geological Survey of Canada. The basement granitic complex is overlain unconformably by the Mississagi formation of Huronian age. The Mississagi formation consists of quartz-pebble conglomerate and argillite, interbedded with quartzite. Above the Mississagi quartzite a narrow band of polymictic conglomerate has been found, and this could represent the Bruce formation. These formations are in turn overlain by the Gowganda formation, which is exposed near the Vermilion River. This consists of boulder conglomerate and laminated argillite. There is a possibility that the Gowganda formation lies unconformably on the older formations, but exact relationships are unknown because the contact area is covered by overburden. Gabbro and diabase intrude the granite and Huronian sedimentary rocks.

The bedding in the Mississagi formation strikes about parallel to the contact with the underlying granite and swings around from north-south on the east side of the granite mass to east-west on the north side of it. The dips of the beds are 30–40 degrees away from the granite. The bedding in the Gowganda formation dips 50°–65°E. The pronounced steepening of the beds near the Vermilion River may be related to faulting along it. A very pronounced narrow regional topographic depression strikes north-south through the pond on claim S.73429. It is possible that faulting along this lineament may have shifted the west side northerly, so that the quartzite beds appear to strike directly into the granite.

URANIUM OCCURRENCES

The radioactive quartz-pebble conglomerate lies directly on the basement granite at three different localities. At other places it is interbedded with quartzite. Narrow interbeds of argillite (locally called greywacke) in the conglomerate are sometimes strongly radioactive. Uraninite has been identified in the bedded argillite and is of detrital origin. Concentration of the uraninite in the argillite may be due to extensive reworking of the detrital material by currents or waves along a shoreline. At any rate, the best uranium mineralization on the property occurs in the bedded argillite between conglomerate beds.

At No. 1 showing there is an outcrop of interbedded argillite and quartz-pebble conglomerate overlain on the north by a coarse boulder conglomerate typical of the Gowganda formation. The main argillite bed is about 18 inches thick. It strikes S.80°E. and dips 55°N. A representative sample of radioactive argillite taken by the author assayed 0.48 percent U_3O_8 and 0.05 percent ThO_2 (C),[1] which checks an assay of a sample from the same locality by the United States Geological Survey reported at 0.49 percent U_3O_8. Seven holes were drilled in the vicinity of this exposure, but at such an angle that they could easily have failed to intersect the main argillitic reef. Assay results of this drilling are very incomplete. The available records state that in hole No. 5 analyses of 0.03–0.05 percent U_3O_8 were obtained from 29- to 55-foot depths. Hole No. 7 is reported to average 0.065 percent U_3O_8 from 127 to 147.5 feet.

No. 2 showing exhibits interbedded argillite and conglomerate with the strongest radioactivity in the argillite. A sample was taken by the author from a test-pit where the argillite is 2–3 feet thick; this assayed 0.08 percent U_3O_8 (R). Six holes were drilled here, but available assays are very few. They indicate a low content, except from 152.5 to 155 feet in hole No. 11 where an assay of 0.13 percent U_3O_8 (C) is recorded.

Low uranium analyses are also reported on samples taken in the vicinity of drill hole No. 9 and in the radioactive conglomerate at the east boundary of claim S.73427.

Analyses of a few character samples show that thorium is sometimes present as well as uranium. For example, a sample that assayed 0.31 percent U_3O_8 con-

[1]All assays of samples taken by the author were made by the Provincial Assay Office.

tained 0.06 percent ThO_2; a second sample contained 0.26 percent U_3O_8 and 0.13 percent ThO_2. The sample taken by the author from the radioactive argillite at No. 1 showing contained 2–5 percent zirconium.

Noranda Mines Limited

In 1953 prospectors of Noranda Mines Limited discovered and staked a radioactive mineral deposit on the north side of Agnew Lake, in lots 9 and 10, concession II, Hyman township. The claims are accessible by motor road and boat from highway No. 17 at McKerrow or Nairn Centre, A group of 48 claims was staked in the vicinity of the discovery. The property was developed by surface work, geiger surveys, and drilling. Ten holes, totalling 2,890 feet, were drilled on the various uranium showings. No uranium mineralization of economic importance was found.

The information given below is based on company records, especially reports by R. S. Woolverton and Vaughn Rivers. The author has not visited the property.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. The property is underlain by sedimentary rocks, consisting of conglomerate, quartzite, and greywacke, intruded by dikes and sills of gabbro, diorite, and diabase. The uranium mineralization is associated with interbeds of quartz-pebble conglomerate in the quartzite. Most of the strata have a very steep dip and have been greatly deformed and metamorphosed.

URANIUM OCCURRENCES

Eight showings of uranium mineralization were found on the property. The most important of these was known as the Ridge showing. Details of this occurrence are shown in Chart G. Surface sampling indicated two uraniferous bodies. The southwestern body averaged 0.28 percent U_3O_8 across 2 feet for a length of 123 feet; the northeastern body averaged 0.16 percent U_3O_8 across 2.1 feet for a length of 187 feet. About 150 feet southeast of the northeastern body several narrow seams of pitchblende were found in a matrix of sheared conglomerate. The largest seam is ¾ inch wide and 2 feet long. Holes were drilled to intersect the Ridge showing at a depth of about 100 feet, and also to test the whole width of the showing at greater depth. In general the drill results indicated a decrease in uranium content compared with the surface results. The main uranium-bearing intersections were as follows;

Hole No.	Core Length (feet)	U_3O_8 (percent)
2	1.9	0.062 (R)
3	2.9 3.9 3.0	0.05 (R) 0.067 (R) 0.035 (R)
4	2.5	0.105 (C)
5	5.9 2.9	0.062 (R) 0.067 (R)
7	2.0 2.0 3.0 3.0	0.067 (R) 0.067 (R) 0.098 (R) 0.05 (R)
8	4.0	0.08 (C)

The drilling revealed that uranium occurs in quartzite as well as in pebble conglomerate. The uranium minerals are erratically distributed, and it is difficult to trace any particular zone along strike.

The Cabin showing occurs about 600 feet northwest of the camp (see Chart G). A band of radioactive conglomerate assayed 0.11 percent U_3O_8 (R) across 12 feet; low uranium content was found in the adjacent quartzite. Some 48 feet to the west, along strike, a 6-foot band assayed 0.027 percent U_3O_8; overburden prevented further extension of the showing on the surface. Holes Nos. 9 and 10 were drilled to test the possible extension. Hole No. 9 cut 3.2 feet of core that assayed 0.08 percent U_3O_8 (C).

The Island showing was found on a small island in John Creek Bay, Agnew Lake, on claim S.68524 (N.E.¼, S.½ lot 11, concession II). A zone of radioactivity is also exposed on the lake bottom when the lake level is low. Several beds of conglomerate, 10–12 feet wide, show low radioactivity over a strike length of 250 feet. Conglomerate beds at the west end of the showing gave 0.152 percent U_3O_8 (R) over 8 feet, and 50 feet to the west another bed assayed 0.068 percent U_3O_8 across 8 feet. The showing may continue another 200 feet to the east, where a 5-foot width assayed 0.028 percent U_3O_8.

The Hilltop showing occurs about ¼ mile west of the entrance to John Creek Bay, on claim S.68519 (SE.¼, S.½ lot 12, concession II), It consists of narrow conglomerate beds at the contact with an older metamorphic rock group. One conglomerate bed, 2–4 feet thick, was traced for 200 feet, and possibly extends 500 feet. It gave assays ranging from 0.053 to 0.182 percent U_3O_8 (R). Another nearby occurrence, named the O.D.W. showing, assayed 0.12 percent U_3O_8 (C) across 20 inches of conglomerate. The bed was traced for 50 feet along the strike.

URANIUM-THORIUM RATIOS

Selected grab samples from each of the main showings were analyzed spectrographically for thorium and uranium. The results indicate a wide range in the uranium-thorium ratio. Typical results from different showings are as follows:

Name of Showing	U_3O_8	ThO_2
	percent	percent
Ridge	0.83	0.24
Cabin	0.17	0.06
Hilltop	0.30	0.16
Hilltop	0.23	0.15
O.D.W.	0.156	0.2–0.3

Pickle Crow Gold Mines Limited

In 1956-57, this company held a group of 121 claims in Pardo township in the vicinity of Tee and Silver lakes. The property is reached by a 22-mile road from the village of River Valley on the Canadian National railway. Uranium was found on the property, in a radioactive quartz-pebble conglomerate similar in appearance to that of the Blind River area. This led to extensive surface work, geological mapping, and diamond-drilling. Sixteen holes, totalling 7,489 feet, were drilled. The uranium content of the drill core analysed was consistently low, so the property was dropped.

The following report is based on the results of a brief visit to the property by the author in 1958, and on records supplied by the company. These included reports by E. L. McVeigh, consulting engineer, dated August 10, 1956, and January 20, 1957.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 41f of the Ontario Department of Mines. Detailed mapping of the property in 1959 led to considerable revision of the geology as shown in Chart H. A broad syncline of Huronian sediments lies with great angular unconformity on a basement of Pre-Huronian greenstone, quartzite, greywacke, and granite. The Huronian sequence begins with a basal radioactive quartz-pebble conglomerate locally grading upwards into quartzite. This is lithologically and stratigraphically equivalent to the Mississagi formation of the Blind River–Elliot Lake uranium area. The quartz-pebble conglomerate is well pyritized and ranges from 2 to 40 feet in thickness. Drilling indicated a thickening of the conglomerate towards the centre of the basin. Overlying the Mississagi formation, which has a maximum thickness of 200–300 feet, are the Gowganda and Lorrain formations. The contact between the Mississagi and Gowganda formations is not easily distinguished in some places. The Gowganda formation is 300–400 feet thick and is composed of boulder conglomerate, greywacke, and slate. The Lorrain formation consists of white quartzite, with thin interbeds of conglomerate made up of quartz and jasper pebbles. The thickness of the Lorrain probably does not exceed 300 feet in the basin area.

The basement rocks consist of steeply-dipping metamorphosed greywacke, quartzite, and volcanic rocks (greenstone). On the McNish-Pardo township line, the quartz-pebble conglomerate lies directly on granite gneiss. In contrast, the Huronian strata form a gently-dipping basin trending N.20°E. and pitching about 5°SW. The right-angled unconformity between older greywacke and basal quartz-pebble conglomerate is well exposed at the log dam at the outlet of Tee Lake.

URANIUM OCCURRENCES

The quartz-pebble conglomerate at the base of the Huronian system is radioactive and has a low content of uranium. The first nine holes, drilled in the general vicinity of the line AB on Chart H, intersected an average thickness of 16.3 feet of conglomerate with analyses ranging from 0.002 to 0.008 percent U_3O_8 (R). In hole No. I-335, drilled closer to the centre of the basin, 2 feet of core averaged 0.017 percent U_3O_8.

In the drilling along line CD, hole No. 1 flattened and had to be abandoned before it reached the conglomerate. Hole No. 3 showed a thickness of 8 feet of conglomerate at a depth of 1,076 feet that assayed 0.006 percent U_3O_8 (R). Hole No. 7 intersected a thickness of 73 feet of interbedded quartzite and conglomerate with the highest assay running 0.009 percent U_3O_8 (R). Hole No. 8 cut 41 feet of well pyritized quartz pebble conglomerate; the highest assay was 0.006 percent U_3O_8 (R).

Picton Uranium Mines Limited

In 1955, this company optioned a group of 43 mining claims on the west shore of Wanapitei Lake, in lots 6–10, concessions IV and V, Maclennan township. Quartz-pebble conglomerate having a low uranium content was found at the lake shore near the south end of lot 8, concession V. A little surface exploration was done, and three short holes were drilled. This work indicated that the occurrence was of too low a grade to be of commercial interest, and the option was dropped.

The author examined the showing when mapping the geology of Maclennan township in 1957. Information on the property was also obtained from the company.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 872A (Falconbridge Sheet) of the Geological Survey of Canada. Maclennan township was mapped in detail in 1957 by the Ontario Department of Mines. The resurvey showed that radioactive quartz-pebble conglomerate is exposed at a few places along the west shore of Wanapitei Lake. At the south end of Massey Bay small patches of the radioactive conglomerate lie with great angular unconformity on Pre-Huronian greywacke. Going northward, the conglomerate lies unconformably on granite, but is largely cut out by gabbroic intrusives so that only small remnants are now found along the lake shore. The conglomerate is part of the Mississagi formation of Huronian age and is identical with the radioactive conglomerate of the Blind River–Elliot Lake camp. When undisturbed by intrusives the conglomerate beds dip east at 10–15 degrees.

URANIUM OCCURRENCES

The original uranium discovery was made on claim S.67654 (S.½ lot 8, concession V) on the shore of Wanapitei Lake. A small test-pit was opened on radioactive quartz-pebble conglomerate containing quartz and chert pebbles in an arkosic matrix, with sparse to heavy pyrite mineralization. The width of the exposure is 40 feet, but the attitude of the conglomerate bed is unknown. Most of the pebbles are under 3 inches in diameter and are fairly well rounded. A representative sample of the conglomerate, taken by the author, assayed 0.01 percent U_3O_8 (R). Picton Uranium Mines reported that selected grab samples of the conglomerate assayed 0.06 and 0.08 percent U_3O_8 (R).

The radioactive conglomerate was traced along the lake shore for a distance of 600 feet. Three holes were drilled across it in the vicinity of a discovery pit. No. 1 hole cut radioactive conglomerate from 67.5 to 82.5 feet; assays ranged from 0.01 to 0.04 percent U_3O_8 (R). Somewhat similar values were obtained in holes Nos. 2 and 3.

Radioactive, pyritized quartz-pebble conglomerate is exposed at a few places south of the discovery pit along, or near, the lake shore as far as the south end of Massey Bay. A representative sample of the conglomerate, taken by the author, from the exposure at the water's edge opposite the Lands and Forests station, assayed 0.009 percent U_3O_8 (R).

Plum Uranium and Metal Mining Company Limited

In 1954 this company held a group of 16 mining claims in lots 4 and 5, concessions IV and V, Baldwin township. These are located about 3 miles north of the village of McKerrow on highway No. 17. The property was investigated by surface work, geophysical surveys, and diamond-drilling. Some of the drilling was done to investigate sulphide occurrences and anomalies. Later, attention was directed to the investigation of radioactive rocks, but the uranium-bearing zone proved to be of no commercial value, so the property was dropped. In 1957, Plum Uranium and Metal Mining Company was merged into Consolidated Frederick Mines Limited.

Information on the property was obtained from records of the company.

GENERAL GEOLOGY

The geology of the area is shown on Map No. 1952-1 (Township of Baldwin) of the Ontario Department of Mines. Details of the uranium occurrences are shown in Chart J. The west side of the property is underlain by amygdaloidal basaltic lava. There is a transition upwards through interbedded lava, conglomerate, and quartzite into a sedimentary formation consisting predominantly of quartzite. Basic intrusives have been injected into the volcanic and sedimentary rocks. The property lies astride the crest of the Baldwin anticline, and most of the radioactive sediments lie between the Worthington and Fairbanks Lake faults. All the strata are greatly deformed.

URANIUM OCCURRENCES

A bed of radioactive quartz-pebble conglomerate in the quartzite formation strikes north-south across claim S.68002, and southwest across claim S.67999 until cut off by the Worthington fault. This conglomerate bed is radioactive over widths of 1–9 feet.

Diamond-drill holes Nos. PB-5–PB-12 inclusive were drilled beneath the radioactive conglomerate. All holes intersected the radioactive zone, but in two of them the material was not sufficiently interesting to warrant sampling. Holes Nos. PB-6, PB-7, PB-11, and PB-12 were drilled over a strike length of 600 feet, in two tiers, and intersected the zone at a maximum slope depth of 185 feet. The uranium analyses obtained in the four holes are as follows:

Hole No.	Sample Width	U_3O_8
	feet	percent
PB-6	2.0	0.07
PB-7	2.0	0.16
PB-11	6.2	0.069
	or 3.0	0.09
PB-12	2.0	0.097

The average of the above intersections is 0.088 percent U_3O_8 across 3.05 feet, or 0.102 percent U_3O_8 across 2.25 feet.

Prosco Limited (Aubay Uranium Mines Limited)

In 1958, Prosco Limited optioned the property of Aubay Uranium Mines Limited, which consisted of a block of 13 mining claims in the south-central part of Vogt township. The property is situated near the south end of Lake Timagami and is reached by a private motor road, which extends north from River Valley on the Canadian National railway.

A conglomerate bed containing gold and uranium mineralization was discovered close to the Aubay boundary, on ground held by Krefeld Graphite Gold Mines. This dips into the Aubay property at a shallow depth. In 1955, Aubay Uranium Mines drilled five holes to intersect the radioactive conglomerate. In 1958, Prosco Limited carried out a program of surface exploration and mapping, and drilled five additional holes. The company reports that analyses for gold and uranium were below ore grade, so the option was relinquished.

The information given below was obtained from the records of Franc R. Joubin and Associates, consulting geologists, who were in charge of the Prosco exploration program in 1958.

GENERAL GEOLOGY

There is no published geological map of the area. The geology in the vicinity of the showing is given in Chart K. The basement rocks consist of steeply-dipping iron formation, rhyolite, and greenstone. The iron formation strikes in an east-westerly direction. Huronian strata lie with great angular unconformity on the basement rocks. The basal Huronian beds consist of radioactive quartz-pebble conglomerate and quartzite that would correlate with the Mississagi formation of the Blind River area. This is overlain by conglomerate, greywacke, and slate of the Gowganda formation. The Huronian rocks generally show a gentle dip of 20–30 degrees. In the vicinity of the gold-uranium showing, the Huronian strata strike north-south, and thus lie in almost right-angled unconformity on the underlying iron formation.

GOLD-URANIUM OCCURRENCE

The interesting feature of this occurrence is that gold occurs with uranium mineralization in the Mississagi quartz-pebble conglomerate. Aubay Uranium Mines reported 0.30 ounces of gold per ton and 0.038 percent U_3O_8 in hole No. 4, from 198.5 to 201.5 feet in the conglomerate. However, Prosco Limited wedged the hole and cut another intersection through the conglomerate, but obtained only low uranium assays. Also, in hole No. 5, Aubay reported 2.0 feet of conglomerate that assayed 0.40 ounces of gold per ton and 0.052 percent U_3O_8, but a wedged intersection in this hole by Prosco Limited only gave assays up to 0.06 ounces of gold per ton. The best assays reported by Prosco Limited were 0.025 percent U_3O_8 and 0.08 ounces of gold per ton. The maximum thickness of quartz-pebble conglomerate cut in any drill hole was 27 feet. A hole drilled about 1,000 feet north of the discovery outcrop showed that the Gowganda conglomerate lies directly on the basement.

Shakespeare Uranium Mines Limited

In 1954 this company held a group of 16 mining claims on the south side of Agnew Lake. Most of the claims were in lots 1–3, concession IV, Shakespeare township. Discoveries of radioactive minerals were made at a number of localities. These were developed by surface work, geiger and scintillometer surveys, and diamond-drilling.

The information given below is taken from company records. The author has not visited the showings.

GENERAL GEOLOGY

The general geology of the area is shown on Map No. 291A (Espanola Sheet) of the Geological Survey of Canada. Basement rocks, consisting of volcanics and pyroclastics, are overlain by a sedimentary group consisting of quartz-pebble conglomerate, quartzite, arkose, and greywacke. The southern part of the property is underlain by granite, diorite, and diabase. The sedimentary rocks are greatly sheared, deformed, and cut by basic intrusives.

URANIUM OCCURRENCES

Radioactive minerals are confined to the pebble conglomerate or quartzite adjacent to it. The most important discovery was on claims S.71029, S.71030–71033, S.71034 (N.½ lot 2, concession IV). The showing consists of several parallel conglomerate beds, which generally strike northeast and dip 70°NW. Going southwest, these beds have been dragged around to the northwest and dip at 15°–25°NE. The width of the radioactive beds, as found by scintillometer surveys, ranges from a few inches to several feet, and uranium mineralization is largely confined to conglomerate containing sulphides.

Minor amounts of radioactivity were found on other parts of the property. In all cases it is associated with pebble conglomerate beds ranging in width from a few inches to 12 feet.

The results of drilling on the property are summarized below, in a report for the company by O. T. Maki, dated December 21, 1954. Unfortunately, information on the exact location of the holes is not available, but it is assumed they are all at the main showing, near the centre of the north half of lot 2, concession IV, Shakespeare township.

A total of 23 holes were drilled on the uranium-bearing zones. The majority of these holes were drilled at a shallow angle to get maximum information with the minimum of footage expended. The drill intersections indicate that the conglomerate bands carry variable uranium values. The highest value obtained was 0.14 percent U_3O_8 across one foot in hole No. 13, in which finely disseminated pitchblende was visible. An intersection of 0.13 percent U_3O_8 was obtained across one foot in hole No. 12, 85 feet west of No. 13. Other intersections varied from sub-marginal to 0.07 percent U_3O_8 across three feet in hole No. 9. Several intersections gave values slightly below 0.10 percent U_3O_8, but these were usually confined to rather narrow sections, from 1.0 to 2.0 feet. Nearly all intersections of conglomerate were slightly radioactive, but samples were only cut from those sections from which higher results could be anticipated.

INDEX

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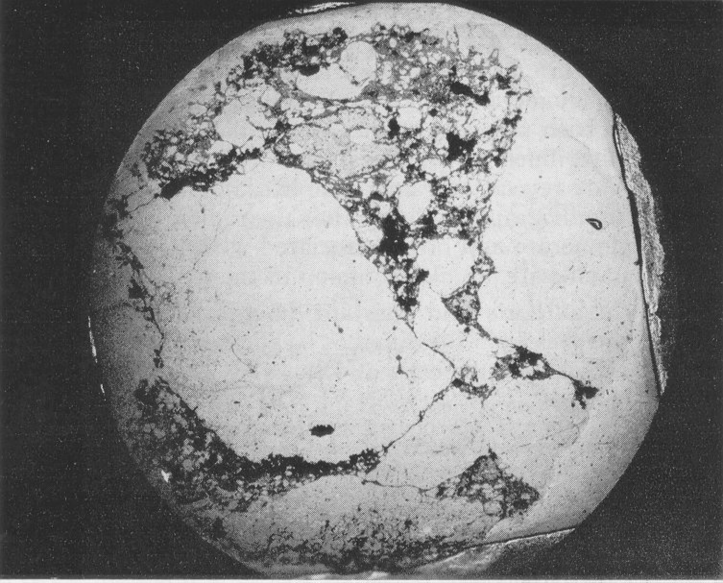

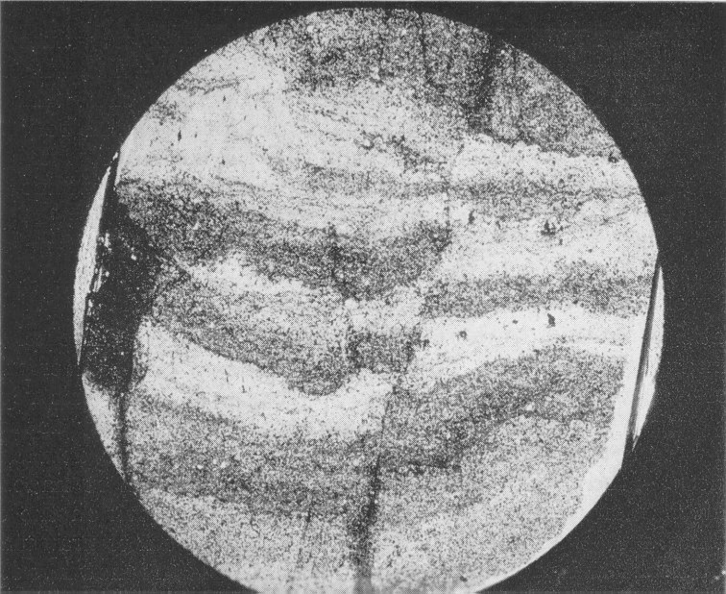

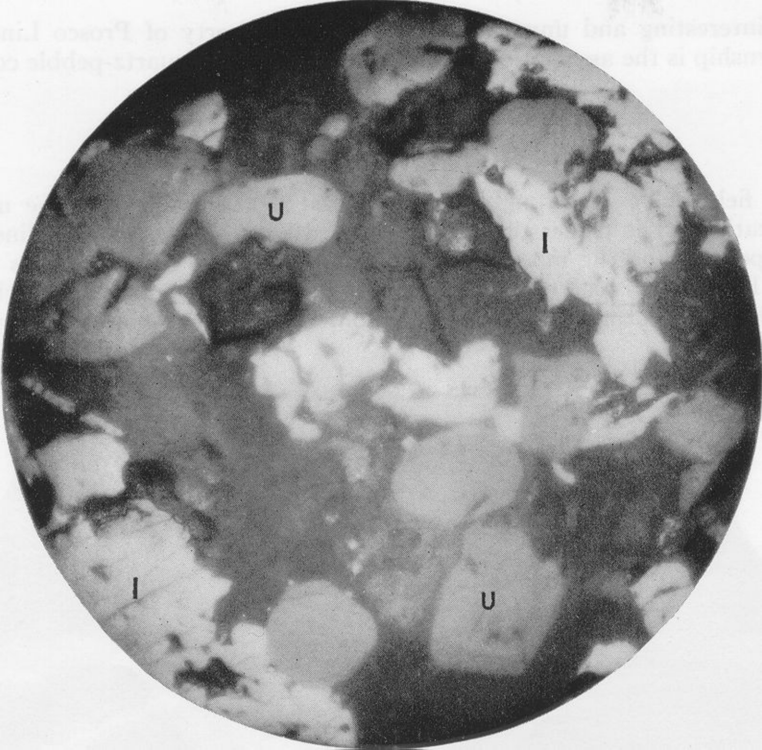
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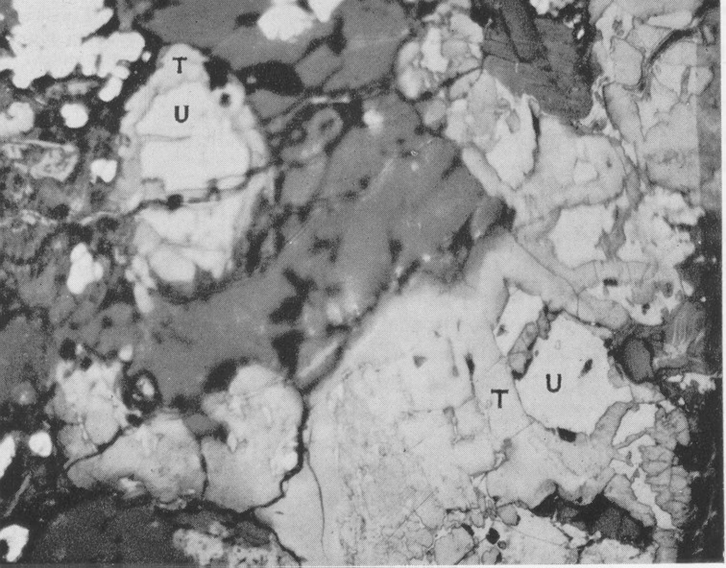
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Uranium-Thorium Report, Sudbury
Chart A

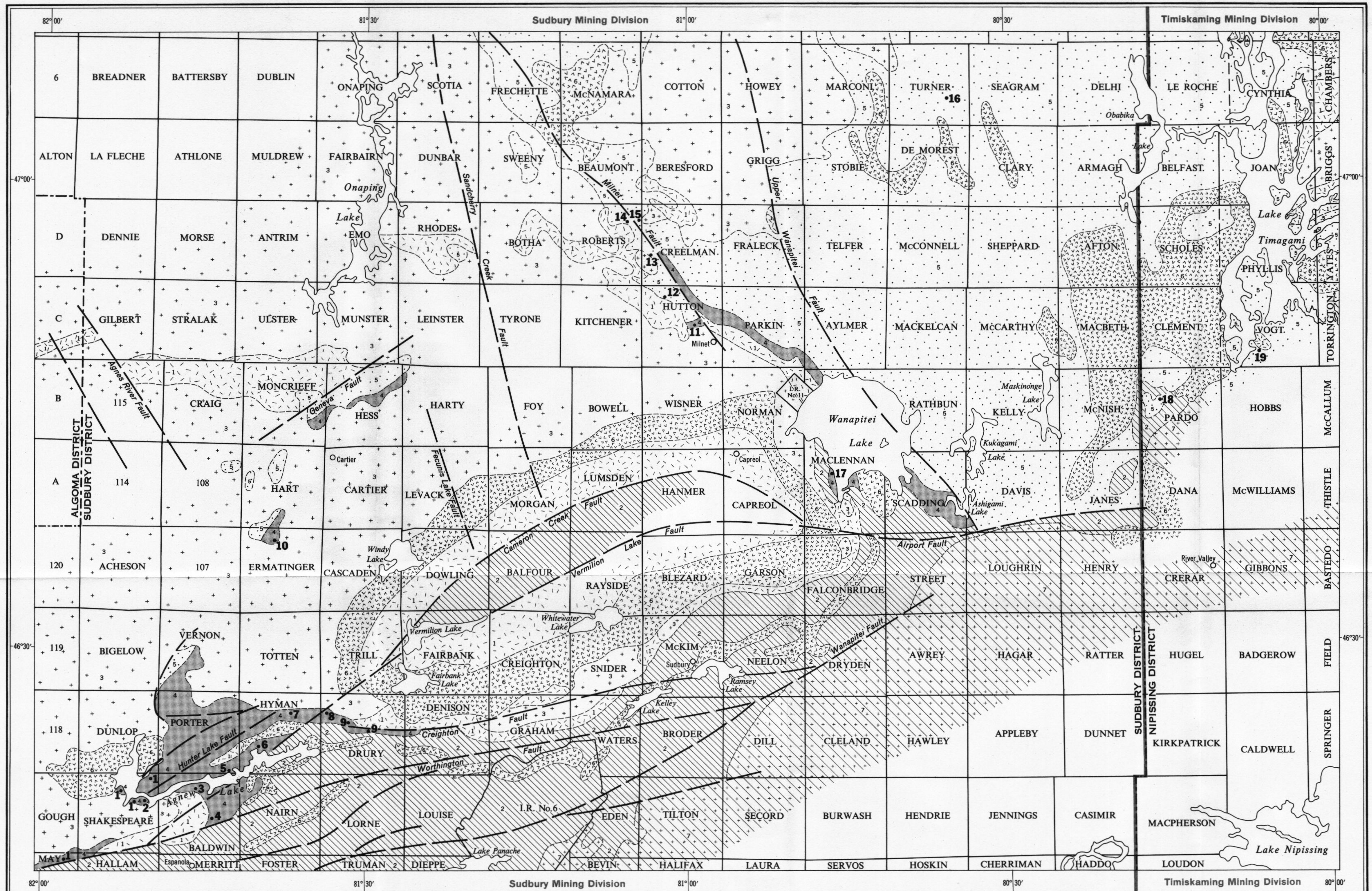


Chart A—Generalized geological sketch map showing the distribution of radioactive occurrences

Published 1961

O.D.M.661

LEGEND

PRECAMBRIAN

POST-HURONIAN

- 7 — Killarnean metamorphic complex.

METAMORPHIC CONTACT

- 6 — Basic intrusives: gabbro, diorite, Sudbury nickel irruptive.

INTRUSIVE CONTACT

HURONIAN

- 5 — Cobalt sedimentary group.
- 4 — Bruce sedimentary group.

GREAT UNCONFORMITY

PRE-HURONIAN

- 3 — Granitic intrusives.

INTRUSIVE CONTACT

- 2 — Sedimentary group.*
- 1 — Volcanic group.

*The age of the sedimentary rocks in the belt extending east from Agnew Lake to Sudbury is uncertain. These rocks may be partly of Huronian age.

SYMBOLS

- Major fault.
- •5 Radioactive quartz-pebble conglomerate. Number refers to list of properties.
- Geological boundary.

SOURCES OF INFORMATION

Base map derived from Map 21c, Ontario Department of Lands and Forests, with geology from Lake Huron sheet Map 155A, Geological Survey of Canada.

LIST OF PROPERTIES

1. Dominion Gulf Co.
2. Shakespeare Uranium Mines, Ltd.
3. Jellicoe Mines (1939) Ltd.
4. Plum Uranium and Metal Mining Co., Ltd.
5. Chemical Research Corp. (Canada), Ltd.
6. Noranda Mines, Ltd.
7. Canadian Thorium Corp., Ltd. (formerly New Thurbois Mines).
8. Alford Explorations, Ltd.
9. Alanen and Maki claims.
10. Alcourt Mines, Ltd.
11. Fano Uranium Mines, Ltd.
12. Doyon-MacLeod-MacIntosh property.
13. L. Leslie property.
14. Elmridge Mines, Ltd.
15. Dyno Mines, Ltd.
16. Harrison Minerals, Ltd.
17. Picton Uranium Mines, Ltd.
18. Pickle Crow Gold Mines, Ltd.
19. Prosco, Ltd. (Aubay Uranium Mines, Ltd.).

Scale: 1 inch to 6 miles

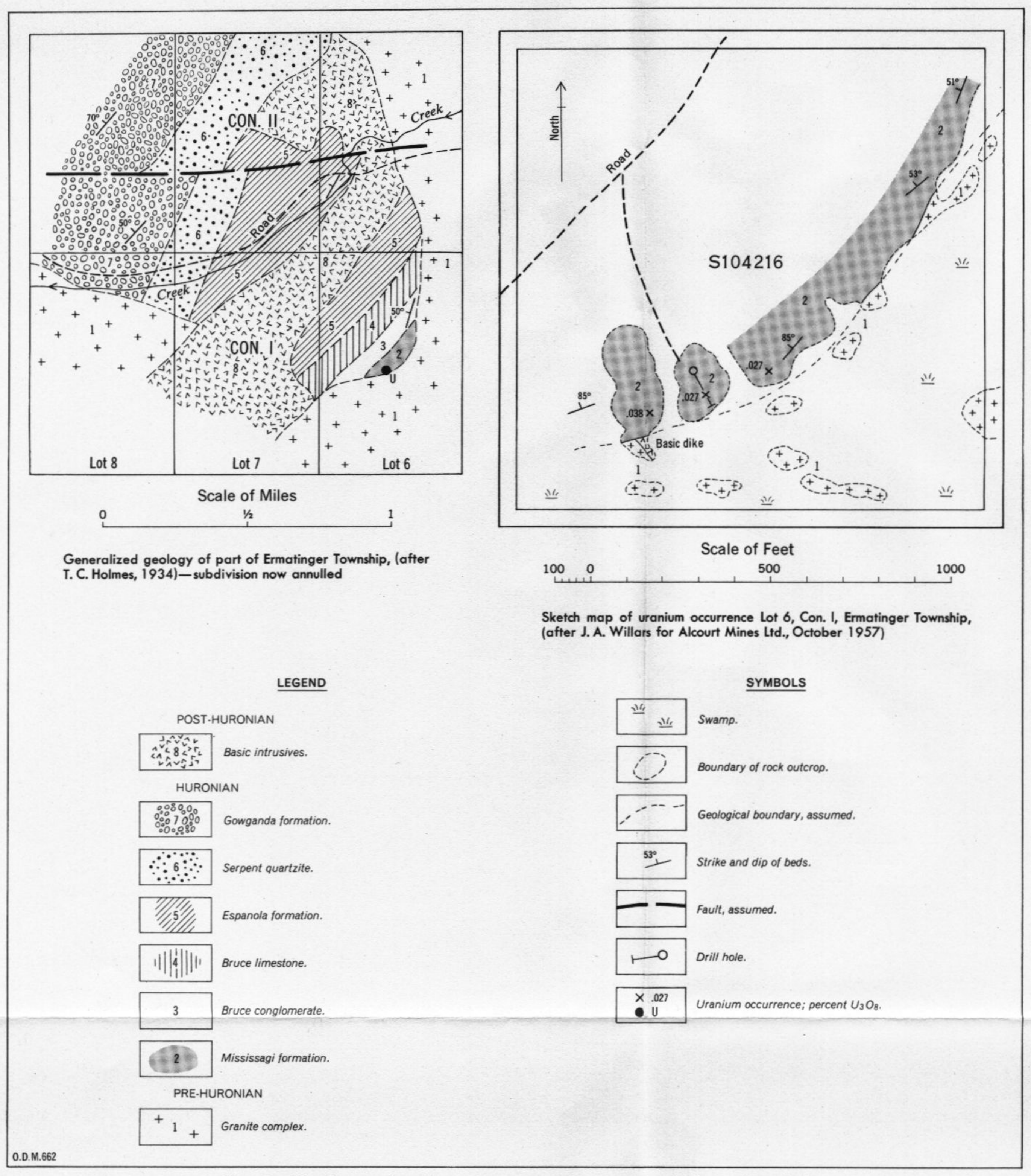


Chart B—Sketch map of uranium occurrence on the property of Alcourt Mines Ltd., Ermatinger Township, and generalized geology of the area

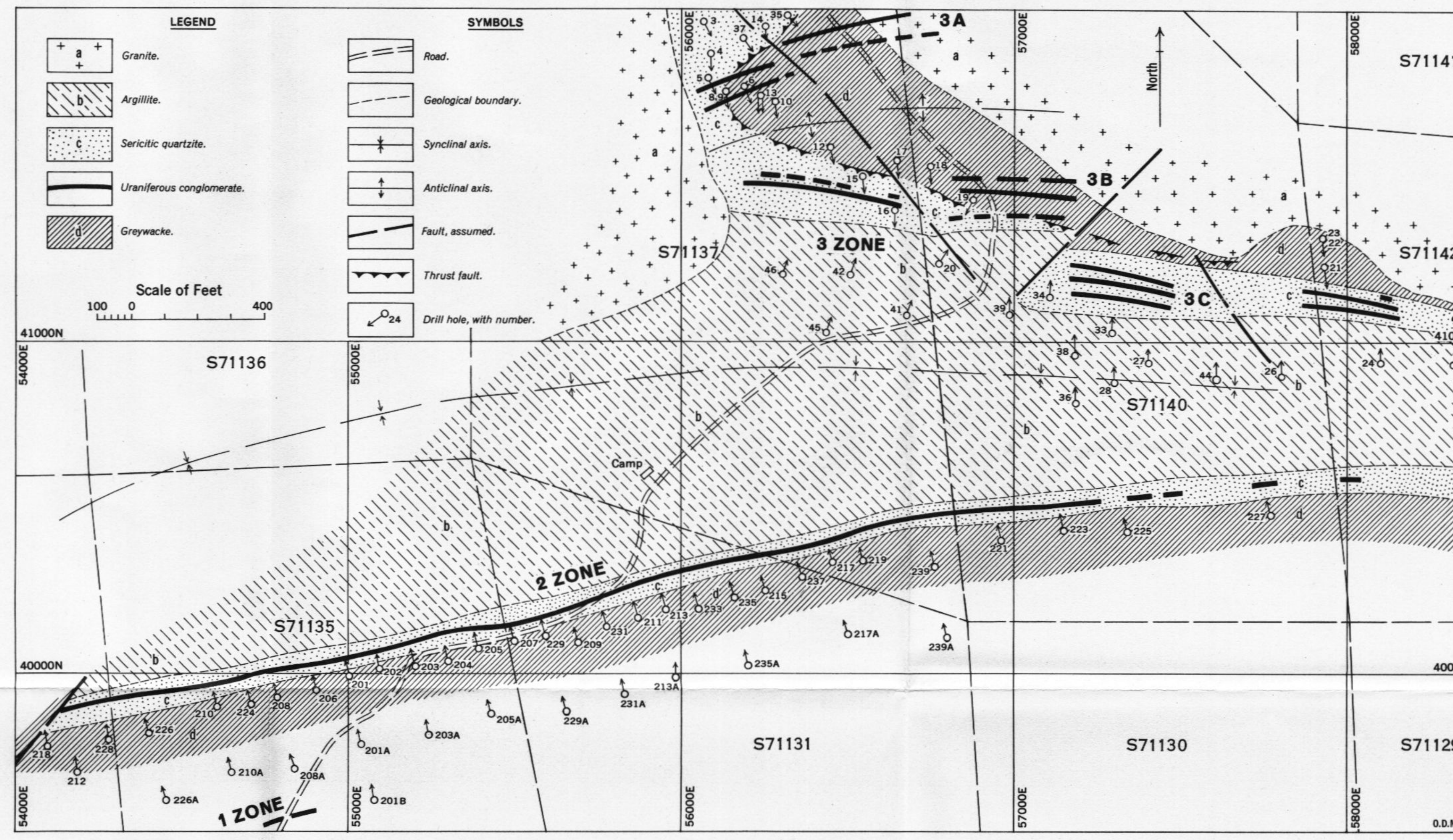


Chart C—Diagrammatic sketch map of the geology and uranium-thorium occurrences on the property of Canadian Thorium Corporation Ltd., in Lots 5-6, Con. V (before annulment), Hyman Township, (modified after company plans by L. G. Phelan, November 1955)

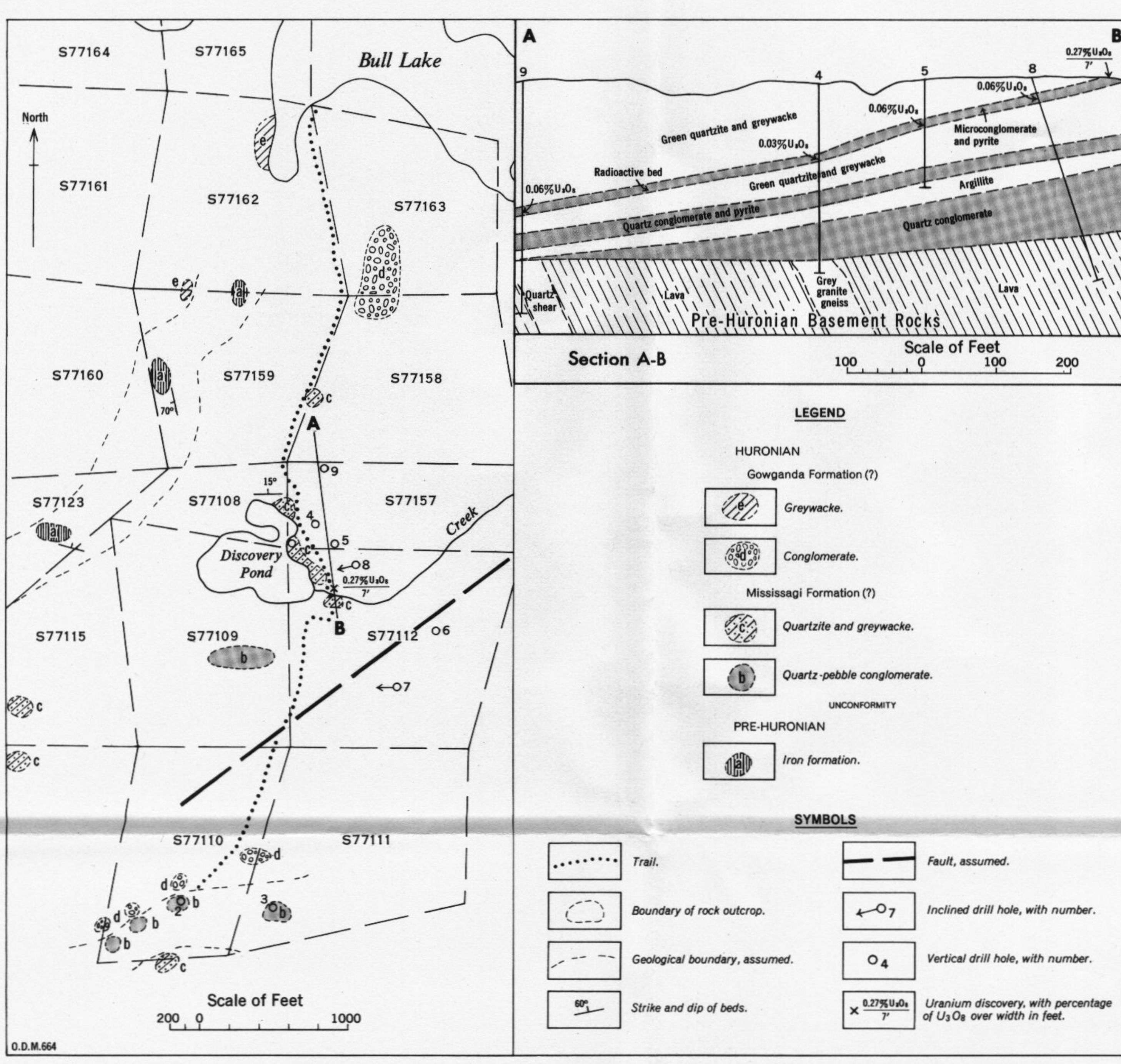


Chart D—Geological sketch map and section showing the uranium occurrence on the property of Harrison Minerals Ltd., Turner Township, (modified after company plans, 1954)

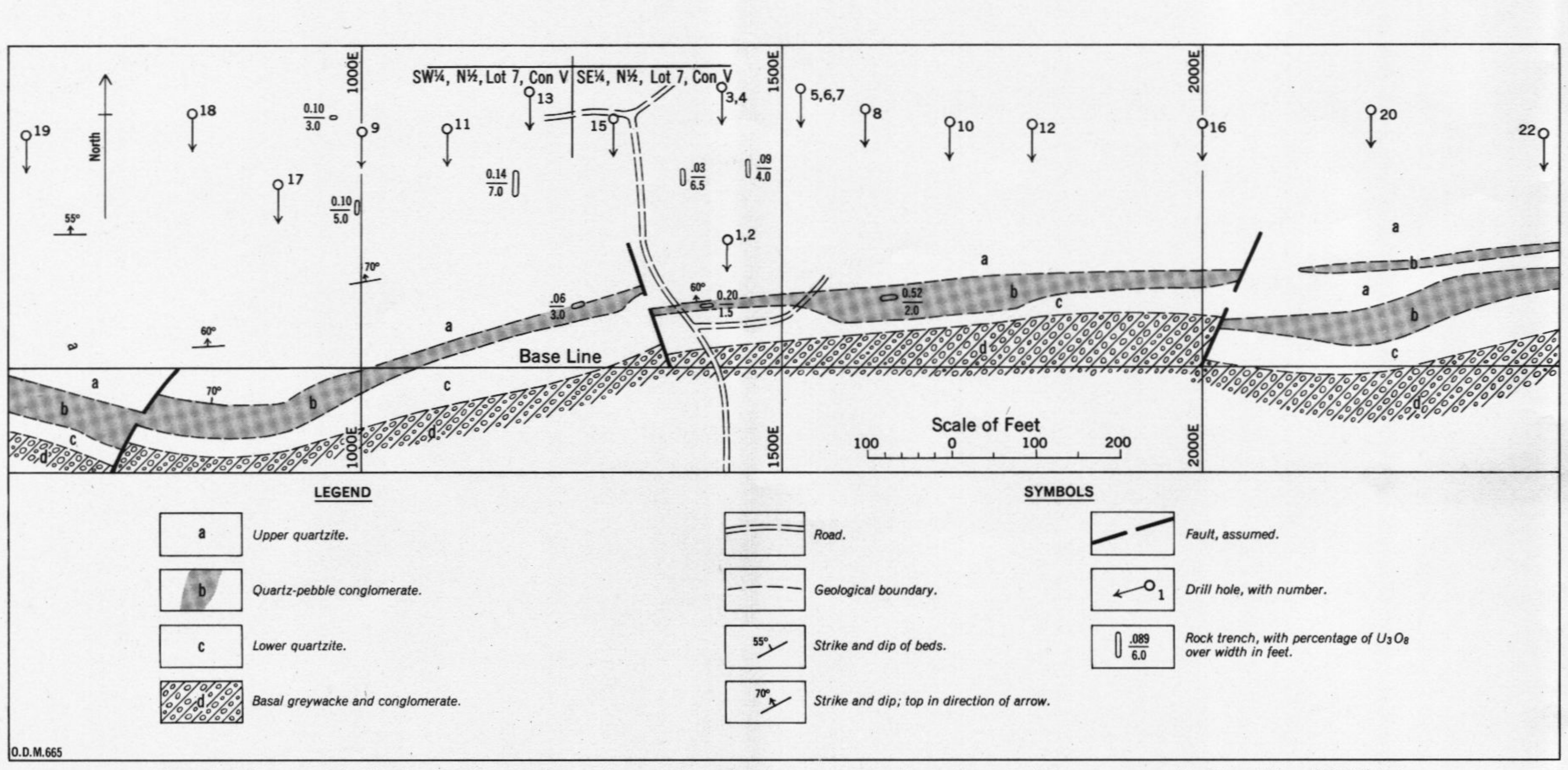


Chart E—Diagrammatic sketch map showing the geology and uranium occurrences on the main part of the property of Jellicoe Mines (1939) Ltd., in Lot 7, Con. V, Baldwin Township, (modified after company plans, July 1955)

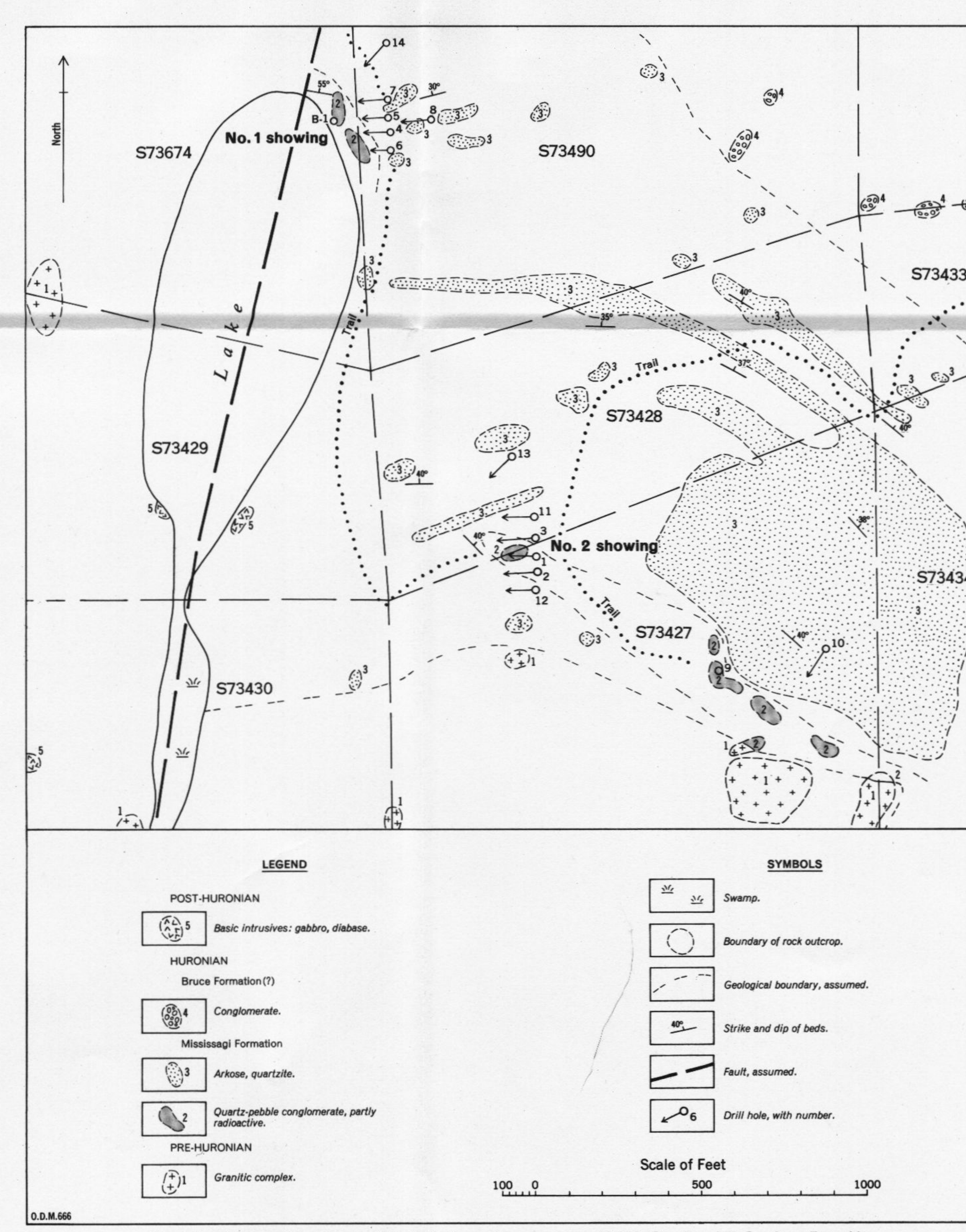
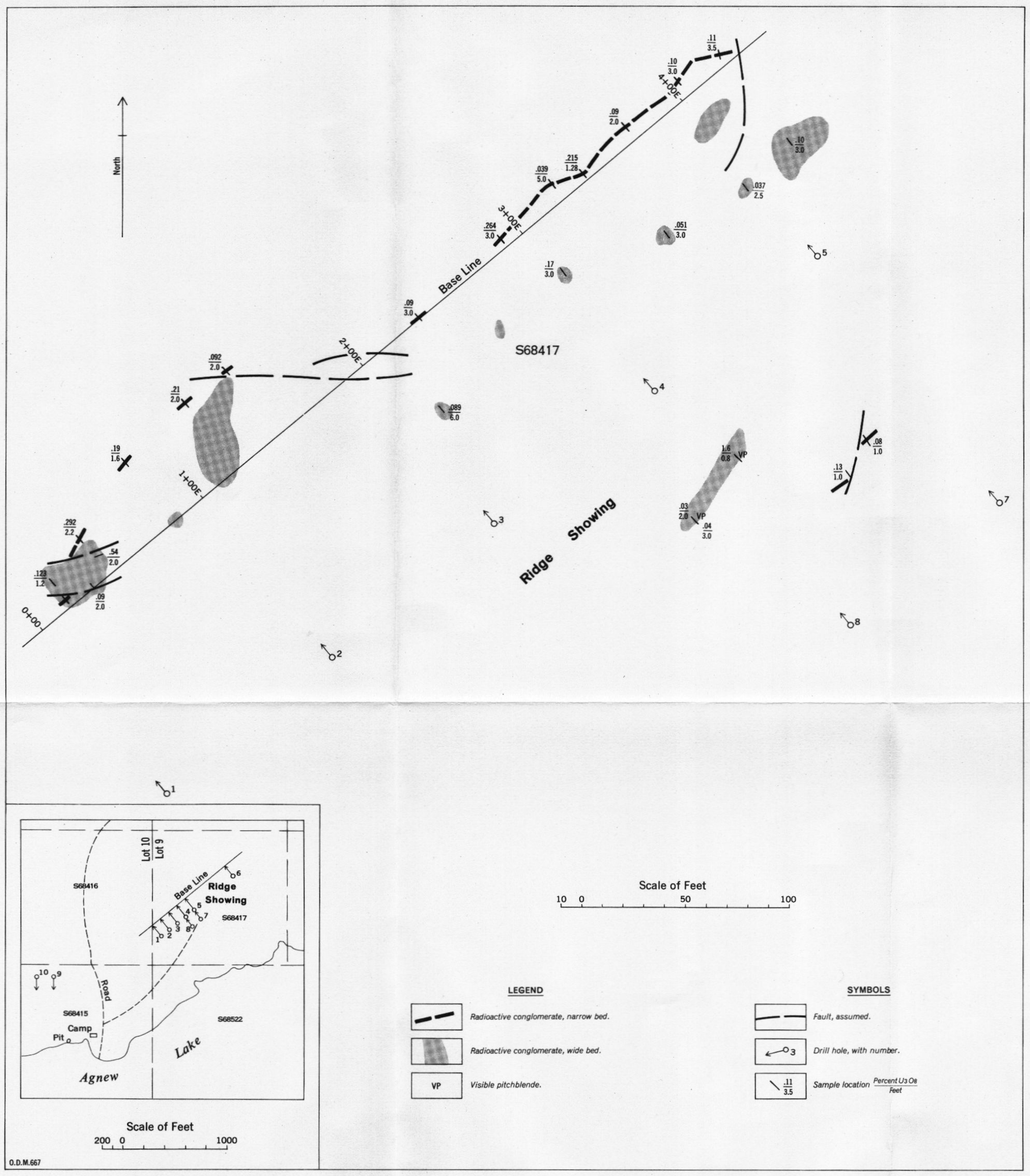


Chart F—Geological sketch map of the L. Leslie uranium occurrence, Lot 11, Con. II and III, Creelman Township, (modified after map by G. R. Hammond for Rio Canadian Explorations Ltd., September 1957)



ChartG—Sketch map showing main uranium discovery on Agnew Lake property of Noranda Mines Ltd., Lots 9-10, Con. II, Hyman Township, (modified after company plans, September 1954)

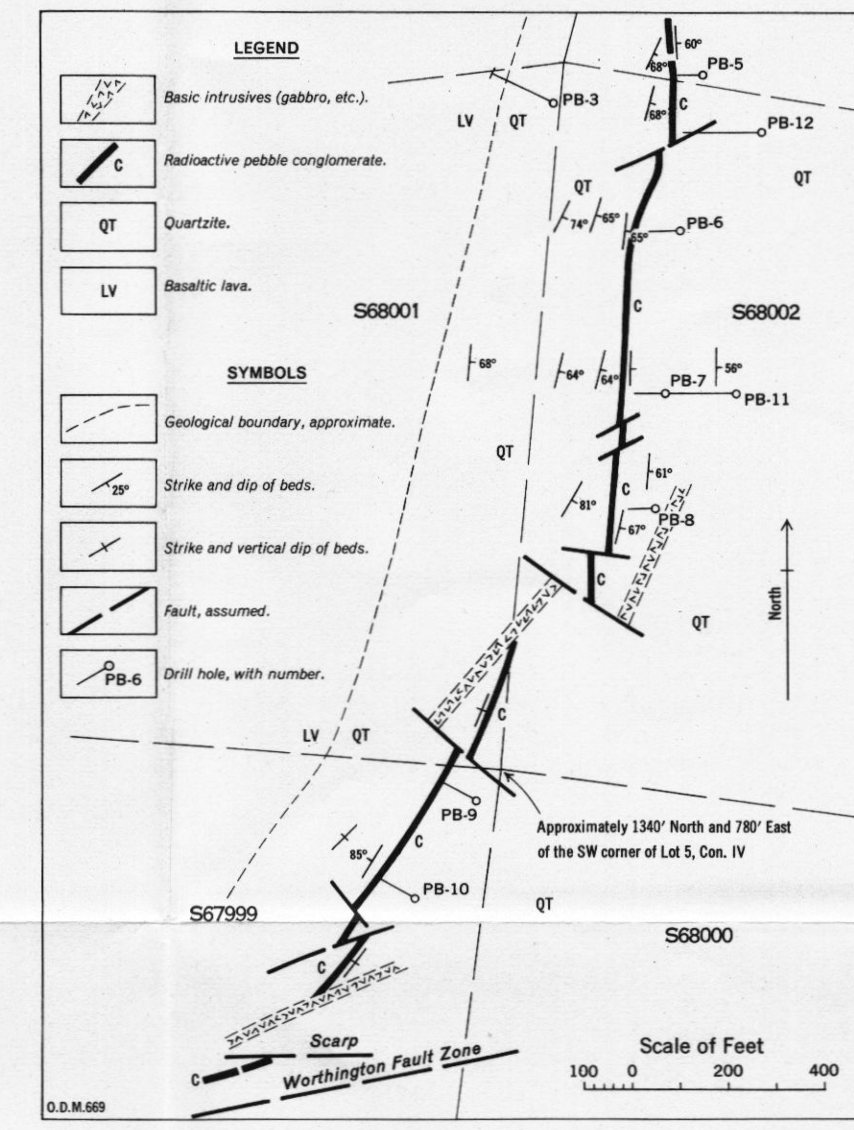


Chart J—Sketch map of uranium property of Plum Uranium and Metal Mining Ltd., Lot 5, Con. IV, Baldwin Township, (after company plans, July 1954)

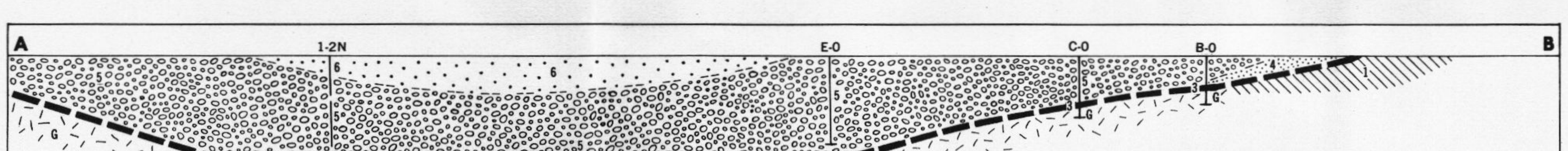


Chart H—Geological sketch map of the uranium occurrence on property of Pickle Crow Gold Mines Ltd., Pardo Township, (modified after map No. 41f, Ontario Department of Mines, 1932, and company plans by E. L. McVeigh, 1956)

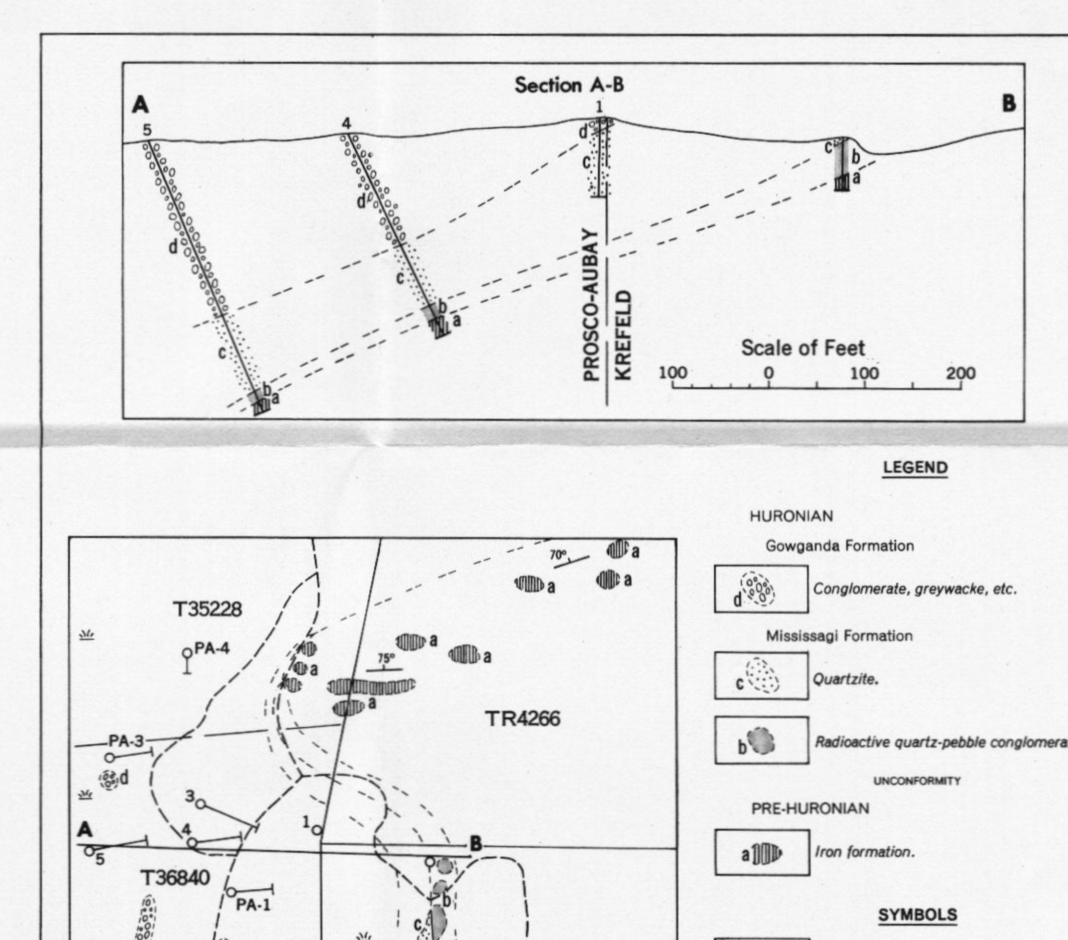


Chart K—Sketch map showing geology and drilling on property of Aubay Uranium Mines Ltd., optioned by Prosco Ltd., in Vogt Township, (modified after plans of Prosco Ltd., November 1958)