SOCONY-VACUUM EXPLORATION COMPANY

GEOLOGY

of the

LIARD RIVER - TROUT LAKE AREA

Northwest Territories

by

J. A. Wallace

Calgary, Alberta

January - 1954

C O N T E N T S

I L L U S T R A T I O N S

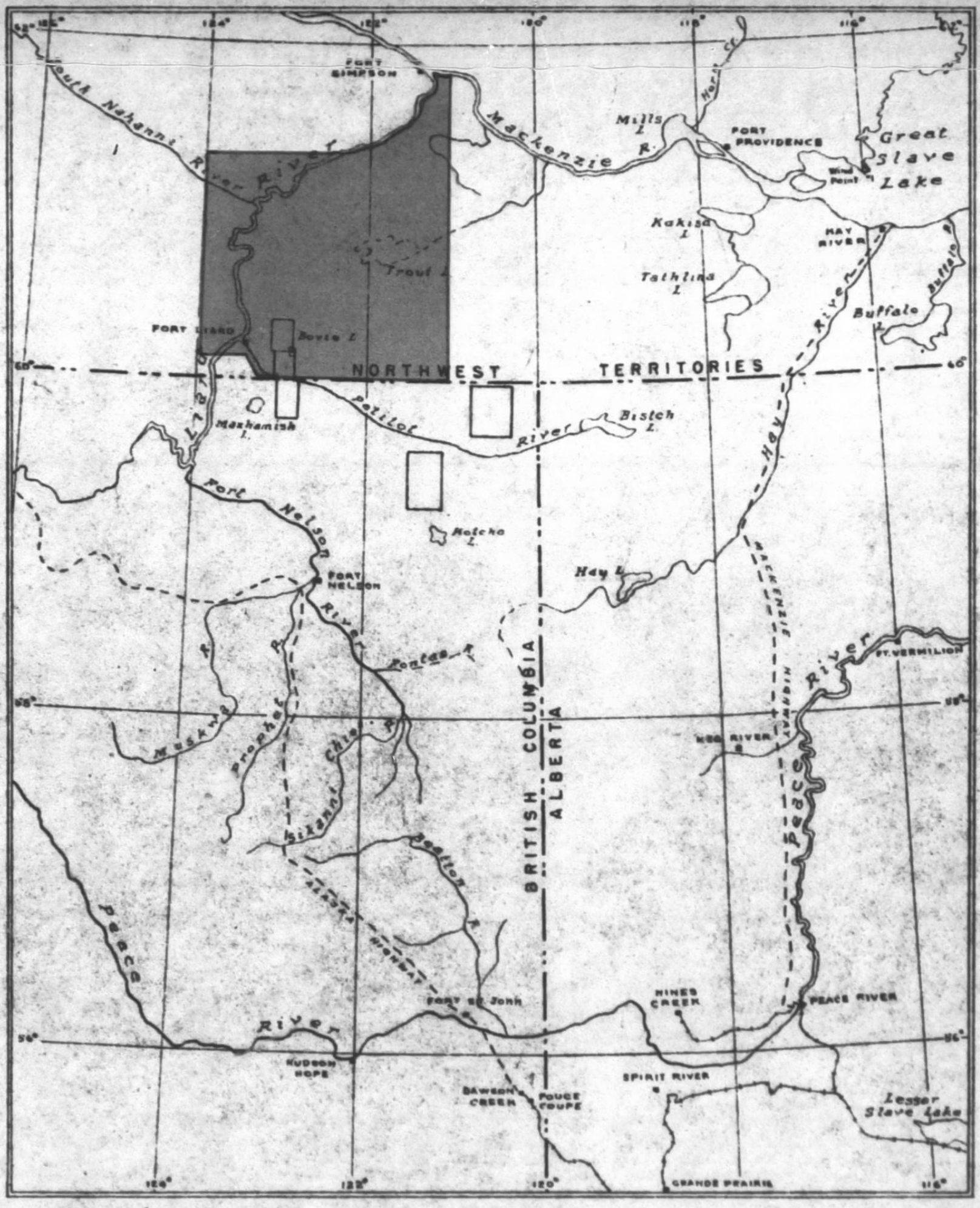
I N T R O D U C T I O N

This report presents the results of the 1952 field season during which a party headed by the writer was engaged in reconnaissance mapping and stratigraphic work in the Fort Liard - Fort Simpson area of the Northwest Territories. This area lies in the extreme southwest corner of the Northwest Territories between north latitudes 60° 00' and 62° 00' and west longitudes 121° 00' and 124° 00' (Plate 1) and includes Socony-Vacuum's permit areas numbered 1 to 22. It is a remote and sparsely settled region containing only the small settlements of Fort Liard and Fort Simpson together with several semi-permanent Indian villages.

The purpose of the season's work was two-fold; first to determine the nature and extent of the rock exposures occurring on the Company's permit areas, and second to get some indication by examination of the outcroppings in the mountains to the west of the permit areas whether potential reservoirs for oil might be expected to be present in the subsurface section under these permit areas.

The chief means of access in summer is by boat along the larger rivers and by float-equipped aircraft which can land either on the rivers or on the many lakes in the area. Helicopter work along the rivers and streams is facilitated in times of low water by many sand and gravel bars but landings in the interstream areas are hindered by deadfall and swampy terrain.

The assignment was carried out by an eight-man party consisting of five geologists, a cook, and two men to operate and maintain the helicopter. Three base camps were set up during the summer, one at Fort Liard, one at South Nahanni, and one at Fort Simpson, and, from these, traverses and fly-trips were made into the permit areas and the mountains. The movement of supplies and personnel between the camp sites was by boat along the Liard River.



INDEX MAP OF REPORT AREA

60 30 0 60 120

Scale 1 inch = 60 miles

PLATE I.

The helicopter was with the group for a total of fifty-seven days though the actual number of days it was available for geological work amounted to only forty days, the remainder of the time being accounted for by bad weather, mercy flights, and breakdowns. Approximately 210 hours' flying time was put on the machine in the forty days and the area covered amounted to something over 4000 square miles.

During the season more than 200 lots of fossils were collected from beds ranging in age from Middle Devonian to Lower Cretaceous. The specimens are being studied and identified by the staff of the Paleontology Division of the Geological Survey of Canada in Ottawa. A small number of micro-fossil samples were also collected and these are being examined by Dr. R.T.D. Wickenden of the Calgary office of the Geological Survey.

PREVIOUS WORK

One of the earliest published accounts of this area is that given by R. G. McConnell (1)* who made a canoe trip in 1888 from Dease Lake in British Columbia, down the Liard River to its junction with the Mackenzie. On the way he passed through the present map area and made some observations regarding the rocks exposed therein. His comments have stood up remarkably well in the light of more recent data. In 1922 Williams and Hume (4) traversed the lower part of the Liard River and in 1943 A.W. Nauss (6) mapped the Nelson and Liard Rivers for the Canol Project. C.O. Hage (7) repeated Nauss' traverse in 1945 with considerable more detail and produced a map which agrees in general outline with the one resulting from this season's work.

* Numbers refer to Bibliography at end of text.

PHYSIOGRAPHY

The parts of the report area lying east and north of the Liard River fall within the northern plains physiographic province of Western Canada and are marked by typically low-lying areas of muskeg broken occasionally by ridges of higher ground. Elevations in this part of the area range from approximately 1700 feet above sea level in the vicinity of Trout Lake to 600 feet at Fort Liard, 500 feet at South Nahanni, and 300 feet at Fort Simpson. Several prominent ridges break the contour of the ground as it slopes downward into the valley of the Liard River, and although some of them can be related to underlying structure, most of the ridges are erosional in origin and bear little, if any, relationship to the configuration of the underlying beds.

The portion of the area situated west of the Liard River contains a series of north-south trending mountain ranges that represent the southern end of the MacKenzie mountains. In general, these hills become lower toward the south and eventually die out just south of the map area. In the ranges visited, the mountain summits rarely exceed 5000 feet and are more commonly of the order of 4000 feet above sea level.

The main drainage of the area is accomplished by the Liard River, a large stream which has its origin 250 miles to the west in the northern parts of the Rocky Mountains and flows northeastward to join the Mackenzie River at Fort Simpson. Its main tributaries within the map area are the Petitot, Kotaneelee and South Nahanni Rivers. The two latter streams flow in from the mountains in the west while the Petitot drains part of the large muskeg area east of the Liard River. Numerous small lakes are to be

found in this swampy ground and they provide the source for many of the smaller west-flowing creeks. It is in the valleys of these smaller creeks that the main rock exposures east of the Liard River are to be found.

The timber cover in the area is heavy and consists for the most part of spruce and tamarack in the swampy portions, and poplar and jackpine on the drier ridges. The timberline in the mountains extends upward to about 3500 feet and above this only stunted spruce and small brush are found.

The entire area shows the effects of glaciation; the plains area and some of the outermost hills by the continental Keewatin sheet, and the mountains by a presumed alpine source. Granite and gneiss form the majority of the boulders observed in the glacial cover. Some of these were found at elevations as high as 4500 feet in the outer range of the hills. Whether these erratics came from the Canadian shield or from the Yukon is difficult to decide but the lack of through-flowing stream valleys from the west would lead to the conclusion that they may have been brought in from the east. The westward movement of the ice is further demonstrated by the NE-SW alignment of drumlinoids, eskers, and glacial striae in the plains portion of the area.

STRATIGRAPHY

General Statement

All the rocks exposed in the map area, with the exception of some minor quartz veins, are of sedimentary origin. They range in age from Silurian to Upper Cretaceous and have a combined thickness of over 10,000 feet. In most of the localities the strata are found in normal sequence

TABLE OF FORMATIONS

Era	Period	Epoch	Formation	Thickness in Feet
Cenozoic	Quaternary	Recent and Pleistocene	glacial drift	0 - 100'
	Unconformity			
Mesozoic	Cretaceous	Upper	Kotaneelee	300' +
			Fort Nelson	900'
		Lower		2700'
	Erosional Unconformity			
Paleozoic	Permo-Pennsylvanian			1300'
	Mississippian			1800'
	Devonian	Upper		1000' +
		Middle	Ramparts	535' +
	Disconformity			
	Silurian		Lone Mountain	2200' +

Plate 2

but toward the north end of the area steep reverse faulting in the Paleozoic rocks has placed Silurian and Devonian beds on younger formations.

The early Paleozoics are composed mainly of dolomite and limestone with minor amounts of shale but the later strata of this era show an increasing percentage of clastics until in the uppermost Pennsylvanian, sandstone is the predominating rock type. A post-Jurassic unconformity has produced an hiatus which in the west embraces most of the Permian and all the Triassic and Jurassic beds. Toward the north and east, the missing section becomes greater and eventually Lower Cretaceous strata rest on Upper Devonian beds. Clastic deposition began again in the Lower Cretaceous and was continuous in the area until the Upper Cretaceous. In most parts of the area semi-consolidated glacial gravels overlie the surface.

SILURIAN

The oldest strata observed within the map area have been assigned tentatively to the Silurian system. These rocks are confined in the outcrop to the northern part of the area and are well exposed in the first canyon of the South Nahanni River (Figure 1), on the lower slopes of Nahanni Butte (Figure 2), and in the mountains north of the junction of the Liard and South Nahanni Rivers. In the subsurface they are thought to extend east of the mountains and under the plains portion of the area, for beds believed to be of a comparable age have been observed on the Slave River at the edge of the Pre-Cambrian shield. (8)

In the exposures examined during the past season, the Silurian strata

FIG. 1

First Canyon, South Nahanni River.
Silurian capped by Middle Devonian.

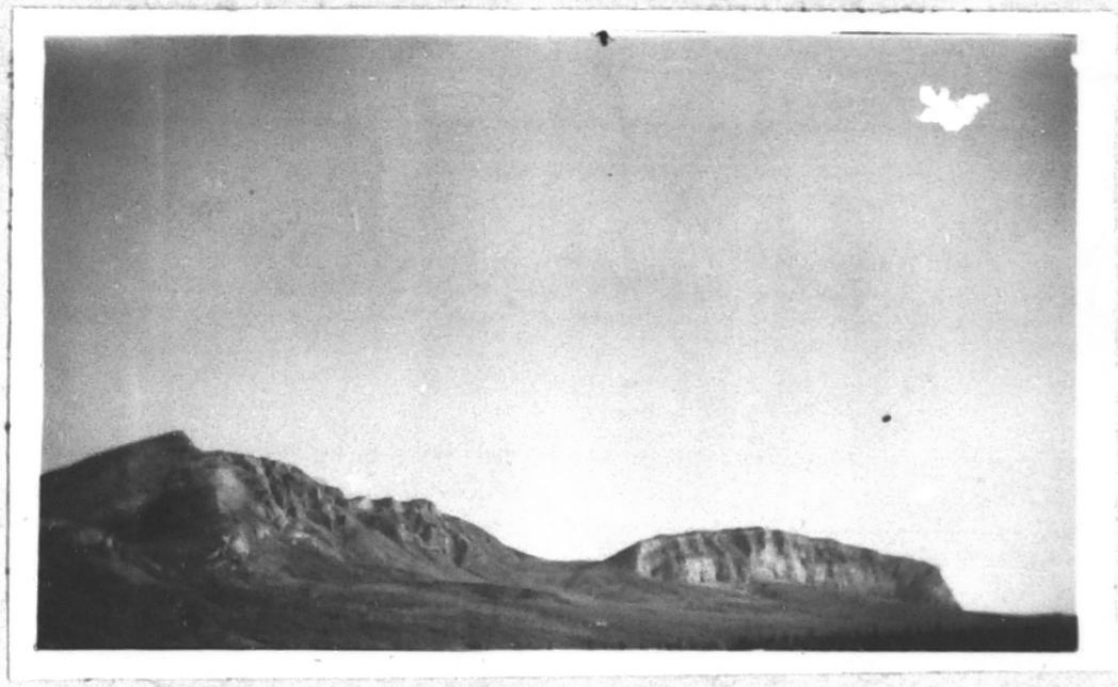


FIG. 2

Nahanni Butte.
Silurian capped by Middle Devonian

were found to consist of alternating light and dark grey, hard, finely crystalline dolomite and limy dolomite. In the lower parts of the observed section the color tends slightly more towards buff-weathering but the darker colors predominate higher up. Most of the color bands are less than 5 feet thick. In the upper parts, quartz and calcite veining are prominent to the extent that in places the rock takes on the appearance of a quartz-dolomite-calcite breccia. Porous zones are not well developed though there is an interval some 300 feet thick and 700 feet from the top of the system which is rough weathering and gives the appearance of vuggy porosity. However, when this rock is broken, it appears to be finely crystalline to dense dolomite with only scant traces of very fine inter-crystalline porosity.

A complete section of Silurian beds was not found anywhere within the map area, but in the first canyon of the South Nahanni River, over 2200 feet of beds assigned to this age was measured. The base of the section was not exposed and at the top of the canyon wall the banded dolomites were found to be overlain disconformably by middle Devonian limestones. The division between the Devonian and the Silurian though not based on faunal evidence is not difficult to place in the field. The overlying beds are predominately limestone with only a few dolomite horizons, they are lighter colored, more fossiliferous, less banded and contain some small chert lenses, thus forming a striking contrast with the Silurian strata. The weathering characteristics of the two ages are also worth noting - the Devonian forms cliffs and steep scarps whereas the Silurian beds are commonly found in somewhat more gentle slopes.

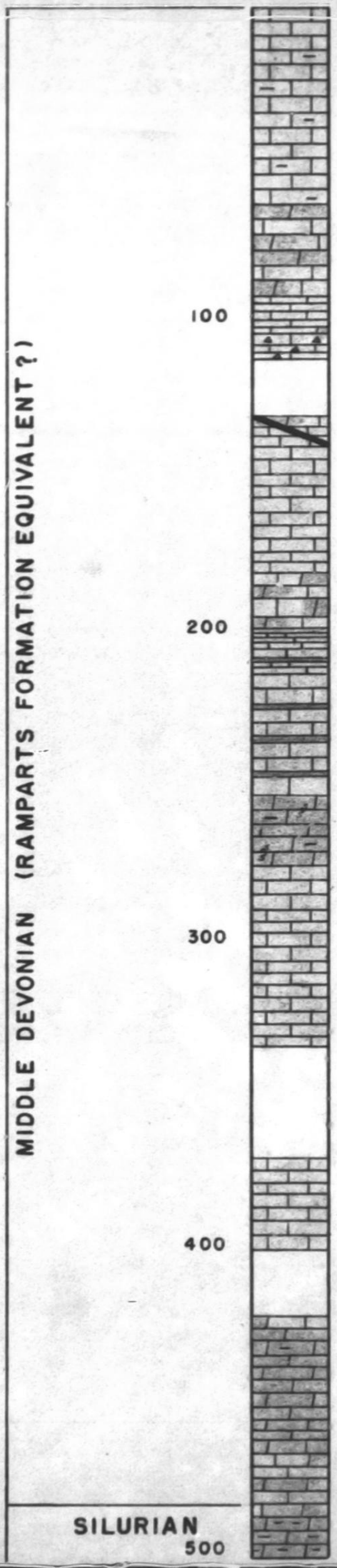
Exact correlation of the Silurian beds with others of the same system is difficult owing to the scarcity of recognizable fossils, but on the basis of the lithology and general appearance there can be little doubt that these strata are correlative with the Lone Mountain dolomite as described by Kindle and Bosworth (2) from the Camsell Bend area.

MIDDLE DEVONIAN

Strata assigned to this age were found to overlie disconformably the beds of the Silurian Lone Mountain formation in the extreme northern portion of the map area. Their presence in the subsurface of the plains parts of the region is inferred from the fact that they are present in outcrop along the eastern edge of the northern Alberta basin and have been reported in all of the wells thus far drilled in the northern parts of that province.

The most nearly complete section observed during the season was in the mountains surrounding Bluefish Lake, though other partial sections were noted on Nahanni Butte and in the first canyon of the South Nahanni River. In the section measured at Bluefish Lake (Plate 3), the beds consisted of a series of interbedded light and dark grey dolomites and limestones of fine to medium crystallinity with some few thin bands, up to five feet thick, of dark grey, limy shale. In the upper part of the section small lenses of black chert were common and quartz veins ranging up to eight inches in thickness were noted. Rapid changes in composition from limestone to dolomite are common both along strike and up and down - dip but in general it appears that the beds are slightly more dolomitic in the lower part of the section.

MIDDLE DEVONIAN SECTION — BLUEFISH LAKE



Ls. Dark grey very finely xtaline w/many coral remains all rather poorly preserved. Bedding somewhat less massive than in other ocps. Traces of black chert.
Ⓕ 44-W-52

Ls. In part dolomitic massively bedded, dense dk. grey to lt. grey, lt weathering. Some scattered coralline remains.

Ls. Thin-bedded, dk. grey, beds 2"-3" thick.
Ls. Very slightly dolomitic massive, dk. grey. Ⓕ 38-W-52
Ls. Thin-bedded, dk. grey w/small black chert lenes.

Covered interval.

Dolomite, limy, lt. grey w/some calcite, med. xtalline, quartz veins 6"-8" thick.

Ls. Lt. grey weathering, med. xtalline, some poorly preserved fossil remains. Ⓕ 39-W-52

Ls. & Dolomite interbedded, lt. grey color, med.-course xtalline.

Limy shale, dk. grey breaks into fairly large pieces.
Ls. Massive grey Ls. w/dolomite patches.
Limy shale as above.

Ls. Dk. grey, lt. weathering w/some minor limy shaly beds.

Dolomite coarse grey, banded w/some darker beds some fractures & vugs filled w/dolomite xtals.

Ls. Lt. grey med. xtalline, weathers lt. grey – few scattered corals poorly preserved.

Interbedded Dolomite & Ls. dk. to med. grey.

Limestone.

Covered interval.

Ls. massive, dense. Lt. to med. grey color.

Covered interval.

Dolomite – lt. grey, to med. grey, with vugs filled w/dolomite xtals and some qtz. fillings.

Ls. & Dol. interbedded, becoming harder, more dolomitic in basal part. At base a very dark grey, finely xtalline silty dolomite. Smells of H_2S on fresh fracture.

Prob. Silurian

SCALE: 1 inch = 50 feet

PLATE No. 3

A total of 490 feet of Middle Devonian beds were measured at the Bluefish Lake locality and although the upper contact with the overlying beds was not observed, it is thought that a stratigraphic interval of not much more than fifty or sixty feet intervenes between the last observed beds of the Middle Devonian and the basal strata of the Upper Devonian.

The contact with the Silurian showed no appreciable discordance and this, together with the fact that Lower Devonian rocks are absent indicates that the relationship of the two systems is that of disconformity. In all localities visited the contact with the Upper Devonian was not exposed but it is believed that the beds of the two units are conformable. On the basis of lithology and stratigraphic position, the Middle Devonian strata have been placed in the Ramparts formation of the Mackenzie River section and they are therefore considered to be time equivalents of the Slave Point - Presquile units of the Hay River area.

No porous horizons were observed in the measured section but in some layers remains of corals and algae made up as much as twenty percent of the rock. Many of the fossils had been extensively dolomitized with the result that original structures were only poorly preserved and pore spaces were at a minimum. It is reported, however, by other workers, that to the north, around Camsell Bend some considerable porosity is developed in these beds mainly as the result of an abundance of organic remains.

UPPER DEVONIAN

Upper Devonian beds are well exposed along the lower parts of the Liard River (Plate 4) and to a lesser extent in many of the west and north flowing tributaries of the main stream. In times of high water much of

the rock is covered but towards the end of the summer the outcrops can be readily observed from a boat or canoe.

The lowermost Upper Devonian beds observed during the season were the greenish silty rocks of the Simpson shales which form the outbanks at the junction of the Liard and Mackenzie Rivers. Above the Simpson shales are found the sandy silts which are thought to be equivalent to the Hay River limestones to the east and which form the cliffs and ledges in the Liard Rapids. A large number of fossils were collected from these beds and identification of the fauna is currently being undertaken in Ottawa. Above these silts are a series of organic limestones containing numerous small reef-like structures. Most of these structures were of small extent in the outcrop (Figure 3) the largest one observed being some 100 feet across. These same strata also contained many small coral and algal groups which exhibited all the features attributed to large reefs such as bowing-up over the growth and down-bending underneath (Figure 3) (c). The final determination of the fossil fauna collected from the Upper Devonian beds will aid materially in fitting these beds into the regional pattern.

As a preliminary attempt at correlation, we can say that the organic limestones of the Blackstone River are equivalent to the upper portion of the Hay River formation of the Mackenzie River area or the Wabamun formation of the Edmonton area. It can also be suggested that the calcareous siltstones of the Liard Rapids section are equivalent to the Hay River limestones and thus possibly correlative with the Hisku member of the Edmonton area.

(a)

(b)

(c)

FIG. 3

Upper Devonian

(a) Blackstone River, showing reef material in right center.
(b) Blackstone River, a large algal head in reef material.
(c) Poplar River, a small algal mass enclosed by limestone.

UPPER DEVONIAN SECTION — LIARD RAPIDS

Siltstone, limy, interbedded w/shale. Ⓕ J-1-1 ; J-1-2
J-1-3 ; J-1-4

Interbedded siltstone.

Limestone and some shale bands.
M.ᵐ1 - shale band. Ⓕ J-4-1
Siltstone and some limestone Ⓕ J-1-5
Shale. Ⓕ 1-E-36
Siltstone and some limestone, calcareous. Ⓕ J-4-2
Shale. Ⓕ 2-E-36

Ⓕ 4-E-36
Siltstone (calc.)
Ⓕ J-4-3
M.ᵐ2 shale.
Ⓕ J-4-4 ; J-4-5 ; 5-E-36
Siltstone with a few thin shale bands, thin banded, green-grey, calcareous. Ⓕ J-2-1 ; J-2-2
Siltstone. Ⓕ J-4-6 ; 7-E-36
M.ᵐ3 shale.
Ⓕ J-2-3 ; J-2-4
Sandstone & Limestone (dirty grey) + a few shaley beds. Traces of ironstone layers.

Shaley sandstone - soft thin bedded, one prominent limy band.

Ⓕ J-2-5 ; J-2-6
Sandstone with some limestone bands.

Shale or shaley sandstone.

Limestone.

Shale.

M.ᵐ4 Limestone.

Ⓕ J-2-7 ; J-2-8 ; J-2-9
J-3-1 ; J-3-2 ; J-3-3

Shale with 2or3 thin limestone bands, soft green-brown, noncalcareous.

M.ᵐ5
Siltstone & Limestone. Ⓕ J-3-4 ; J-3-5

Shale soft, green-brown, non calcareous.

Limestone. Ⓕ J-3-7

Shale.

Siltstone (calc.) Ⓕ J-3-6 ; J-3-8

M.ᵐ6 Ⓕ J-3-9
Siltstone (calc.)

Shale - dk. grey, noncalcareous, blocky, soft, slight rusty weathering, with some bands of slighty calcareous shale & limy siltstone.

Base of exposed section

SCALE: 1 inch = 50 feet

PLATE No. 4

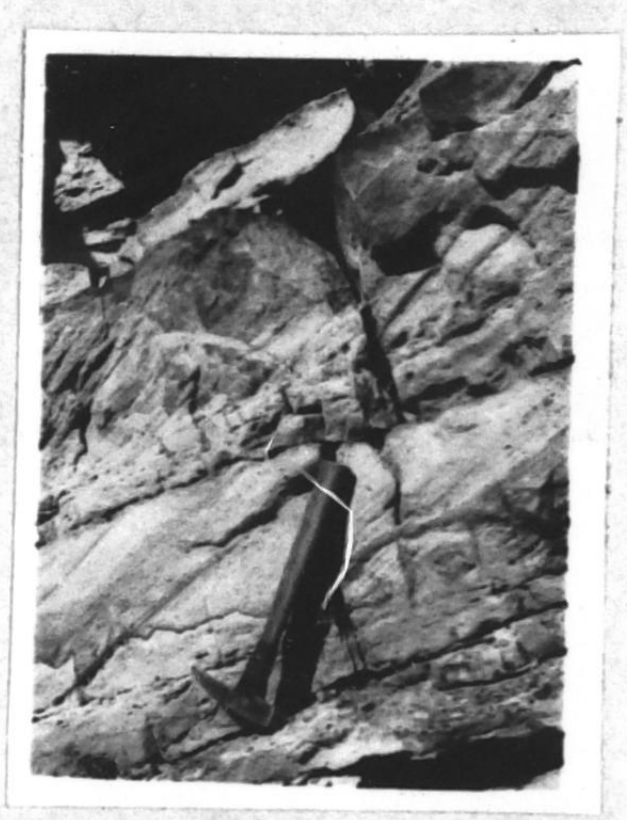
MISSISSIPPIAN

Rocks of Mississippian age are well exposed in the mountains of the Liard Range. They usually form the lower parts of cliffs that are capped by the prominent sandstones of the Pennsylvanian. They also crop out on the ridge that is the topographic expression of the Bovie Lake structure and in the Petitot River where it is crossed by that structure. Other smaller exposures are to be found along the Liard River between Fort Liard and Netla Indian Village. In the subsurface they are thought to extend to the east of Bovie Lake for some distance though it is doubtful if they continue as far east as Trout Lake. To the north, the boundary of the system in the plains portion is somewhere south of the junction of the Liard and South Nahanni Rivers. In the mountains, however, they extend north of this latter stream for some considerable distance, probably almost as far as the North Nahanni River.

The oldest Mississippian strata observed in the map area were a series of dark grey, thin bedded, fissile shales. In appearance they resemble the Cretaceous shales except that the Mississippian beds are generally more calcareous and often have thin stringers of limestone or limy sandstone associated with them. The upper part of the Mississippian consists of a series of grey to brown, finely crystalline limestones interbedded with shaly and silty limestone. A prominent band of dense, cherty limestone occurs near the top of the Mississippian section in the mountains and correlative beds are exposed on the Bovie Lake structure (Figure 4). The chert is black to dark brown in color and occurs as branching nodular structures running throughout the rock. Occasionally, however, it occurs as a massive bed or lens.

FIG. 4

Mississippian on Petitot River
showing chert nodules in Limestone.



(a)

(b)

FIG. 5

Pennsylvanian sandstone showing:-

(a) Crossbedding.
(b) Weathering of some of the softer beds.

No complete section of Mississippian strata was found within the area covered this year and until such time as the fossil determinations have been made, no composite section can be assembled. It would appear, however, that on the basis of present data, an estimated thickness of approximately 1800 feet would not be excessive for the Mississippian section exposed in the mountains. Thinning to the east due to erosion and probably also in some measure to deposition should make for a much lesser thickness of Mississippian under our Netla permits. It is quite possible that the wedge out of these beds occurs somewhere under the Netla lands and thus the Mississippian could not be expected to be present in the subsurface of our permits further to the east.

The only Carboniferous fossils thus far to be reported on by the Geological Survey are a small number of micro-fossil samples collected from limestones occurring in the upper part of the Mississippian of the Liard Range. Dr. R.T.D. Wickenden of the Geological Survey's Calgary office identified one specimen as ... "Plectogyra similar to a species illustrated but not named specifically from the Meramecian part of the Mississippian by Zeller." He also found several specimens of Endothyra which resembled a Meramec form figured by Zeller. A number of ostracods occurred in one of the samples and these included Bairdia cf. depressa Geis; Bairdia cf. permagna Geis; Glytopleura cf. elegantis Geis; Paraparchites cf. carbonarius (Hall) after Geis. The whole assemblage suggests that the beds belong to the Meramec stage of the Mississippian and therefore are correlative with the Tunnel Mountain member of the upper part of the Rundle formation in the Alberta Foothills. This correlation

indicates that the upper limestones of the Mississippian in the Liard River area are equivalent in time to the pay zone in the Turner Valley oil field.

Porous horizons were not abundant in the Mississippian sections studied in the field. However, some of the coarser limestones might contain sufficient inter-crystalline porosity to make them attractive drilling objectives particularly if they were to be found near the wedge edge of the system.

PENNSYLVANIAN

Strata tentatively assigned to the Pennsylvanian system form excellent exposures in the mountains running along the west side of the Liard River. They are also considered to be present on the south end of the Bovie Lake structure so that their presence under the plains area east of the river is proven, though here again, like the Mississippian beds their precise extent is unknown. In the mountains they crop out to the north of the South Nahanni River but are not found among the exposures along the North Nahanni.

The lowermost Pennsylvanian beds consist of dark grey, thin-bedded shale with some red concretionary ironstone bands. This basal shale seldom exceeds 100 feet in thickness and is everywhere followed by a succession of massive, cross-bedded, brownish, sugary, quartzose sandstones (Figure 5) and sandy shale which makes up the balance of the section. Toward the upper part of the section the shale intervals become very thin and the sandstones are dominant. At the extreme southern part of the area, on Pointed Mountain, the uppermost sandstones are succeeded by about 200 feet of light blue-grey chert. No fossils have been found in these

chert beds and their precise age is unknown. For the purpose of this report, however, they are being grouped with the Pennsylvanian rocks.

No complete section of Pennsylvanian beds was encountered in any one locality in the area but from the numerous partial sections measured during the summer, a composite section has been assembled (Plate 5). The lithology as shown in this illustration has been taken from sections measured at Pointed Mountain, the Liard Range near Fort Liard, and on Jackfish Mountain. Detailed thicknesses vary from one locality to another but in general the sequence of units is the same.

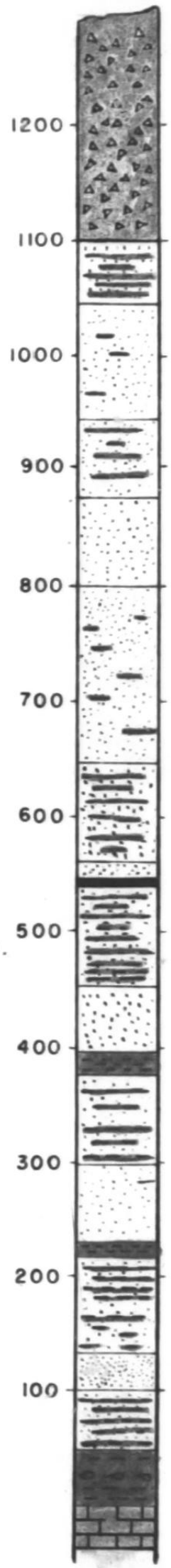
Examination of this plate shows that the Pennsylvanian may be expected to be on the order of 1300 feet thick in the area close to the mountains. Eastward truncation and thinning of the beds would make for thinner sections under the plains part of the area.

The presence of poorly cemented quartzose sands (Figure 5) together with traces of bituminous material make it evident that under favorable conditions the Pennsylvanian strata could prove very interesting objectives in the search for oil. The thinned and truncated edge of these strata, particularly if it were to be associated with a structure, could provide all the essentials for a trap for petroleum. In this regard the Netla Reservation might easily become some of the most interesting of our northern acreage.

LOWER CRETACEOUS

Marine strata of Lower Cretaceous age crop out at intervals along the Liard River and on the lower parts of its major tributaries from the

COMPOSITE PENNSYLVANIAN SECTION
LIARD MOUNTAINS



Top of section not observed.

Chert, blue-grey to dark grey, massive.

Sandstone & shale interbedded; ss. clean fine grain buff, cross bedded.
Shale - dk. grey, fissile w/ some ironstone concretions.

Sandstone, argillaceous, with some thin interbeds of sandy shale.

Sandstone as below, with thin shaly streaks.

Sandstone, fine grained, cross bedded, quartzose, clean, light buff to white colour.

Sandstone, massive, quartzose, buff to light weathering cliff-forming; some thin shaly layers.

Shale & sandstone interbedded.

Sandstone, quartzose.
Coal, hard, one foot thick, not present in all localities.

Sandstone & sandy shale, buff to grey, more shaly in lower part.

Sandstone, med. grain, quartzose, light buff weathering, finely bedded.

Shale, dk. grey, some concretions.

Sandy shale w/ thin sandy interbeds, dk. grey, rusty weathering.

Sandstone, med. grained, light buff colour, quartzose.

Shale, black to dk. grey, very fine bedded.

Sandy shale, dk. grey, rusty weathering in part, some ironstone concretions.

Sandstone, med. grain, buff colour, quartzose.

Sandstone & shale, thin bedded to blocky, rusty weathering, dk. grey.

Shale, dk. grey, thin bedded, non-calc, some red ironstone concretions.

Mississippian.

Limestone, Lt. grey to dk. grey, interbeds of grey shale.

Scale 1 inch = 150 feet

Plate No. 5.

east. They occur also in the channel of the Kotaneelee River where it flows between the Liard and Labiche ranges just west of the map area. The beds doubtless underlie much of the low swampy ground between Fort Liard and Trout Lake, though extensive aerial reconnaissance of this area failed to show any exposures.

The base of the sequence was not observed in any of the localities visited thus no complete section could be recorded. It is believed, however, that the 2157 feet of beds measured along the Petitot River offer an almost complete record of the Lower Cretaceous in the area. It is estimated that not much more than an additional 500 feet would complete this section.

The lowest beds observed on the Petitot River consisted of 396 feet of interbedded sandstone and shale. In the lower part the Sandstone is very fine-grained, greyish-green in color, cross-bedded (Figure 6) and alternates with layers of dark grey shale containing some ironstone concretions. Toward the middle of the sequence the sands become more massive, slightly darker in color and contain some minor amounts of glauconite. The top 60 feet of this unit is composed of massive, grey, buff-weathering, medium-grained sandstone that shows some large branching "palm-like" structures along the bedding. Overlying this unit is 743 feet of black, fissile shale in which there are several well developed ironstone bands. This in turn is overlain by 283 feet of interbedded, black shale and shaly, greenish sandstone somewhat similar in aspect to the lowermost unit of the section. The youngest beds of this age consist of approximately 735 feet of dark grey, fissile shale with some ironstone beds and coalized wood fragments. These shales form the greater part of the exposures along the

FIG. 6

Fine-grained, crossbedded sandstone
Cretaceous, Petitot River.

FIG. 7

Canyon on Petitot River
Fort Nelson Formation

river from a point one and one-third miles above its mouth up to the contact with the overlying Fort Nelson formation approximately five miles from Fort Liard.

The oldest Lower Cretaceous fauna represented in our collections comes from the lower part of the 283-foot sandstone and shale unit and includes Gastroplites of canadensis (Whiteaves); Arctica sp. indet.; Goniomya sp. indet.; and Tellina sp. These forms belong to the Gastroplites fauna of the Peace River and indicate an early Albian age. Correlation is suggested with the Scatter sandstone or lower Lepine shale of northeastern British Columbia. Some 190 feet higher stratigraphically in the section specimens of Posidonomy nahwisi McLearn were collected and these indicate the presence of the Neogastroplites fauna. The ironstone bands of the uppermost unit yielded more genera from this group including Neogastroplites cornutus (Whiteaves); Neogastroplites cf. selwyni (Whiteaves); and a poorly preserved specimen of Beudanticeras sp. This fauna is said to be either middle or upper Albian in age and indicates a correlation with the Goodrich and Sikanni formations to the south. Such a correlation shows that the prominent sandstones of these formations have been replaced to the north by shales and interbedded sands and shales.

The fauna from this section indicates a marine environment of deposition but the presence of coalized wood fragments suggests that near-shore conditions were at times predominant. Reports of coal seams occurring in the Lower Cretaceous have been circulated for many years at Fort Liard, but no coal was found at any of the Lower Cretaceous localities examined by the party.

UPPER CRETACEOUS

Fort Nelson Formation

Rocks belonging to this formation are exposed along the Petitot River beginning at a point five miles above its junction with the Liard River. They are presumed to be present in the subsurface over much of the plains area, though here again the lack of exposures makes precise delineation of their extent impossible.

In the section along the Petitot River exposures are not continuous and the lack of well established marker beds renders it difficult to determine the true thickness of the formation. By assuming that the observed dip remains constant at four degrees between outcrops, a total thickness of 905 feet is established for this formation. This compares with a figure of 500 - 800 feet given by Hage (7) and 679+ feet given by Wright and Slavin (9).

The lowermost beds belonging to this formation are composed of 20 feet of grey, buff-weathering, fine-grained, cross-bedded sandstone. Thin interbeds of greenish shale and platy sandstone break the outcrop into layers up to three feet thick, in which ripple marks, carbonaceous fragments and pyrite nodules are common. The 600 foot interval overlying this sandstone is largely covered, and only occasional outcrops of grey shale and sandy shale appear along the river bank. The uppermost sandstones and conglomerates of the formation are exposed in the walls of the canyon which in places are over 100 feet high (Figure 7). These beds consist of 305 feet of coarse-grained, buff sandstone interbedded with conglomerate. The latter has pebbles up to one inch in diameter of black chert, sandstone, quartzite, and milky quartz, and is cemented by a matrix of coarse

sandstone. Cross-bedding is prominent in this unit. The uppermost conglomerate bed is overlain conformably by a dark grey shale which is presumed to belong to the Kotaneelee formation.

Two other localities yielded small incomplete sections of the Fort Nelson formation. On Waterfall Creek a short distance above where it enters the Liard River the following sequence representing the upper part of the formation was measured:

Top of Section	Thickness in Feet
Concealed	
Conglomerate containing pebbles of white chert, quartz, and sandstone in matrix of coarse, dark sandstone	35
Coal, shaly with stringers of good coal	3
Sandstone, buff to brown, fine-grained, massive, thick-bedded, carbonaceous partings	55
Shale, dark grey to black	6
Sandstone, brownish, fine-grained, thin-bedded with some ironstones	15
Shale, dark grey to black, slightly platy	15
Underlying beds concealed	
Total Thickness -	129 feet

Another small exposure representing the top of the formation was measured during a traverse of the Kotaneelee River beginning 14 miles above its mouth. The section observed at this locality consisted of the following:

Top of Section	Thickness in Feet
Overlying beds - Kotaneelee formation	
Sandstone, buff-colored, medium grained, cross-bedded, less massive in lower parts, plant remains common	40
Conglomerate and sandstone, with white chert pebbles and some coaly layers and fragments, in sandstone matrix	25
Sandstone and shale, interbedded with some massive sandstones & conglomerate stringers near base	100
Shale, dark grey, blocky, with some soft grey, cross-bedded sandstones containing glauconite and carbonaceous fragments	30
Underlying beds concealed	
Total Thickness -	195 feet

No diagnostic fossils have been collected from the Fort Nelson formation but because of its stratigraphic position and its lithologic similarity, it is correlated with the Dunvegan formation of the region to the south. It is thus Cenomanian in age and represents the beginning of Upper Cretaceous deposition.

Kotaneelee Formation

Isolated exposures of the strata belonging to this formation were observed in the lower parts of the Kotaneelee River, and at one locality on the Petitot River. In the subsurface the formation is thought to be confined to the extreme southern end of the map area, erosion having removed it further north. In both localities the beds consisted of black shale with some thin bands of blocky, rusty shale. It is estimated that approximately 300 feet of strata were seen in these outcrops. No fossils were collected but Hage (7) found several genera which indicated that the Kotaneelee is correlative with the upper part of the Wapiabi formation of the Alberta Foothills.

STRUCTURE

General Statement

The report area falls astride the boundary of the two major structural provinces in Western Canada. That part which lies west of the Liard River is within the interior plains province, and is characterized by generally low-dipping beds and gentle folds, whereas the area west of the river contains the southern end of the Franklin mountains which in this region form the easternmost edge of the Canadian Cordillera. The two ranges which make up this eastern edge are known as the Liard Range and the Nahanni Range.

Liard Range

The Liard Range begins several miles north of the South Nahanni River and runs very nearly due south for sixty-eight miles as far as Fort Liard where it plunges out before crossing the Liard River. The range is composed of two large complex faulted anticlines, one of which strikes almost north-south throughout its entire length, and the other has a more sinuous trend. Both folds expose Paleozoic strata. In general they show moderately dipping (30°) beds on their western flanks with more steeply inclined and often faulted strata on their eastern limbs and thus the folds are asymmetric towards the east.

The folds have been extensively eroded with the result that the high points on the ridges are no longer along the crest lines of the anticlinal structures. In several instances the softer rocks in the cores of the folds have been removed to a greater degree than those on the limbs so that excellent examples of breached anticlines have been produced (Figure 8).

FIG. 8

View of Liard Range showing
Breached anticline, limestones & sandstones
of Pennsylvanian & Mississippian on flanks.
Mississippian shales in core.

Numerous faults were mapped in these mountains. The greater number of those which could be seen in the field were reverse faults dipping steeply to the west. Most of them followed trends parallel to the main structures and had throws measurable in tens of feet, but others showed indications of much greater displacement. One such large displacement fault is thought to occur along the east boundary of the range. The trace of it was not observed in the field but several facts have been compiled which together present strong evidence for its presence. The distinct topographic break from the mountains to the low-lying muskeg-covered areas of the plains is in itself convincing but when coupled with the fact that the Pennsylvanian which usually forms rugged hills is absent on the eastern side of the range, it becomes even more significant. There is, of course, the possibility that the Pennsylvanian beds thin out rapidly eastward and thus might not be expected on the east side of the range but this would require a pinchout of 1300 feet in a distance of 6 miles. The complete lack of outcrops in the east-flowing streams in front of the range strongly suggests that soft strata such as the Lower Cretaceous shales are present in front of the mountains. The presence of an imbricated zone close to the east edge of the range offers some confirmation that extensive movement has taken place on that side of the range. The throw on this fault would be on the order of 3000 feet.

One or two faults were observed to dip to the west at low angles. A good example of this is shown in Figures 9 and 10. At this locality the Mississippian and Pennsylvanian beds have been folded into an anticline which as the compressive forces became more intense, faulted and allowed the older beds to ride over the younger. The small crenulations

FIG. 9

Panorama showing Mississippian limestone resting on Pennsylvanian sandstone. Liard Range.

FIG. 10

Close-up showing crenulations in limestone at point 'X' in Fig. 9.

in the Mississippian strata which accompanied this slippage are clearly visible in the picture as is the low west-dipping fault trace. It is notable that at the only point in the Liard Range where this type of faulting has taken place the two anticlines which form the range approach each other, and are closer together than at any other locality in the range. It appears as if the eastern fold acted as a buttress against which the western fold was pushed thus allowing the stresses to build up to the point where thrust faulting rather than folding took place. The total movement in the fault shown would probably be of the order of several hundreds of feet.

Nahanni Range

The Nahanni Range begins at Nahanni Butte near the junction of the Liard and South Nahanni Rivers and runs north some eighty miles to Camsell Bend on the Mackenzie River. Only the extreme southern end of these mountains falls within the map area but the structural trend associated with them, if projected south into the plains portion of the area, passes through the Northern Foothills Agreement, Bovie Lake and Maxhamish Lake Blocks. It is therefore of some interest to attempt an interpretation of the structure of the Nahanni Range so that it may be applied to the Bovie Lake prospect.

The mountains of the Nahanni Range are set off slightly to the east and are parallel to the northern end of the Liard Range. They consist of a single block of west-dipping Devonian and Silurian beds, bounded on the east by an almost north-south trending reverse fault. Here again the trace of the fault was not observed in the field but there is good evidence

for its presence. As mentioned earlier in the section on Physiography, the part of the area lying east of the mountains is a flat, almost featureless plain with many lakes and swampy areas. The Nahanni mountains rise abruptly from this plain in a scarp which in places is over 2500 feet high. Exposures are scarce in the flat country east of the range, the nearest one observed by our party being fifteen miles down the Liard from Nahanni Butte. In this locality, flat-lying shales that are believed to be Upper Devonian in age were found cropping out on the bank of the river. Still further downstream more shales were exposed so that it is reasonable to assume that all of this part of the plains is underlain by Upper Devonian strata. If this is true, then the throw on the fault along the front of the mountains which places the Silurian at an altitude well above the plains must be of the order of 4500 feet. The steep scarp on the east side of the range is, therefore, a fault line scarp produced as a result of erosion of the fault surface. The presence of numerous quartz veins and traces of hydrothermal mineralization in the beds around Nahanni Butte are further evidences of tectonic unrest along this line. At a few scattered localities along the eastern edge of the mountains east dips have been recorded but these are considered to be the result of drag along the fault plane at the time of movement.

An examination of the structural features in the Liard and Nahanni ranges shows that the axes of the folds are more or less parallel north-south and have associated with them, steeply-dipping north-south striking reverse faults. This indicates the forces which gave rise to these features were those of simple compression in an east-west direction.

The magnitude of the displacements along some of the more prominent faults such as the one bounding the east side of the Mahanni Range makes it difficult to escape the conclusion that the basement complex exercised considerable control on both the direction and amount of displacement along the faults. It may be inferred that the stresses accompanying the orogeny were relieved in part by slippage along previously existing lines of weakness in the basement. In some cases, the fault penetrated to the surface, but in other instances a fold is the only surface expression. The Mahanni Range fault is an example of the former and is interpreted as being the result of up-throwing of the basement block on the west side of the fault, and down-throwing of the block to the east. Inasmuch as the general line of weakness along the Mahanni front extends southward with diminishing intensity toward Bovie Lake, it is concluded that the underlying causes of the surface structure in the latter locality were the same as those in the Mahanni Range.

Plains Area

The portion of the area included under the term plains, extends westward from the eastern edge of the map up to the mountain front. For the most part, the underlying beds are gently inclined strata with dips ranging up to ten degrees. Steeper dips are present in some localities in the western part of the area where the structural trends associated with the southward dying-out of the mountains pass into the plains. In cases where steeper than usual dips cannot be readily related to these regional structural trends, the underlying causes for them may be sought in compaction over reef-like structures or in deformation of surface beds due to ice movement. The gentle undulations shown by the outcroppings along the Blackstone and Poplar Rivers are easily ascribed to compaction

since the reef cores are exposed at several places and the actual drape of the over-lying beds may be observed directly. On the other hand, the steep and erratic dips near the water line on the Liard River opposite Matou River are considered to be the result of deformation due to ice movement.

Bovie Lake Structure

The Bovie Lake feature was first noted by Dr. W.I. Wright during an aeroplane reconnaissance of the area in 1947. Because of the remoteness of the area, however, little attention was paid to the structure until the summer of 1950 when it was staked by Wright and subsequently mapped by Slavin (9). The findings of these two authors are included in a previous report, GR-NY 250.

In the entire plains area covered during the 1953 field season, the Bovie Lake structure was the only one observed in which the underlying causes could be related directly to tectonic movement. From the air, the feature appears as a series of three en-echelon ridges with gentle slopes on their westward sides and a sharp, well-defined scarp forming the eastern flanks. The crests of the ridges stand at an elevation of some 500 feet above the surrounding plains. The Petitot River cuts westward across the feature between the two southerly ridges and the Muskeg River runs around the north end of the northern ridge. The greater part of the readily accessible rock exposures are confined to these two streams but some outcrops are also to be found along the scarps in the interstream areas.

Structural mapping along the Petitot River reveals a series of fairly steep west-dipping Mississippian strata overlain by Lower Cretaceous shales.

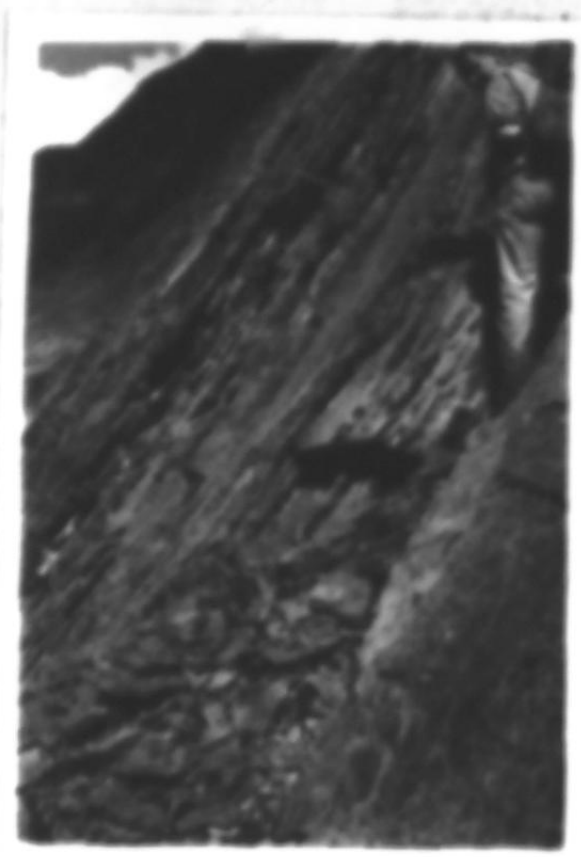
A zone of very steep dips is present in these shales a short distance west of the highest point on the structure (Figure II) but these beds are succeeded to the west by more gentle dipping strata as the beds pass into a broad syncline west of the structure. The east limb of the feature is not exposed and it is presumed that this lack of outcrops together with the presence of the scarps on the east side indicates that the east limb has been faulted off. By fitting this fault into the regional structural pattern, it may be postulated that it is genetically related to the fault on the east side of the Nahanni Range and to the numerous smaller faults in the Liard Range. If this is so, then it is probably a steep west-dipping reverse fault with a vertical displacement of the order of a thousand feet or more.

That the structure plunges to the north is shown by the occurrence of Cretaceous rocks in the valley of the Muskeg River at an elevation of some 600 feet below the exposures of the Mississippian limestones which cap the Bovie Lake ridge. Southward plunge is indicated by both the strike of the beds at the south end of the ridge and the dying out of the ridge itself.

Oil and Gas Horizons

In the preliminary stages of exploration in the map area, the greatest hope for production will probably be centered on the Upper Devonian and younger beds. The absence of well-developed porous intervals in the pre-Upper Devonian strata exposed in the mountains together with a general reduction in porosity in the Middle Devonian westward from the Great Slave Lake region, suggests that the Presquile type of porosity is disappearing to the west and is not to be expected in the beds underlying the map area. While this does not completely condemn the section below

(a)



(b)

(c)

FIG. 11

Steep dips in Cretaceous shales, west limb, Bovie Lake structure.

the Upper Devonian, the absence of the Presquile dolomite which has long been considered one of the major objectives in the region would obviously make deeper drilling less attractive.

The Upper Devonian rocks are exposed along the lower part of the Liard River and in some of its tributaries, thus in the northern-most permits they cannot be considered as potential reservoirs. In the southern part of the area, however, around Trout Lake where they are covered by what may amount to some thousands of feet of Mesozoic, and perhaps also by some Paleozoic rocks, they might well be found to contain oil. The presence of a biostromal type of limestone in the north indicates that conditions at the time of deposition were favorable for the growth of reef-building organisms and thus raises the possibility that bioherms might be found in the deeper parts of the basin.

The Mississippian limestones are believed to be confined in the subsurface to the southwestern part of the map area, having been removed by post-Paleozoic erosion from most of the remaining portions. The non-deposition of Mississippian beds can be postulated for the northeasterly part of the block where a pre-Cambrian high similar to the Peace River high has been deduced from well control. It is probable that any production obtained in the Mississippian would come from the limestones in the upper part of the system. Since these beds are exposed on the Bovie Lake structure they cannot there be considered as a reservoir but in other localities where they may be buried and where either the truncated edge of these beds or a favorable structure is present, they could be regarded as a possible objective in drilling.

The poorly cemented quartzose sands of the Pennsylvanian are potentially the best reservoir rocks observed in the area . In the outcroppings in

the mountains, porous sands up to 30 or 40 feet thick were found in this system. Unfortunately, erosion or non-deposition has served to limit these rocks to approximately the same localities as the Mississippian beds namely to the southwestern part of the area. The presence of bitumen in the Pennsylvanian rocks in the mountains indicates that organic material was at one time present in these beds so that we may hope that under suitable stratigraphic and/or structural conditions oil may be found in them.

Inasmuch as the Cretaceous sandstones and shales are widely exposed in the rivers and streams in the southern parts of the area, the chances of their retaining oil appear to be slight. In addition, the argillaceous content of the sands were found to be fairly high and this too would make them relatively unfavorable as reservoirs for oil.

Oil and Gas Seepages

No seepages of oil or gas were observed during the field season. There have been in the past, however, numerous reports of oil and/or gas seeps in the general Fort Liard area, and some considerable effort was made to check these reported occurrences of hydrocarbons. In every case we found that when the local Indians were questioned regarding the precise location of seeps, they became vague and often had two or more versions as to the exact spot where the seepage was said to occur. One such seepage where "the Indians used to oil their guns" is reported to occur on the Muskeg River where it is joined by the Arrowhead River. This location is in itself interesting because it is at this point that the axis of the northern extension of the Bovie Lake structure crosses the Muskeg River, and if oil or gas were to be found here it might well be significant. However, a diligent search by the members of the field party failed to

reveal any trace of the seep.

A similar occurrence is said to occur on the Petitot River but here again no evidence of oil or was was found.

A gas seep in the muskeg area northeast of Bovie Lake is also "known" to the Indians who live at the lake during the summer, but all of those questioned were reluctant to either show where the seepage occurs or to indicate how it might be reached.

An accumulation of pack rat droppings was observed staining the surface of a sandstone outcrop on the north side of the gap in Pointed Mountain. This material had hardened into a tar-like substance which at first examination looked very much like bitumen. There can be little doubt that the occurrence of this type of material in the mountains has given rise to many of the reports of oil seepages spread by the trappers who travel this area in the winter. It might be noted however that the Pennsylvanian sandstones on Pointed Mountain were observed in some localities to have bitumen infillings in cavities and fractures, but the nature of these occurrences were not such that they could be classed as seepages.

Summary of Conclusions and Recommendations

This report presents the results of a geological reconnaissance of the Liard River - Trout Lake region of the Northwest Territories. The area covered during the field season amounted to some 4000 square miles and the combined thickness of the exposed sedimentary section amounted to something in excess of 10,000 feet. The oldest rocks observed belong to the Silurian system and the youngest were those of the Upper Cretaceous.

Reefoid developments were noted in the exposures of the Upper Devonian strata on the Blackstone River. These reefs are thought to be of a somewhat younger age than those reported by Wright (8) from the Hay River and may be equivalent to the D-1 horizons of the region to the south.

In the Carboniferous, some of the coarser crystalline limestones of the Mississippian and the less well consolidated quartzose sandstones of the Pennsylvanian could, under favorable stratigraphic and/or structural conditions, become attractive drilling objectives.

The structural aspects of the area fall into two broad categories; the mountains lying to the west of the Liard River, and the plains lying to the east. The former is characterized by sharp folding accompanied by steep reverse faulting while the latter part is underlain by beds which are largely flat-lying. The Bovie Lake feature occurs in the plains portion of the area. It is a faulted anticline with the east limb broken by a steep west-dipping reverse fault. Plunge to the north and south is indicated though there is a suggestion from the topography that the feature may be divided into three parts with structural saddles separating each part. Present surface data is insufficient to confirm the three-fold division.

The most attractive horizons from the point of view of possible hydrocarbon reservoirs are within the Upper Devonian and Pennsylvanian strata. Inasmuch as these beds crop out in northern parts of the area and in the mountains, the localities where exploration should be concentrated are in the southwest part of the area, east of the Liard River.

Since the completion of the field work outlined in this report we have dropped all our permit lands in the Northwest Territories with the exception of the two Bovie Lake blocks. Thus there can be no immediate application of the results of the season's work. However, it is not unreasonable to suppose that interest will be revived in these lands at some future date and against this time the following observations and suggestions are made:

1. Since much of this past season's work was confined to reconnaissance and the locating of suitable stratigraphic sections, it is recommended that a field party be sent into the area to remeasure the critical Paleozoic sections exposed on Jackfish and Bluefish Mountains. In addition, this party could continue northward from Nahanni Butte to Camsell Bend so that more detailed stratigraphic data on the Middle Devonian may be obtained.
2. It is suggested that a helicopter-equipped party consisting of three geologists and a cook would be the most efficient in accomplishing this task.

B I B L I O G R A P H Y

1. McConnell, R.G. — Geological Survey of Canada, Annual Report, Volume IV, 1888-1889 Part D.

2. Kindle, E.M. & Bosworth, T.O. — Oil Bearing Rock of Lower Mackenzie River Valley Summary Report 1920, Part B, p. 37.

3. Williams, M.Y. & Hume, G.S. — Geological Survey of Canada, Summary Report 1921, Part B, pp. 45-78

4. Williams, M.Y. & Hume, G.S. — Geological Survey of Canada, Summary Report 1922, Part B, pp. 47-87

5. Cameron & Warren, P.S. — The South Nahanni River, Canadian Field Naturalist, Vol. 52, No. 2 - 1938

6. Nauss, A.W. — The Nelson-Liard River Area, N.W.T. Imperial Oil Limited Canol Project #6 - 1944, GR-NY 75

7. Hage, C.O. — Geological Survey of Canada Paper 45-22 "Geological Reconnaissance along the Lower Liard River, N.W.T."

8. Wright, W.I. — Geology of the Great Slave Lake Region, N.W.T. - 1951 GR-NY 282

9. Wright, W.I. & Slavin, R.L. — Geology of Maxhamish Lake & Bovie Lake Areas, B.C. & N.W.T. 1951 - GR-NY 250

A P P E N D I X I

List of Fossil Localities

&

Report on Fossil Lots Collected

LIST OF FOSSIL LOCALITIES

Most of these fossil localities have been located on Aerial Photographs obtained from the Royal Canadian Air Force.

Aerial Photograph abbreviation - A.P.

1E/52 A.P. A11942-8 - Outcrop south side of Petitot River approximately 1/4 mile from its junction with the Liard River. (Cret.?)

2E/52 A.P. A11942-8 - Outcrop approximately 1 mile west of Bovie Lake. These fossils collected 200 feet south of fossils 2-T-52 near same stratigraphic equivalent. (Miss.?)

3E/52 Same ridge as above but approximately 2000 feet north of station 2-T-52. (Miss.?)

E5A-52 A.P. A12040-297 - Pointed Mountain. North side of the gap; near top of Mountain. (Penn.?)

E5C-52 A.P. A12040-297 - Stratigraphically above E5A-52. (Penn.?)

E5H-52 A.P. A12040-297 - Stratigraphically below both E5A and E5C. (Miss.?)

E5J-52 A.P. A12040-297 - Below E5H. (Miss.?)

E6A-52 A.P. A12328-364 - Along top of Labiche Range.

E7D-52 Junction of Arrowhead and Muskeg Rivers on the northwest side.

E8A-52 A.P. A12040-261 - Pointed Mountain. West of Fisherman's Lake and south of gap. (Penn.?)

E8B-52 A.P. A12040-261 - Believed stratigraphically lower than E8A. (Penn.?)

E8F-52 A.P. A12040-261 - Northwest approximately 2/3 mile of E8B but believed nearly stratigraphic equivalent.

E8J-52 A.P. A12040-261 - Approximately 1/2 mile west E8F - Similar to outcrop at E5A. (Penn.?)

E9H-52 A.P. A12040-261 - Gulley going down into gap between two sections of Pointed Mountain west of Fisherman's Lake.

E10C-52 A.P. A12320-111 - Approximately four miles north from the Labiche River on a Labiche range spur. Sandstone stratigraphically as above. (Penn.? or Miss.?)

E10D-52 A.P. A12320-111 - Stratigraphically below E10C.

E10E-52 A.P. A12320-111 - Stratigraphically below E10D; large brachiopod in lense of limestone.

E10F-52 A.P. A12320-111 - Stratigraphically below E10E.

E11A-52 A.P. A12320-109 - Two miles north from Labiche River where it cuts through Labiche Range of mountains. (Penn.?)

E11D-52 A.P. A12320-109 - Stratigraphically lower than E11A.

E12A-52 A.P. A12040-299 - Along ridge west of centre of photograph. (Penn. or Miss.)

E12F-52 A.P. A12040-299 - Approximately 1/2 mile north of E12A.

E12H-52 A.P. A12040-299 - Approximately 1-1/2 miles north and slightly east of E12A. (Penn.?)

E13B-52 A.P. A12034-277 - Near northwest corner of photograph. (Miss.?)

E13C-52 A.P. A12034-277 - Stratigraphically above E13G. (Miss.?)

E13E-52 A.P. A12034-277 - Near same horizon as E13G. (Miss.?)

E13I-52 A.P. A12034-277 - Believed between E13B and E13G stratigraphically.

E13J-52 A.P. A12034-277 - Below E13B.

E14B-52 A.P. A12034-276 - Top of Mississippian? Section measured here.

E14F-52 A.P. A12034-276 - Talus believed between E14E and E14G.

E14G-52 A.P. A12034-276 - Believed stratigraphically below E14E.

E14I-52 A.P. A12034-276 - Below E14F.

E15A-52 A.P. A12034-276 - Below E14I.

E15B-52 A.P. A12034-204 - Approximately 1 inch southwest of centre of photograph at edge of cliff near a minor fault. (Miss.?)

E15C-52 A.P. A12034-204 - Near prominent ridge below E15B; also stratigraphically lower.

E15D-52 A.P. A12034-204 - Stratigraphically between E15B and E15D.

E15F-52 A.P. A12034-204 - Believed to be below or stratigraphically equivalent of E15C.

E15G-52 A.P. A12034-204 - Below E15F.

E15H-52 A.P. A12034-204 - Below E15G.

E16A-52 A.P. A12034-276 - Stratigraphically below E15A.

E16B-52 A.P. A12034-276 - May be below E16A but from here down the section in part has been repeated by folding.

E16C-52 A.P. A12034-276 - Can this be correlated with any of the previous fossils in E14, 15 and 16? Observations by helicopter north of here indicate the section may have been repeated by folding.

E16F-52 A.P. A12034-275 - Two inches southwest of centre of photograph; Talus (Miss.?)

E17E-52 A.P. A12034-274 - Two inches west and very slightly south of centre of photograph. (Miss.?)

E20A-52 Outcrop on top of anticlinal structure extending south from Bovie Lake and on the south side of the Petitot River. Photo 167/6/3-71.

E20B-52 Outcrop two miles north of the anticline on the Petitot River. Photo 167/6/3-74.

E21A-52 Northerly exposure on top ridge west of Bovie Lake. Photo 167/6/3-79. (Miss.?)

E23C-52 A.P. A12034-299 - Three inches east and one inch north of centre of photograph. (Miss.?)

E23G-52 A.P. A12034-299 - Edge straight east of centre of photograph. (Miss.?)

E23H-52 A.P. A12034-299 - Two and one-half inches east and one-half inch south of centre of photograph. (Miss.?)

E24F-52 A.P. A11942-37 - One-half inch north and one inch west of the centre of the photograph. (Middle Dev.?)

E25A-52 A.P. A11942-37 - Near topographic cairn. (Middle Dev.?)

E25D-52 A.P. A11942-37 - Two and one-half inches east and one inch south of centre of photograph. (Middle Dev.?)

E25F-52 A.P. A11942-37 - Two inches east and two inches south of centre of photograph. (Middle Dev.?)

E26-200-201-52 A.P. A12034-225 - Section measured down spur 3 inches north and 1-1/2 inches east of centre of photograph. This section continues down into the Mississippian? from section indicated from fossil lot 35-M-52.

E26-201-202-52
202-203

E26-203-204-52
204-205
209-210
213-214
214-215
215-216

E26-216-217-52 A.P. A12034-225 - This section of measured Miss. ends about 1/2 inch east and 2-1/2 inches north of centre of photograph. (Miss.?)

E31A-52 South Nahanni N.W. 60/120 - aeronautical map. Fossils from outcrop 2 miles north and slightly west of junction of Meilleur Creek with the South Nahanni River. (Sil.?)

E31B-52 South Nahanni N.W. 60/120 - aeronautical map. Fossils from outcrop at creek joining the South Nahanni River 1-1/2 miles upstream from Prairie Creek, in Deadman's Valley. (Dev.?)

E32A-52 A.P. A11989-383 - One-third of an inch west and one-quarter of an inch north of the centre of the photograph. This section is stratigraphically above 25-T-52. (Miss.?)

E32A5-52 A.P. A11989-383 - Stratigraphically above E32A.

E33A-52 These fossils were picked up from a rock scarp near a small lake between the Birch River and the Blackstone River. (Upper Dev.?)

E34A-52 These fossils were found at the east end of Liard Rapids at "Beaver Dam."

E36A-52 Section measured on Liard Rapids. Sequence noted on enclosed Summary of Stratigraphic Position of Fossils Collected on the Liard Rapids.

E10D-52 A.P. A12320-111 - Stratigraphically below E10C.

E10E-52 A.P. A12320-111 - Stratigraphically below E10D; large brachiopod in lense of limestone.

E10F-52 A.P. A12320-111 - Stratigraphically below E10E.

E11A-52 A.P. A12320-109 - Two miles north from Labiche River where it cuts through Labiche Range of mountains. (Penn.?)

E11D-52 A.P. A12320-109 - Stratigraphically lower than E11A.

E12A-52 A.P. A12040-299 - Along ridge west of centre of photograph. (Penn. or Miss.)

E12F-52 A.P. A12040-299 - Approximately 1/2 mile north of E12A.

E12H-52 A.P. A12040-299 - Approximately 1-1/2 miles north and slightly east of E12A. (Penn.?)

E13B-52 A.P. A12034-277 - Near northwest corner of photograph. (Miss.?)

E13G-52 A.P. A12034-277 - Stratigraphically above E13G. (Miss.?)

E13H-52 A.P. A12034-277 - Near same horizon as E13G. (Miss.?)

E13I-52 A.P. A12034-277 - Believed between E13B and E13G stratigraphically.

E13J-52 A.P. A12034-277 - Below E13B.

E14E-52 A.P. A12034-276 - Top of Mississippian? Section measured here.

E14F-52 A.P. A12034-276 - Talus believed between E14E and E14G.

E14G-52 A.P. A12034-276 - Believed stratigraphically below E14E.

E14I-52 A.P. A12034-276 - Below E14F.

E15A-52 A.P. A12034-276 - Below E14I.

E15B-52 A.P. A12034-204 - Approximately 1 inch southwest of centre of photograph at edge of cliff near a minor fault. (Miss.?)

E15C-52 A.P. A12034-204 - Near prominent ridge below E15B; also stratigraphically lower.

E15D-52 A.P. A12034-204 - Stratigraphically between E15B and E15D.

E15F-52 A.P. A12034-204 - Believed to be below or stratigraphically equivalent of E15C.

E15G-52 A.P. A12034-204 - Below E15F.

E15H-52 A.P. A12034-204 - Below E15G.

E16A-52 A.P. A12034-276 - Stratigraphically below E15A.

E16B-52 A.P. A12034-276 - May be below E16A but from here down the section in part has been repeated by folding.

E16C-52 A.P. A12034-276 - Can this be correlated with any of the previous fossils in E14, 15 and 16? Observations by helicopter north of here indicate the section may have been repeated by folding.

E16F-52 A.P. A12034-275 - Two inches southwest of centre of photograph; Talus (Miss.?)

E17E-52 A.P. A12034-274 - Two inches west and very slightly south of centre of photograph. (Miss.?)

E20A-52 Outcrop on top of anticlinal structure extending south from Bovie Lake and on the south side of the Petitot River. Photo 167/6/3-71.

E20B-52 Outcrop two miles north of the anticline on the Petitot River. Photo 167/6/3-74.

E21A-52 Northerly exposure on top ridge west of Bovie Lake. Photo 167/6/3-79. (Miss.?)

E23C-52 A.P. A12034-299 - Three inches east and one inch north of centre of photograph. (Miss.?)

E23G-52 A.P. A12034-299 - Edge straight east of centre of photograph. (Miss.?)

E23H-52 A.P. A12034-299 - Two and one-half inches east and one-half inch south of centre of photograph. (Miss.?)

E24F-52 A.P. A11942-37 - One-half inch north and one inch west of the centre of the photograph. (Middle Dev.?)

E25A-52 A.P. A11942-37 - Near topographic cairn. (Middle Dev.?)

E25D-52 A.P. A11942-37 - Two and one-half inches east and one inch south of centre of photograph. (Middle Dev.?)

E25F-52 A.P. A11942-37 - Two inches east and two inches south of centre of photograph. (Middle Dev.?)

J-1-1	Liard River above Liard Rapids. Devonian.
J-1-2	Same location as J-1-1 but stratigraphically higher. Devonian.
J-1-4	Liard River, downstream from J-1-1. Devonian.
J-1-6	Liard River. Devonian. Stratigraphic position uncertain.
J-2-1	Liard Rapids, downstream from J-1-5 and stratigraphically lower. Devonian.
J-2-2	Same location as J-2-1 and stratigraphically equivalent. Devonian.
J-2-3	Liard Rapids, downstream from J-2-2 and stratigraphically lower. Devonian.
J-2-4	Same location as J-2-3 and stratigraphically equivalent. Devonian.
J-2-5 (2) & J-2-6	Liard Rapids downstream from J-2-4 and stratigraphically lower. Devonian.
J-2-7, J-2-8 & J-2-9	Liard Rapids, downstream from J-2-5 and stratigraphically lower. Devonian.
J-3-1, J-3-2 & J-3-3	Liard Rapids, stratigraphically equivalent to J-2-7. Devonian.
J-3-4 & J-3-5	Liard Rapids, stratigraphically lower than J-2-7. Devonian.
J-3-6 & J-3-8	Liard Rapids, stratigraphically lower than J-3-5. Devonian.
J-3-7	Liard Rapids, stratigraphically higher than J-3-6 but lower than J-3-5.
J-3-9	Liard River, stratigraphically lower than J-3-7 and equivalent to F16-T-1. Devonian.
J-4-1	Liard Rapids, stratigraphically equivalent to J-1-5. Devonian.
J-4-2	Liard Rapids, stratigraphically lower than J-4-1 but higher than J-2-1. Devonian.
J-4-3	Liard Rapids. Devonian.
J-4-4	Liard Rapids. Devonian.
J-4-5	Liard Rapids. Devonian.
J-4-6	Liard Rapids. Devonian.

1-T-52 Petitot River, on north side of River about one mile upstream from Junction of Petitot and Liard Rivers. Cretaceous.
(4 sample bags)

2-T-52 Lower ridge west of Bovie Lake. Mississippian?

3-T-52 Upper ridge west of Bovie Lake. Mississippian? 3-T-52 is stratigraphically higher than 2-T-52.

4-T-52 Upper ridge west of Bovie Lake. Mississippian? 4-T-52 is same strata as 3-T-52.

5-T-52 Same as 4-T-52 but 25 feet lower.

6A-T-52 Labiche Range, in area covered by Department of National Defence. Aerial Photograph A12320-112. Penn?

6-T-52 Similar location to 5-T-52. Penn? Stratigraphically lower than 5-T-52.

7-T-52 Similar location to 5-T-52. Stratigraphically lower than 6-T-52. Miss.?
(2 sample bags)

8-T-52 Liard Range, on spur towards Pointed Mountain - Penn.?

9-T-52 Same location as 8-T-52 but stratigraphically higher. Penn.?

10-T-52 Same location as 8-T-52 but stratigraphically above 9-T-52. Penn.?

11-T-52 Same location as 8-T-52, stratigraphically above 10-T-52. Penn.?
(4 sample bags)

12-T-52 Same location as 8-T-52, stratigraphically above 11-T-52. Penn.

13-T-52 Liard Range, just northeast of location of 8-T-52. Believed from fossils to be same horizon as 11-T-52. Penn.

14-T-52 Liard Range, see Aerial Photograph A12034-278. Mississippian.

15-T-52 Same location as 14-T-52. Mississippian.

16-T-52 Same location as 14-T-52. Pennsylvanian.

17-T-52 Liard Range, Aerial Photograph 12034-203. Mississippian.

18-T-52 Same location as 17-T-52 but higher. Mississippian.

T-7T-T1 Same location as 17-T-52 but from Talus stratigraphically higher than 18-T-52. Mississippian.

T-7T-T2 Same location as 17-T-52 but from Talus stratigraphically higher than T-7T-T1. Mississippian.

19-T-52 Liard Range, see Aerial Photograph A12034-201. Mississippian.

20-T-52 Same location as 19-T-52. Mississippian.

21-T-52 Same location as 19-T-52 but stratigraphically higher than 20-T-52. Mississippian.

22-T-52 Liard Range, about five miles north of Sawmill Mountain. Mississippian.

23-T-52 Same location as 22-T-52 but stratigraphically higher. Mississippian.

24-T-52 Bluefish Mountain - Devonian?

T-12T-T1 Same location as 24-T-52 but from Talus stratigraphically higher than 24-T-52. Mississippian.

26-T-52 Bluefish Mountain, stratigraphically higher than T-12T-T1. Mississippian.

25-T-52 Bluefish Mountain, stratigraphically higher than 26-T-52. Mississippian.

T-12T-T2 Bluefish Mountain, from Talus at 25-T-52. Mississippian?

F14-T-1 Blackstone River about twenty-five miles upstream from junction with Liard River. Devonian. "Leiorhynchus" zone.

F15-T-1 Birch River about 7 miles upstream from junction with Liard River. Devonian. Believed to be stratigraphically lower than F14-T-1.

F15-T-2 Poplar River about 5 miles upstream from junction with Liard River. Devonian.

F16-T-1 Liard River, on south side of River about 4 miles below Liard Rapids. Devonian.

1-W-52 Outcrop on south side of Petitot River about one-half mile from its junction with the Liard River - Cretaceous.

2-W-52 Outcrop on south side of Petitot River, presumably higher than 1-W-52 - Cretaceous.

3-W-52 Outcrop on Petitot River about four miles upstream from junction of Petitot and Liard Rivers, higher stratigraphically than 2-W-52. Cretaceous.

4-W-52 Ridge west of Bovie Lake - Mississippian.

5-W-52 Upper ridge west of Bovie Lake; 5-W-52 stratigraphically higher than 4-W-52. Mississippian.

6-W-52 Pointed Mountain. Permo-Pennsylvanian?

7-W-52 Pointed Mountain, below 6-W-52. Permo-Pennsylvanian?

10-W-52 Pointed Mountain, below 6-W-52. Permo-Pennsylvanian?

11-W-52 Pointed Mountain, below 6-W-52 but above 10-W-52, collected in drift. Permo-Pennsylvanian.

12-W-52 Labiche Range - just north of where the Labiche River cuts through the range. Pennsylvanian?

13-W-52 Same location as 12-W-52 but stratigraphically lower - Pennsylvanian?

14-W-52 Same location as 12-W-52 but below 13-W-52. Pennsylvanian?

15-W-52 Labiche Range; see Department of National Defence aerial photo 12328-364 - Pennsylvanian?

16-W-52 Same location as 15-W-52 but stratigraphically higher? Pennsylvanian.

17-W-52 Liard Range, aerial photo 12034-276. Mississippian?

18-W-52 Same location as 17-W-52. Mississippian?

19-W-52 Same location as 17-W-52. Pennsylvanian.

20-W-52 Same location as 17-W-52, below 19-W-52. Pennsylvanian.

21-W-52 Same location as 17-W-52, below 20-W-52. Pennsylvanian.

20A-W-52 Liard Range. Aerial Photograph 12034-274. Mississippian.

20X-W-52 Same location as 20A-W-52 but stratigraphically higher. Mississippian.

20B-W-52 Same location as 20A-W-52 but stratigraphically higher than 20X-W-52. Mississippian.

22-W-52 Same location as 20A-W-52 but stratigraphically higher than 20B-W-52. Mississippian.

23-W-52 Liard Range. Aerial Photograph 12034-203. Mississippian.

24-W-52 Same location as 23-W-52 but stratigraphically higher. Mississippian.

25-W-52 Same location as 23-W-52. Mississippian. Believed to be about equal to 23-W-52.

26-W-52 Liard Range. Aerial Photograph 12034-200. Pennsylvanian.

27-W-52 Petitot River, point where Petitot River crosses B.C. - N.W.T. Boundary. Mississippian.

28-W-52 Liard Range, Aerial Photograph 12034-258. Mississippian.

29-W-52 Same location as 28-W-52 but stratigraphically higher. Mississippian.

30-W-52 Mattson Creek, about 5 miles upstream from junction with South Nahanni River. Devonian?

31-W-52 Blackstone River, about 15 miles upstream from junction with Liard River. Devonian.

32-W-52 Same location as 31-W-52. Devonian.

33-W-52 Little Butte, about 3 miles southwest of Nahanni Butte. Devonian.

34-W-52 Poplar River about 5 miles upstream from junction with Liard River. Devonian.

35-W-52 Jackfish Mountain west of Nahanni Butte. Mississippian.

36-W-52 Jackfish Mountain, stratigraphically lower than 35-W-52. Mississippian. Talus.

37-W-52 Jackfish Mountain, stratigraphically lower than 36-W-52. Mississippian.

38-W-52 Mountain immediately north of Bluefish Lake, near Nahanni Butte. Devonian.

39-W-52 Bluefish Lake, stratigraphically lower than 38-W-52. Devonian.

40-W-52 Birch River, about 7 miles upstream from junction with Liard River. Devonian.

41-W-52 Same location as 40-W-52 but stratigraphically lower. Devonian.

42-W-52 Same location as 40-W-52 but stratigraphically higher. Devonian.

43-W-52 Same location as 40-W-52 and stratigraphically equivalent to 41-W-52. Devonian.

44-W-52 Bluefish Lake, stratigraphically higher than 38-W-52. Devonian.

45-W-52 Bluefish Lake, stratigraphically lower than 44-W-52. Devonian.

46-W-52 Bluefish Lake, stratigraphically lower than 45-W-52. Devonian.

47-W-52 Poplar River, about 5 miles upstream from junction with Liard. Same beds as F15-T-2. Devonian.

48-W-52 Same location as 47-W-52 but stratigraphically higher. Devonian.

49-W-52 Jean-Marie Creek, at junction of two creeks east of Deep Lake. Devonian. Talus.

50-W-52 Same location as 49-W-52 but stratigraphically higher. Devonian.

50A-W-52 Same location as 50-W-52. Collected from Talus at 50-W-52. Devonian.

51-W-52 Liard Rapids. Devonian.

51A-W-52 Liard Rapids, same beds as 51-W-52 but from Talus. Devonian.

52-W-52 Liard River downstream from 51-W-52 and stratigraphically lower. Devonian.

53-W-52 Liard River, on south side of River across from Matou River. Devonian.

Report on Samples containing Microfossils, from the Southwestern part of the Northwest Territories

submitted by J.A. Wallace

Lot E 4 E on the north side of the gap in Pointed Mountain at west end of Fisherman Lake, near Fort Liard.

Foraminifera

Plectogyra similar to a species illustrated but not named specifically from the Meramecian part of the Mississippian by Zeller.

Endothyra similar to one illustrated but not named from beds of Meramec stage by Zeller.

Endothyra new species

Ostracods

Bairdia cf. depressa Geis
Bairdia cf. permagna Geis
Bairdia sp. A
Bairdia sp. B
Glytopleura cf. elegantis Geis
Paraparchites cf. carbonarius (Hall) after Geis

These fossils indicate the Meramec stage of the Mississippian period.

Lot E 10 D LaBiche Range about one mile north of where LaBiche River flows through the range and reaches the plateau country in the east-southwest of Fort Liard. This sample contained many fragments of bryozoans and ostracods but none was good enough for identification.

E 26-200-201 Jackfish Mountain about 12 miles northwest of junction of Liard and South Nahanni River on south side of Nahanni River. Shows on R.C.A.F. Photograph A. 12034-225; section measured down spur 3 inches north 1-1/2 inches east of center of this photograph.

Foraminifera

Plectogyra apparently the same as one in E 4 E.

Ostracods

Bairdia similar to species A of E 4 E but smaller.

Amphissites new species

These fossils indicate Mississippian age, probably about Meramec stage.

E 26-201-202 same as E 26-200-201 but stratigraphically lower.

Foraminifera

Pelectogyra sp.

Ostracods

Bairdia sp. fairly close to permagna Geis but preservation not good enough to be certain.

Bairdia species not identifiable.

Mississippian age is indicated by these fossils but no stage within the Mississippian can be determined at this time.

25 T 52 Bluefish Mountain about eight miles northwest of junction of Liard and South Nahanni rivers, stratigraphically higher than 26 T 52.

Fragments of bryozoans, conodonts and the following ostracods:

Acratia (?) sp.
Cavellina sp.
Corrigella cf. tuberculospinosa (Jones and Kirby) after Cooper
Healdia sp.
Knightina n. sp.
Jonesina sp.
Paraparchites cf. claytonensis Knight fide Cooper
Paraparchites sp.

These ostracods show close resemblance to some described from beds of Pennsylvanian age in central United States.

26 T 52 Bluefish Mountain same locality as 25 T 52, stratigraphically higher than T-12-T52

Several ostracods were found in this sample but none complete enough to permit identification.

No age determination possible at present.

4 W 52 Bovie Lake, N.W.T. East facing cliff west of the Lake.

This rock is about 90% crinoid fragments. No other identifiable fossils were found.

18 W 52 Liard Range about 30 miles northwest of Fort Liard. R.C.A.F. Air Photograph A 12034-276 on spur just left of center of photo.

Few fragments of bryozoans and brachiopods, no identifiable fossils found. (Very small sample.)

29 X-W 52 Liard Range about 30 miles northwest of Fort Liard, R.C.A.F. Photograph 12034-274.

Foraminifera

Plectogyra - no specimens complete enough for specific identification.

Several ostracods including a species of

Bairdia but all specimens obtained are partly broken.

The Plectogyra indicates Mississippian age possibly about the same zone as E 26-201-202.

21 W 52 Liard Range about 30 miles northwest of Fort Liard.

No microfossils.

27 W 52 Petitot River near anticline.

Plectogyra sp.
Bairdia sp.

These specimens are not well enough preserved to permit specific identification. The genus Plectogyra indicates Mississippian age.

32 W 52 On limestone ridge southeast of Liard River paralleling the "Long Reach" of the Liard River, N.W.T.

Tentaculies sp. probably Devonian.

Signed: R.T.D. Wickenden,
Geologist in Charge,
Western Canada Subsurface
Office,
Geological Survey of Canada.

Report on Fossils from Liard River Area, N.W.T.

Submitted by Socony-Vacuum Exploration Company

Determinations

G.S.C. No. 21951, Field No. 1-T-52

From: "Petitot River, on north side of River, about one mile upstream from Junction of Petitot and Liard Rivers."

Gastroplites cf. *canadensis* (Whiteaves)
Arctica sp. indet.
Goniomya sp. indet.
Tellina sp. indet.
? *Mactra* sp. indet.
? *Aucellina* sp. indet.

numerous poorly preserved pelecypods and gastropods, genus and species indet.

G.S.C. No. 21986, Field No. 1-W-52

From: "Outcrop on south side of Petitot River about one-half mile from its junction with the Liard River."

Fragments of an indeterminate large pelecypod
(? possibly a large *Pecten* sensu lato)

G.S.C. No. 21987, Field No. 2-W-52

From: "Outcrop on south side of Petitot River; presumably higher than 1-W-52."

Posidonomya nahwisi McLearn

G.S.C. 21988, Field No. 3-W-52

From: "Outcrop on Petitot River about four miles upstream from junction of Petitot and Liard Rivers; higher stratigraphically than 2-W-52."

Neogastroplites cornutus (Whiteaves)
Neogastroplites cf. *selwyni* (Whiteaves)
? *Beudanticeras* sp. indet. (poor, badly squashed specimen)

G.S.C. 22070, Field No. IE/52

From "A.P. A11942-8- Outcrop, south side of Petitot River approximately 1/4 mile from its junction with the Liard River."

No identifiable fossils

G.S.C. 22078, Field No. E7D-52

From: "Junction of Arrowhead and Muskeg Rivers on the northwest side."

No identifiable fossils. The ammonite-like body within the concretion is probably inorganic.

Stratigraphy

The age of the lots Nos. 21986, 22070 and 22078 cannot be determined due to the total lack of identifiable fossils.

Lot No. 21951 contains Gastroplites cf. canadensis (Whiteaves) the index fossil of the Gastroplites zone, which belongs to the late Lower Cretaceous Fort St. John Group of NE British Columbia and adjacent areas of the Northwest Territories. In terms of the international standard stages this zone is of an early Albian age.

The beds containing Gastroplites cf. canadensis (Whiteaves) on Petitot River may be correlated with the upper part of the Scatter formation or with the lower part of the Lepine formation of neighbouring areas, which carry the Gastroplites fauna.

In the Peace and Pine River valleys the Hasler formation and the upper part of the Commotion formation contain Gastroplites. Consequently they are of the same age as the beds with Gastroplites cf. canadensis (Whiteaves) on Petitot River.

Lots Nos. 21987 and 21988 are considered to be of the same age and are younger than the beds with G. cf. canadensis (Whiteaves). The Posidonomya nahwisi fauna is shown to be but a faunal facies of the widerspread

Neogastroplites zone in the upper part of the late Lower Cretaceous - Fort St. John Group (see F.H. McLearn, G.S.C. Mem. 259, p. 84, 87, 88, 93). The Neogastroplites zone is younger than the Gastroplites zone and has been found in Goodrich formation on the Pine and Peace Rivers, in the lower part of the Sikanni formation and in unnamed equivalent rocks in the Halfway, Sikanni Chief, Buckinghorse, and Tetsa River valleys. The Neogastroplites fauna was already recorded from Petitot River valley by Hage (G.S.C. Paper 45-22).

In terms of the international standard stages the Neogastroplites zone is of Albian (? middle or upper?) age.

Signed: J. A. Jeletzky,
Geological Survey of Canada,
Division of Stratigraphic Palaeontology,
Ottawa.

TROUT LAKE

RIVER

ARROWHEAD

MUSKEG

RIVER

Celibeta Lake

Lake Bowe

Maxhamish Lake

RETITOT

NORTHWEST TERRITORIES

BRITISH COLUMBIA

RIVER

RIVER

LINE OF CROSS SECTION A-B

HOR SCALE 2 inches = 1 mile
VERT SCALE 1 inch = 2500 feet

LINE OF CROSS SECTION C-D

HOR SCALE 2 inches = 1 mile
VERT SCALE 1 inch = 2500 feet

INDEX MAP OF REPORT AREA

GEOLOGICAL MAP OF
LIARD RIVER — TROUT L
NORTHWEST TERRITO
SCALE: 1 inch = 2 mile

—LEGEND—

UPPER CRETACEOUS
- Kfk KOTANEELEE
- Kfn FORT NELSON

LOWER CRETACEOUS
- Kfj FORT ST. JOHN

PERMO-PENNSYLVANIAN
- Cp

MISSISSIPPIAN
- Cm

UPPER DEVONIAN
- Dr

MIDDLE DEVONIAN
- Dm RAMPARTS

SILURIAN
- S LONE MOUNTAIN

GEOLOGICAL BOUNDARY (observed)
GEOLOGICAL BOUNDARY (inferred)
ANTICLINAL AXIS
SYNCLINAL AXIS
FAULT
ESCARPMENT
FOSSILS (COLLECTION NUMBER SHOWN AT EACH LOCALITY)
BEDDING (observed)
BEDDING (observed from air photograph)
SLUMPED ROCK EXPOSURE
TRIANGULATION POINT

SHELL OIL EXPLORATION COMPANY
CALGARY, ALBERTA

PLATE No. 6

30x

West Canadian Graphic Industries Ltd.

LIARD RIVER

BLACKSTONE RIVER

NETLA RIVER

RIVER

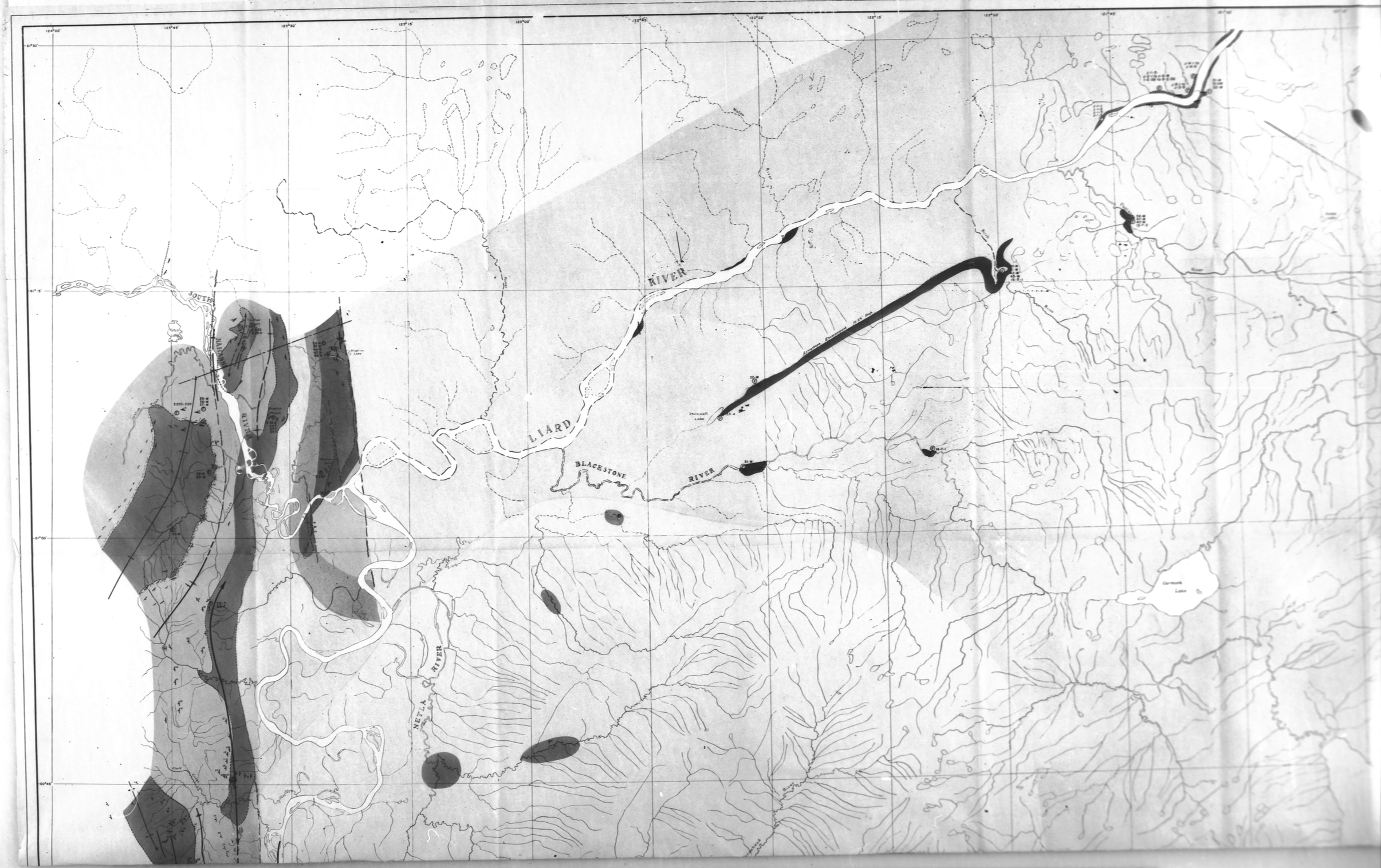
Stairwall Lake

Cormark Lake

TROUT LAKE

30x

West Canadian Graphic Industries Ltd.


RIVER
LIARD
BLACKSTONE
RIVER
NETLA
RIVER
30x

RIVER

LIARD

BLACKSTONE RIVER

NETLA RIVER

Limestone Escarpments

Stonewall Lake

Cormack Lake

THOUT RIVER

30x

West Canadian Graphic Industries Ltd.

RIVER

LIARD

BLACKSTONE RIVER

NETLA RIVER

Cormack Lake

TROUT RIVER

TROUT LAKE

RIVER

TROUT LAKE

RIVER

ARROWHEAD

MUSKEG

RIVER

RIVER

Fisherman Lake

Pt. Lisas

Lake Bove

Celibeta Lake

Mazhamah Lake

RIVER

60°00'

BRITISH COLUMBIA

NORTHWEST TERRITORIES

LINE OF CROSS SECTION A-B
HOR. SCALE: 2 inches = 1 mile
VERT. SCALE: 1 inch = 2500 feet

LINE OF CROSS SECTION C-B
HOR. SCALE: 2 inches = 1 mile
VERT. SCALE: 1 inch = 2500 feet

INDEX MAP OF REPORT AREA

GEOLOGICAL MAP OF
LIARD RIVER — TROUT LAKE AREA
NORTHWEST TERRITORIES
SCALE: 1 inch = 2 miles

—LEGEND—

UPPER CRETACEOUS
- KOTAneelee
- PORT NELSON

LOWER CRETACEOUS
- PORT ST JOHN

PERMO-PENNSYLVANIAN

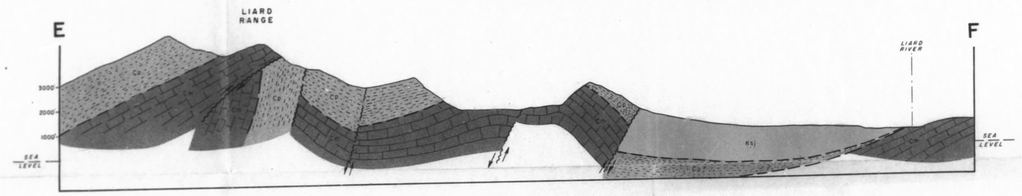
MISSISSIPPIAN

UPPER DEVONIAN

MIDDLE DEVONIAN
- HOMPUTS

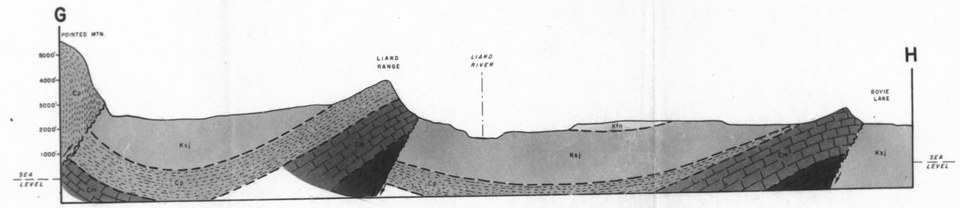
SILURIAN
- LONE MOUNTAIN

30x



CROSS SECTION E-F

HOR. SCALE: 1 INCH = 1 MILE
VERT. SCALE: 1 INCH = 2000 FEET



CROSS SECTION G-H

HOR. SCALE: 1 INCH = 2 MILES
VERT. SCALE: 1 INCH = 2000 FEET

LEGEND

UPPER CRET.
- Kfn ..... FT. NELSON FM.

LOWER CRET.
- Ksj ..... FT. ST. JOHN FM.

CARBONIFEROUS
- Cp ..... PENNSYLVANIAN
- Cm ..... MISSISSIPPIAN

DEVONIAN
- Dv ..... DEVONIAN (UNDIFF.)

SOCONY - VACUUM EXPLORATION COMPANY
CALGARY ALBERTA

PLATE NO. 7.

Geology by: J.A.W.
To Accompany Report

Date: January, 1954
Map File No:

DEVONIAN

NOTES:

1. Localities for each area arranged stratigraphically, highest bed on left.
2. Between Birch and Blackstone Rivers.
3. Stratigraphic order unknown.

COLLECTION LOCALITY NUMBER

J-14-1 | 1E-36A | 2E-36A | J-4-2, 3E-36A | J-4-3, 3E-36A | J-4-4, 4-5 | 6E-36A | J-4-6, 7E-36A, 8E-36A | Liard Rapids (1) | J-2-3, J-2-4 | 51W, 51A-W | J-2-5, J-2-6 | E-34A | 52-W | J-3-2 to 9, J-3-10 & 3 | J-3-4 and 5 | J-3-7 | J-3-6 and 8 | J-3-9 and F16-7I | Jean-Marie Creek | 50 W | 49 W | 48 W | 47 W, 34W, 47W | Poplar River | 46 W | F15-7I, 40 W | Birch River | 41W, 43 W | E-33A | Stonewall Lake (2) | F14-7-1 | Blackstone River | 31 W | J-1-2 | J-1-2 | J-1-2 | Liard River Above Rapids (3) | J-2-1 | J-1-4 | 53 W | 24-7 | 44 W | Bluefish Lake | 45 W | 46 W | Mountain | 38 W | E-24F | E-25A | Locality unspecified | E-25D | E-25F

—BRACHIOPODA—

1. Atrypa
2. Atrypa cf. canadensis *Webster*
3. Atrypa cf. devoniana *Webster*
4. Athyris
5. cf. Athyris gen. nov. cf. angelica *Hall*
6. Camarotoechia cf. horsfordi *Hall*
7. Camarotoechia cf. letiensis *(Gosselet)*
8. Chonetes
9. Crania
10. Cyrtina
11. ? Cyrtina
12. Cyrtiopsis
13. Cyrtiopsis keteticus *(Crickmay)*
14. Cyrtospirifer
15. Cyrtospirifer sp. A
16. Douvillinid
17. Gypidula sp. A.
18. Gypidula sp. B.
19. Hypothyridina
20. Hypothyridina cf. emmonsi *(Hall and Whitfield)*
21. Indospirifer sp. A.
22. Leioproductus cf. plicatus *(Kindle)*
23. cf. Leptostrophia
24. Lingula
25. Nervostrophia
26. Nudirostra basilica *(Crickmay)*
27. Productella
28. Productellid
29. Pugnax sp. A.
30. Pugnoides sp. B.
31. Pugnoides sp. C.
32. "Reticularia" sp. A.
33. Schizophoria
34. Spiriferoid
35. Spiriferoid gen. nov. A.
36. Stropheodontid
37. ? Theodossia sp.

—CORALS—

1. Alveolites
2. Auloporo
3. Cladopora
4. Coenites
5. Corals
6. Cup corals
7. Cystiphyllid
8. Disphyllid
9. Disphyllum
10. Favosites
11. Hexagonaria
12. Hexagonaria cf. magna *(Fenton and Fenton)*
13. Leptoinophyllid
14. Macgeea
15. Mictophyllum
16. Mictophyllum cf. nobile *(Lang and Smith)*
17. Pachyphyllum
18. Pachyphyllum cf. exigua *(Lambe)*
19. Pachyphyllum nevadense *Stumm*
20. Pachyphyllum cf. woodmani *(White)*
21. Phillipsastrea
22. Spongophyllum sp. nov.
23. Synaptophyllum
24. Synaptophyllum cf. arundinaceum *(Billings)*
25. Synaptophyllum stramineum *(Billings)*
26. Syringopora
27. Tabulophyllum
28. Tabulophyllum cf. mcconnelli *(Whiteaves)*
29. Thamnopora

—INCERTAE SEDIS—

1. Amphipora
2. Stromatoporoid

—MOLLUSCA—

1. cf. Actinopteria
2. Conocardium
3. Gastropods
4. Leptostrophia
5. cf. Murchinsonia
6. Nautiloids
7. Pelecypod
8. Trochonemopsis

—BRYOZOA—

1. Fennestrellid bryozoan
2. Trepostome bryozoan

—ARTHROPODA—

1. Leperditioid ostracods
2. Scutellum

SOCONY-VACUUM OIL CO. OF CANADA LTD.
CALGARY, ALBERTA

PLATE No. 8

Compiled by:
Drawn by: R.J.S.
Approved by:

Date: June, 1954
File No:

CHART OF DEVONIAN FAUNA

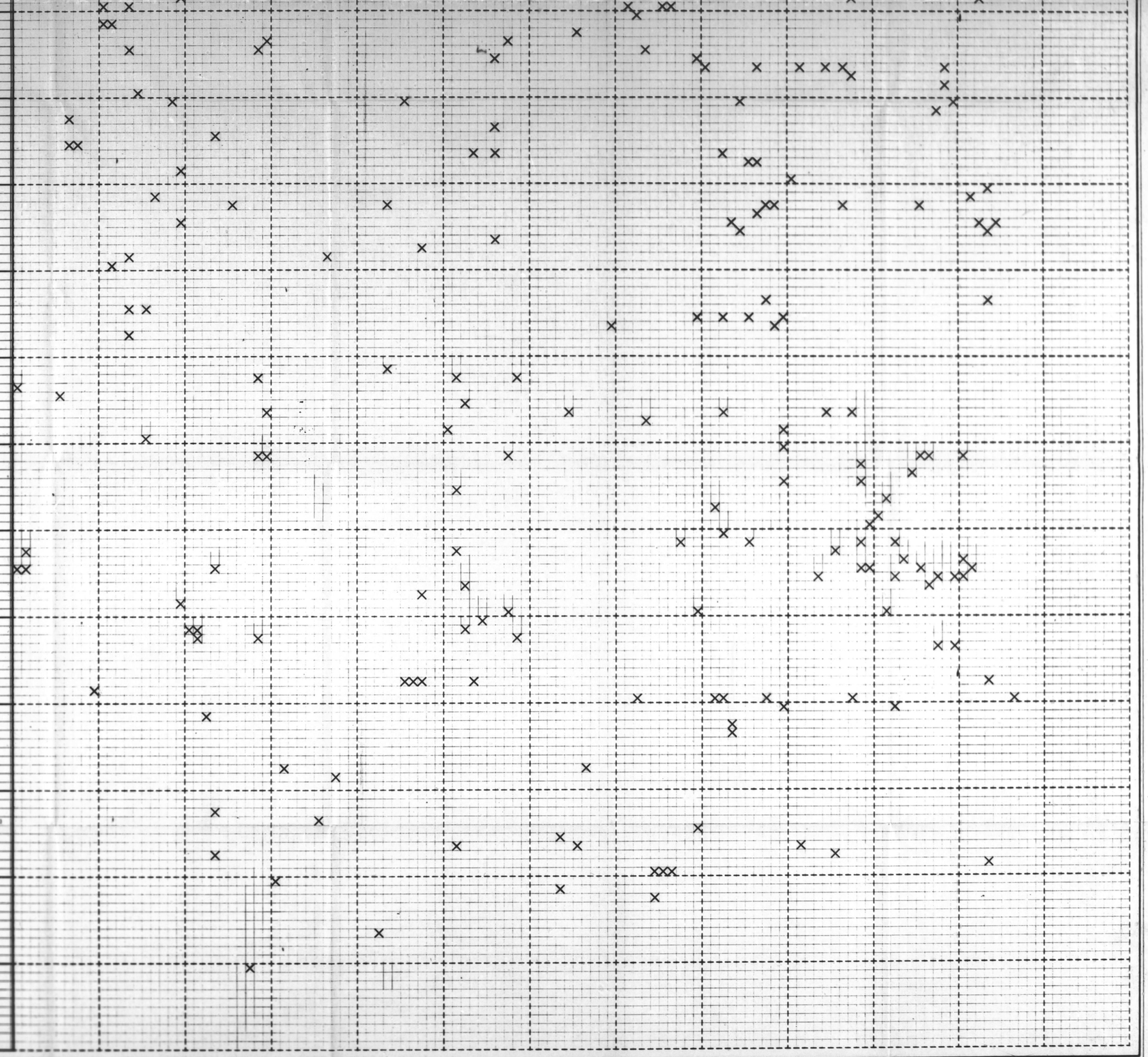
DEVONIAN

NOTES:

1. Localities for each area arranged stratigraphically, highest bed on left.
2. Between Birch and Blackstone Rivers.
3. Stratigraphic order unknown.

COLLECTION LOCALITY NUMBER

	J-4-1	JE-36A	2E-36A	J-4-2, 3E-36A	J-4-3, 5E-36A	J-4-4, J-4-5	6E-36A	J-4-6, 7E-36A, 8E-36A	Liard Rapids (1)	J-2-3, J-2-4	51-W, 51A-W	J-2-5, J-2-6	E-34A	52-W	52A-W to 9, J-3-1 to 3	J-3-4 and 5	J-3-7	J-3-8 and 8	Jean-Marie Creek	J-3-9 and F16-T1	50 W	49 W	Poplar River	48 W	F15-T2, 34W, 47W	42 W	Birch River	F15-T1, 40 W	41-W, 43-W	Stonewall Lake (2)	F14-T1	Blackstone River	31 W	J-1-2	J-1-1	Liard River	J-2-2	Above Rapids (3)	J-1-4	53 W	24 W	Bluefish Lake and Mountain	44 W	45 W	46 W	38 W	E-24F	E-25A	E-25D	E-25F	Locality unspecified
—BRACHIOPODA—																																																		
1. Atrypa																																																	
2. Atrypa cf. canadensis *Webster*																																																	
3. Atrypa cf. devoniana *Webster*																																																	
4. Athyris																																																	
5. cf Athyris gen nov. cf angelica *Hall*																																																
6. Camarotoechia cf. horsfordi *Hall*																																																
7. Camarotoechia cf. letiensis *(Gosselet)*																																																
8. Chonetes																																																	
9. Cranaena																																																
10. Cyrtina																																																
11. ? Cyrtina																																																
12. Cyrtiopsis																																																
13. Cyrtiopsis keteticus *(Crickmay)*																																																
14. Cyrtospirifer																																																
15. Cyrtospirifer sp. A																																																
16. Douvillinid																																																
17. Gypidula sp. A.																																																
18. Gypidula sp. B.																																																
19. Hypothyridina																																																
20. Hypothyridina cf. emmonsi *(Hall and Whitfield)*																																																
21. Indospirifer sp. A.																																																
22. Leioproductus cf. plicatus *(Kindle)*																																																
23. cf. Leptostrophia																																																
24. Lingula																																																
25. Nervostrophia																																																
26. Nudirostra basilica *(Crickmay)*																																																
27. Productella																																																
28. Productellid																																																
29. Pugnax sp. A.																																																
30. Pugnoides sp. B.																																																
31. Pugnoides sp. C																																																
32. "Reticularia" sp. A.																																																
33. Schizophoria																																																
34. Spiriferoid																																																
35. Spiriferoid gen. nov. A.																																																
36. Strophreodontid																																																
37. ? Theodossia sp.																																																
—CORALS—																																																
1. Alveolites																																																
2. Autopora																																																
3. Cladopora																																																
4. Coenites																																																
5. Corals																																																
6. Cup corals																																																
7. Cystiphyllid																																															
8. Disphyllid																																																
9. Disphyllum																																																
10. Favosites																																																
11. Hexagonaria																																																
12. Hexagonaria cf magna *(Fenton and Fenton)*																																																
13. Leptoinophyllid																																																
14. Macgeea																																																
15. Mictophyllum																																																
16. Mictophyllum cf. nobile *(Lang and Smith)*																																																
17. Pachyphyllum																																																
18. Pachyphyllum cf. exigua *(Lambe)*																																																
19. Pachyphyllum nevadense *Stumm*																																																	
20. Pachyphyllum cf woodmani *(White)*																																																
21. Phillipsastrea																																																
22. Spongophyllum sp. nov.																																																
23. Synaptophyllum																																																
24. Synaptophyllum cf. arundinaceum *(Billings)*																																																
25. Synaptophyllum stramineum *(Billings)*																																																
26. Syringopora																																																
27. Tabulophyllum																																															
28. Tabulophyllum cf. mcconnelli *(Whiteaves)*																																															
29. Thamnopora																																																
—INCERTAE SEDIS—																																																
1. Amphipora																																																
2. Stromatoporoid																																															



104. Spirifer sp. aff. S. occidentalis *Girty*
105. Spirifer cf. S. occidentalis *Girty*
106. Spirifer opimus *Hall*
107. Spirifer sp. cf. S. opimus *Hall*
108. Spirifer sp. cf. S. pulcaensis *Weller*
109. Spirifer rockymontanus *Marcou*
110. Spirifer rowleyi *Weller*
111. Spirifer ex. gp. S. rowleyi *Weller*
112. Spirifer sp. cf. S. rowleyi *Weller*
113. Spirifer striatiformis *Meek*
114. Spirifer cf. striatiformis *Meek*
115. Spirifer sp. aff. S. striatiformis *Meek*
116. Spirifer aff. S. tostetiatus *Hall*
117. Spiriferella cf. S. keilhavii *Buch*
118. Spiriferella sp. aff. S. minnewankensis *Shimer*
119. Spiriferella cf. S. neglecta *(Hall)*
120. Spiriferella gp. S. saranae *Vernevil*
121. Strentorhynchus sp.
122. Spirifer keokuk *Hall*
123. Syringothyris aff. S. textus *Hall*
124. Schizophoria sp.
125. Pseudosyrinx sp.
126. Pseudosyrinx gigas *Weller*
127. Schellwienella sp.
128. Schellwienella indet.
129. Schellwienella inequalis *Hall*
130. Schellwienella cf. S. inequalis *Hall*
131. Schellwienella inflata *White and Whitfield*
132. Schellwienella sp. cf. S. inflata
133. Squamularia sp.
134. Squamularia perplexa *McChesney*

—BRYOZOA—
1. Bryozoa indet.
2. Fenestella sp.
3. Fenestellid Bryozoa
4. Fenestrellina sp.
5. Polypora sp.

—CORALS HYDROZOA—
1. Amplexoid corals
2. Caninia sp.
3. Caninioid corals
4. Chaetetes
5. Colonial corals of Lithostrotion type
6. Corals
7. Cup corals
8. Faberophyllum
9. Mapsiphyllid corals
10. Lithostrotionid fragments
11. Lithostrotion sp.
12. Lithostrotionella sp.
13. Lithostrotionella pennsylvanicum *Shimer*
14. Lithostrotionella pantlense *(Warren)*
15. Lithostrotion pauciradiale *McCoy*
16. Lithostrotion sp. cf. L. pauciradiale *McCoy*
17. Michelinia (Pleurodictyum) sp.
18. Phaceloid Lithostrotionella
19. Phaceloid Lithostrotionid
20. Pleurodictyum sp.
21. Pseudozaphrentis sp.
22. Pseudozaphrentoides sp.
23. Species K
24. Syringopora sp.
25. Syringopora aculeata *Girty*
26. Syringopora aff. S. aculeata *Girty*
27. Syringopora pennsylvanica *Shimer*
28. Syringopora sp. cf. S. pennsylvanica *Shimer*
29. Zaphrentid corals
30. Zaphrentoid corals
31. Zaphrentoides sp.
32. Ekvasophyllum sp.
33. Triplophyllites sp.

—ECHINODERMA—
1. Crinoid fragments
2. Crinoid ossicles
3. Crinoid stem
4. Pentremites godoni *Defrance*
5. Pentremites cf. P. princetonensis *Ulrich*
6. Platycrinus sp.
7. Pentremites sp.

—MISCELLANEOUS—
1. Fossil fragment indet.
2. Internal moulds indet.

—MOLLUSCA—
1. Allorisma sp. aff. A. alcertense *Shimer* (Pelecypod)
2. Aviculopecten sp. aff. A. orchiculatus *Newell* (Pelecypod)
3. Bellerophon sp. (Gastropod)
4. Edmondia sp. (Pelecypod)
5. Euomphalus (Gastropod)
6. Euomphalus sp.
7. Gastropod coiled
8. Pleurotomaria
9. Polidevkinella sp. (Pelecypod)
10. Sphenotus sp. (Pelecypod)
11. Aviculopecten orchiculatus *Newell* (Pelecypod)

—PLANTS—
1. Lepidodendron sp.

—VERTEBRATA—
1. Fish remains

SOCONY-VACUUM OIL CO. OF CANADA LTD.
CALGARY, ALBERTA

PLATE No. 9

Compiled by:
Drawn by: R.J.S.
Approved by:

Date: June, 1954
File No:

CHART OF CARBONIFEROUS FAUNA

COLLECTION LOCALITY NUMBER

2-T-52 3-T-52 4-T-52 5-T-52 6-T-52 7-T-52 7A-T-52 8-T-52 9-T-52 10-T-52 11-T-52 12-T-52 13-T-52 14-T-52 17-T-52 18-T-52 T-7T-71 T-7T-72 19-T-52 20-T-52 21-T-52 22-T-52 23-T-52 T-12T-71 26-T-52 T-12T-72 4-W-52 5-W-52 6-W-52 7-W-52 11-W-52 12-W-52 13-W-52 14-W-52 15-W-52 16-W-52 17-W-52 18-W-52 19-W-52 20-W-52 21-W-52 20A-W-52 20B-W-52 22-W-52 23-W-52 24-W-52 25-W-52 26-W-52 27-W-52 28-W-52 29-W-52 35-W-52 36-W-52 37-W-52 3E-52 E5A-52 E5C-52 E5H-52 E5J-52 E6A-52 E6B-52 E6C-52 E6F-52 E6G-52 E6H-52 E6F-52 E7F-52 E10C-52 E10D-52 E10E-52 E10F-52 E11A-52 E11D-52 E12A-52 E12F-52 E12H-52 E13B-52 E13G-52 E13H-52 E13J-52 E13K-52 E14E-52 E14F-52 E14G-52 E14J-52 E15A-52 E15B-52 E15C-52A E15C-52 E15F-52 E15G-52 E15H-52 E16A-52 E16B-52 E16C-52 E16F-52 E16G-52 E20A-52 E20B-52 E21A-52 E23C-52 E23G-52 E23H-52 E23K-52 E25-200-201-52 E26-201-202-52 E26-202-203-52 E26-203-204-52 E26-204-205-52 E26-209-210-52 E26-213-214-52 E26-214-215-52 E26-215-216-52 E26-216-217-52 E32A-52 E32A-5-52

—ARTHROPODA—

1. Phillipsia sp.
2. Phillipsia sp. cf. P.eroccidens *(Hall and Whitfield)*
3. Trilobite fragments

—BRACHIOPODA—

1. Ambocoelia sp.
2. Athyris sp.
3. Athyris of A. lamellosa
4. Brachiopods
5. Brachythyris sp.
6. Brachythyris sp. cf. B. gurlei *Weller*
7. Brachythyris peculiaris *Shumard*
8. Brachythyris aff. B. peculiaris *Shumard*
9. Brachythyris suborbicularis *Hall*
10. Brachythyris sp. aff. B. subcardiformis *(Hall)*
11. Buxtonia sp.
12. Camarotoechia sp.
13. Camarotoechia allani *Warren*
14. Camarotoechia sp. aff. C. allani *Warren*
15. Chonetes sp.
16. Chonetes illinoisensis
17. Chonetes aff. C. illinoisensis *Worther*
18. Choristites sp.
19. Cleiothyridina sp.
20. Cleiothyridina lata *Shimer*
21. Cleiothyridina aff. C. lata *Shimer*
22. Cleiothyridina obmaxima *McChesney*
23. Composita sp.
24. Composita sp. indet
25. Composita humilis *Girty*
26. Composita sp. cf. C. humilis *Girty*
27. Composita subtilita *(Hall)*
28. Composita trilobata *Dunbar and Condra*
29. Composita trinuclea *(Hall)*
30. Dictyoclostus sp.
31. Dictyoclostus americanus *Dunbar and Condra*
32. Dictyoclostus sp. aff. D. americanus
33. Dictyoclostus sp. cf. D. americanus
34. Dictyoclostus burlingtonensis *Hall*
35. Dictyoclostus aff. D. burlingtonensis *Hall*
36. Dictyoclostus ferrylenensis *Weller*
37. Dictyoclostus gallatinensis *Girty*
38. Dictyoclostus sp. aff. D. gallatinensis *Girty*
39. Dictyoclostus sp. aff. D. jasperensis *Warren*
40. Dictyoclostus morrowensis *(Mather)*
41. Dictyoclostus sp. aff. D. morrowensis *(Mather)*
42. Dictyoclostus portlockianus *(Norwood and Pratten)*
43. Dictyoclostus tenuicostatus *Hall*
44. Dictyoclostus sp. aff. D. viminalis *(White)*
45. Dielasma sp.
46. Dielasma sp. cf. D. arkansanum *Weller*
47. Dielasma cf. D. choutauensis *Weller*
48. Dielasma sinuata *Weller*
49. Dielasma aff. D. sinuata *Weller*
50. Dielasma sp. cf. D. subspatulatum *Weller*
51. Dimegelasma sp.
52. Echinoconchus sp.
53. Echinoconchus alternatus *(Norwood and Pratten)*
54. Eumetria sp.
55. Eumetria cf. E. osagensis *(Swallow)*
56. Eumetria sp. cf. E. verneuiliana *(Hall)*
57. Fasciculate spirifers of Neospirifer group
58. Internal moulds indet.
59. Leiorhynchus sp.
60. Leiorhynchus sp. A.
61. Leptaena analoga *Phillips*
62. Linoproductus sp.
63. Linoproductus sp. indet. possible L. menisus
64. Linoproductus sp. cf. L. ovatus *Hall*
65. Marginifera sp.
66. Neospirifer sp.
67. Neospirifer cameratus *(Morton)*
68. Neospirifer sp. aff. N. cameratus *(Morton)*
69. Neospirifer gorei *(Mather)*
70. Orbiculoidea sp.
71. Orbiculoidea sp. cf. O. arenaria *Shimer*
72. Orthotetes sp.
73. Orthotetes keokuk *Hall*
74. Platyrachella sp. cf. P. rutherfordi *Warren*
75. Productids
76. Productus sp.
77. Productus altonensis
78. Productus parvus
79. Punctospirifer sp.
80. Punctospirifer sp. aff. P. solidirostris
81. Reticularia sp.
82. Reticularia pseudolineata *(Hall)*
83. Reticularia sp. cf. R. pseudolineata *(Hall)*
84. Rhipidomella sp.
85. Rhipidomella cf. R. missouriensis *(Shallow)*
86. Rhynchopora sp.
87. Schizophoria cf. S. poststriatula *Weller*
88. Spirifer sp.
89. Spirifer indet.
90. Spirifer sp. cf. S. bifurcatus
91. Spirifer aff. S. bifurcatus *Hall*
92. Spirifer aff. S. cascadensis *Warren*
93. Spirifer centronatus *Winchell*
94. Spirifer sp. cf. S. centronatus *Winchell*
95. Spirifer ex. gp. S. centronatus *Winchell*
96. Spirifer esplanadensis *Brown*
97. Spirifer sp. aff. S. esplanadensis *Brown*
98. Spirifer sp. cf. S. esplanadensis *Brown*
99. Spirifer goveii *Mather*
100. Spirifer sp. aff. S. increbescens *Hall*
101. Spirifer sp. aff. S. keokuk *Hall*
102. Spirifer logani *Hall*
103. Spirifer sp. cf. S. logani *Hall*
104. Spirifer sp. aff. S. accidentalis *Girty*
105. Spirifer cf. S. accidentalis *Girty*
106. Spirifer opimus *Hall*
107. Spirifer sp. cf. S. opimus *Hall*
108. Spirifer sp. cf. S. pellgensis *Weller*
109. Spirifer rockymontanus *Marcou*
110. Spirifer rowleyi *Weller*
111. Spirifer ex. gp. S. rowleyi *Weller*
112. Spirifer sp. cf. S. rowleyi *Weller*
113. Spirifer striatiformis *Meek*
114. Spirifer cf. striatiformis *Meek*

CHART OF CARBONIFEROUS FAUNA

COLLECTION LOCALITY NUMBER

—ARTHROPODA—	
1. Phillipsia sp.	
2. Phillipsia sp. cf P.peroccidens *(Hall and Whitfield)*	
3. Trilobite fragments	
—BRACHIOPODA—	
1. Ambocoelia sp.	
2. Athyris sp.	
3. Athyris of A. lamellosa	
4. Brachiopods	
5. Brachythyris sp.	
6. Brachythyris sp. cf B. gurleii *Weller*	
7. Brachythyris peculiaris *Shumard*	
8. Brachythyris aff B. peculiaris *Shumard*	
9. Brachythyris suborbicularis *Hall*	
10. Brachythyris sp. aff B. subcardiformis *(Hall)*	
11. Buxtonia sp.	
12. Camarotoechia sp.	
13. Camarotoechia allani *Warren*	
14. Camarotoechia sp. aff C allani *Warren*	
15. Chonetes sp.	
16. Chonetes illinoisensis	
17. Chonetes aff. C. illinoisensis *Worthen*	
18. Choristites sp.	
19. Cleiothyridina sp.	
20. Cleiothyridina lata *Shimer*	
21. Cleiothyridina aff. C. lata *Shimer*	
22. Cleiothyridina obmaxima *McChesney*	
23. Composita sp.	
24. Composita sp. indet	
25. Composita humilis *Girty*	
26. Composita sp. cf. C. humilis *Girty*	
27. Composita subtilita *(Hall)*	
28. Composita trilobata *Dunbar and Condra*	
29. Composita trinucleo *(Hall)*	
30. Dictyoclostus sp.	
31. Dictyoclostus americanus *Dunbar and Condra*	
32. Dictyoclostus sp. aff. D. americanus	
33. Dictyoclostus sp. cf. D. americanus	
34. Dictyoclostus burlingtonensis *Hall*	
35. Dictyoclostus aff. D. burlingtonensis *Hall*	
36. Dictyoclostus ferrylenensis *Weller*	
37. Dictyoclostus gallatinensis *Girty*	
38. Dictyoclostus sp. aff. D. gallatinensis *Girty*	
39. Dictyoclostus sp. aff D. jasperensis *Warren*	
40. Dictyoclostus marrowensis *(Mather)*	
41. Dictyoclostus sp. aff. D. marrowensis *(Mather)*	
42. Dictyoclostus portlockianus *(Norwood and Pratten)*	
43. Dictyoclostus tenuicostatus *Hall*	
44. Dictyoclostus sp. aff. D. viminalis *(White)*	
45. Dielasma sp.	
46. Dielasma sp. cf. D. arkansanum *Weller*	
47. Dielasma cf. D. choutequensis *Weller*	
48. Dielasma sinuata *Weller*	
49. Dielasma aff D. sinuata *Weller*	
50. Dielasma sp. cf D. subspatulatum *Weller*	
51. Dimegelasma sp.	
52. Echinoconchus sp.	
53. Echinoconchus alternatus *(Norwood and Pratten)*	
54. Eumetria sp.	
55. Eumetria cf E. osagensis *(Swallow)*	
56. Eumetria sp. cf. E. verneuliana *(Hall)*	
57. Fasciculate spirifers of Neospirifer group	
58. Internal moulds indet.	
59. Leiorhynchus sp.	
60. Leiorhynchus sp. A.	
61. Leptaena analoga *Phillips*	
62. Linoproductus sp.	
63. Linoproductus sp. indet. possible L. menisus	
64. Linoproductus sp. cf. L. ovatus *Hall*	
65. Marginifera sp.	
66. Neospirifer sp.	
67. Neospirifer cameratus *(Morton)*	
68. Neospirifer sp. aff. N. cameratus *(Morton)*	
69. Neospirifer gorei *(Mather)*	
70. Orbiculoidea sp.	
71. Orbiculoidea sp. cf. O. arenaria *Shimer*	
72. Orthotetes sp.