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REPORT ON THE GEOLOGY

OF

PERMIT 5358

CAMSELL BEND AREA

NORTHWEST TERRITORIES

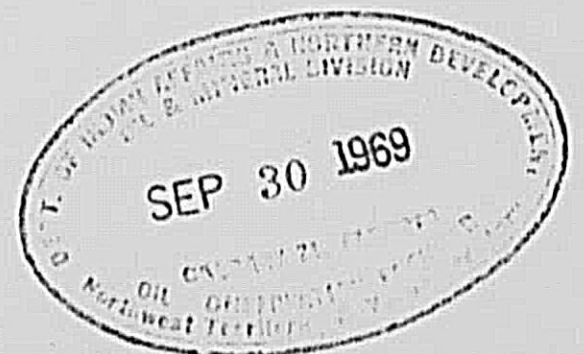
Prepared for

Ranger Oil (Canada) Ltd.

By

W. B. BRADY CONSULTING LTD.

November, 1968



INTRODUCTION

Northwest Territories Exploration Permit 5380 is located between $62^{\circ} 10'$ and $62^{\circ} 20'$ North latitude, $123^{\circ} 45'$ and $124^{\circ} 00'$ West longitude, approximately 10 miles west of Camsell Bend on the Mackenzie River. The permit area contains 59,640 acres, and was filed upon by Ranger Oil (Canada) Ltd. in October, 1966. The major portion of the permit lands are located immediately west of the Ram Thrust, in the area occupied by English Chief Syncline. This study was initiated for the purpose of evaluating the economic potential of the Permit area.

2 Maps enclosed

GENERAL GEOLOGY

The subject permit is located within the Camsell Range of the Franklin Mountains, and close to the boundary between the Cordilleran and Plains geological provinces.

Rocks exposed at the surface within the study area are mainly of Devonian Age, and include formations from Arnica up to un-named Mississippian or Cretaceous shales. The structure of the area is expressed mainly as a series of rather broad folds, broken by thrust and normal faulting. The major fold axes are those of Yohin Syncline, Ram Anticline, and English Chief Syncline. The Camsell Thrust is the major fault of the area, the Ram Thrust underlies Ram Plateau, and its trace is nearly coincident with the axis of the Ram Anticline. The map herewith presented is adapted from Geological Survey of Canada Map 22-1961, Camsell Bend, with minor additions and interpretations inserted by the writer. These amendments are derived from personal observations in the field.

STRATIGRAPHIC SUMMARY

The oldest rocks exposed in the vicinity of Permit 5350 are ascribed to the Arnica formation of Lower and/or Middle Devonian Age. These strata consist of about 1,400 feet of dark grey to black, fine to crypto-grained dolomite, generally massive bedded, and with intergranular and vuggy porosity.

The Arnica is locally overlain by the Manitou formation, which consists of about 150 feet of massive, dark grey, coarsely crystalline dolomite. The Manitou and Arnica formations taken together are in part equivalent to the Funeral formation, and also to the Bear Rock formation.

The Headless formation locally overlies the Manitou, and is taken as including about 211 feet of dark grey, argillaceous, fossiliferous, fine to crypto-grained thinly bedded limestone, with interbeds of calcareous grey shale. It was formerly considered to be the basal unit of the Nahanni

formation, but in current usage, these strata are elevated to the status of a formation.

The Nahanni formation is the main ridge and upland forming unit of the study area. Its thickness is quite variable, but is reported to be about 360 feet in the Camsell Range, where it consists of grey, medium to coarse crystalline, medium to massive bedded limestone, with interbeds of grey argillaceous limestone. The base of the Nahanni is gradational with the underlying Headless formation.

The Horn River formation overlies the Nahanni, perhaps disconformably, and is the lowest formation of Upper Devonian Age. The Horn River is in turn overlain by the Fort Simpson formation which locally consists of approximately 2,500 feet of dark grey shale and mudstone, with interbeds of limestone, calcareous siltstone and sandstone. The shales, which predominate in the lower half of the formation, are

non-calcareous; the mudstones, which make up the major percentage of the upper half, are calcareous and silty. These beds are gradational to the map unit designated 'Upper Devonian Sandstone Unit', which is about 650 feet in thickness, and consists of olive-grey shale interbedded with calcareous sandstone and siltstone. The next higher member is here termed 'Calcareous Sandstone Unit', and corresponds to Map-Unit 21 of Douglas and Norris, 1961. It consists of 660 feet of grey and greenish-grey thickly bedded calcareous sandstone, with interbeds of greenish-grey mudstone and siltstone, and thin stringers of grey finely crystalline limestone. Map Unit 22, here indicated as 'Upper Devonian Undivided', consists of the Upper Devonian Sandstone Unit, plus the Calcareous Sandstone Unit. This grouping is made in areas where the two component units are poorly exposed, and hence not subject to accurate mapping.

The Upper Devonian Shale Unit overlies the Calcareous Sandstone Unit, and consists of approximately 700 feet of greenish-grey and grey calcareous silty shale, with thin bands of fine-grained silty limestone and stringers of siltstone and fine-grained sandstone.

The Upper Devonian Siltstone Unit contains strata of late Fammenian Age, which are the youngest Devonian strata in the vicinity. This unit has a thickness of about 575 feet, and consists of argillaceous, calcareous siltstone with shale interbeds, grading upward into grey-brown, argillaceous, thinly bedded limestone.

Post - Devonian

A small area located near the northeast corner of the permit contains about 100 feet of non-fossiliferous grey shale, which lie above the Upper Devonian Siltstone Unit. The age of

these shales is unknown, but is possibly Mississippian, or even Cretaceous.

STRUCTURAL GEOLOGY

The structure of the Camsell Range is that of a westward dipping homocline, expressed in rocks of Middle and Upper Devonian age. It is underlain by the Camsell Thrust, which at its trace has a nearly flat to gentle west dip. The Ram Thrust may be a branch of the Camsell Thrust, but this is by no means certain. The fault diminishes in a northward direction and disappears near Carlson Lake, almost exactly on strike of the axis of Ram Anticline. Both features, the fault and the anticline, are probably the direct effects of the same tectonic event, and perhaps should be considered as being the same structure.

Within the permit area, the Ram structure dips eastward into Yohin Syncline, and westward into English Chief

Syncline. The plunge of the Ram structure is gently northward, and all strata down to and including the Arnica are exposed at surface on Ram Plateau. In addition, the same beds are exposed above the Camsell Thrust, and also in the core of English Chief Anticline, located a short distance west of the permit lands.

The permit acreage is almost entirely occupied by English Chief Syncline, and by Ram Plateau. In view of the structural disposition of the Devonian strata, and the deep breaching of the elevated portions, it appears highly improbable that any hydrocarbons will be found in those beds.

Very little is known of the pre-Arnica stratigraphy within the Permit lands. Strata as old as Sunblood formation of Ordovician Age crop out in Whittaker Range, approximately 25 miles to the west. In this area porosity is scarce, as it is also in the subsurface to the north.

Shell West Wrigley G-70, located at $63^{\circ} 09' 17''$ North latitude, $124^{\circ} 11' 50''$ West longitude and located in the same structural basin as in the permit acreage, tested the Whittaker formation and recovered only 455 feet of mud-cut slightly salt water. Porosity in the entire pre-Arnica section is very poor, and scattered. There is very little reason to believe that any improvement may be expected in the vicinity of the permit.

SUMMARY AND RECOMMENDATIONS

Strata ranging in age from possible Cretaceous to Lower Middle Devonian are exposed at surface in the vicinity of Permit 5350. The permit lands are located mainly in English Chief Syncline, and the remainder are on Ram Plateau, where all strata of Arnica age and younger are breached by erosion. The west flank of English Chief Syncline is poor prospecting ground, because the same series is exposed in

the core of the conjugate English Chief Anticline.

Where pre-Arnica beds are exposed or have been penetrated by drilling, porosity has been observed to be poor.

It appears that the probability of finding hydrocarbons within the boundaries of Permit 5350 is very small, and it is therefore recommended that the Permit be dropped.

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REFERENCES

DOUGLAS, R. J. W., and NORRIS, D. K., 1960, "Virginia Falls and Sibbertson Lake Map-Areas, Northwest Territories". G.S.C. Paper 60-19, 95F and 95G.

....., 1961, "Camsell Bend and Root River Map-Areas, District of Mackenzie, Northwest Territories". G.S.C. Paper 61-13, 95J & K.

REPORT ON
PHOTOGEOLOGICAL INVESTIGATION

KEELE RIVER AREA
(Permit 5407 and 5408)

Northwest Territories

Prepared for
Ranger Oil (Canada) Ltd.

By
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Calgary, Alberta

November, 1968

INTRODUCTION

Northwest Territories Exploration Permits numbered 5407 and 5408, held by Ranger Oil (Canada) Ltd. are located north of Keele River, at latitude $64^{\circ} 15'$ North, longitude $126^{\circ} 00'$ West. The two permits contain a total of approximately 55,946 acres. The land was filed upon by Ranger Oil (Canada) Ltd. in October, 1966, and this study was undertaken at the request of that company for the purpose of ascertaining the geological characteristics of the area, especially as regards to its petroleum possibilities.

The study area is located near the eastern edge of the Mackenzie Mountains. The major structural feature of the vicinity are Summit Anticline and Red Dog Syncline.

STRATIGRAPHY

Very little has been published pertaining to the stratigraphy of the area. The Geological Survey of Canada has not yet mapped the area, and the writer knows of no other pertinent literature. The following stratigraphic summary is derived from reports on the geology of nearby areas, as published by the Geological Survey, and from field observations by W. B. Brady and others. The oldest rocks exposed in the area reach the surface in the core of Summit Anticline. These strata are probably of Silurian age, or older, and may correspond at least in part to the Ronning Formation. They consist mainly of carbonates, with minor shale beds, especially at the top of the unit, and exhibit a massive appearance in photographs. These strata are overlain by a unit consisting of limestone breccia, of massive appearance, probably equivalent to the Bear Rock formation of Lower and/or Middle Devonian age.

This unit forms the lateral ridges of Summit Anticline, and has a thickness estimated to be in the order of 2,800 feet. In the Mackenzie Mountains to the south, the Bear Rock formation consists mainly of limestone and dolomite, massive to unbedded, brecciated, and attaining a thickness of about 1,000 feet. The upper part of the formation is resistant, and forms ridges, but the lower portion is much more recessive.

The next higher unit consists of a series of alternating resistant and recessive limestone beds, attaining a thickness of approximately 1,000 feet. It is considered to be the Nahanni formation, and is present on the flanks of Summit Anticline, where it has been eroded into a series of flatirons.

On Rouge Range the thickness of the Nahanni is 750 feet; on Redstone Range, Douglas and Norris ascribe 380 feet of strata, plus an undetermined thickness of covered interval, to the Nahanni formation.

The Nahanni is overlain by a series of black shales, approximately 100 feet thick, tentatively ascribed to the Horn River Formation of Upper Devonian Age. The Horn River Formation is in turn overlain by the Fort Simpson Formation of approximately 2,000 feet thick. The shales are soft and recessive, and are believed to underlie the area located between the Nahanni outcrops on the northeast flank of Summit Anticline, and the bed of Summit Creek.

East of Summit Creek, the surface appears to be formed on Mesozoic beds, probably of Cretaceous Age. These strata consist mainly of shales, with minor amounts of sandstone. The sandstones occur in zones, interbedded with shale, and form ridges and cappings on hilltops. There are indications that the Cretaceous has a slightly more westerly strike than do the underlying Mesozoic beds. The thickness of the Cretaceous beds

in the permit area is not known, but is estimated to be at least 2,000 feet. The main sandstone unit has a thickness estimated at 400 feet, and occurs about 1,000 feet above the base of the Cretaceous. Other thinner sandstone or siltstone units occur at variable intervals lower in the section, and form low, persistent ridges and lineaments, especially in the central portion of the permit area.

Northward and northwestward of the permit area, near the head of Tertiary Creek and south of Summit Lake, strata of probable Tertiary age form the surface. These beds are poorly exposed, and appear to be nearly flat-lying sandstones with only a very low dip to the north.

STRUCTURAL GEOLOGY

The subject permits are located mainly upon the western edge of the Mackenzie Plain, but at their western end include a portion of the Canyon Ranges of the Mackenzie Mountains. The local tectonic habit is folding, and although faulting may be present, no faults traces were observed. It is possible that a thrust fault reaches the surface in the valley of Summit Creek, but if so, its' trace is obscured by alluvium.

The main structural element in the Permit area is Summit Anticline, a large southeastwardly plunging fold, expressed mainly in Paleozoic rocks. The anticline is breached along its' axis, exposing beds probably of Silurian age and possibly even older, in the axial region. The fold is assymetrical, the east flank dips at angles

of 40 to 50 degrees, the west flank at 20 to 30 degrees. The southeastward plunge is fairly gentle, in the order of 5 degrees. The northwestward extension of the fold was not studied, but it appears to be overlapped by beds of probable Tertiary age. Summit Creek lies in a strike valley which follows the outline of the anticlinal fold. A change of strike occurs as the valley is crossed in an eastward direction, attitudes being somewhat more westerly than on the anticlinal plunge. This may be due to the presence of faulting in the valley bottom, or as previously mentioned, to an unconformity between Paleozoic and Mesozoic strata. East of Summit Creek, northeast dips of 10 to 25 degrees persist as far as the axis of "Red Dog Syncline". This is a broad, open fold, the axis of which trends parallel to Summit Anticline. Photo dips indicate that a depression of the synclinal axis may occur near the north boundary of

the permit. A small, rather indistinct, anticlinal fold is developed at a short distance east of the synclinal axis, near the southeast corner of the Permits. This anticline appears to be of low structural relief, and probably is not of importance at the Paleozoic horizon.

SUMMARY AND CONCLUSIONS

Northwest Territories Exploration Permits 5407 and 5408, are located in the belt of folding adjacent to the eastern edge of the Canyon Ranges of the Mackenzie Mountains. A large anticline-syncline pair crosses the permits in a northwesterly direction. Strata exposed at the surface range in age from Tertiary to possible Ordovician. It is highly improbable that any hydrocarbon entrapment exists within the area studied, because of the deep stratigraphic

breaching on Summit Anticline. It is recommended that no further

work be undertaken on these permits.

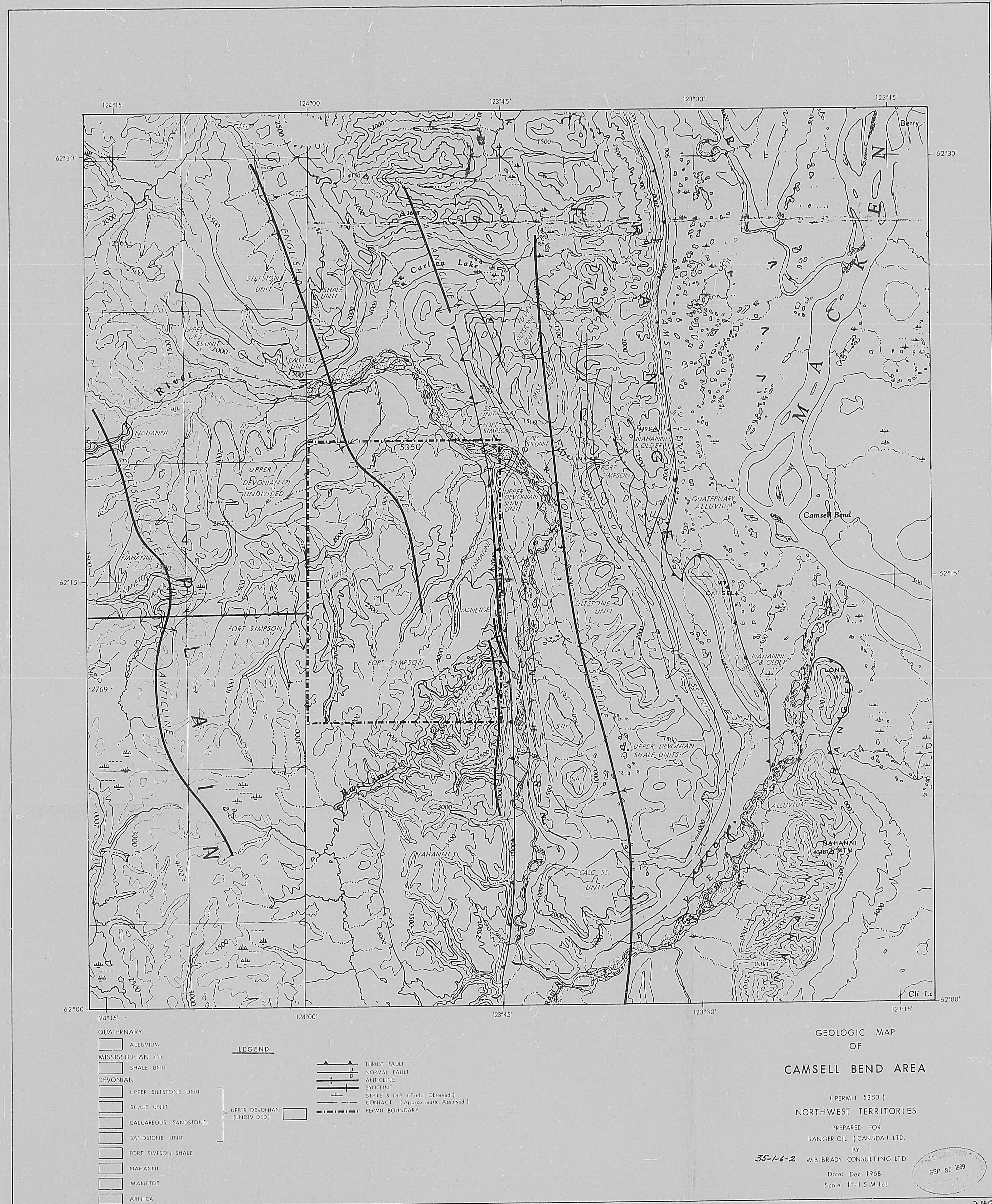
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