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REPORT OF GEOLOGICAL FIELD PARTY #54 (1970)
ANDERSON PLAINS, COLVILLE HILLS AREA
NORTHWEST TERRITORIES

PROJECT NO. 57-1-6-70-5

Z.F. NIKIFORUK
FEBRUARY, 1972

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INTRODUCTION

This report is an account of the short geological reconnaissance and sample project conducted by Field Party #54 during August 3 - 10 and September 6 - 11, 1970, in the general Anderson Plains-Colville Hills area of the Northwest Territories. Main purpose and objectives of Field Party #54 are tabulated below:

1. Collect oil seep and oil sand samples for oil correlation and comparison purposes.
2. Collect samples for source rock analysis.
3. Spot check the anticlines on the Rond Lake Permit Block.
4. Make geological reconnaissance flights over the Great Bear and Tadenet Permit Blocks.
5. Visit the outcrops of the Basal Cambrian sand on the west flank of the Coppermine Arch.
6. Check out the apparent structure seen from the air south of the Rond Lake Permit Block.
7. Locate the apparent oil seep (as seen previously from the air) on the West River north of the Tadenet Permit Block.
8. Sample the Cretaceous section exposed on the St. Charles Rapids on the Great Bear River for source rock and micropaleontological analysis.

9. Make spot checks along Maunoir Ridge.

SUMMARY OF FIELD PARTY OPERATIONS

During August 3 - 10, 1970, personnel on Field Party #54 consisted of L.E. Swayne and Z.F. Nikiforuk: W.H. Monroe, wellsite geologist on Mobil Colville E-15, replaced Swayne during August 7, 1970. During September 6 - 11, 1970, the writer was the only member of the Field Party #54 to go into the field.

Field Party #54 personnel and equipment left Calgary on August 1, 1970 and arrived in Norman Wells, via P.W.A. the same day. A Single Otter aircraft chartered from Northward Aviation transferred personnel and equipment from Norman Wells to the base of operations at the Colville E-15 drilling camp.

Arrangements had been made to use the Heath and Sherwood Drilling Co. camp as a base for field operations. Field transportation was by means of a helicopter chartered from Bow Helicopters of Calgary and had arrived from Inuvik the previous day. The helicopter was a float-equipped Bell 47J2A machine and performed satisfactorily except it was a very low powered machine. Because of its low power many spots of interest could not be visited as the pilot was concerned about the machine's ability to take off from a confined area.

The areas to be visited were quite remote from the base of operation so that fuel had to be set out ahead of time. Gas

caches were placed on Simpson Lake and Ennak Lake in the Tadenet Block area, Kilekale Lake on the Great Bear Block and on Tunago Lake south of the Rond Lake Block. No difficulty was experienced in finding the gas caches that were set out by the Northward Aviation about two weeks prior to Field Party #54's commencement of operations.

The September 6 - 11, 1970 portion of field operations was conducted using Mobil's float-equipped Beaver aircraft piloted by M. R. Lamb. Base of operations was Norman Wells; the writer was the only geologist on this portion of the field project.

RESULTS OF FIELD WORK

Rond Lake Permit Block and Immediate Area

Surface outcrops on the Rond Lake Permit Block and the immediate surrounding area consist of (a) Ronning dolomite, (b) Bear Rock dolomite breccia, (c) Gossage limestone, (d) Hume limestones and shales, (d) Hare Indian shales, (e) Cretaceous sandstones and shales. Exposure is generally poor in the area away from the Belot Hills structural trend, as glacial drift and muskeg cover is very extensive. The best outcrops as indicated above are on the Belot Hills and consist of Ronning and Bear Rock dolomites, Gossage limestone and one outcrop of Basal Cretaceous sandstone. Outcrops of the Ronning dolomite were examined in three places along the Belot Hills anticlinal trend.

1. On the northwest trending branch of the Belot Hills anticline 67°10'N, 126°50'W poorly exposed outcrops of the Ronning cherty dolomites are present on the prominent topographic knob. Lithologically, the Ronning here is a tan to light brown, fine crystalline dolomite with white and dark grey chert occurring as vug and fracture filling. Porosity other than an occasional vug was not noted in the Ronning at this location. However, the spotty nature of the outcrop did not enable a thorough check of the Ronning at this point. Fossils were not found in the outcrops of this location.

2. The second location where Ronning dolomites were examined, on the Rond Lake Permit Block, was on the prominent topographic knob at 67°02'N, 126°28'W. This spot is at the place where the north trending Belot Hills anticline bifurcates with the main branch continuing to the northwest and a short branch continuing northward for 5 or 6 miles before plunging out.

Lithologically the Ronning at the second location consists of dolomite, light grey to brown, fine crystalline, much milky and grey secondary chert, several bands of about 2 feet in thickness had fair to good vuggy porosity, with the vugs being of various size and ranging from pinhead size to about 3/4 inch across. One outcrop stratigraphically about 100 feet below the vuggy dolomite and separated by a covered interval was relatively

fossiliferous. The fossils were silicified Halysites chain corals, brachiopods, orthocone cephalopods, stromatoporoids, and solitary corals. This fossil assemblage would place this portion of the Ronning Group in the Mt. Kindle formation. It is interesting to note that the G.S.C. missed both of these Ronning outcrops during their mapping under Operation Norman (G.S.C. Paper 70-12 Map 12 - 1970).

3. The third area where Ronning dolomite outcrops were examined was off the southeast corner of the Rond Lake Permit Block and south of the south end of Lac Belot (66°40'N, 126°20'W). At this location, the discontinuous outcrops consist of dolomite, light brown, fine crystalline, with milky and grey chert bands and blebs. No well developed porosity was observed but a few small scattered vugs were noted.

Bear Rock dolomite breccia outcrops were examined at several places along the Belot Hills trend south of the bifurcation point at 67°02'N, 126°28'W. At every locality visited along this portion of the Belot Hills, the Bear Rock consisted of a massive chaotic dolomite breccia. Individual blocks within the breccia vary in size from tiny angular fragments to huge blocks the size of a house. Structural attitude of the Bear Rock breccia is impossible to obtain due to the chaotic arrangement of the blocks. Individual blocks that form the breccia show well

developed bedding, as a rule, but the attitude of any particular block, even of an extremely large one, does not necessarily provide the true attitude of the Bear Rock formation itself.

From the air it is possible to estimate the general dip and strike of the Bear Rock breccia, as there are some beds within the breccia that do not appear to have been disturbed. The non-disrupted beds are near or at the top of the formation and generally form the steeply dipping west flank of the Belot Hills trend south of the bifurcation point. A field mapping problem exists where outcrops are limited in that sometimes it is impossible to decide if bedding in a particular outcrop represents true formational attitude or just the attitude of a large breccia block. In most cases it was decided not to use small outcrops when dealing with the Bear Rock breccia except on the west flank where observation from the air confirmed that the bed was part of the undisturbed portion.

North and northwest of the Ronning outcrops at the bifurcation point of the Belot Hills trend pelletoid, dark brown to black, fine to medium grained, fetid limestones assigned to the Gossage formation form scattered outcrops. These limestones are found in small scattered outcrops along the ridge up to the next Ronning dolomite outcrops that form the prominent topographic knob. Northwest of the last Ronning outcrop only one outcrop of Gossage

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limestone was found. The ridge continues for approximately 20 miles before plunging out, however no further outcrops were seen from the air, although it is assumed that the ridge northwest of the last Ronning outcrop is formed by Gossage limestone.

Only one outcrop of Cretaceous was located on the Belot Hills trend. This outcrop is on the east end of Saturday Lake at 67°53'N, 126°30'W on the west flank of the Belot Hills. The outcrop consists of approximately 100 feet of grey weathering, fine to medium grained, bitumen impregnated quartz sandstone. Cross bedding on a fine to massive scale is beautifully exhibited in the outcrop. An easterly source is indicated by the west dipping cross beds. Thin dark grey shale beds separate the cross bedding sets into layers 2 to 10 feet thick. From the air the sandstone sequence has a low (2-3°) dip to the west. At the outcrop, however, it is not possible to measure a regional dip due to the cross bedded nature of the sandstone; the shale partings themselves being part of the cross bedding pattern as well.

The slightly west dipping sandstones extend to the foot of the Belot Hills. Above the low dipping sandstone and about 150 feet higher up the slope another, small, outcrop of sandstone is present. This outcrop is separated by a covered overgrown interval from the main outcrop below and has a high westward dip (dip 56°W strike 180°).

At the extreme eastern end of the main outcrop the sandstone beds are curved sharply upwards. This would seem to indicate that the steeply dipping beds on the flank of the Belot Hills are in physical continuation with the slightly dipping beds at the foot of the hills. Physical continuation of sandstone beds in the two outcrops would rule out any faulting along the west flank of this portion of the Belot Hills.

The Belot Hills trend is an anticlinal ridge expressed mainly by outcrops of the Ronning, Bear Rock and Gossage carbonates. One outcrop of Cretaceous sandstone provides some critical evidence on the structure of one portion of the Belot Hills trend. South of the point of bifurcation to just south of the south end of Lac Belot the Belot Hills trend is formed by outcrops of the Bear Rock breccia. Structural attitudes could not be obtained over most of this part of the trend due to the chaotic nature of the breccia. However, the Bear Rock beds forming the west flank are mainly of undisturbed Bear Rock and give reliable attitude measurements. Dip on the west flank is steep varying from 30° to 56° to the west, strike being mainly north-south, parallel to the ridge. On approaching the top of the ridge dips on the undisturbed beds flatten out very quickly. The structure being such that the gently dipping beds of the plains area west of the ridge bend up sharply to form the west flank of the hills, and then flatten out again on the top. In

effect, what we have is the west half of a box anticline. Outcrops are non-existent on the east side of this portion of the Belot Hills, so that it is not known if the east half of the box fold exists or if it is formed by a thrust fault.

Immediately to the west of the north end of Lac Belot, at the bifurcation point of the ridge, Ronning dolomites appear in outcrop. The Ronning dolomite here forms a domal culmination on the anticlinal trend. Ronning beds were noted to dip south under the Bear Rock breccia to the south, and to dip northward under the Gossage limestones to the north. Faulting is suspected as the domal culmination is broken by a north-south trending valley that separates two areas of Ronning outcrops.

Northwestward along the ridge, from the Ronning outcrops at the bifurcation point, to the next Ronning outcrop on the high topographic knob, some 15 miles distance, scattered outcrops of Gossage limestone are present. Northeastward and southwestward dips in the scattered Gossage outcrops indicate that this portion of the ridge is anticlinal in character.

The Ronning outcrops on this second prominent topographic knob form another domal culmination on the anticlinal ridge. Outcrops on the knob are very poor and far between. However, enough outcrop is present to indicate its domal character. This culmination appears faulted as well, in that a small valley with

a northwest trend splits the knob into two.

Northwestward from the above domal culmination the ridge continues for some 20 miles before plunging out. Only one outcrop of Gossage limestone was found. However, it certainly appears that this portion of the ridge is anticlinal in character as well.

Structure South of the Rond Lake Block

An apparent structure was seen south of the Rond Lake Block, at approximately 66°25'N, 126°35'W, on flights from Norman Wells to the Colville E-15 wildcat well. A search was made for this structure, however it could not be located. The surface outcrops are formed by gently west dipping Bear Rock and Ronning dolomites. It was concluded that a significant structure did not exist after a diligent search, with the helicopter flying at low and high elevations, and with several spot checks being made on the ground.

Great Bear Permit Block Reconnaissance

A reconnaissance flight was made over the Great Bear Permit Block. Main purpose of the reconnaissance flight was to locate outcrops and to see if any surface structures of the Belot Hills type were located on the permit block. No surface structures were evident from the air. Thick deposits of glacial material are present over most of the block; these would mask minor

structures but certainly structures of the Belot Hills type, if present, would be conspicuous.

Only one outcrop was found. Its location is on the high hills at 66°32'N, 123°20'W, 6 or 7 miles north of Smith Arm and southeast of Kilekale Lake. The outcrop consists of 200 feet of flat lying, badly slumped, soft, grey and dark grey Cretaceous shales. Ironstone nodules and thin ironstone bands along with small gypsum crystals are common in the outcrop. No macro-fossils were found but a "middle" Cretaceous microfauna was identified at the Field Research Laboratory.

Maunoir Ridge Reconnaissance

Spot checks were made along Maunoir Ridge, from Maunoir Dome south to just east of the south end of Lac Des Bois. Maunoir Dome is a culmination that is similar to, but much larger, than the domal culminations on Belot Ridge. Like the Belot Ridge domes it too exposes Ronning dolomites in its core with the flanking overlying beds being Gossage limestones or Bear Rock breccia.

The main Maunoir Ridge trends slightly west of north between Lac Maunoir and Lac Des Bois. Outcrop on the ridge is not very plentiful and exposures that are present consist of Ronning dolomites. One discontinuous outcrop section is present across the ridge just to the east of the north end of Lac Des Bois. Here an old glacial drainage channel cuts diagonally across the

ridge. Exposures in the channel show that Maunoir Ridge is an assymetric anticline with the west limb being steeper than the east limb. Limited time available and poor exposures did not allow mapping in sufficient detail to see if closure exists on the Maunoir structure.

Tadenet Block Reconnaissance

Main purpose of a reconnaissance flight over the Tadenet Permit Block was to see if structures of the Belot Hills type exist; check on the structure mapped by the G.S.C. south of the Anderson River at Long. 127°15'W; and check on an apparent oil seep on the West River north of the block.

No structures of the Belot Hills type were observed during the flight over the permit block. Very little outcrop is present over most of the block with the main outcrop being along the Anderson River. Away from the river extensive muskegs and glacial drift mask the bedrock. Many small rounded hills are present in the area west and northwest of Simpson Lake. These hills are formed of clean fine to medium sand and are probably erosional remnants of the Basal Cretaceous.

A check was made of the faulted anticlinal structure that was mapped by the G.S.C. south of Anderson River at 127°15'W. Only one suitable landing spot was found for the helicopter on the

structure. At this location gently west dipping Gossage limestones were present; from the air no east dipping beds could be discerned. The structure from the air appears to be an upfaulted block of Gossage limestone that dips gently westward, with beds plunging gently to the north and south from the central portion of the fault block. More detailed work is warranted in the future on this particular structure before recommendations for drilling can be given.

Outcrops of Gossage limestone were also examined along the Anderson River canyon just east of Ennak Lake at latitude 68°10'N. Here, gently west dipping beds of Gossage formation outcrop in the river bed, forming rapids, and in the canyon walls. One notable feature of the Gossage outcrops, at this locality, is the many small amplitude and short wave length, anticlinal and synclinal structures. Amplitude being in the order of 10 to 20 feet and wave length of 100 to 200 feet. These structures do not have a systematic trend direction but trend in various directions. Most do not have any direct relationship to one another except an occasional anticline pair with an intervening syncline.

Exact origin of these small structures is unclear, but they might possibly be compaction structures associated with Gossage deposition over a Ronning erosional surface with high relief. The small size of the structures does not warrant their consider-

ation as possible hydrocarbon traps, but if the underlying Ronning is an erosional surface of high relief, it would warrant consideration as a possible hydrocarbon reservoir.

What appeared to be an oil seep was spotted from the air, on a flight to Franklin Bay, by the writer and G.F. Johnson in 1968. The apparent seep was on a hillside above the West River just north of the Tadenet Permit Block. Its location was marked on a map at the time. A search of the West River area was made by helicopter but failed to turn up an oil seep. However, several stagnant dark coloured pools of water are located on the hillside in the approximate area and these could well have been mistaken to be oil seeps from the Beaver aircraft.

Coppermine Arch Trip

A trip to the Coppermine Arch was made by Beaver aircraft at the beginning of the second week in September. At the time Indian Summer weather prevailed in Norman Wells; however, the story was different on the Coppermine Arch where winter had already set in. Much snow was on the ground, most lakes frozen over and even the large rivers were clogged with floating slush and ice. Fortunately, a large lake that has Basal Cambrian sandstone shoreline exposures was still open. A short time, while the pilot refueled, was available for outcrop examination. A longer stay was impossible as ice was forming on the floats

and the pilot was concerned about taking off with ice coated floats. The outcrops on the shore consisted of approximately 100 feet of sandstone, top nor bottom exposed, light brown, medium to coarse grained, strongly cross bedded, with the cross beds dipping at low angles, friable and very porous.

Great Bear River Sampling Project

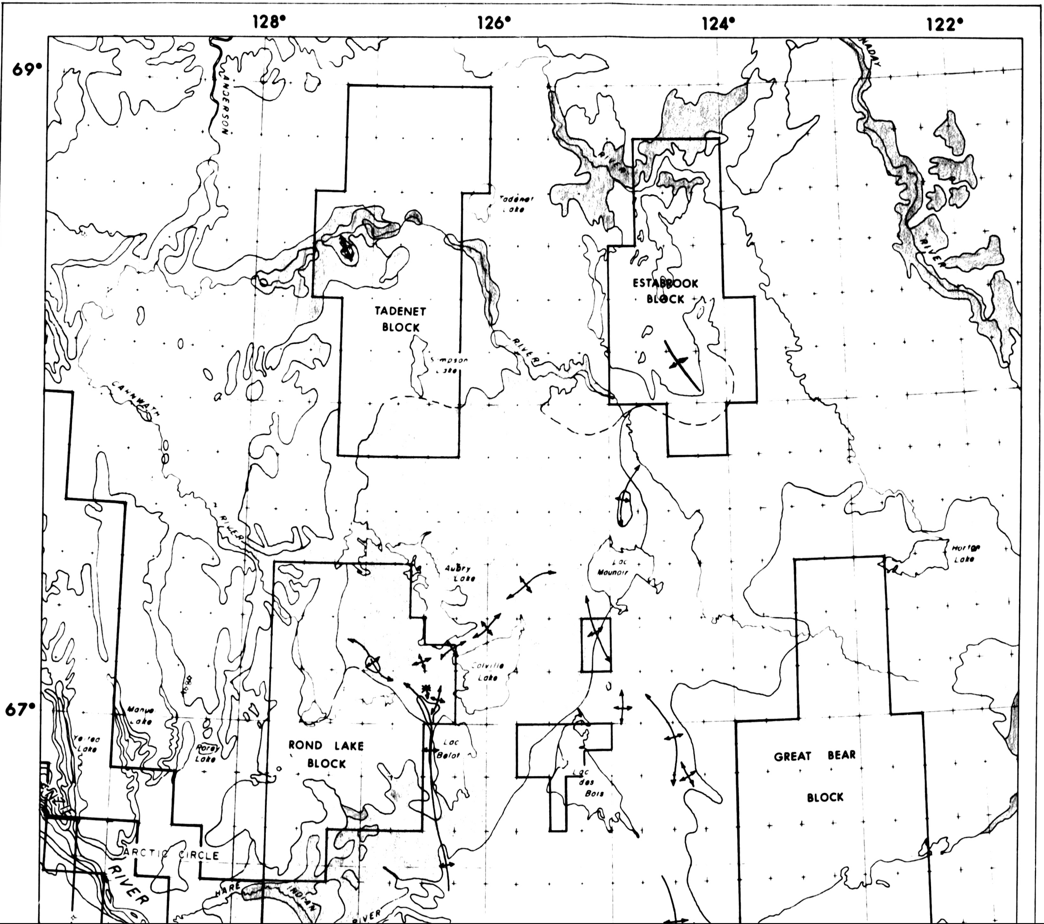
An attempt was made during the second week in September to sample the Cretaceous section exposed along, and upstream from, the St. Charles rapids on the Great Bear River. Samples were to be collected for source rock and micropaleontological analysis. Low water levels and large boulders on the river bed precluded any landing by the float equipped Beaver on the river. As no helicopters were available in Norman Wells at the time, no part of the Great Bear River project was completed.

CONCLUSIONS AND RECOMMENDATIONS

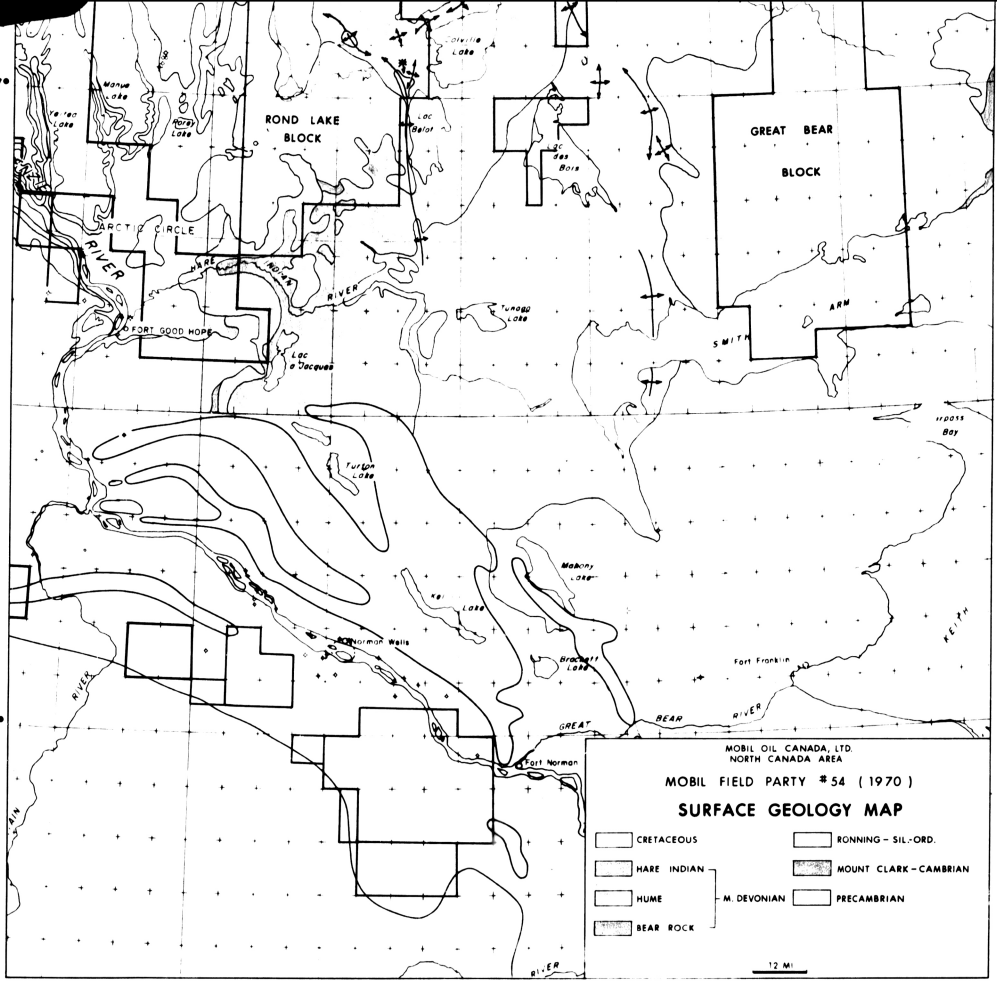
On the basis of spot checks the Belot Hills and Maunoir Ridge trends are shown to be anticlinal structures. Two domal culminations are developed on the Belot Hills anticlinal trend and one on Maunoir Ridge. All three domal culminations are considered to be possible drilling prospects. The Mt. Clark sandstone would be the primary target horizon. Maunoir Ridge between Lac Des Bois and Lac Maunoir is an assymetric anticline. No readily apparent closure was seen on this anticline. The faulted doubly plunging

anticline, as mapped by the G.S.C. south of Anderson River, on the Tadenet Permit Block, appears to be a slightly tilted fault block of Gossage limestone. No other readily apparent surface structures are present on the Great Bear Permit Block.

Further detailed structural mapping is recommended on the Belot Hills, Maunoir Ridge and the Anderson River structure on the Tadenet Block. Lack of adequate exposures will hinder detailed mapping but, nonetheless, an effort to further elucidate the known structures should be made. A study of the Cambrian, incorporating all surface and subsurface data, should be made, in that the Cambrian is the main reservoir horizon in the area of Mobil's Anderson Plains acreage blocks.



128°
126°
124°
122°
69°
67°
ANDERSON
TADENET BLOCK
Tadenet Lake
Simpson Lake
RIVER
ESTABROOK BLOCK
RIVER
CARNWATH
RIVER
Aubry Lake
Lac Maunoir
Horton Lake
Colville Lake
RIVER
RIVER
Manuel Lake
Yeltea Lake
Rorey Lake
ROND LAKE BLOCK
Lac Belot
Lac des Bois
GREAT BEAR BLOCK
ARCTIC CIRCLE
RIVER
HARE
INDIAN
RIVER


67°
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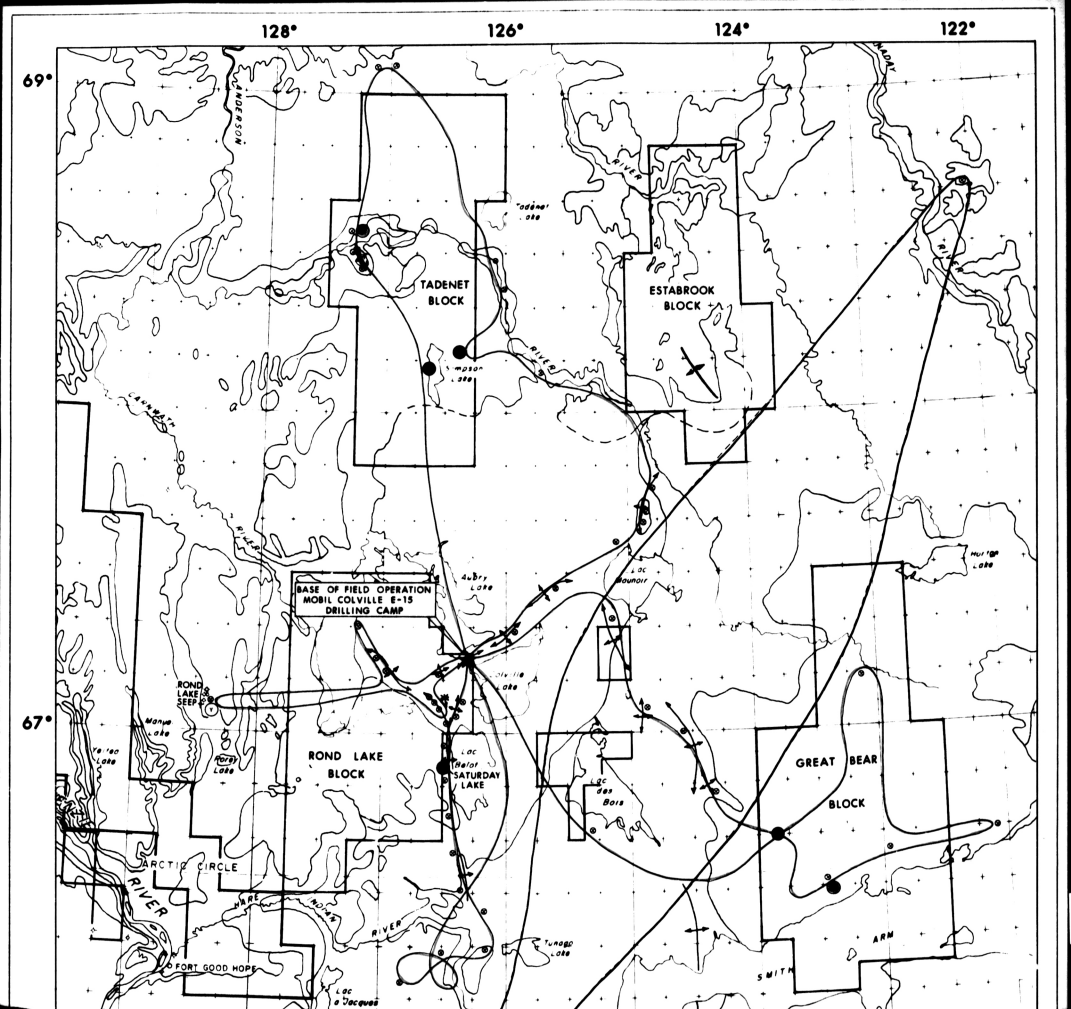
ROND LAKE BLOCK
GREAT BEAR BLOCK
ARCTIC CIRCLE
HARE INDIAN RIVER
FORT GOOD HOPE
Lac a Jacques
Turton Lake
Norman Wells
Mahony Lake
Kel Lake
Brackett Lake
Fort Franklin
GREAT BEAR RIVER
Fort Norman
SMITH ARM
KEITH
MOBIL OIL CANADA, LTD.
NORTH CANADA AREA
MOBIL FIELD PARTY #54 (1970)
SURFACE GEOLOGY MAP
CRETACEOUS
HARE INDIAN
HUME
BEAR ROCK
M. DEVONIAN
RONNING – SIL.-ORD.
MOUNT CLARK – CAMBRIAN
PRECAMBRIAN
12 MI


128°
126°
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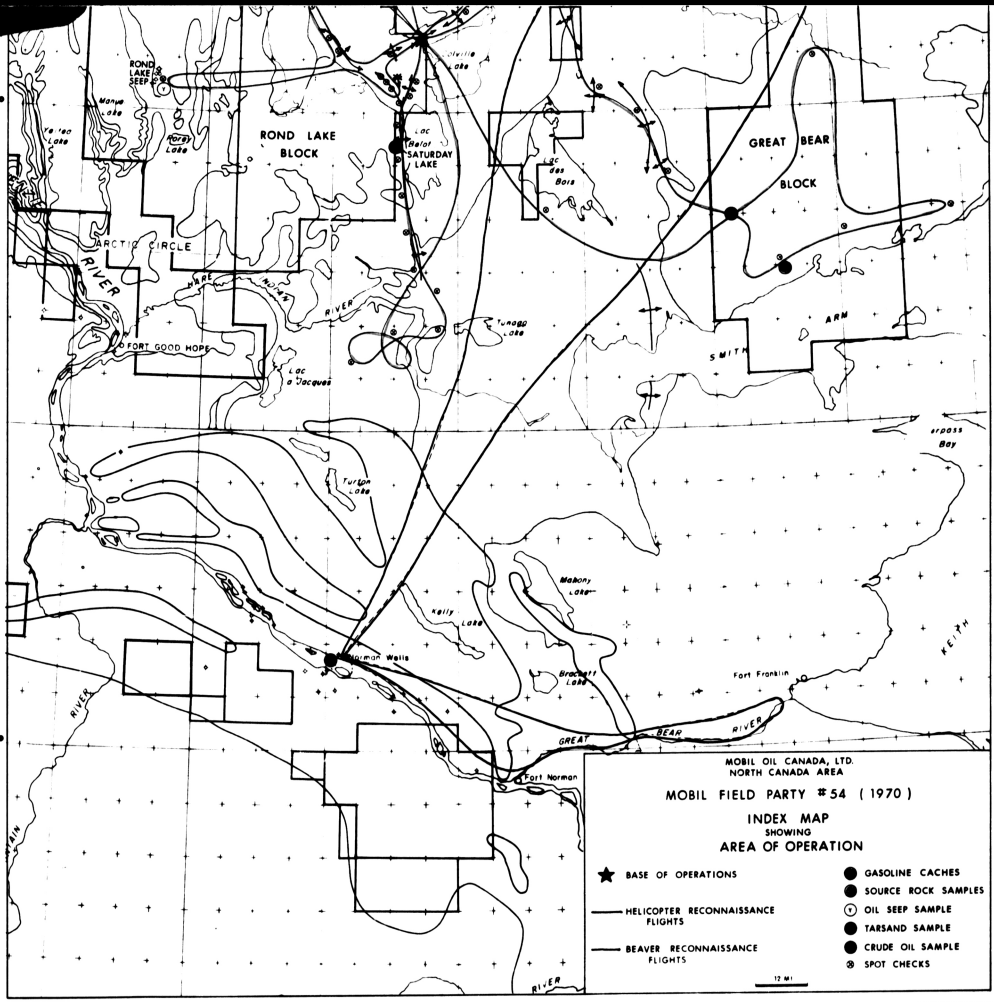
67°
TADENET BLOCK
ESTABROOK BLOCK
ROND LAKE BLOCK
GREAT BEAR BLOCK
BASE OF FIELD OPERATION
MOBIL COLVILLE E-15
DRILLING CAMP
ROND LAKE SEEP
SATURDAY LAKE
ARCTIC CIRCLE
FORT GOOD HOPE
ANDERSON RIVER
MACKENZIE RIVER
SMITH ARM
Aubry Lake
Tadenet Lake
Thompson Lake
Hunter Lake
Manya Lake
Moray Lake
Tunago Lake
Lac de Bois
Lac Boundary
Lac a Jacques


67°
66°
ROND LAKE SEEP
ROND LAKE BLOCK
Manue Lake
Forsyth Lake
Lac Belot
SATURDAY LAKE
Lac des Bois
GREAT BEAR BLOCK
ARCTIC CIRCLE
RIVER
FORT GOOD HOPE
Lac a Jacques
Tunago Lake
SMITH ARM
Turton Lake
Mahony Lake
Kelly Lake
Norman Wells
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GASOLINE CACHES
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OIL SEEP SAMPLE
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12 MI