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GEOLOGY AND URANIUM POTENTIAL OF THE OTISH MOUNTAINS AREA

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GEOLOGY AND URANIUM POTENTIAL
OF
THE OTISH MOUNTAINS AREA
QUEBEC
FOR
ATLANTIC RICHFIELD CANADA LTD.
NORTH AMERICAN PRODUCING DIVISION

D. S. McPhee

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GEOLOGY AND URANIUM POTENTIAL OF
THE OTISH MOUNTAINS AREA, QUEBEC

SUMMARY

This report describes a geological and geochemical field programme exploring for uranium in the sediments of the Otish Mountains area of north-central Quebec.

The programme consisted of reconnaissance geology and prospecting with a portable scintillometer over areas of pebble conglomerate at or near the base of the sediments. A limited amount of time was spent in the upper sections of the sediments as well as the basement rocks.

The geochemical programme consisted of taking water samples at one mile intervals over the whole area of sediments that had not been claimed by other companies. It was planned to test all water samples for radon content so that more detailed geochemical work could be carried out in areas with anomalous radon values. Equipment difficulties forced the cancellation of this phase of the geochemical programme.

An aerial radiometric-magnetometer-V.L.F. survey was carried out over the area in late summer of 1969. A limited amount of ground checking was carried out on data from the day-to-day flight records covering the eastern section of the survey area.

Thirteen claims were staked on strike of a previously claimed area underlain by known conglomerate. A new area of pebble conglomerate was found during the summer of 1969. Radioactivity was noted at several locations within this section of conglomerate and fifty claims were staked to cover this area.

LOCATION AND ACCESSIBILITY

A base camp was established at Kervesco Lake in the autumn of 1968 in order to stake a large block of claims in the West Peribonca River area. This camp which is central to the area was used during the summer of 1969.

Kervesco Lake is approximately 240 miles north of Lac Sebastien, a float plane base in the Lake St.Jean area of central Quebec. Chicoutimi, 16 miles south of Lac Sebastien was used as a staging point for men and supplies. Gasoline and oil for the aerial radiometric survey and the helicopter were shipped by boat and rail to Gagnon, which is approximately 115 miles east-southeast of Lake Kervesco, and then to Lake Pollet, 13 miles northwest of the base camp, by bush aircraft.

A Bell G-2 helicopter on floats provided by Klondike Helicopters was used to move men in the field and collect water samples. In certain sections of the area where bush cover was heavy this model of helicopter was inadequate as landings could not be made in restricted areas.

FIELD PERSONNEL

The party consisted of eight people who served in the following capacities:

- | | |
|-------------------------------------|----------------|
| 1) Party Chief | Duncan McPhee |
| 2) Assistant Party Chief | Giles Tremblay |
| 3) Student Geologist | Norman Kalman |
| 4) " " | Robert Boyle |
| 5) " " | Steven Lummis |
| 6) " " | David Pollock |
| 7) Helicopter Pilot and
Engineer | Al Ascah |
| 8) Cook | Pat Bailley |

Fixed wing aircraft for the transportation of personnel and food, were provided by Saguenay Air Service. Fuel for the helicopter and radiometric survey was transported by Ron Austin, Atlantic Richfield Company, Calgary, Fecteau Transport of Gagnon, and Wheeler Northland of Sept-Iles. The writer wishes to acknowledge the help of the above individuals and organizations.

PHYSIOGRAPHY

Much of the region is a rolling plain with lines of northeast-trending hills. The elevation of the plain is 2000 to 2200 feet above sea level. The hills rise 500 - 700 feet above the plain in the western section of the region. Between the West and East branches of the Peribonca River the Otish Mountains rise abruptly to 3200 to 3725 feet above sea level.

The Otish Mountains area is located at the height of land in Central Quebec. The main drainage system is to the south via the Peribonca and Savanne River systems which empty into Lake St. Jean and Saguenay River. The southeastern part of the area is drained by the Outardes River which empties into the St. Lawrence River at Baie Comeau. The Eastmain River system drains the northern section of the area. It flows to the west into James Bay.

TABLE OF FORMATIONS

CENOZOIC	Pleistocene & Recent	Swamp, river and beach deposits, till, moraine and outwash sands and gravel.
	Unconformity	
		Pyroxenite and Peridotite
	Otish Mount Gabbro	Olivine gabbro, uralitized gabbro and granophyre.
Intrusive contact		
	Upper Formation	(Member B: purple and red arkose. (conglomerate, argillaceous arkose. ((Member A: Pink and grey dolomite cemented (subarkose and arkose. Minor (pink dolomite.
	Indicator Lake Formation	(Upper Orthoquartzite Member (orthoquartzite and subarkose ((Upper Subarkose Member (coarse grey arkose and subarkose, (minor conglomerate. ((Lower Orthoquartzite Member (white orthoquartzite and subarkose. ((Lower Subarkose Member (green-grey pebbly subarkose, arkose, (oligomictic conglomerate.
	Proterozoic Otish Mountain Group	
	Unconformity	
ARCHEAN		Gneissic to porphyroblastic granite and granodiorite, quartz. feldspar, biotite gneiss, migmatite, minor amphibolite lenses.

GENERAL GEOLOGY

The consolidated rocks of the area are both Early and Late Precambrian. An early Precambrian granitic complex composed of massive granite with migmatitic and pegmatitic zones, with minor amounts of biotite gneiss and amphibolite constitutes the basement. These rocks are exposed in the low-lying parts of the area and the range of hills north of the Otish Mountains. This basement complex is overlain by sedimentary rocks of the Otish Mountains Group. Grey to grey-green arkose with interbedded quartz-pebble and quartz-boulder conglomerate predominate in the lower sections of the Otish Mountains Group. Higher in the section, pink, grey, and white orthoquartzite, subarkose, and siltstone predominate. Dykes and thick sills of gabbro cut the sediments and basement rocks. Much of the area is covered by glacial deposits of boulders, gravel, sand and till.

The sediments, gabbro and basement rocks are cut into many fault blocks by a conjugate system of faults which strike north-south and east-northeast.

Northeast-trending folding affecting the Otish Mountains Group is probably related to the faults.

GRANITIC COMPLEX

The predominant rock of the basement is a medium to coarse-grained massive granite. The complex also includes varieties of

gneissic granite, granodiorite, pegmatite and migmatite. The fresh surfaces of the granitic rocks are pink; weathered surfaces are pale pink, white or buff.

The basement rocks include minor amounts of quartz-plagioclase - biotite gneiss and amphibolite which are dark grey to black on fresh surfaces and dull medium to dark grey to brownish-black on the weathered surfaces.

REGOLITH

The unconformity between the basement complex and the Otish Mountain Group has been seen in four localities in the region. In the main Otish Mountain area it is exposed along the north shore of a small lake northeast of Lake Conflans and along the southwestern flank of the main Otish Mountains ridge. It is also exposed in the two outliers of sediments covered by the claims near the Savanne River.

The rock immediately underlying the sedimentary rocks is a bright green colour and evidently represents an ancient weathering profile. Structures and textures of the granite or granite gneiss, underlying the sediments, are preserved in the rock with small pegmatite dykes cutting the granite or gneiss and the green rock. Quartz grains are preserved but all the feldspars are changed to greenish mica.

doubtful!

The rock is interpreted as a saprolite developed on the basement complex which was subsequently recrystallized after burial by the Otish Mountain Group. Folding and/or faulting has resulted in a strong foliation in some of the exposures.

OTISH MOUNTAINS GROUP

E. H. Chown (unpublished reports) has divided the Otish Mountains Group of sediments into an Upper and Lower Formation. He has proposed the name "Indicator Lake Formation" for the lower division although no type section has been designated and no formal description has been made or will be put forward until final reports covering all the Otish Mountains region have been completed.

INDICATOR LAKE FORMATION

Chown has divided the Indicator Lake Formation into four members:

	Thickness	
	West	East
Upper Orthoquartzite	350-450 feet	150-200 feet
Upper Subarkose	50-300	0-50
Lower Orthoquartzite	250	200
Lower Subarkose	350-400	100-200

10-15' f.fls.

The subarkose facies are pale grey-green rocks. The dominant type is a coarse sandstone or grit ranging from subarkose to arkose with beds of pebbles, cobbles and or boulders. Few thick conglomerate beds are present although the abundance of pebbles, cobbles or boulders increases near the base and the

lower subarkose unit is more conglomeratic than the upper subarkose.

Most of the pebbles, cobbles and boulders are composed of white quartz. Jasper, iron formation and metaquartzite occur but are very minor. Minor granite and greenstone pebbles and cobbles were noted in the northeastern section of the area.

Boulders and cobbles predominate in the conglomerate exposed in the northeastern exposures with cobbles and pebble conglomerate along the southeastern margin of the Otish sediments. In the Savanne River and West Peribonca River areas the subarkose unit contains pebble-sized conglomerate.

The orthoquartzite facies rocks are white to light pink or interbedded white and pink. Many, which appear to be orthoquartzite are found, on closer examination, to contain considerable well-rounded feldspar grains and are subarkoses and arkoses. Near the top of the sequence some of the beds are partly cemented by dolomite.

UPPER FORMATION

The Upper Formation is well exposed in the main ridge of the Otish Mountains in the northeastern section of the area. It is also exposed on the highest hills south of Lake Mangeron and south of Lake Pluto.

The base of the upper division is taken at the appearance in the unit of a distinctive and fairly continuous unit of reddish massive subarkose in which streaks and rounded spots have been reduced to a light grey or buff colour. This "white spot" unit is 50 to 75 feet thick.

The lower unit, (Member A) is a pale pink to grey, well sorted, laminated arkose and subarkose with a dolomitic cement. The unit may be cross-bedded and where dolomite cement is present differential weathering may accentuate the cross-bedding. This unit contains minor lenses of pebble conglomerate, which are generally polymictic with pebbles of feldspar, granite, quartz and gneiss.

The upper unit, (Member B) consists of coarse grained dark red arkose, red argillaceous sandstone, and minor polymictic conglomerate. An argillaceous sandstone with grey to greenish-grey reduction spots forms a 30 foot bed at the base of the unit.

The thickness of the Upper Formation is over 150 feet. Its true thickness is unknown as the top has been removed by erosion.

DISPERSAL PATTERN

Chown (unpublished reports) has found that in general the arkose facies of the Indicator Lake Formation and the whole of the Upper Formation show a trend indicating a flow from the northeast

into the basin and along the basin toward the Mistassini basin. The orthoquartzite units, however, clearly show current directions toward the north. There are anomalous current directions in parts of the area. Near Kervesco Lake current directions at two localities in the lower formation indicate a current trending north-northeast. Near Mangeron Lake current directions trend northwest and southwest at the one locality.

CORRELATION

The Otish Mountains Group may be traced westward through outliers to the Mistassini Group. The Indicator Lake Formation appears to correlate well with the Papaskwasati Formation which is the basal unit of the Mistassini Group. The Upper Division of the Otish Mountains Group may be the terrestrial clastic equivalent of the upper carbonate formations of the Mistassini Group.

OTISH MOUNTAINS GABBRO

In the western region of the Otish Basin area three major sills are recognized: one intruding near the unconformity, cutting both basement and sedimentary rocks, a second and third sills intruding the sediments at higher levels in the section. In the east-central section of the area the middle sill appears to have disappeared and the lower sill is poorly developed. All the sills are connected by a series of dykes and inclined sheets.

The rock in the lower sill is mainly fresh olivine gabbro. The upper sill, dykes and inclined sheets are largely or completely composed of uralitized gabbro.

The third or upper sill is preserved at or near the top of the high hills that form the northern boundary of the Otish Basin. Near Conflans Lake it is at least 400 feet thick. North of Manet and Pollet Lakes it appears to be a composite sill: a main sill about 200 feet thick separated by 6 to 30 feet of sediments from an underlying sill 75 feet thick. Beneath this sill are 2 sills 5 to 10 feet thick which join the lower sill.

ULTRABASIC ROCKS

Small intrusions of pyroxenite are found cutting the basement complex northeast of Conflans Lake and in an area of gabbro hills southeast of the Savanne River. South of the area Berard (1964) and Chown (1964) have found that similar pyroxenites intrude the Otish Mountains gabbro.

STRUCTURE

Regional northeast trending folds are the dominant structural features affecting the sediments and gabbro.

The section of the Otish Mountains region southeast of the Savanne River is a broad zone of flat-topped hills formed

by remnants of north dipping gabbro sills which have been intruded near the unconformity separating the basement rocks and sediments.

The southern edge of the Otish Mountains is represented by a zone 1 to 2 miles wide that trends northeast through Kervesco Lake. The zone forms the highest hills of the Otish Mountains region and is a major anticline overturned to the north and cut by strike-slip and normal faults. This may be related to a major thrust zone and may represent the "Grenville Front" in this section of Quebec.

The central section of the Otish Mountain Basin is a broad syncline 4 to 6 miles wide with dips on the flanks that rarely exceed 20 degrees. The transition from the southern edge of the Mountains to the central zone is not well exposed but south of Lake Mangeron the rocks are slightly disturbed and it is presumed that the overturned folds in the Kervesco Lake area die out into a zone of minor folds.

A broad series of flat-topped hills, frequently capped by gabbro form the northern edge of the Otish Mountains. The sediments and gabbro sills dip gently to the south. The most northern ridge of the region is composed of basement rocks.

RESULTS OF GEOLOGICAL WORK

No significant zones of uranium mineralization were found as a result of the 1969 field programme. One additional

area of quartz-pebble and quartz-cobble conglomerate was found along the southeastern edge of the main Otish Mountains ridge. Erratic patches of radioactivity were noted about 40 feet above the basement sediment contact. These radioactive zones were rusty in places although no pyrite was visible in the hand specimens. Fifty claims were staked along the strike of this area of conglomerate. Assay results from this portion of the area were up to 0.05% ThO_2 but less than 0.01% U_3O_8 .

Along the Savanne River south of the 52° parallel additional outcrops of quartz-pebble conglomerate were found. The conglomerate was radioactive in most exposures with several exposures giving counts of 4 to 6 times the background level. Two grab samples, however, assayed no uranium and 0.04% and 0.02% ThO_2 .

The exposures of conglomerate at the base of the Otish sediments along the north edge of the basin are not significantly radioactive. The conglomerate contains pebbles, cobbles and boulders up to 10" in diameter. One bed, 3 to 4 inches thick, contains densely packed quartz pebbles and small cobbles up to 3" in diameter in a rusty, highly weathered matrix. Radioactivity of this bed was up to 4 times the background readings but assays were less than 0.01% U_3O_8 and 0.01% ThO_2 .

The preliminary results of the airborne survey were evaluated and the most interesting anomalous values of lines 1 to 18 were checked in the field during the last few days of the season.

Lac aux Deux Decharges

In the Lake des Deux Descharges region an anomalous area was found to be due to a field of quartz-pebble conglomerate boulders up to 5 feet across. This boulder field is south of a gabbro ridge and the source of the conglomerate is unknown. Ground radiation levels are up to 10 times the background level. A sample from this area assayed 0.01% U_3O_8 and 0.01% ThO_2 .

probably below.

what kind? Lake, stream, swamp, ground or mixture?

GEOCHEMICAL SURVEY

Water samples were taken at 1 mile intervals along lines spaced 1 mile apart. It was planned to test all water samples in the field for radon content and if anomalous values were obtained to do detailed water and/or stream sediment sampling in areas of interest. The radon detection unit, however, did not operate satisfactorily so that this phase of the programme had to be abandoned.

The water samples were analyzed for uranium, copper, and zinc. The results were computer treated so that meaningful contour intervals could be selected and values could be related to type of sample water.

not necessary. May be misleading.

COPPER

The highest copper values in the area were obtained in the northeast corner of the area. A well-defined north-south trending anomaly coincides with a suspected major fault and this section of the area will therefore merit additional work.

but lateral to stream, is a fault trace.

Another area with intermediate anomalous copper values occurs between the west and east branches of the Peribonca River, near the 52° parallel. Several small (one sample) anomalies with intermediate copper values will warrant a limited amount of work.

ZINC

A number of small anomalies occur throughout the sampled area but no well-defined zone has been outlined.

URANIUM

Several areas that contain intermediate to high uranium values have been outlined. Between Kervesco Lake and the Savanne River intermediate to high uranium values have been obtained at 6 sample locations. As part of this section of the area is underlain by quartz-pebble conglomerate additional work is warranted.

questionable

however it looks as though most is underlain by granite & drift.

Interesting uranium values have also been found west of Pluto Lake and south of the 52° parallel near the western edge of the sampled area. Low anomalous values have also been obtained at a number of sample sites in other parts of the area. Geological and/or geochemical work is warranted on those areas in which intermediate to high uranium values were obtained and a limited amount of work should be done on the areas with low anomalous values to see if these are significant.

questionable

CONCLUSIONS AND RECOMMENDATIONS

Although the 1969 field programme did not indicate any significant areas of uranium mineralization the preliminary radio-metric data and the geochemical programme indicates areas in which additional work is warranted. In talks with the geologist of the Quebec Department of Natural Resources and the mining companies active in the Otish region it is now known that different types of uranium mineralization have been discovered. Vein deposits have been found in the basement rocks north of the Otish sediments, in the gabbro sills cutting the sediments, and in the sediments themselves. Soquem, in the Indicator Lake area, has found uranium within the sediments in nodular concentrations but no economic amounts have yet been outlined. The Borealis Group in the Lake des Deux Descharges region have drilled a number of radon geochemical anomalies. L. S. Phelan their exploration manager, states that they have found uranium mineralization in the sediments.

The uranium and copper geochemical anomalies are interesting and it is therefore proposed that detailed stream sediment sampling be carried out to further evaluate these sections of the area. In order to provide field control on areas that need to be sampled it is recommended that radon testing be carried out on water samples in conjunction with the sediment sampling for uranium, and a cold extraction method on water samples in conjunction with the sediments for copper. With these relatively rapid field methods it will be possible to plan the sampling programme and extend it, if necessary,

questionable.

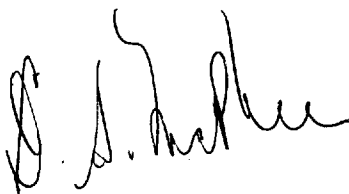
Too Late.

110'

without waiting for the analytical results from the laboratories.
The field methods will also help in the week to week evaluation
of the area without waiting until the end of the field season.

As overburden covers much of the area it is also
proposed that ground prospecting be carried out in tracing *OK*
boulders where anomalous radiometric or geochemical anomalies
occur.

The final results of the 1969 airborne radiometric
results have not been received and therefore planning of the
ground evaluation of the anomalies cannot be made at this time.
It is proposed, however, that ground prospecting and radon *kind?*
sampling will be carried out in the evaluation of the airborne
anomalies.



D. S. McPhee

March 1970.

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