STRATIGRAPHY

OF THE

LIARD PLATEAU AREA

Imperial Oil Ltd.

1962

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INTRODUCTION

Area Covered

The Liard Plateau Area is located between Latitudes 60°00' N. and 61°30' N. It is bounded on the east by the Liard River, and on the west by 126° W. Longitude. The principal area of investigation during the 1962 field season comprises some 6,000 square miles on the eastern portion of the plateau. (Fig. 1).

Accessibility

Access to this region in summer is difficult, except by float-equipped aircraft operating either from fixed bases such as Fort Nelson, British Columbia, or from previously prepared facilities at convenient points along the Alaska Highway and at settlements along navigable rivers.

Access in winter is feasible by "cat train", or by truck along seismic trails and "winter roads", built to drilling locations.

Purpose of Study

The purpose of the 1962 field work was to gather stratigraphic data on the Upper Paleozoic, Mattson Formation, and to gain more information about the Devonian rocks. The rocks were

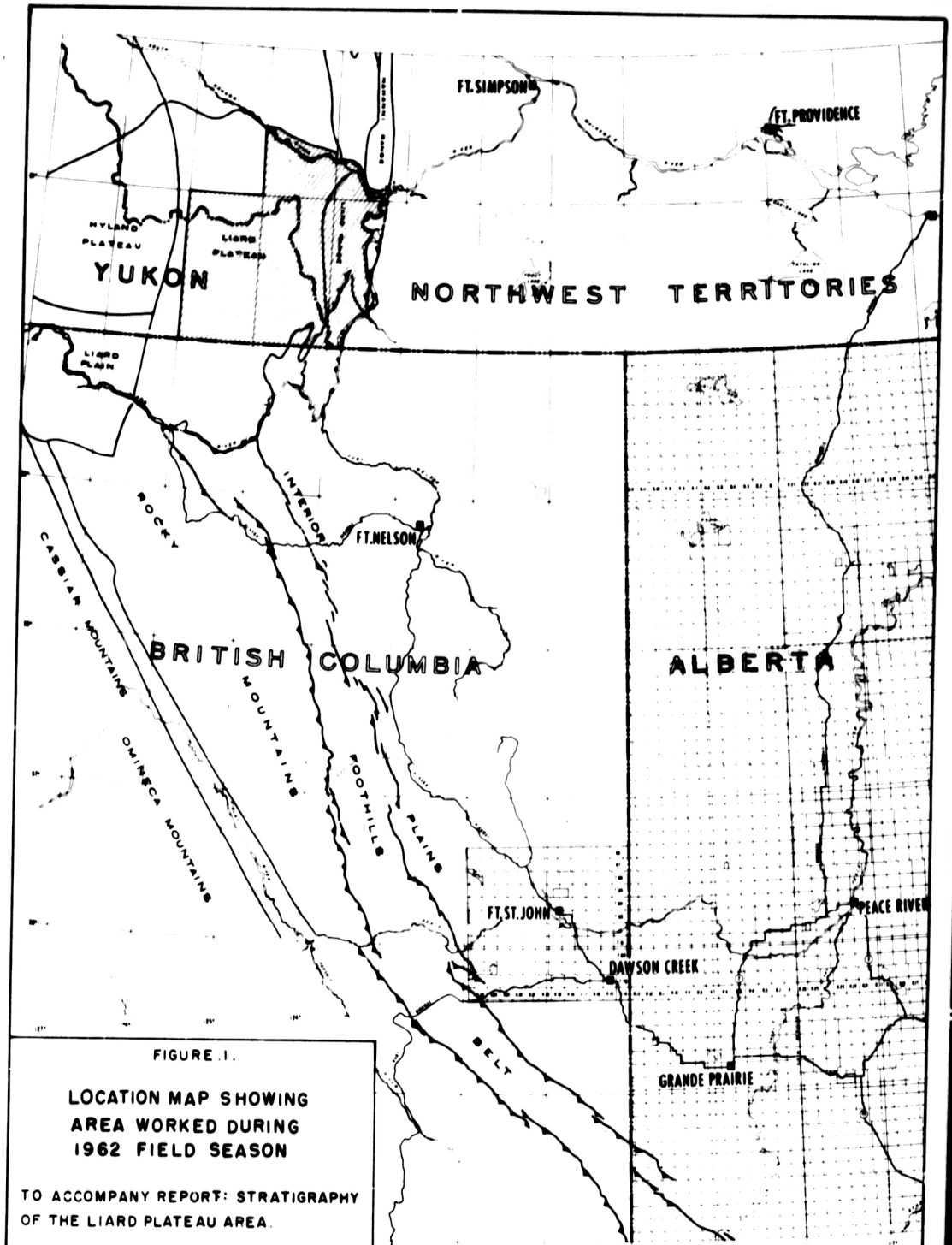

FIGURE 1.

LOCATION MAP SHOWING
AREA WORKED DURING
1962 FIELD SEASON

TO ACCOMPANY REPORT: STRATIGRAPHY OF THE LIARD PLATEAU AREA.

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studied most extensively by means of measured sections. Outcrop sections with rocks of pre-Devonian, Devonian, Mississippian, Pennsylvanian, Permian, Triassic, and Cretaceous ages were studied at various locations. Outcroppings of rocks ranging from the Proterozoic to Cretaceous were inspected in the course of helicopter reconnaissances.

The studies were performed to evaluate Northwest Territories Permit No. 1143, held by Imperial Oil Limited.

Method of Study

Crew.--A seven man geological party spent more than seven weeks, between the latter part of May and July 24, 1962, in the field. Support aircraft included a Hiller 12-E helicopter, on charter from Okanagan Air Services, and Imperial Oil's Otter aircraft.

Base Camps.--The project area was worked from a base camp on Larsen Lake, Yukon Territory. The crew, equipment, and non-perishable supplies were transported from Dawson Creek, British Columbia to Liard River Cabins at Mile 496, Alaska Highway by truck and car. They were then flown to Larsen Lake by the Company's float-equipped Otter aircraft, operating off the Liard River. Additional supplies of gasoline were transported by truck to Muncho Lake, on the Alaska Highway, from where the Otter could operate more safely than from the Liard River. Weekly

supply trips by the Otter brought perishable goods from Dawson Creek to Larsen Lake.

Work in the extreme northeastern part of the area was aided by a gas cache at the confluence of Liard and South Nahanni Rivers at South Nahanni. This gas was barged, by Dick Turner of South Nahanni, from Fort Nelson via way of the Nelson and Liard River system.

Communications.--Communications were maintained by a Spilsbury and Tindall TRT-300 transistorized radio powered by a heavy duty 12-volt wet battery. This radio provided direct communication with Company radio facilities at Fort Nelson and Dawson Creek and Canadian National Telegraphs radio-telephone installations at Fort Nelson and Blueberry, B.C. In addition, the same radio provided ground-to-air contact with aircraft used in operations, ensuring both a greater degree of safety and more efficient usage.

Base camp to fly camp radio schedules were maintained twice daily. The fly camp radios were Spilsbury and Tindall PRT-20 transistorized transceivers powered by two 90-volt 'B' batteries and six 'D' size flashlight cells. These light, small radios radiate one and one-half watts of radio energy when properly tuned and loaded with the correct antenna. The performance of these radios was most satisfactory. Their use saved many hours of helicopter time -- flights to check fly camps daily

were eliminated, supplies for fly camps could be ordered when needed and requests for moves or information about local weather could be transmitted, thus increasing the efficiency of the overall operation.

Weather.--Generally good weather prevailed through July, with most of the fifteen "weather days" recorded occurring in June. It was noted that local weather varied greatly within the area.

Operations.--The field party was subdivided into three sub-crews, each with two men, a senior geologist and a junior assistant. They operated mainly from fly camps, engaged in measuring sections. After each section was completed these sub-crews returned to base camp to write up field notes and plot logs of the outcrop section. The duration of the fly camps varied from two days to two weeks.

Sections measured were sampled at ten foot intervals. Measurements were accomplished using tape and brunton, plane-table, or jacob's staff. Quality of the exposures was poor to fair, with the best exposures occurring in creek beds or along ridges above tree-line.

Stratigraphic reconnaissance was done by the party chief, using the helicopter. Some early stages of reconnaissance were accomplished with the Otter.

Flying hours for the helicopter totalled 140 hours, and approximately 50 hours were flown by the Otter.

Previous Investigations

Several reports about the geology of the area have been published. Among these, reports by Douglas and Norris, (1959, 1960), Hage (1945), and Stott (1960) are most pertinent. Many oil companies have conducted geological studies on the Liard Plateau and adjacent areas. Recent drilling in the Liard Plateau has indicated the existence of petroleum reserves. The actual potential of the area is, however, unknown.

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General Remarks

Rocks ranging in age from Proterozoic to Upper Cretaceous occur in the area. The sedimentary section is estimated to have a thickness of approximately 20,000 feet. This total thickness will not be encountered in any one locality because of local erosion or non-deposition.

The interpreted stratigraphic section for the Liard Plateau is well presented by Douglas and Norris (1959, p. 5). A Table of Formations (Fig. 2) shows the divisions made, as well as the lithology and thickness of the units as recognized for this report. Locations of sections measured in 1962 and the line of a stratigraphic cross section are indicated on one of the maps accompanying this report (in pocket). A second map shows the

Figure 2

TABLE OF FORMATIONS

Era	Period or Epoch	Group, formation, map unit	Lithology	Thickness (feet)
MESOZOIC	Lower and Upper Cretaceous		Shale - sandstone sequence with basal conglomerate in many places.	3300 to 6300
	Triassic		Micaceous, silty shales	0 to 60±
PALAEOZOIC	Permian	Trophet Formation	Dark cherts and mudstones	400±
	Carboniferous and Permian	Sattson Formation	Limestones, limy dolomite, becoming increasingly shaly towards base.	0 to 4500
	Devonian and Mississippian	Besa R. Formation "Mississippian Limestone"	Limestone with numerous interbeds of shale and shaly siltstone.	0 to 2000±
		Besa R. Formation	Shale, limy, silty	3000+
	Middle Devonian and older	Mahamil Formation	Limestone, dark grey, medium bedded, shaly.	700±
			Dolomites, banded, dark and medium grey, undivided.	5000+
			Quartzite conglomerate, massive boulder conglomerate.	100+
			Unconformity	
PROTEROZOIC			Argillites, thinly bedded, platy, green.	

To accompany report:
"Stratigraphy of the Liard Plateau Area"
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thickness and distribution of the Mattson Formation. Also included is a stratigraphic cross section showing the relationships among the rocks in the principal sections measured.

Proterozoic

Precambrian rocks were not definitely identified. The lower-most rocks exposed in the area occur in the west. These are thinly bedded, platy argillites overlain unconformably by a massive conglomerate.

Paleozoic

Middle Devonian and Older

A massive boulder conglomerate which is thought to represent earliest Paleozoic deposition is exposed in the southwest part of the area. Definite age criteria are not known, however, the angular relationship with the underlying rocks and the lithology suggest that this is a basal, early Paleozoic deposit.

Banded, dark and medium grey dolomites are found at several localities in the southwest and northeast portions of the area. Their stratigraphic position suggest Ordovician or Silurian age. The thickness can only be estimated because of the folding and faulting which affects these rocks. There appears to be more than 5000 feet of section represented by these rocks.

The Ordovician-Silurian dolomites, in the northeast part

of the area, grade upwards into dark grey, medium bedded limestones. These limestones have been named Nahanni Formation by Hage (1945, p. 5) and are thought to be Middle Devonian or older. They grade laterally into shaly limestones and shales toward the south and west.

Devonian and Mississippian

Above the Nahanni Formation there is a succession of dark shales, shaly limestones, and fine grained, thin beds of sandstone and siltstone. These rocks (Douglas and Norris, 1959, map units 4, 5, and 6) represent an interval from Upper Devonian to Mississippian time. On the stratigraphic cross section these rocks are called 'Besa River Formation'.

The beds below the Mattson Formation, at some localities in the eastern part of the area, are grey limestones with interbeds of dark calcareous shale and fine grained sand. Harker recognizes faunal zones ranging in age from Upper Kinderhook to Lower Chester in these limestones. The beds are referred to herein as "Mississippian Limestones", and correspond to Douglas and Norris' (1959) map unit 7. The limestones become progressively more shaly toward the south and west. No limestones occur at the base of the Mattson in the sections at Tika Creek and Beavercrow Mountain.

Carboniferous and Permian

The Mattson Formation, a succession of thick sandstones with thin interbeds of silty carbonaceous shale and with interbedded limestones in the upper part, represents deposition during the period from Mississippian to Permian time. Previously, it was thought that sands of Permian age occurred only at the top of the Tika Creek and Liard Range sections. Results of the present study suggest that the upper portion of the Mattson at other localities is also Permian in age.

The Mattson Formation thins to the west and southwest, due to erosion and non-deposition. It is sharply bevelled to the northeast.

Above the Mattson Formation there are cherts, silts and mudstones in the southern part of the area. These are Permian in age. The Mattson in the northern part of the area is overlain by sands and shales of Lower Cretaceous age.

Permian

Cherts, sandstones, siltstones, and mudstones occur above the Mattson Formation in the southern part of the area. These are Permian in age, and on the basis of lithologic similarity to beds in British Columbia, will be referred to herein as the Prophet Formation. The Prophet Formation is thought to be unconformable with the underlying Mattson Formation and is itself truncated

toward the north where it is overstepped by beds of Lower Cretaceous age.

Mesozoic

Triassic

In the southeast, exposures of maroon and green, micaceous, silty shales beneath basal Cretaceous sands and overlying Permian chert occur on Kotaneelee River. Their stratigraphic position and lithologic similarity with Triassic rocks toward the south in British Columbia strongly suggests they are Triassic in age. The Triassic rocks thicken very rapidly southward.

Cretaceous

Strata representing deposition during both Lower and Upper Cretaceous time, occur in the area. Work on these rocks during the 1962 field season consisted only of rather superficial examination of some sections described by Stott (1960). The lowermost Cretaceous deposits consist of coarse sands and conglomerates in most places. These coarse rocks are overlain by mudstones, argillaceous sands and sandy shales.

STRUCTURAL GEOLOGY

The Liard Plateau is the southernmost expression of the Mackenzie Mountains.

The structures consist of relatively simple folds with broad, gentle synclines and more highly compressed anticlines. These anticlines are, in some places, overturned and faulted with complex local structures. Most of the structures are south plunging.

The trend of most structural features is predominantly north and south with most of the thrust faults dipping steeply toward the west.

P. W. J. Wood

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