

Bill Rogers

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August 21, 1958

Mr. C. R. Nicholls
Champlin Oil & Refining Ltd.
Box 9365
Fort Worth 7, Texas
U. S. A.

Dear Mr. Nicholls:

Attached is a resume of the serial trip to the Mackenzie Plain area briefly outlining the pertinent geological observations in each of the permit areas. In addition, there is a detailed log of the trip, which is accompanied by an index map showing the routes flown.

We feel that the trip will be of considerable benefit to the Geophoto personnel in carrying out their photogeologic evaluation of the area. It was also possible to evaluate the very brief reconnaissance photogeologic mapping completed on the permit areas prior to the trip and to verify a number of the structures mapped.

Yours very truly,
GEOPHOTO SERVICES, LTD.

Fred C. Brechtel

Fred C. Brechtel

FCB:js
Enclosures

c.c. Mr. R. W. Mallory



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AUG 22 1958

Resume of Aerial Reconnaissance Trip to Mackenzie Plain Area,
Northwest Territories

The aerial reconnaissance of the project area was conducted on August 6th, 7th, 8th, 1958 by Mallory and Rogers of Champlin and Brechtel and Gould of Geophoto. The approximate routes of the flights within the area are shown on the accompanying index map. On August 6 the party flew in a de Havilland Beaver aircraft from Fort Nelson to Fort Simpson to refuel, then to Norman Wells by a route west of the Mackenzie River that included four of the Champlin permit areas. Observations on each area, from south to north in the order visited, are as follows:

Ram River Permit

The domal uplift mapped on the air photographs was readily seen from the air and appears to plunge northwesterly and southeasterly from an apex located near the center of the permit. The topography reflects the structure in that the Middle Devonian carbonates, probably the Ramparts formation, which constitute the rimrock of the numerous canyons, form dip slopes from which the softer Upper Devonian Fort Creek shales have been largely stripped by erosion. The lower canyon walls are heavily mantled by slide rock which prevents recognition of pre-Devonian rocks, if present.

Unnamed River Permit

The preliminary photogeologic mapping indicates the presence of a northwesterly plunging anticlinal nose along the east edge of the Unnamed River permit, subsidiary to a larger, northerly plunging anticline about one mile east of the permit boundary. The larger feature is clearly visible from the air, with well-defined north plunge, and appears to be expressed at the surface in resistant Devonian beds younger than the Ramparts formation, probably sandstones of the Upper Devonian Imperial formation. South plunge is not distinctly evident, but may be present (in minor amounts) south of the southeast corner of the permit, where the fold has been breached and definition of the fold is not obvious in the topography. Topography is fairly rugged, with heavily timbered slopes. Bedding is visible in walls of the deeper canyons.

Redstone River Permit

A northeasterly trending anticline shown on Hume's map as crossing the Redstone River near the west permit boundary was not recognised on the air photographs nor during the reconnaissance flight. The northerly trending anticline mapped by Hume near the northeast corner of

the permit was mapped on the air photographs and was confirmed during the aerial reconnaissance, although the best expression of this structure occurs north of the permit boundary. Within the permit area, a northerly trending distinctive alignment was observed, which suggests that the east flank may be faulted. No evidence of a south-easterly extension of this fold was noted from the air.

Mirror Lake Permit

The air photographs indicate the presence of Devonian and possibly older carbonates in the southwestern part of the Mirror Lake permit, dipping northeast off the Macdougal anticline shown on Hume's map, but the remainder of the permit appears to be entirely masked by glacial deposits and muskeg. No evidence of outcrops was seen from the air northeast of a line passing northwest through Mirror Lake. Southwest of this line, however, prominent dip slopes of the Ramparts formation occur along the Carcajou Canyon on the northeast flank of Macdougal anticline.

On the morning of August 7, unfavorable weather prevented examination of the area west of 128° and a flight was taken up the Mackenzie to observe the section exposed near Bear Rock. An afternoon flight followed up the Mountain River across the Whirlpool anticline into the Mountain River permit, but due to poor visibility, we turned back to Norman Wells before crossing the axis of the Imperial anticline. Relatively steep north dips were observed in Devonian shales on the north flank in the banks of Mountain River. The north flank of the Imperial anticline was further observed on the return trip, which followed the Ramparts-Fort Creek contact as far east as Imperial River.

On the morning of August 8, visibility had improved, but was locally poor. A flight was made to the Arctic Red River in the western part of the area, and crossed the axis of Imperial anticline near the junction of the Imperial and Carcajou Rivers, following the south flank of the Imperial anticline into the Mountain River permit. This well-defined structure was crossed at the Gayna River and again west of the permit.

West of the Hume River, the flight followed the south flank of an easterly trending, possibly closed anticline expressed in Cretaceous rocks which had been mapped on the air photographs, and then down the Arctic Red River and across the anticlinal axis to the syncline bordering it to the north. Fairly recent tractor roads, possibly from two to five years old, were noted in the area between Ramparts and Hume Rivers on the return trip.

After a stop to refuel at Norman Wells, the party flew to Yellowknife to make connections with commercial airlines for transportation to Calgary. A detailed log of the flights summarized above follows:

Log of Aerial Reconnaissance Trip to Mackenzie Plain Area,
Northwest Territories

The party, consisting of Bob Mallory and Bill Rogers of Champlin, and Fred Brechtel and Don Gould of Geophoto, left Calgary at 1:30 p.m. on Tuesday, August 5th, 1953, via commercial airlines for Fort Nelson. We arrived at Fort Nelson about 9:00 p.m. and found pilot Walt Forsberg of Wardair at the Avonlee Hotel, where we that evening had a brief conference on plans for the next day's flight. Two hotels, stores, gas stations on Alaska Highway; this is new Fort Nelson (designated Zero by citizens), six miles from airport, eight miles from float plane dock.

Wednesday, August 6th. Took cab to float plane landing on Fort Nelson River at 7:15 a.m., where the plane, a De Havilland Beaver, was moored to the dock.

7:30 a.m. Beaver started.

7:40 Take-off for Fort Simpson. Surface heavily timbered.

7:51 Mouth of Sahtaneh River. Veer northwest to follow down Fort Nelson River. Altitude 3,100 feet, about 2,000 feet above the ground. Speed 100 m.p.h. Cross south-flowing river at $123^{\circ}07' W.$ about one mile above its junction with the Fort Nelson River. Then veer north along west bank of this tributary.

8:10 Outcrop on east bank of tributary. Dark shale, nearly flat, about five miles above mouth of river, probably Lower Cretaceous.

8:17 Cross west-flowing part of same tributary about $123^{\circ}07' W.$, $59^{\circ}25' N.$

8:19 Pass Gulf States well location about two miles south of lake at $123^{\circ}09' W.$, $59^{\circ}33' N.$

8:33 Cross west-flowing stream tributary of Petitot River, about five miles east of south end of Marshamish Lake. Timber sparse. Swampy, with many ponds.

8:36 Veer northeast over small river west of a hill at $122^{\circ}55' W.$, $59^{\circ}55' N.$, which is topographic expression of anticline developed in Paleozoic limestones striking north-south.

8:37 Veer back north along east side of ridge to Petitot River. Limestone dips 10° or more westward on west flank, and more steeply on east flank.

8:40 Veer northwest down Petitot River across the axis. Lime-stone dips about 30° west, then dark shale dips about 80° west, then 45° west.

8:45 Make 180° left turn, return to extension of ridge north of Petitot River. Pass Texaco well location on a north-south trending structure.

8:47 Veer north for Fort Simpson. Lake Bovie ahead.

9:00 Cross Celibets Lake.

9:05 Cross Muskeg River.

9:17 Trout Lake visible between 1 o'clock and 2 o'clock through a gap in a low ridge.

9:23 Heading toward east end of Cormack Lake. Peaks of Liard Range at 9 o'clock. Trout Lake from 1 to 3 o'clock. Drumlins below trend northeast. Altitude 3,600. Speed 105 m.p.h.

9:30 Cross outlet of Cormack Lake, head of Poplar River. Winter tractor road partly visible heading due north.

9:40 Glacial linears trend northeast. Goose Lake ahead.

9:45 Pass Goose Lake. Bend in Liard River at 11 o'clock.

9:50 Cross Jean-Marie Creek.

10:00 Cross island in Liard River. Air strip visible inside bend west of river.

10:02 Fort Simpson on the west bank of Mackenzie River at 11 o'clock. Shale outcrop in river bank at junction with the Liard River.

10:05 Circle and land upstream at Fort Simpson. (Took Kodachrome shots).

11:05 Take off for Little Doctor Lake after refuelling and coffee break. at local restaurant. Supply depot for aircraft. R.C.M.P. post.

11:14 Cross Martin River, south of its junction with an east-flowing tributary. Shale outcrops in banks along the Martin River.

11:20 Cross east-facing semi-scarp of upland east of Sibbeston Lake. Nahanni Range ahead.

11:32 Sibbeston Lake at 9 o'clock. Glacial linears trend northwest. (Kodachrome).

11:36 Tsetso Lake on left.

11:43 Notch in Nahanni Range. Pass over Little Doctor Lake through gap. (Kodachrome). Prominent exposures of Devonian carbonates are present on either bank of the west end of Little Doctor Lake, and it was hoped that we could land there and sample the section. However, the vertical walls of the outcrops and the impracticability of walking along the lake's edge caused us to change our plan and to continue straight west toward the Ram River permit area.

11:55 Bend in Ram River. Topography of Ram River permit extremely rugged, with canyons over 1,000 feet deep and exposures of Devonian carbonates in wall. (Kodachrome). Flew west across north end of domal structure to stream junction on west flank, where we turned south and then east, flying counter-clockwise around the higher points of the Ram River topography, which consists of steep cliffs of well-bedded, gray carbonates and shale with heavy talus covering the lower parts of the slopes. It was impossible to determine whether or not the Silurian section is exposed at the bottom of the canyons, but the domal structure with both north and south plunge is quite evident.

12:06 p.m. Return to bend in Ram River and head north down Ram River.

12:14 Cli Lake at 3 o'clock.

12:17 Junction of Ram River with the North Nahanni River. Follow up the North Nahanni River, with a sharp, dissected ridge, the southern part of the Camsell Range, on the left, consisting of gray, well-bedded carbonates forming rugged cliffs. Nahanni Mountain is on the east at 2 o'clock.

12:19 Sharp east dip on the flank of the Camsell Range immediately on the left; appears to be a fault scarp. (Kodachrome). East-dipping sandstone and shale are seen on the east side of the valley of North Nahanni River.

12:28 Ramparts limestone in the river bank, with dark gray shale, apparently the Fort Creek, in canyons which enter the North Nahanni River from the east.

12:32 Leave the North Nahanni River at the bend and veer northwest.

12:37 Pass lake in southwest part of Unnamed River permit on the left. Veer east to circle the northward-plunging anticline in the southeast part of the Unnamed River permit.

12:40 Fly south along the east flank of the anticlinal axis outside the permit area. The resistant beds holding up the topography of this mountainous portion appear to be younger than the Ramparts formation, which forms the rimrock in the Kan River block. In the Unnamed River block, however, the rim of the canyons appears to be formed by beds younger than the Ramparts and probably represents sandstones in the Imperial formation.

12:50 Slight south plunge of the anticlinal axis is suggested, but may or may not be present. Veer west across the southern part of the axis over a lake at which a camp was noted.

1:00 Cruise northwest parallel to our earlier course, which is about two miles to the west.

1:18 Cross the west end of an island in the Root River.

1:26 Swing northwest across ridge extending south from Mount Dahadinni, then northeast again. Cruise north along the east flank of the range south of Mount Dahadinni. Steep easterly dip in carbonate rocks is evident.

1:40 Cross the range at a pair of lakes to the Dahadinni River on the west flank of this range, then follow the Dahadinni River north into quadrangle 95N/11.

1:50 Sharp, right-angle bend of Dahadinni River.

2:03 Cloverleaf Lake visible (moose feeding). Abandoned camp seen on east shore.

2:05 Landed to examine abandoned camp. Ate lunch. Old correspondence indicates camp serviced by helicopter in 1956. Boxes labelled Shell Oil. Outcrop of brown, massive, coarse-grained, cross-bedded, friable sandstone with salt and pepper texture and oxidized exterior. Probably Cretaceous.

2:54 Take off for Redstone River permit.

3:00 Noted distinctive alignment along lake on the east line of Redstone River permit, with west dip evident on the west side of the lake in what appears to be limestone and black shale.

3:10 Fly west up the Redstone River across the permit area and veer south at sharp bend in river. Two faults were noted, one on each side of the river along the west edge of the mosaic, developed in dark shale with some overlying resistant beds. The faults trend northwesterly and may be part of the same fault zone.

3:15 Veer east and cross anticlinal axis in the southwest corner of the mosaic.

3:20 Return to Redstone River, cross it flying northeast.

3:25 Southwest dip on the west flank of the anticlinal axis which crosses the northeast corner of the Redstone River permit. Continue northward and cross the axis to the northeast flank, where northeast dip is evident.

3:35 Cross the Keele River, flying northwesterly. Continue up the Keele River about a mile north of the stream.

3:41 Cross lower part of Summit Creek.

3:47 Veer north along the west side of a bare-topped range of mountains and leave the Keele River, flying northwest.

3:50 Cross flat upland with numerous swamps and polygonal ground at several points, due to permafrost action. Prominent, aligned, white scars in the distance at 3 o'clock, trending north-south.

3:54 Flat upland begins to slope northward and become dissected, with numerous mud slides. A plume of vapor or steam issues from one of the mud flows.

3:56 Cross Little Bear River.

4:00 Follow Grotto Creek northwest. MacKay Range at 4 o'clock. Tractor trails on upland east of Grotto valley, probably connected with prominent tractor road seen on air photos near Mirror Lake. Glacial linears trend north.

4:07 Bend in Carcajou River. Ramparts-Fort Creek shale contact very well exposed on east bank.

4:10 Mirror Lake on right. (Kodachrome). Carcajou River cut into Ramparts formation along strike.

4:16 Veer northerly, leave Carcajou River. Glacial linears trend northwest. Abandoned tractor road on ridge. Ponds and muskeg with some timber.

4:22 Three Day Lake on right. Seismograph lines evident.

4:25 Approach Norman Wells. (Kodachrome).

4:28 Land at dock to refuel. Disembarked, contacted Imperial office, were cordially received and provided with transportation to quarters. Later met Mr. MacMillan, superintendent of refinery. Party messed at refinery mess hall.

Thursday, August 7th.

8:00 a.m. Partly overcast. Heavy cloudbanks to the west and north. Pilot checked weather by radio and found that a front has moved in from the southwest with a 500-foot ceiling at Aklavik. Unfavorable for projected flight to west.

10:02 Take off for Bear Rock upriver to study Devonian and Silurian section.

10:22 Ridge about five miles north of Mackenzie River. Dip of thin-bedded limestone or sandstone in this cuesta is gently south-southwest. A tractor trail leads up to the west end of this ridge and to the east.

10:30 Fly past Bear Rock on the left. (Kodachrome).

10:34 Mouth of Great Bear River. (Kodachrome).

10:35 Turn around. Fly up-section through Silurian and Devonian carbonates at Bear Rock.

10:46 Return to cuesta, examine lake with a view to landing.

10:50 Land on Mackenzie River at mouth of Jungle Ridge Creek. Brechtel and Gould wait on shore in order to lighten load, while Mallory and Rogers return to lake to examine possible oil seep.

12:15 p.m. Pick up Brechtel and Gould, return to Norman Wells.

12:33 Land at Norman Wells. Lunch.

2:17 Take off for Mountain River. Brisk wind from north; weather slightly improved to west.

2:33 Pass Ogilvie Island on right.

2:42 Patricia Island.

2:50 Carcajou Ridge on right. Ramparts limestone dips steeply southward.

3:05 Fast Mountain. Double scarp on south flank, with moderate dip. Vertical north flank and west plunge. Dark shale outcrop on east bank of Mackenzie River above Sans Sault Rapids.

3:10 Follow Mountain River southwest.

3:18 Cross Whirlpool anticline. Well site visible on west river bank.

3:20 Veer west from Mountain River toward Hume River in an attempt to reach western part of project area. Too cloudy, however, and it was decided to return to Mountain River and follow it southward.

3:25 Fly southward along Mountain River, approaching Imperial anticline. Dips around 30° northward are visible in dark shale along banks of Mountain River.

3:28 Mouth of Gayna River. Canyon deep and rugged. Visibility very poor. Pilot makes sharp left turn and heads northward back away from Imperial anticline down the Mountain River. North to Whirlpool anticline and then east along the north edge of the Mountain River permit.

3:45 Visibility slightly improved. Sink-holes visible in Rasparts formation on eastern part of Imperial anticline. (Kodachrome).

3:50 Rainbow arch visible several miles northward on the left.

3:55 Rete Lake on left across Carcajou River.

4:01 Junction of Imperial River with Carcajou River on right. Red color visible in Fort Creek shale apparently due to burning. East and west dip visible and show reversal on Imperial anticline.

4:06 Visibility to west still poor. Head northeast across the Mackenzie River, and cross faulted anticline east of Oscar Creek to Oscar Lake. (Kodachrome).

4:20 Circle Oscar Lake, then fly south to upper Kelly Lake, where Cambrian section is exposed. This is rusty, well-bedded, apparently quartzite, has much steel-gray talus.

4:30 Land at Kelly Lake.

6:15 Return to Norman Wells. (Kodachrome).

Friday, August 8th.

8:20 a.m. Take off downstream from Norman Wells. Abandoned village of Canol visible on south bank.

8:26 Leave Mackenzie River off Rader Island, headed west.

8:30 Cross Devo Creek.

8:35 Cross Carcajou River above junction with Imperial River. Glacial linears trend northwest.

8:40 Follow Rankin Creek westward.

8:52 Cross south end of indented, heart-shaped lake.

8:58 Mountain River. Turn north. South dip visible in Cretaceous shale, on south flank of Imperial anticline. (Kodachrome).

9:06 Veer west along south flank of the Imperial anticline. (Kodachrome).

9:10 Mountain River gorge through the Imperial anticline. Ramparts limestone dips steeply south. (Kodachrome).

9:12 Cross Gayna River and axis of anticline. North dip in Ramparts limestone.

9:13 A knob of probable Silurian shows north dip.

9:17 Veer south through resistant section mapped as Imperial formation. Note rollover of Imperial anticline with Ramparts limestone forming an arch.

9:19 Touch bend of Gayna River, flying west, with dark Cretaceous shale in the north bank.

9:26 Cross Hume River north of a prominent scarp of Silurian limestone. Junction with large tributary north of Jule Lake. Bedding visible in Cretaceous rocks on left.

9:30 Fly along axis of syncline north of Imperial River anticline.

9:33 Cross lake near observation monument. Camp visible near monument.

9:36 Cross Ramparts River.

9:48 North dip in Cretaceous south of tributary of Arctic Red River.

9:52 Rollover visible in Cretaceous on Arctic Red River, shown by contact of dark shale with overlying yellowish sandstone. (Kodachrome).

9:53 North dip in Cretaceous on Arctic Red River.

9:56 Cross synclinal axis at stream cutoff.

10:02 Turn around at junction north of synclinal axis, follow Arctic Red River southward.

10:07 Veer east along south flank of anticline.

10:13 Tractor lines visible, appear less than five years old.

10:20 Cross Ramparts River.

10:27 North-south tractor road in area of numerous lakes winds eastward south of the easternmost lake. Hume River to the right.

10:33 Cross Hume River.

10:37 Cross Mountain River at bend, with West Mountain at 1 o'clock.

10:42 Sans Sault Rapids on left. (Kodachrome).

11:15 Land at Norman Wells to refuel.

11:40 Take off for Great Bear Lake. (Kodachrome).

11:54 Cross Prohibition Creek with Fort Creek shale burned red in cut. (Kodachrome).

12:06 p.m. Brackett Lake. Visibility limited.

12:44 Fox Point on left. Start across Keith Arm of Great Bear Lake. Visibility good.

1:00 Lionel Island. (Kodachromes).

1:40 Point Leith immediately on left.

1:50 Sawmill Bay on left.

1:58 Land at Gunbarrel Inlet after crossing Ordovician-Precambrian contact. Ordovician is gray limestone, badly shattered by frost action, but arranged in parallel ridges. Precambrian is mainly granite in knobs rounded by glacial action.

4:00 Take off for Yellowknife.

5:15 Pass Nazenau Lake. All Precambrian since leaving Gunbarrel Inlet.

5:26 Gray Rock uranium mine. Veer left for power plant.

5:35 Dam and power plant on Snare River. Veer south along power line past Big Spruce Lake.

6:40 Arrive Yellowknife, where the party remained overnight, returning to Calgary via Edmonton on commercial airlines on Saturday afternoon, arriving at Calgary 10:25 p.m., Saturday, August 9, 1958.



Champlin Oil & Refining Co.

INTER-OFFICE CORRESPONDENCE

TO: Mr. Ira H. Stein

PERMITS

2254-60

OFFICE: Calgary, Alberta

FROM: R. W. Mallory

DATE: August 14, 1958

SUBJECT: Reconnaissance Trip; Mackenzie Plains Area, Northwest Territories -
August 5th to 9th, 1958

In the absence of Mr. C. R. Nichols, Messrs. Rodgers and Mallory accompanied a reconnaissance flight by Messrs. Don Gould and Fred Brechtel of Geophoto into the subject area. This letter will summarize the results of geophoto work to date and this reconnaissance trip. A report of this trip is also being prepared by Geophoto. Please refer to Index Map of the Mackenzie Plains Area as prepared by Geophoto Services Limited for a location map of the areas to be discussed.

Geophoto had prepared preliminary maps of our several permit areas and the structural information on these maps, as well as in other areas which Geophoto had worked prior to the trip, appeared to be correctly mapped in nearly all instances. Because of poor weather in certain areas we were unable to examine certain stratigraphic problems which Geophoto had hoped to solve during this trip. In regard to our local permit areas we have the following comments.

Ram River

A large anticline with at least several hundred feet of closure which has been eroded well down into the Devonian or possibly into the top of the Silurian. The terrain is extremely rough with 1,500-foot canyons. A limited amount of field work to determine age of oldest beds exposed and to search for possible oil seeps would be appropriate.

Unnamed River

Our permit area appears to be northwest of possible closure on a large anticlinal feature which has been eroded at least into the Fort Creek shale. It may be advisable to acquire additional permits after maps have been inspected.

Redstone River

Several anticlinal folds in area with actual closure questionable. Portions of the permit are eroded at least into the Fort Creek shale.

Mirror Lake

Northeast dipping Pre-Fort Creek Beds outcrop at the southwest corner of the permit. There are few outcrop exposures over the rest of the permit which does have Devonian reef possibilities since the Fort Creek is covered. There is no nearby subsurface control, but, since the block is only 20 miles from Norman Wells it is considered of potential interest.



.....Continued

Mr. Ira H. Stein

August 14, 1958

Mountain River

These permits cover a portion of the large Imperial anticline in the core of which Pre-Fort Creek Beds are exposed. There appear to be local closures along this feature and it would be appropriate to search the crest of the anticline for oil seepages.

In addition to the permit areas we confirmed presence of a large surface anticline in Cretaceous Beds, located between the Red and Rampart Rivers between $100^{\circ} 30' W$ - $131^{\circ} 20' W$ and between $65^{\circ} 30' N$ - $65^{\circ} 40' N$. The terrain here is better drained than elsewhere in the Mackenzie Plains Project and a number of seismic trails were noted. It is believed that the Cretaceous structure reflects Pre-Cretaceous structure and, since this area should have the entire Fort Creek section present, we consider this feature of considerable interest.

In all of the above permit areas the best access for heavy equipment will probably be along river valleys in the winter months.

So far as general areas' interests are concerned we were impressed with: (1) The western portion of the assigned geophoto work (west of the Mountain River permits). This area has surface folds, good outcrops along rivers and it appeared that much of the area would be underlain by the entire Devonian section, including the Fort Creek (reef bearing) shale. (2) The area along the Mackenzie River between Garcajou Ridge and Fort Norman. This area is accessible, has the Fort Creek shale buried at shallow depth and, being close to Norman Wells, has good probability of reef development in the Fort Creek shale.

Conclusions

1. The one oil field in the Northwest Territories produces from a Devonian reef at shallow depth and was discovered by drilling near oil seeps. There is comparatively little knowledge available as to the extent of this or other possible reef trends.
2. Present topography is closely related to structure.
3. A legitimate structural and limited seismic program including the drilling of several well located test wells, has been carried out (as part of the Canol Project), so far with negative results.
4. The Devonian Fort Creek shale, with an approximate thickness of 2,000 feet, is the principal formation within which reef buildup in a shale section can be anticipated. Underlying the Fort Creek is a thick carbonate section (3,000 feet plus) of Devonian and Silurian Beds. Several porous zones are reported to be present and there is the possibility of reef facies development within the massive limestone sections.

.....Continued

Mr. Ira H. Stein

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5. To avoid heavy transportation expenses seismic and/or drilling activity should be confined to the immediate vicinity of the Mackenzie River and its main tributaries and a few other readily accessible areas. The search for oil reserves could further be limited to areas with drilling depths not over 4,000 feet.

Recommendations

1. Prepare photogeologic maps of permit areas (in progress).
2. Prepare photogeologic map of the west end of the photo coverage area west of $128^{\circ} 30'$ (in progress).

The following are tentative suggestions for future work following completion of the above items.

1. Extend Geophoto work (within present over-all photo coverage area) east to $125^{\circ} 30'$ and south to $64^{\circ} 30'$. This will provide coverage in the vicinity of the Norman Wells Field, which area we consider of greatest interest.
2. Extend Geophoto work south and east through remainder of photo coverage areas on a reconnaissance basis except in specific areas of interest where detail coverage should be obtained.
3. Make a stratigraphic study of the Mackenzie Plains Area, such study to include well data, literature and field work as necessary, with particular emphasis on the occurrences and trends of Devonian reefs.
4. Locate, examine and evaluate oil seepages within the Mackenzie Plains Area.
5. Attempt to obtain, rework and interpret any available seismic work in the area.
6. Carry out stratigraphic drilling program in readily accessible locations along the Mackenzie River northwest and southeast of Norman Wells.
7. Additional acreage acquisitions and possible droppings of portions of present permits should be considered when Geophoto maps become available.
8. Consideration should be given to deferring any additional large expenditures until the second 18 months of the permits in order to

.....Continued

Mr. Ira H. Stein

August 14, 1958

take full advantage of deposits which have been, or may be, made on
the permit acreage.

ORIGINAL SIGNED BY
R. W. MALLORY

R. W. MALLORY

RWM:hvp

c.c.: Mr. C. R. Nichols