GEOLOGICAL REPORT

PERMIT 2858

NORTHWEST TERRITORIES

PREPARED FOR

PAYSON-COWELL SYNDICATE

by

D. BRUCE BULLOCK & ASSOCIATES LTD.

CONSULTING GEOLOGISTS
CALGARY, Alberta
November, 1960

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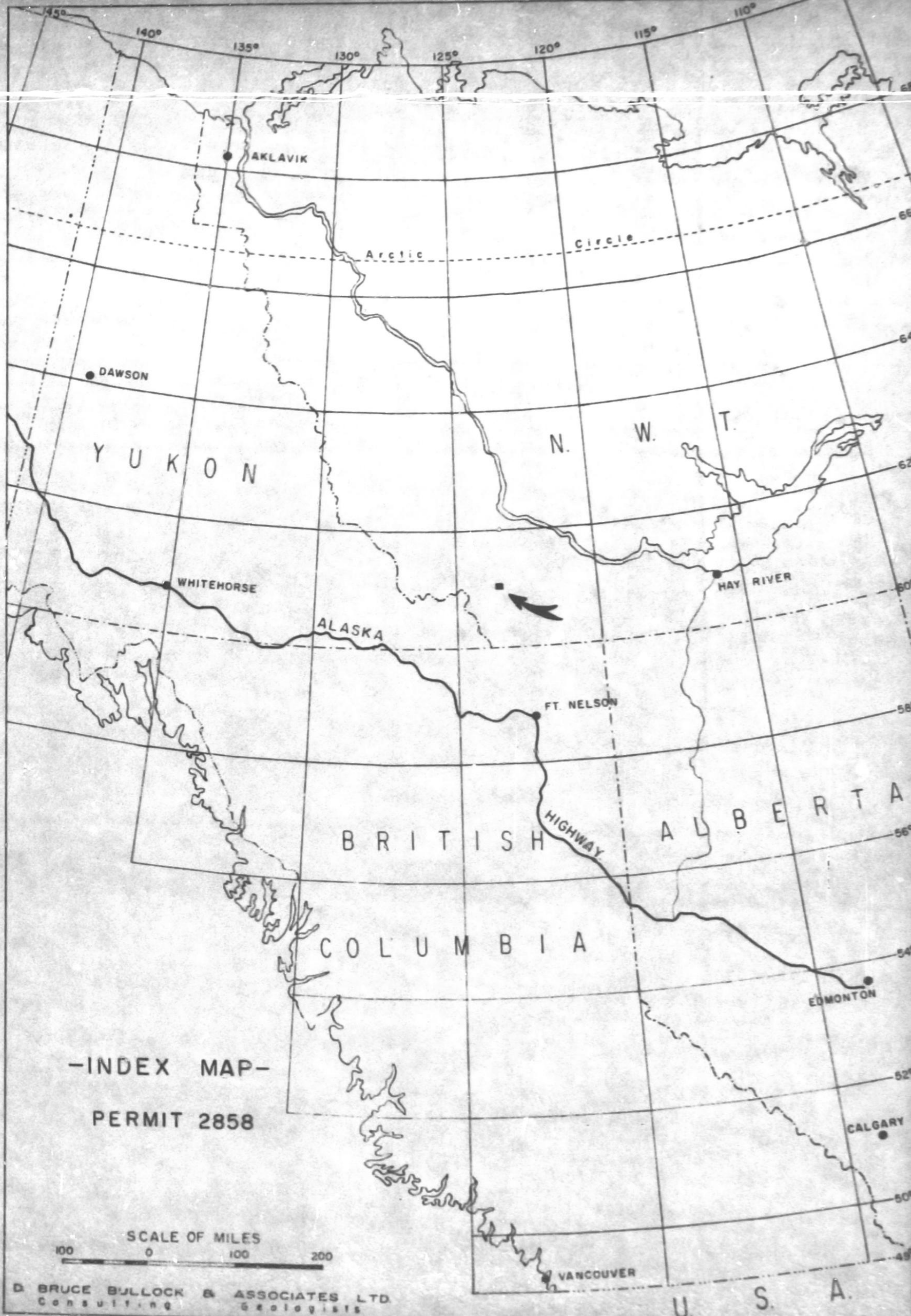
145°
140°
135°
130°
125°
120°
115°
110°
AKLAVIK
Arctic Circle
DAWSON
YUKON
N. W. T.
WHITEHORSE
HAY RIVER
ALASKA
FT. NELSON
HIGHWAY
BRITISH COLUMBIA
ALBERTA
EDMONTON
CALGARY
VANCOUVER
U. S. A.
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PERMIT 2858
SCALE OF MILES
100 0 100 200
D. BRUCE BULLOCK & ASSOCIATES LTD.
Consulting Geologists

INTRODUCTION

This report details with work which has been carried out on the southern part of Permit 2858.

D. Bruce Bullock & Associates Ltd. were operating in the general area during the summer of 1960, from May 29 to July 18, 1960, the party was based at Nahanni Butte. While camped at Nahanni Butte the party chief - G.K. Williams - carried out the work pertaining to this permit, which consisted of a reconnaissance of the permit area on July 13 and a stratigraphic section measured on Turner Mountain on July 18, 1960.

For transportation a Model "J" Bell helicopter was used, supplied by Bullock Wings & Rotors Ltd. and flown by E.J. Amann.

The geology of the general area in which Permit 2858 is situated has been mapped and published (C. O. Hage, G. S. C. paper 44-22). Because of the paucity of outcrop on the southern half of the permit, and the fact that the general geological setting is published, work done this year concentrated on the stratigraphy, especially Middle Devonian rocks exposed nearest the permit.

PREVIOUS WORK

This area was mapped in 1943 by C.O. Hage and his work is published in G.S.C. paper 44-22. The Geological Survey of Canada covered a large area in 1958 in Operation Mackenzie; the map sheet which includes the permit is expected to be published this winter. The Liard map sheet, just south of the permit is published in G.S.C. paper 59-6 by R.J.W. Douglass.

LOCATION AND ACCESSIBILITY

Permit 2858, N.E. corner, latitude 61° 10' N, longitude 123° 15' W, is situated at the junction of the South Nahanni and Liard Rivers. Access into the permit is possible by river barge from Fort Nelson in British Columbia, a distance of approximately 250 river miles. The season of navigation lasts from about June 1 to September 30. Float planes are able to land on the Nahanni River, at its mouth. Recently an air strip has been constructed on the south side of the Nahanni River, this strip will be used by large freight aircraft during winter months.

PHYSIOGRAPHY

The Nahanni River flows around the southern end of the Nahanni Range and joins the Liard River in the permit area. The Nahanni Range rises to an elevation of nearly 4, 500 feet, 3, 500 feet above the lowlands; this range is present in the northern part of the permit. A small ridge rising 350 feet is present in the western part of the permit. The southeastern portion of the permit, roughly two-thirds of the area, are in the low flat river valley; it is thickly forested by large spruce and poplar trees.

STRATIGRAPHY

Strata from Silurian to Mississippian outcrop within or near the permit area. The stratigraphic section to be expected in the subsurface is as follows:

TABLE OF FORMATIONS

Mississippian — up to 1,500 feet

Upper part contains argillaceous limestone, crinoidal limestone and shale, lower part grey shale with a basal sandstone or siltstone. If Mississippian rocks are present in the subsurface probably they would be only the lower or shale beds.

Upper Devonian — 4,000 feet (?)

Grey and green shale, basal black shale.

Middle Devonian

Nahanni Formation — 650 feet

Upper part dense limestone, lower part coarse dolomite with porosity.

Lone Mountain Formation — 1,400 feet

Banded light and dark dolomite, mostly micro-crystalline, coarse porous dolomite in upper-part.

Basal Sandstone — 100 feet

Quartzitic sandstone, sandy dolomite.

Silurian - Ordovician — 1,400 feet

Micro-crystalline dolomite, dark, fine to medium crystalline dolomite, some vuggy reef layers.

Cambrian - Ordovician — 600 feet +

Quartzitic sandstone, silty dolomite, red-weathering.

CAMBRIAN - ORDOVICIAN

Rocks mapped as Cambrian are found in the Nahanni Range, fifty miles north of the permit. Six hundred feet are present, with the base not exposed. The lithology is quartzite and red weathering silty dolomite. No fossils were found, so the age may be younger than Cambrian.

ORDOVICIAN - SILURIAN

Overlying the Cambrian are about 1,400 feet of dolomite, Ordovician fossils occur near the base of the unit. Silurian strata may be present within this unit. At the base of the unit are several stromatopora and coral beds in poor reef layers with some vuggy porosity. The upper part of the section consists of tight silty dolomite.

MIDDLE DEVONIAN

As rocks of this age contain the most prospective reservoir horizons, they were studied in detail near Nahanni Butte, a graphic log is presented with this report. We recognize a basal sandstone and two formations, the Lone Mountain and Nahanni formations. The basal sandstone is 130 feet thick, it unconformably overlies the older rocks.

The Lone Mountain formation is 1,970 feet thick, and is divisible into three members. The basal 300 feet consist of light weathering, light grey, dense dolomite. The middle unit is 1,410 feet thick and consists of similar dolomite interbedded with dark beds, giving the unit a banded appearance. The dark beds often contain traces of organic matter, including fragments of fossils. The upper part of this banded unit contains several layers of breccia, several bands with fine to medium crystalline dolomite with poor porosity. The upper unit of the Lone Mountain formation, Unit M, is 260 feet thick and consists of coarse to very coarse crystalline, thick bedded to massive dolomite, with some good porosity.

The Nahanni formation in the area of the permit contains three members. The lower unit ("Watt Mt." on the log) is 100 feet thick. It is a variable unit with marked lateral and vertical variations from dense limestone to coarse dolomite. There are several shale bands of an inch or more in thickness. In the Nahanni Butte area there may be a

disconformity at the base of the "Watt Mt." member. The middle member of the Nahanni formation is 200 feet of well bedded, coarse dolomite, with some good porosity. The upper member of the formation is mostly limestone with some dolomite beds. Although corals and stromatopora form several reef layers, these are usually tight. The limestone is commonly very fine grained and tight.

UPPER DEVONIAN

About 100 feet of black shale overlies the Nahanni on Nahanni Butte. Aside from these shales there are only a few widely scattered outcrops of green or grey shale. Although limestone forms a large part of the Upper Devonian in the plains area east of the permit, no limestone is believed to be present in the Nahanni area. The reason for this belief is that the broad valley west of the Nahanni Range, which is underlain by Upper Devonian, contains no ridges or topography which would suggest

any lithology other than soft shale. The width of this valley is the basis of estimating a thickness in the order of 4,000 feet, of course this estimate may be too high as a result of hidden structure in the valley.

MISSISSIPPIAN

West of the permit there are thick Mississippian deposits outcropping in the mountains. Pre-Cretaceous erosion removed most of the Mississippian in the area near the permit. If Mississippian strata are present beneath the permit they will be the lower portion only which is soft dark shale and silty shale.

STRUCTURE

The Nahanni Range is formed of Middle Devonian and older carbonates, the range strikes north - south and dips to the west from 20° - 45°. A thrust fault bounds the range on the east; the vertical throw is at least 5,000 feet, the dip of the fault is to the west, its angle unknown. Strata east of the fault are Upper Devonian shale and possibly younger beds. The range plunges to the south; in the centre of permit 2858 the range ends abruptly in the half dome shaped mountain named Nahanni Butte. A continuation of the Nahanni Range structure continues south through the permit but is offset to the west from the main range, it also plunges south and is soon lost as a topographic feature.

The majority of the south half of permit 2858 lies south and east of the mountainous structures. As there are no outcrops the structure is unknown. As the area is

close to mountain structures the upper shales are no doubt badly folded, possibly overturned near the faults. The competent carbonates at depth however are probably not severely deformed.

SUMMARY AND CONCLUSIONS

Investigations of the stratigraphy in the Nahanni Range show that excellent reservoir rocks are present in the Middle Devonian beds. Less favourable but still prospective reservoir horizons occur in the Ordovician - Silurian. In the Middle Devonian exposed along Nahanni Range, the reservoir quality of the beds improve from north to south, and have a maximum development near Nahanni Butte. Good porosity can be expected in the subsurface in the area adjacent to the Butte, lying to the east and south. Structure of the plains area in and near the permit cannot be determined by surface mapping. The southern half of permit 2858 is adjacent to a disruption in the Nahanni Mountain range and complex structure can be anticipated in the subsurface.

G. Keith Williams

G. Keith Williams, P. Eng.

D. Bruce Bullock

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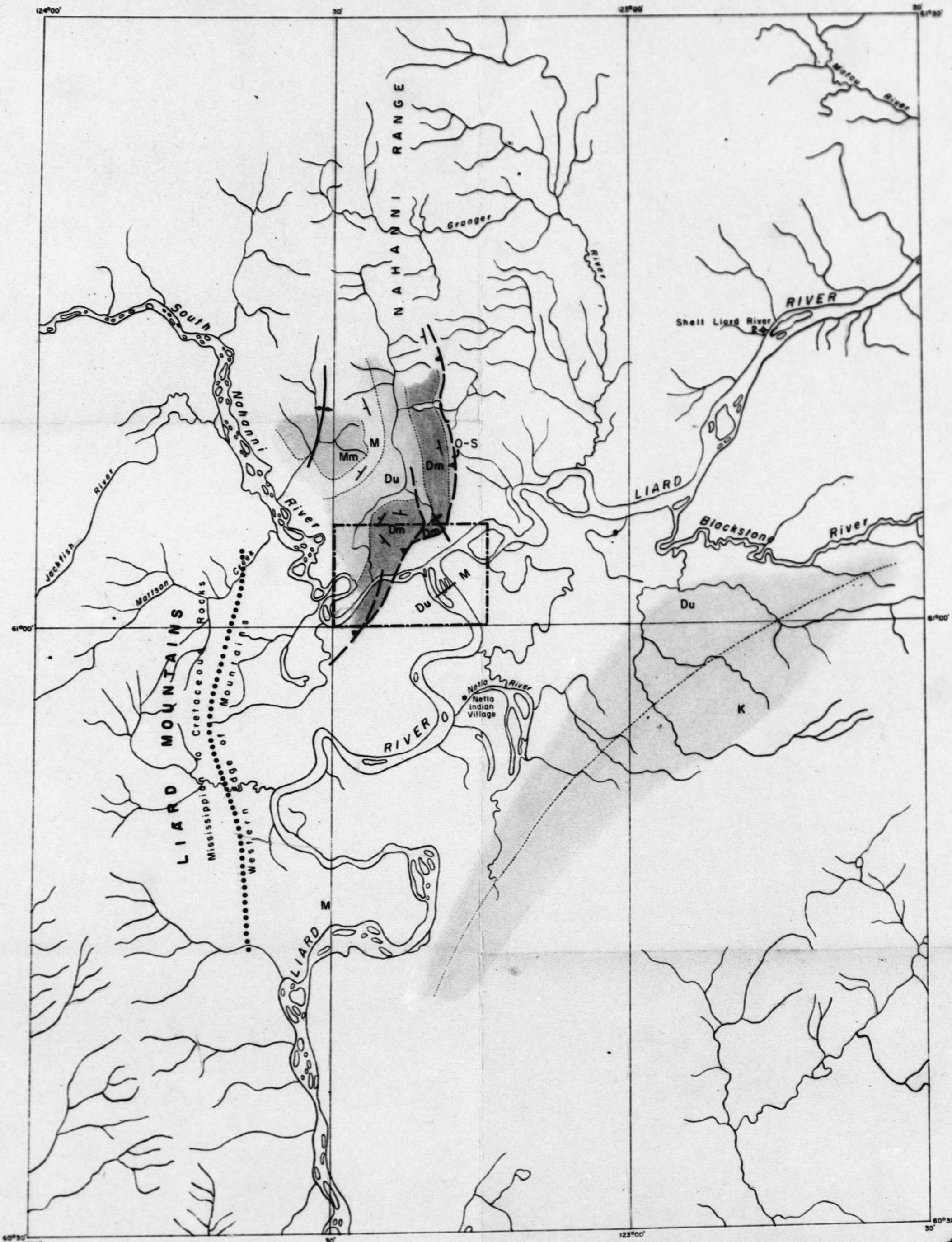

-LEGEND-

K	CRETACEOUS
	MISSISSIPPIAN
Mm	Mattson formation
M	Mississippian unnamed
Du	UPPER DEVONIAN
Dm	MIDDLE DEVONIAN
O-S	ORDOVICIAN – SILURIAN
-----	PERMIT 2858 (S) BOUNDARIES

To accompany Geological Report to Payson-Cowell Synd., November, 1960

GEOLOGICAL MAP
PERMIT 2858
NAHANNI BUTTE AREA
N.W.T.

SCALE : 1 inch to 4 miles

November, 1960

578-1-1-2

Fig 2

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