

Siedens

Report on the Geology
of the

Mahony Lake-Fort Franklin Area
Northwest Territories

98-2-15-6

98-2-15-6

REPORT on the GEOLOGY
of the
MAHONY LAKE - FORT FRANKLIN AREA
NORTHWEST TERRITORIES



Prepared For
SIEBENS OIL & GAS LTD.
by
V. ZAY SMITH ASSOCIATES LTD.

1967

TABLE of CONTENTS

	Page
INTRODUCTION	1
CLIMATE	2
ACCESSIBILITY	3
GEOLOGIC FIELD WORK	3
 PHYSIOGRAPHY	 4
 STRATIGRAPHY	 7
INTRODUCTION	7
CAMBRIAN	7
SILURIAN-ORDOVICIAN	9
DEVONIAN	12
Bear Rock Formation	12
Hume Formation	14
Hare Indian Formation	15
UPPER DEVONIAN	16
CRETACEOUS	16
TERTIARY	17
QUATERNARY	17
 STRUCTURAL GEOLOGY	 18
INTRODUCTION	18
REGIONAL STRUCTURE	19
Interior Plains	19
Franklin Mountains	21
Mackenzie Plain	21
LOCAL STRUCTURE of the PERMIT ACREAGE	22
Lac a Jacques Area	22
Smith Arm Area	23
Mahony Lake Area	23

	Page
OIL and GAS PROSPECTS	24
Indications of Hydrocarbons	24
Recommendations	26
SELECTED BIBLIOGRAPHY	27

ILLUSTRATIONS

Figure 1 Regional Location Map (Opposite Page 1)

Figure 2 Stratigraphic Correlation Chart (Opposite Page 7)

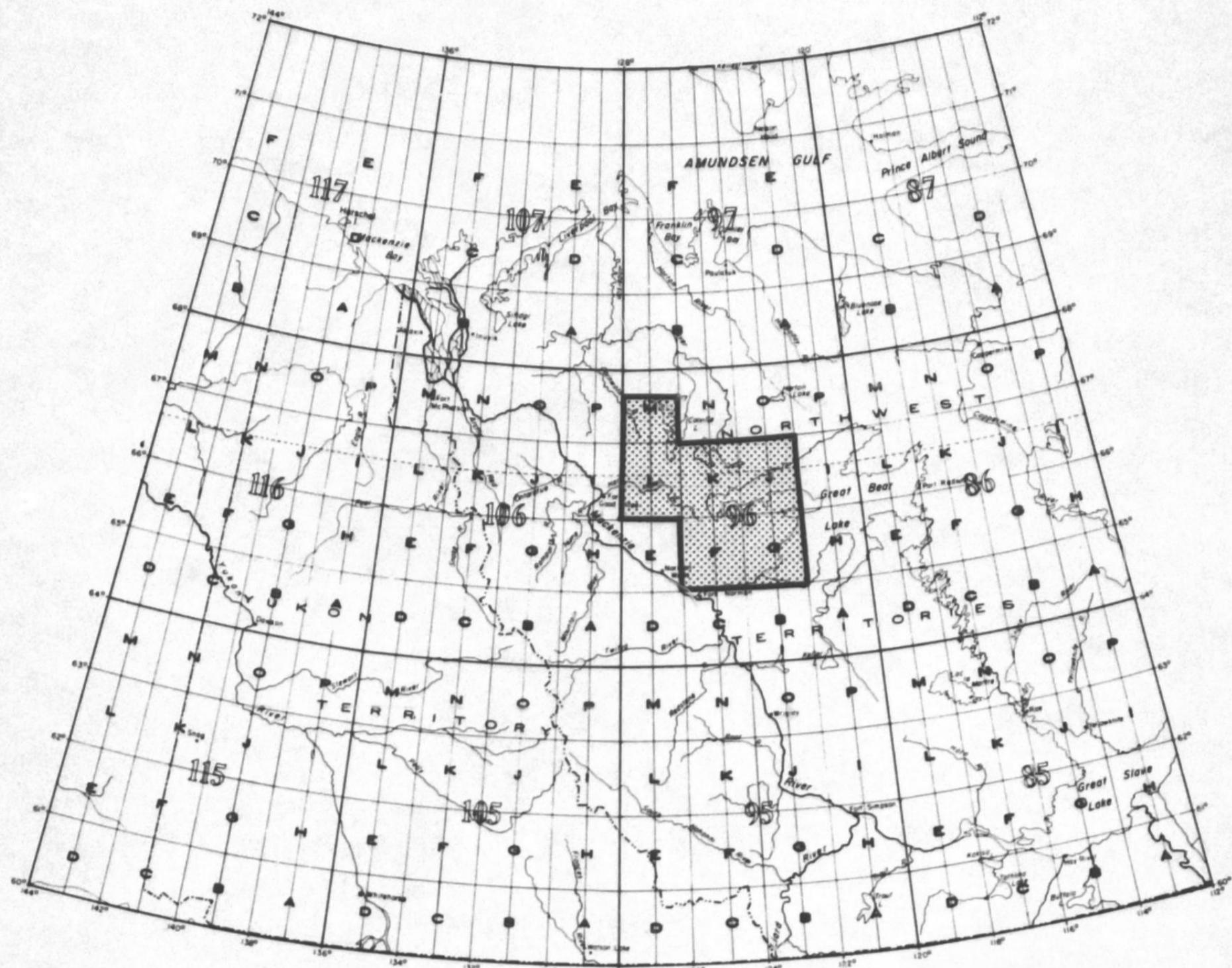
**Areal Geology and Structural Interpretation Maps of the
Mahony Lake - Fort Franklin Area, N.W.T. (Scale 1" to 2 miles)**

Map Sheets:		In Map Case
96	F	"
96	G	"
96	J	"
96	K	"
96	L	"

DIAGRAMMATIC GEOLOGIC CROSS-SECTIONS

A-B-C and **D-E-F** (In Map Case)

**STRATIGRAPHIC SECTION LOGS
FIELD SECTIONS 1 to 12** (In Map Case)



REGIONAL LOCATION MAP

 Project Area

REPORT on the GEOLOGY
of the
MAHONY LAKE - FORT FRANKLIN AREA,
NORTHWEST TERRITORIES

INTRODUCTION

This report deals with a geologic evaluation of exploratory permits 5082-5085, 5088, 5131-5142, 5240-5245, and 5249-5256 inclusive, comprising approximately 1,242,150 acres, and surrounding terrain. The permits are held by Siebens Oil & Gas Ltd. The object of the work is to study and illustrate the geologic setting of the area and to evaluate the oil and gas potential of the permit acreage.

The geologic evaluation is based on a variety of geologic data and techniques. It includes photogeologic mapping, structure contour mapping, surface field geologic work and subsurface geology. The interpretation also incorporates data

available in geologic literature and reports on open file with the Department of Indian Affairs & Northern Development.

The outline of the project is shown on the Regional Location Map, Figure 1. It covers approximately 22,500 square miles. A series of detailed areal geology and structural interpretation maps were prepared to cover the project area at the scale of 1 inch to 2 miles. Five map sheets are included. The mapping was based on detailed photogeologic interpretation incorporating field observations and published and open file information. Geologic field work was undertaken in August, 1967. A series of field stratigraphic sections were examined, measured and sampled at 12 different locations as shown on the accompanying areal geology and structural interpretation maps. The field stratigraphic data was plotted on a series of stratigraphic logs which accompany this report. The field work also consisted of an examination of the structural interpretation in order to check and verify the photogeologic mapping. A structure contour map was prepared photogrammetrically to show the configuration of structure by means of contours in part of the area. This interpretation is also shown on the accompanying evaluation maps. A series of geologic cross-sections were constructed to display structural and stratigraphic relationships. They are based on the structural interpretation and the stratigraphic data collected and compiled in the field, subsurface information provided by wells and published and open file reports.

References to literature and open file data in the body of the report are indicated by the author's name followed by the date of publication. A **Selected Bibliography** appears at the end of the report.

CLIMATE

The climate in the Mahony Lake - Fort Franklin area is subarctic and consists of long cold winters and short warm summers. In the winter mean minimum temperatures as low as -50 degrees are common; maximum temperatures in the summer are in the order of 85°. The area is situated well within the permafrost zone in which ground is frozen perennially. The area is frost free for approximately 60 days per year and the growing season is only 100 days in length. Total annual precipitation is 12 inches and snow covers the ground for

approximately 200 days of the year. Many hours of daylight are present during the short summertime, whereas the winter has few daylight hours.

ACCESSIBILITY

Although the permit acreage can only be reached by helicopter or float and/or ski-equipped fixed-wing aircraft, the permits are relatively accessible for this part of the Northwest Territories. Norman Wells is located along the Mackenzie River about 60 miles south and west of the permit acreage. The Mackenzie River serves as the main line of transportation in the summer months when it is ice-free for at least three months of the year. However, much material, equipment and personnel are flown into the N.W.T., and exploration activities can be carried out during most of the year. Schedule air service is available three times weekly from Edmonton to Norman Wells and return. Also, Calgary Exploration Services Ltd. operates the Calex winter road system which is usable during winter months from Fort Providence north along the Mackenzie River valley to Norman Wells. It usually opens for use in December.

GEOLOGIC FIELD WORK

Geologic field investigations were undertaken in the Mahony Lake - Fort Franklin area during the summer of 1967. The field party consisted of a three-man geologic team and supporting personnel. Dr. Horst Scherp served as party chief. A base camp was established at Lac a Jacques. The field party was supported by helicopter and fixed-wing aircraft with supplies ferried to the base camp from Norman Wells. One of the objects of the field work was to compile a series of stratigraphic sections. This was accomplished by examining, measuring and sampling a series of stratigraphic sections exposed in the project area. In addition, considerable time was devoted to structural checking in an attempt to verify and confirm the photogeologic interpretation.

PHYSIOGRAPHY

The Mahony Lake - Fort Franklin project covers parts of three physiographic provinces: the Interior Plains, the Franklin Mountains and the Mackenzie Plain.

The Interior Plains dominate the project area. They cover most of the northern, central and eastern parts of the project. The Interior Plains form a vast area of low terrain lying between the Precambrian Shield to the east and the Cordilleran Belt to the west. The land stands at elevations ranging from as low as 400 feet to more than 2,000 feet in that part of the Interior Plains included by the project. However, at most places elevations range from 800 to 1,500 feet. Although topographic relief is subdued, some abrupt changes occur locally. A series of flat-topped plateaus surmount the plains in the eastern part of the project in the vicinity of Smith and Keith Arms of Great Bear Lake. These plateaus rise from lake level at about 500 feet to elevations of 1,500 to 1,800 feet. Thus, topographic relief in the order of 1,000 to 1,300 feet is present. These plateaus are erosional remnants formed prior to the Pleistocene Epoch and consist of flat-lying to gently dipping Cretaceous strata. At several places in the Interior Plains, the flat terrain is interrupted by a series of narrow, linear ridges. They rise above the plains expressing local relief of 500 to 1,000 feet. These ridges were also produced by pre-Pleistocene differential erosion and their form is structurally controlled. The most conspicuous ridges are present in the Aubry-Colville Lakes - Lac Belot areas in the west central part of the project.

Lakes are numerous and scattered throughout the area. They range in size from small potholes to the gigantic arms of Great Bear Lake. Great Bear Lake is the northernmost one of a series of proglacial lakes located along the outer fringes of the Precambrian Shield. The lake series extends from the Great Lakes system of Ontario through Lake Winnipeg, Lake Athabasca, Great Slave Lake and Great Bear Lake in Manitoba, Saskatchewan, Alberta and the Northwest Territories. At one time Great Bear Lake drained through the present channel of Hare Indian River, the outlet being located at the westernmost end of Smith Arm. The lake stood about 100 feet higher than its present level. However, the Great Bear River system eventually effected stream capture providing a lower outlet which flows into the Mackenzie River just a few miles south of the project at Fort Norman. The Mackenzie River is the principle drainage for this part of the continent.

The Interior Plains have been subjected to multiple continental glaciation. At most places bedrock is mantled by a veneer of glacial drift. Outcrops are scarce and are restricted mainly to ridge crests and places where streams have incised through the mantle of glacial drift. However, some excellent exposures are present locally. During the last glacial advance, a mass of ice moved out of the Great Bear Lake area towards the northwest being deflected by the Cordilleran Belt. Numerous glacial lineations in the form of drumlins and grooved till plains are present to indicate the ice movement.

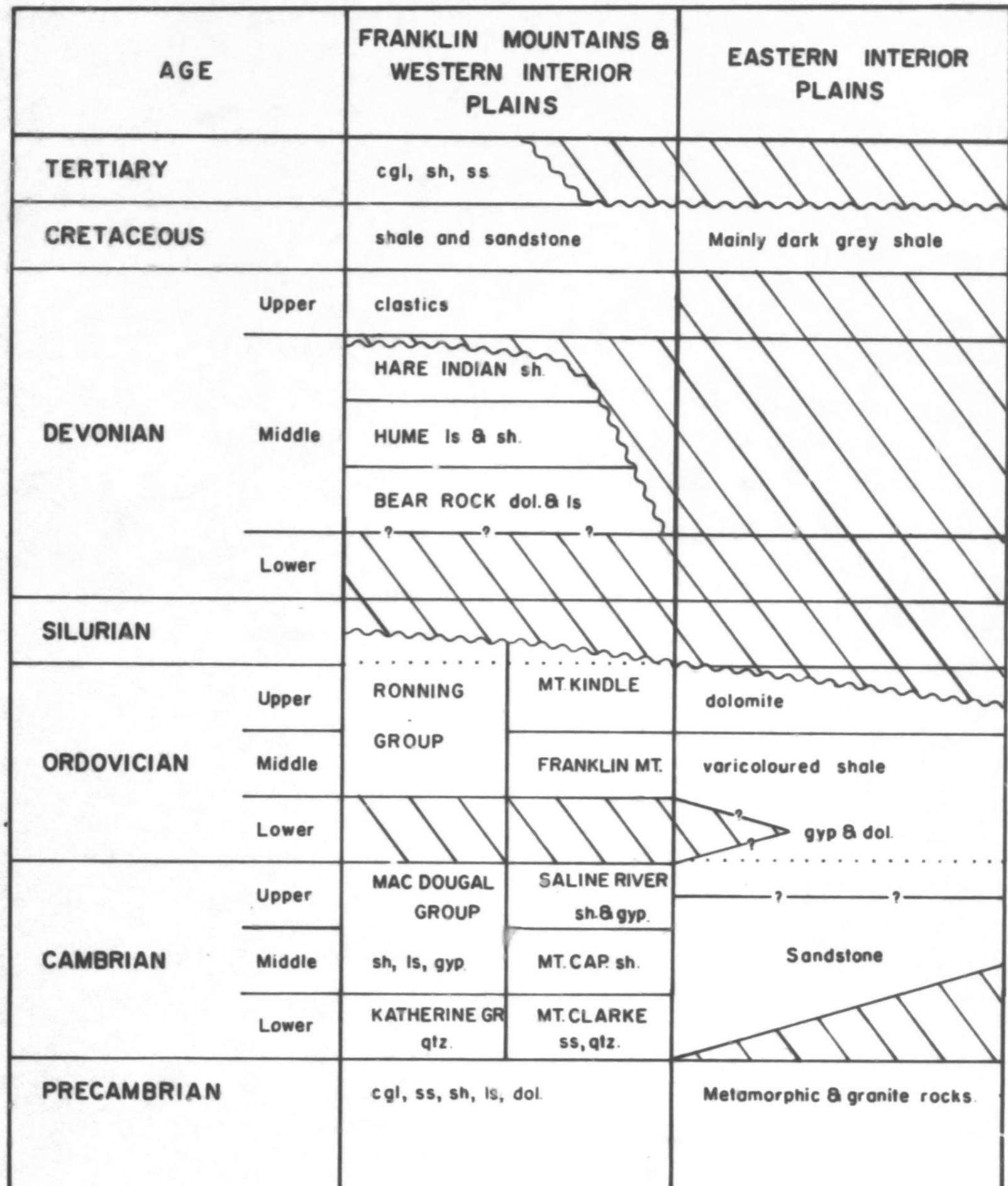
In summary, the landscape in the Interior Plains is comprised of a flat-lying to moderately deformed plains which had probably reached the mature stage in the erosional cycle prior to the Pleistocene Epoch. Thereupon, it was subjected to multiple continental glaciation and much of the area was reverted to the initial stage in the erosional cycle. At the present time it is undergoing light to moderate erosion by streams.

The Franklin Mountains lie in the southwest part of the project and occupy only a small portion of it. In the project area the Franklin Mountains reach elevations of 2,300 feet and are made up of a series of linear, northwesterly to westerly trending belts of rugged terrain which rise 1,000 to 1,800 feet above the surrounding land. The form and shape of the mountains are governed by moderate to complex structural conditions which controlled differential erosion, most of which occurred prior to the Pleistocene Epoch. At places the mountainous terrain was overridden by the multiple continental glaciation which dominated the area during Pleistocene time. However, rock exposures are numerous. Thus, the landscape of the Franklin Mountains consists of a moderately to complexly deformed mountain terrain that had reached the mature stage in the erosional cycle prior to the Pleistocene Epoch when it was subjected to multiple glaciation. The land is being vigorously eroded by streams at the present time.

Only a small part of the Mackenzie Plain is included within the project. It is located in the southwestern part of the project on Map Sheet 96 F and forms an expanse of low-lying terrain between the Norman Range on the west and the easternmost part of the Franklin Mountains on the east. It stands at an elevation of about 400 feet. Local relief is very subdued and measured in a few tens of feet except where Great Bear and

Brackett Rivers have incised below the level of the plain. Outcrops are very scarce because bedrock is mantled by extensive deposits of glacial drift which were deposited during the multiple glaciation of the Pleistocene Epoch. Lakes are very numerous and dominate the plain.

FIGURE 2



STRATIGRAPHIC CORRELATION CHART

STRATIGRAPHY

INTRODUCTION

The stratigraphic succession in the Mahony Lake - Fort Franklin area contains rocks deposited during Paleozoic, Mesozoic and Cenozoic eras. However, periods of non-deposition, uplift and erosion have caused important gaps in the stratigraphic record. The Paleozoic section is made up of Cambrian, Ordovician, Silurian and Devonian Systems. Cambrian strata are mainly clastics associated with significant amounts of evaporites and locally carbonates. Ordovician and Silurian strata are comprised mainly by carbonates although some clastics and evaporites are present. An important unconformity marks the top of the Siluro-Ordovician section. The Middle Devonian Series is made up mainly of carbonates and shale. Upper Devonian strata are fine clastics. A significant gap in the stratigraphic record occurs between the Devonian and Cretaceous when the post-Devonian, pre-Cretaceous unconformity was developed. Thus, Mesozoic beds are represented by sandstones and shales of Cretaceous age. They unconformably overlie Paleozoic strata. Cenozoic sediments consist of Tertiary clastics, which are preserved in a local structural basin, and a thin, widely-distributed surficial veneer of Quaternary deposits. These deposits are comprised mainly by Pleistocene glacial drift and Recent alluvium and hillwash. The age, correlation and lithology of the stratigraphic units present in the Mahony Lake - Fort Franklin area are illustrated in Figure 2.

CAMBRIAN

Cambrian strata probably are widespread in the subsurface of the Mahony Lake - Fort Franklin area. However, their exposures are confined to a few scattered localities in the Franklin Mountains in the southwest part of the project. Consequently, the interpretation of Cambrian stratigraphy is based on scattered control in outcrops and wells southwest of the project area, a few outcrops in the Franklin Mountains and exposures east and northeast of the project where Cambrian strata lap up onto the Precambrian Shield. Cambrian beds are included in the map unit labelled C on the accompanying evaluation maps.

The Cambrian sequence is probably represented by two units. A basal sandstone unit, which ranges in thickness from 100 feet in the east to an estimated 700 feet or more to the west and southwest, is overlain by a variable section comprised of red and green shales, dolomite and evaporites. The latter section ranges in thickness from approximately 200 feet in the east to perhaps as much as 3,000 feet in the west.

In the Mackenzie Mountains southwest of the project area Link (1921) applied the name Katherine Group to a section of unfossiliferous varicolored quartzites and black bituminous shales. Although the total thickness of the sequence is unknown, it probably exceeds 2,200 feet in thickness. The name Macdougal Group was applied by Link (1921) to a section conformably overlying the Katherine Group. The sequence consists of 997 to 1,297 feet of varicolored shale, limestone, sandstone, siltstone and numerous red gypsiferous beds. The gypsiferous sequence is about 100 feet below the top and is 200 to 500 feet thick. The section is believed to be Middle or Upper Cambrian in age because of trilobites collected from the lower and middle parts of the assemblage. The Macdougal Group may thicken to the northeast toward the project area. The Imperial Vermillion Ridge No. 1 well, which is located just east of the Norman Range at the southwest corner of the project, penetrated 3,175 feet of green and red shale, dolomite limestone, gypsum and salt. Approximately 2,680 feet of the section was salt. Whether the section represents a true stratigraphic thickness or has been affected by flowage accompanying folding and faulting is unknown.

In the McConnell Range south of the project area the Cambrian section consists of three formations. They are in ascending order: the Mount Clark, Mount Cap and Saline River Formations. The lowest formation consists of 736 feet of sandstone and orthoquartzite and is correlated with the Katherine Group. The middle unit, the Mount Cap Formation, overlies the Mount Clark conformably and is made up of green and rusty shale, sandstone, limestone and dolomite. Trilobites indicate a Middle Cambrian age, and the upper and lower contacts appear conformable. The section is at least 777 feet thick. One hundred feet of variegated shale with interbeds of gypsum comprise the upper unit and it is called the Saline River Formation. The Saline River and the Mount Cap Formation correlate with the Macdougal Group.

East of the project area along the edge of the Precambrian Shield, Cambrian strata are made of a white to grey gritty friable to well indurated cross-bedded sandstone. It is variable in thickness but is reported by the Geological Survey of Canada to be 100 to 200 feet thick. It corresponds to map unit 20 on G.S.C. Map 18-1960. It is probably Cambrian in age. Other published reports indicate the sandstone may be as much as 400 feet thick and porous. Thus, it could constitute a good reservoir rock. It is overlain by an unnamed unit which is about 350 feet thick and consists of red and green gypsiferous shale. Paterina has been reported in this sequence and indicates an Upper Cambrian age for the lower part of the section. Thus, the basal sandstone is tentatively correlated with the clastics of the Mount Clark and Katherine Groups in the Cordilleran belt to the southwest whereas the lower part of the unnamed red and green gypsiferous shale probably correlates with the Saline River and underlying Mount Cap Formations and the Macdougal Group to the southwest.

SILURIAN and ORDOVICIAN

The Ordovician and Silurian Systems are discussed together because it is difficult to differentiate between them on a lithologic basis. They constitute a distinct rock unit over much of the project area. The boundary between two systems is very difficult to position even on a paleontological basis. Moreover, prior to Borden's work (1956) when corals in the lower Mackenzie River area were identified as Ordovician in age, the true age of some of the lower beds had not been recognized. They had been included in the Silurian System because fossiliferous overlying dolomites contained Middle Silurian corals.

The Siluro-Ordovician sequence is mainly dolomite and is probably present everywhere in the project. Exposures are common in the Franklin Mountains, and the map unit is labelled "SO" on the accompanying evaluation maps. It also forms bedrock over a broad belt in the Interior Plains. Although strata are mantled by glacial drift in this area, exposures are present along linear structural ridges and in stream cuts where rivers have incised several hundred feet beneath the level of the plains. Exposures also exist in sinkholes north of Mahony Lake. In the eastern part of the project the Siluro-Ordovician section probably subcrops beneath Cretaceous strata. The

dominant lithology is dolomite and it is mainly light grey, dark grey-buff to brown, dense and massive to vuggy and porous, and in places cherty. Some sections are fossiliferous. A conspicuous unconformity marks the top of the section. Within the project the Siluro-Ordovician sequence probably ranges in thickness from about 400 feet in the east to about 2,000 feet in the west. Thinning to the east is due partly to depositional thinning, but mainly to erosional truncation during the formation of the post-Silurian, pre-Middle Devonian unconformity. Significant local variations in thickness occur. For example, the Siluro-Ordovician sequence is reported by Smith (1964) to thin from the easternmost part of the Franklin Mountains in the McConnell Range towards Bear Rock in the Norman Range where the section is only 500 feet thick. At this locality Devonian beds unconformably overlie Ordovician strata, the Silurian sequence having been removed by local uplift and erosion during the development of the unconformity.

The Siluro-Ordovician sequence has been subjected to considerable investigation and discussion in the geologic literature dealing with the Northwest Territories. The terminology that has been applied is illustrated in Figure 2 on the Stratigraphic Correlation Chart. The name Ronning Group was applied by Hume (1954) to Ordovician and Silurian strata exposed in the Mackenzie and Franklin Mountains. In the McConnell Range to the south, beds which correlate with the Ronning Group are called the Franklin Mountain Formation and the Mount Kindle Formation. The Franklin Mountain Formation consists of 500 to 1,000 feet of red and green shale, which is calcareous and sandy in part, and an overlying yellow thin-bedded finely crystalline limestone. The formation is Ordovician in age: Borden (1956), Bell (1959), and Douglas and Norris (1961). It is overlain by Mount Kindle beds which are Ordovician and Silurian in age and which correlate with the upper part of the Ronning Group. The Mount Kindle Formation consists of a grey dolomitic limestone composed largely of fossilized coral reefs. Sproule (1959) studied the Siluro-Ordovician sequence as exposed in the Fort Norman-Kelly Lake area in the southwestern part of the project. In that area the sections consist of three rock units: a lower thin-bedded dolomite and shale, which is 300 feet thick, a middle massive cliff-forming grey-buff dolomite, which is about 650 feet thick, and an upper light grey dolomite containing corals which is correlated with the

Mount Kindle Formation. It is about 450 feet thick. Thus, the Siluro-Ordovician sequence is approximately 1,400 feet thick in that area. Ordovician strata are also exposed east of the project area along the eastern edge of the Interior Plains near the boundary with the Precambrian Shield. Silurian strata are not present there having been bevelled by post-Silurian, pre-Middle Devonian erosion, their eastern limit being located many miles to the west. To the east the Geological Survey of Canada reports a unit of red and green gypsiferous shale, which is 350 feet thick, to be present. Part of the sequence is interpreted to be Lower Ordovician in age. It probably correlates with the Franklin Mountain Formation. It is overlain by brown to buff dolomite which is finely crystalline to granular and vuggy in places. It is about 200 feet thick and is correlated with part of the Mount Kindle Formation.

During the geologic field work the Siluro-Ordovician sequence was examined at seven field stations. At Jacques Ridge, Field Section No. 1, the sequence underlies Bear Rock strata and consists of more than 340 feet of light grey to buff, massive and dense to vuggy and porous dolomite. The base of the formation was not reached but Catenipora, which was noted at the base of the exposure, suggests an Upper Ordovician age. Thus, the Silurian part of the section is probably less than 300 feet thick in this area. Exposures along Hare Indian River, 35 to 40 miles northeast of Jacques Ridge at Field Sections Nos. 2, 3 and 4 in permits 5139, 5138 and 5133 were studied. The assemblage consists of light to dark grey, buff to brown massive to thin-bedded, dense to vuggy dolomite. When one pieces the section together and examines the topographic and structural relationships, the exposures represent the upper 400 feet of the sequence. The section was also examined farther east along Hare Indian River at Field Section No. 12, located near the western edge of Smith Arm, and in sinkholes to the south. Two hundred and sixty-eight feet of beds are exposed at Section No. 12. They consist of light to medium grey, brownish grey dense, massive dolomite which contains scattered vuggy porosity. Some cherty facies are present in part replacing stromatoporoids and algae. Exposures along Belot Ridge were also visited in the field and about 190 feet of strata were measured at Field Section No. 6. The sequence underlies the Bear Rock Formation and consists of light grey dense to vuggy fossiliferous dolomite.

Analysis of the stratigraphic relation of the sections and the structural interpretation indicates that the section near Smith Arm probably is 700 to 800 feet stratigraphically below the sections along Hare Indian River to the west. Thus, at least 1,300 to 1,500 feet of the Siluro-Ordovician sequence is present in this general area.

DEVONIAN

The Devonian System has been subjected to considerable study and attention because of its productive history. A reef of Devonian age forms the reservoir at the Norman Wells oilfield. The Devonian System in the project is considered to be represented mainly by rocks of Middle Devonian age. The Upper Devonian section is present only at one place in the southwest corner of the map area.

Devonian strata are restricted to the western and southern parts of the projects, and their restricted distribution is due largely to post-Devonian, pre-Cretaceous erosion. The Middle Devonian Series can be divided into three formations in the Mahony Lake - Fort Franklin project. They are, in ascending order: the Bear Rock, Hume and Hare Indian Formations.

Bear Rock Formation

The type section of the Bear Rock Formation is located at Bear Rock at the southern tip of the Norman Range a few miles south of the project. The term was introduced by Hume and Link (1945) for a sequence of brecciated and nonbedded dolomites and limestones and associated evaporites which crop out in the Norman Wells area. Unfortunately, the type locality is one of the thinnest sections available (275 feet) because the section probably was subjected to local erosion prior to deposition of overlying Middle Devonian beds.

In the project the Bear Rock Formation is made up mainly of limestone and dolomite. The sequence is brecciated at places. The carbonates are light-grey, buff to dark brown, thin-bedded to massive, dense to vuggy and porous. The beds are occasionally petroliferous and sometimes fossiliferous. Indeterminate

fossil fragments are present and include brachiopods, gastropods and ostracods. The Bear Rock Formation ranges in thickness from 275 feet at the type section to an estimated 750 feet in the Hare Indian River area. The formation unconformably overlies the Siluro-Ordovician sequence. Relief of about 100 feet or more has been observed locally on the erosional surface. The upper contact with the overlying Hume Formation is sharp. However, in some places it is possibly gradational, and a disconformity may be present locally in some areas. Exposures of the Bear Rock Formation in the project are restricted to the Franklin Mountains, a few places in the western part of the Interior Plains, such as along Hare Indian River, and in linear structural ridges in the Lac Belot area. On the accompanying evaluation map the Bear Rock Formation is labelled Dbr. However, in the southwestern corner of the project it is undifferentiated and is mapped in the undivided map unit labelled Dm.

Oil staining and a strong petroliferous odor was noted in the field at outcrops along Hare Indian River. Because of the porosity and oil shows in the Bear Rock Formation, it must be considered a potential reservoir rock where buried west of the project.

Brecciation is a unique characteristic of the Bear Rock Formation. Breccias occur irregularly in beds and lenses and appear not to be restricted to any particular part of the formation. Marked variation in size of breccia particles exists. They range from a micro-breccia to blocks as long as 20 feet. Most blocks are in the order of 1 inch to 1 to 2 feet in size. Breccia fragments are usually irregular in shape and display no sorting. Origination of the breccia has intrigued geologists since it was first observed. Many concepts have been advanced. Most have been based on tectonic shattering, fracturing as a result of volume change of anhydrite to gypsum, original deposition as a fanglomerate, solution collapse phenomena following the Laramide orogeny, and finally, local uplift and solution-collapse associated with a karst-like environment following Bear Rock deposition and prior to the Hume interval. The last concept seems to be the one currently in vogue.

The Bear Rock Formation was observed at six locations during the field work. The thickest section, which is incomplete, consisted of 480 feet of poorly exposed, light grey, buff to brown, dense to porous (vuggy and pinpoint) dolomitic limestone. Some brecciation was observed in the middle part of the section located at Jacques Ridge, Field Section 1. The beds overlie the Siluro-Ordovician sequence, the top not being reached. As much as 330 feet of Bear Rock limestone was exposed in cliffs standing above the Hare Indian River north-northeast of Jacques Ridge. There the Bear Rock Formation consists of buff to dark brown, dense, massive to thin-bedded, fossiliferous in part, partly brecciated limestone and dolomite. Some porosity is present and a petroliferous odor was noted. To the north along Belot Ridge at Field sections 5 and 6, the Bear Rock consists of a light grey, buff to brown, calcareous dolomite; some vuggy and porous facies, which are fossiliferous in part, and some local brecciation was observed.

Hume Formation

The Hume Formation is the name applied by Bassett (1961) to a 400-foot thick section of grey argillaceous limestone and grey calcareous shale exposed on the east branch of Hume River along the front of Mackenzie Mountains southwest of the project. Previously the name Ramparts Formation had been used in referring to the Middle Devonian section overlying Bear Rock beds. Among geologists who have published considerable material about the sequence are Kindle and Bosworth (1921), Hume (1954), Lenz (1959 and 1961), Warren and Stelck (1962), Douglas et al (1963), and Ziegler (1967).

The Hume Formation forms bedrock in a wide northerly trending belt along the western edge of the project. It is well exposed in cliffs along Hare Indian River and also along the Anderson River north of the project. Exposures are common in places in the Franklin Mountains. The Hume Formation can be divided into an upper massive limestone and a thicker lower unit of bedded limestones which become increasingly argillaceous toward the base. The lower unit is approximately 200 feet thick while the upper massive limestone is approximately 100 feet thick. The lower limestone member contains nodular bedding in places as a result of a great abundance and variety of fossils present. The upper massive limestone beds are in places

extremely fossiliferous and are biohermal in part. Several small bioherms have been reported present in the upper Carnwath River area. The lower limestone member of the Hume Formation is reported to be in gradational contact with the underlying Bear Rock beds at some places. However, the contact appeared to be quite sharp at some localities in the project. The upper massive part of the formation is conformably overlain by shales of the Hare Indian Formation except where these beds have been removed by sub-Cretaceous erosion. In these areas basal Cretaceous beds rest unconformably on the Hume Formation. Because of the limited areal extent and recessive outcrop character of the Hare Indian shale, the Hume and Hare Indian Formations have been mapped together in the western part of the project and are labelled Dhh on the accompanying evaluation map. Elsewhere they are included with the undivided Middle Devonian map unit labelled D_m.

The Hume Formation was examined at several field stations in the project, mainly in the vicinity of Echo Bend located 5 miles north of Lac a Jacques. Approximately 100 feet of the formation is exposed. It consists of light grey, buff to dark brown-grey, hard and dense to platy and thin-bedded, partly micro-crystalline, highly fossiliferous limestone. Some vuggy porosity is present. Colonial corals are common. Bryozoans, gastropods, rugose corals, brachiopods and crinoids are also present.

Hare Indian Formation

An assemblage of grey and green shale overlies the Hume Formation conformably and ranges in thickness from about 500 to 700 feet. Bassett (1961) retained the name Hare Indian for the shale sequence. The Hare Indian is present only in the western part of the map area where sub-Cretaceous erosion restricted its distribution. Because of its limited areal extent and recessive outcrop character it has been mapped together with the Hume Formation and labelled Dhh on the accompanying evaluation maps. It was examined briefly at one location in the field. At Field Section 10, 3 miles west of Lac a Jacques, a small part of the section is exposed and it consists of about 35 feet of light grey platy calcareous shale overlain by 5 feet of medium brown-grey dense, hard platy limestone.

UPPER DEVONIAN

Strata of Upper Devonian age are present in only one small part of the project. They are mapped in the extreme southwestern corner west of the Norman Range. The section is mainly shale and is labelled Du on the evaluation map.

CRETACEOUS

Cretaceous strata cover a vast part of the eastern portion of the project in the vicinity of Great Bear Lake and are labelled K on the evaluation maps. At most places bedrock is mantled by glacial drift and little is known concerning the true thickness and lithologies. The easternmost exposures were not visited during the field work; however, examination of the evaluation maps suggests that at least 1,500 feet and possibly 2,000 feet or more of Cretaceous strata may be preserved in the middle of a gentle structural basin which is probably present in the Great Bear Lake area. According to the Geological Survey of Canada, exposures in the vicinity of Smith Arm consist of grey shale. Moreover, some palynological evidence exists to indicate that Lower Cretaceous strata are present east of the project area. Outcrops of shale and sandstone have been noted in stream cuts along Great Bear River in the southern part of the project, east of the Franklin Mountains. Although earlier geologists suggested that they might be Devonian in age, later workers have now placed the section in the Cretaceous System.

Cretaceous rocks are also mapped at places in the central and western part of the Interior Plains. The rocks are preserved as erosional remnants lying on progressively older Paleozoic rocks from east to west across the map area. This relationship demonstrates the profound unconformity at the base of the Cretaceous. In places the Cretaceous sequence contains a distinctive basal sandstone. The unit consists of a light grey fine to coarse-grained, clean friable porous quartzose sandstone. It is commonly cross-bedded. At places laminations of carbonaceous material and bituminous material are present. In some areas, such as along Belot Ridge, the sandstone is saturated with brown oil. The sandstone is rarely exposed completely and is probably variable in thickness. It may attain thicknesses as much as 200 feet in places. It is not known if it is present everywhere. Dark grey and black shales containing minor lenses of sandy shale and siltstone overlie the basal Cretaceous sandstone. Fossils obtained from this shale indicate its age to be lower Albian (Lower Cretaceous).

TERTIARY

Tertiary sediments are interpreted to form bedrock over the greater part of the valley present in the southwestern corner of the project area in the Brackett Lake and River area. This is in the northern extension of the Mackenzie Plain physiographic and structural subdivision. Exposures of sandstone, siltstone and shale of Tertiary age have been reported along Brackett River as indicated on the accompanying evaluation map. Good outcrops are present south of the project area at places along the Mackenzie and Great Bear Rivers. The Tertiary section to the south is made up of gravel, sandstone and mudstone. Thin coal and lignite seams are also present. Fossil leaves indicate a lower Eocene age. The Tertiary sequence appears to be more than 5,000 feet thick at the south end of the MacKay Range located 20 miles south of the project. However, the Tertiary sequence in the Brackett Lake area is probably very much thinner. The Tertiary assemblage was probably deposited under continental conditions in a rapidly subsiding trough accompanying crustal movements during and following the Laramide orogeny. The Tertiary assemblage is labelled T on the accompanying evaluation map.

QUATERNARY

Quaternary deposits within the map area consist mainly of Pleistocene glacial till and Recent alluvium and hillwash. Although their distribution is widespread, the mapping of Quaternary deposits, which are labelled Q on the accompanying maps, is restricted to a few river valleys. However, extensive deposits of glacial drift mask bedrock in the Interior Plains.

STRUCTURAL GEOLOGY

INTRODUCTION

The structural setting of the project is shown on the accompanying areal geology and structural interpretation maps. The geologic maps were prepared at the scale of 1" to 2 miles. Stereoscopic examination of contact prints of air photographs provided most of the control for the structural interpretation. Rates of dip of strata were estimated and assigned to dip classifications as shown in the legend on the evaluation maps. Faults and axes of folds observed on air photographs were traced on them and subsequently transferred and drafted to the base maps. Formational boundaries and intraformational key beds were also delineated during the study. The structural analysis incorporated data available in literature and open file reports. In addition, considerable time was spent during the field work to check the structural interpretation and verify them in the field. At places dips were measured in the field and are indicated by the letter "FO" on the evaluation maps.

Some detailed structural work was done in the vicinity of permits 5082-5085, 5088, and 5132 to 5142. They form a block in the western part of the project area in the Lac a Jacques - Hare Indian River area. A structural contour map was prepared photogrammetrically to show the configuration of structure by means of contours. The contours portray the structural interpretation quantitatively and depict the size, shape and magnitude of geologic structure. The structural datum is the top of the Bear Rock Formation of Devonian age, and the contour interval is 100 feet. Topographic elevations of the structural datum were plotted and elevations of other stratigraphic markers were reduced to the structural datum as shown on the evaluation map. This data was compiled photogrammetrically in part using a Multiplex, a precise photogrammetric plotting instrument. Glass diapositives for the Multiplex were obtained from the Federal government in Ottawa.

Formline structure contours were drawn in one area covering the permit acreage located immediately west of Smith Arm. Formline structure contours are qualitative in scope and are represented by lines drawn parallel to the strike of surface beds as determined from photo-estimated dips and strikes. They are used to show the form and shape of the folds. However, no quantitative measurements are involved.

A series of geologic cross-sections were drawn along the lines shown on the evaluation maps. They also aid in depicting the structural geology.

REGIONAL STRUCTURE

The project area can be divided into three main structural subdivisions and they correspond closely to the physiographic provinces. The structural subdivisions are the Interior Plains, Franklin Mountains and the Mackenzie Plain.

Interior Plains

The Interior Plains structural subdivision covers all of the project area except the southwestern part. The Interior Plains form a vast stable area of low structural relief lying between the craton to the east and the mobile belt of the Cordilleran region to the west. At most places the beds are flat-lying to gently dipping. Rates of dip seldom exceed 3° . However, at a few places structures are defined by steep dips which may attain an attitude of 45° or greater locally.

In the eastern part of the project area Cretaceous strata form bedrock. At most places the strata are relatively non-resistant. Bedrock is mantled by glacial drift. Outcrops are scarce. Thus, detailed structural analysis is difficult on air photography. However, the regional distribution of sediments, the topographic forms that are preserved and the few dips that have been observed suggest that the beds are flat-lying to gently dipping. Along Great Bear River in the southern part of the project the Cretaceous beds are dipping gently to the east towards Great Bear Lake. Thus, this fact coupled with the regional distribution of Cretaceous strata suggests that a Mesozoic structural basin may be present in the Great Bear Lake area. The Mahony Lake - Fort Franklin project covers the western flank and central parts.

The structural setting is different in the western and central parts of the Interior Plains included by the project. In this area bedrock is comprised mainly by Paleozoic strata ranging in age

from Ordovician through Middle Devonian. Some Cretaceous beds are present. Regionally the Paleozoic beds strike in a northerly direction and dip very gently to the west. Some gentle folds and high angle faults are also present. Distinctive alignments observed on air photography also suggest the presence of additional faults and fracture zones. Moreover, the relatively gentle and simple structure of the Interior Plains is interrupted at several places by linear belts of intense deformation. One example is the structural trend lying immediately west of Lac Belot. It consists of a northerly to northwesterly, trending slightly sinuous, narrow, elongate, moderately to tightly folded, faulted anticline. Structural trend extends from a point about 12 miles due south of Lac Belot northerly for a distance of 36 miles where it bifurcates. The right prong can be traced north another six miles whereas the other structure extends to the northwest about 28 miles. Dips defining the structure range from 15° to 45° at most places. However, beds are dipping much more steeply in local areas. Another narrow elongate structural zone is present in the area between Colville and Aubry Lakes. It consists of a northeasterly trending, moderately to tightly folded, anticlinal structure which is approximately 25 miles long. Another intense structural zone in the Interior Plains is present in the central part of the project in the Tunago-Lac Des Bois area. It extends from the southern project boundary at lat. 66° N., long. $126^{\circ} 16' W.$, northeasterly through the Tunago Lake area to Lac Des Bois, a distance of 65 miles. It is interpreted to be a high angle fault of moderate displacement. Folding may be associated with the fault in some places although it is difficult to establish this from examination of air photographs. Additional linear zones are present in the central part of the project in a belt extending from Ford Bay on Smith Arm north to the northern project boundary. These structures are mainly moderately to intensely deformed and consist of narrow, linear, slightly sinuous north-trending faulted anticlinal structures.

The basement probably played an important role in the deformation of these intense structural zones in the Interior Plains. This is suggested by the nature of the deformation and the relation of folds to faults. Deformation probably followed fracture patterns in the basement resulting in the formation of folds in overlying strata. In any event, the regional westerly dip of the beds was imposed prior to the deposition of Cretaceous strata and thus preceded the Laramide orogeny.

Franklin Mountains

Only a small part of the Franklin Mountains structural subdivision is included by the project. It is located in the southwestern part of the map area. The structure is moderate to intense and is locally very complex. Structural trend is variable. In the Norman Range and in the ridge that crosses Great Bear River to the east, structural trend is north-north-westerly. However, in that part of the Franklin Mountains located immediately south of Lac a Jacques, structural trend is mainly westerly. Dips defining structures range from very gentle to nearly vertical. At most places they are in the order of 10° to 45° . At most places structure consists of narrow to broad, elongate, moderately to tightly folded faulted anticlines and synclines. Although folds are significant, faults play a very important role in the structural pattern. Two main structural trends are present. Northerly to northwesterly and westerly. Although most of the deformation probably took place during the Laramide orogeny, some of the structure possibly was formed earlier, perhaps during the Hercynian orogeny which affected northern Canada during the Pennsylvanian period.

Mackenzie Plain

Only a very small part of the Mackenzie Plain structural subdivision is included by the project. It occupies the valley bordered by the Norman Range on the west in the southwest corner of the project. Bedrock is mantled by extensive deposits of glacial drift and outcrops are very scarce. Consequently, details of structure cannot be determined accurately through photogeologic or field geologic mapping techniques. Tertiary beds are known to occupy the central part of the Mackenzie Plain located in the project area. One would expect them to be flat-lying to gently deformed. However, at depth one could expect to encounter structures in Paleozoic rocks, similar to those present in the Franklin Mountains structural subdivision.

LOCAL STRUCTURE of the PERMIT ACREAGE

For the sake of convenience and discussion the permit acreage can be divided into three blocks: a westernmost block in the vicinity of Lac a Jacques, a central block near the western edge of Smith Arm and a southern block in the vicinity of Mahony Lake.

Lac a Jacques Area

The permit acreage in the vicinity of Lac a Jacques lies mainly in the Interior Plains. The beds dip regionally to the west at about 50 feet per mile. The structure contour mapping indicates the presence of some gentle structures. The most conspicuous one is formed by a broad, gentle, southwesterly trending anticline which can be traced from a point at approximately lat. $66^{\circ} 28' N.$, long. $126^{\circ} 22' W.$ in permit 5138 southwesterly to about lat. $66^{\circ} 12' N.$, long. $126^{\circ} 52' W.$, a distance of about 25 miles. The northeasternmost segment of the structure is well defined by dips that were verified in the field. The southwestern part of the structure was mapped originally as a structural terrace. However, the quantitative structural analysis suggests that a broad gentle anticline may extend through the area, and closure could be present in permit 5134. Another gentle fold is present in permit 5142. It consists of a northerly plunging anticline which has been verified by field observed dips.

The southern end of one of the intense linear structural zones is covered by permits 5082 and 5088 at the southern end of Lac Belot. Another north-northwesterly plunging folded anticlinal structure is present in the western part of permit 5085. This structure was also confirmed in the field.

Smith Arm Area

Discussion of the Smith Arm acreage can be divided into two parts. Permits 5249 - 5253 located south of Smith Arm, cover an area where bedrock is mantled by vast deposits of glacial drift. Outcrops are nonexistent. Consequently, little can be said in regard to the precise structural setting of the area. The evaluation maps show that bedrock is formed by Cretaceous beds which are probably flat-lying to gently dipping in the permit acreage. However, structure is reasonably well expressed at the surface in the block immediately west of Smith Arm. The permit acreage is dominated by a very broad gentle north-northeasterly trending faulted anticline. The highest point of the structure appears to be in the vicinity of where the axis is crossed by Hare Indian River in permit 5255. Beds on the west flank dip gently to the west-northwest at rates of less than 1°. The east flank is slightly steeper where defining dips are in the range of 1° to 3°. From a point where the axis crosses Hare Indian River the axis plunges to the north-northeast very gently and can be traced on air photographs for a distance of about 15 miles. However, the nature of the fold south of Hare Indian River is not well defined because bedrock is mantled by glacial drift and a thin Cretaceous cover. Some high angle faults of small displacement in the order of a few tens of feet are associated with the structure.

Mahony Lake

The structural setting of the permit acreage in the vicinity of Mahony Lake is difficult to determine because bedrock is covered at most places by glacial drift. Furthermore, because of the nature of the terrain, little or no morphological expression of bedrock is apparent except in the southeastern corner where the northern tip of one of the ranges comprising the Franklin Mountains is present. It is marked by a moderately deformed northwesterly trending anticline which appears to plunge towards Mahony Lake. Thus, one could expect the structural trend in Paleozoic rocks to be northwesterly within the permit acreage.

OIL and GAS PROSPECTS

Indications of Hydrocarbons

Evidence of the presence of hydrocarbons in this part of the Northwest Territories is abundant. Oil is produced from Middle Devonian reef limestones in the Norman Wells oilfield located along the Mackenzie River 50 miles south of the project. Several oil and gas seepages have been observed and reported in the general area and those which are present in the map area are indicated on the evaluation sheets. Oil staining has been noticed in bedrock outcrops and some exposures are petroliferous.

The Norman Wells oilfield was discovered in 1920 by a well drilled in the vicinity of an oil seep along the Mackenzie River. Production is obtained from the Kee Scarp Formation which is a reef limestone of Middle Devonian age. Trapping conditions are formed by a stratigraphic trap at the updip edge of the reef mass on the northeast flank of a major syncline. The Norman Range forms the upper part of the flank of the syncline, and beds correlative with the producing reservoir are exposed on the flank of the range only 2 miles from the productive field. Drilling depths to the productive reef limestones range from 1,200 to 1,600 feet and the oilfield covers approximately 4,325 acres. Reserves are estimated at 419 million barrels of oil in place. The oil is of light gravity and more than 500,000 barrels are produced annually. A refinery present at Norman Wells is capable of processing 1,500 to 2,000 barrels per day.

The incidence of oil and gas seepages within and adjacent to the project area is extremely high. Gas seeps have been found along the Ontaratué River west of the map area and along the Crossley River to the north. A gas seep has also been reported from the vicinity of Hare Indian River approximately 4 miles west of the map area. A large oil seep is present in basal Cretaceous sands near Rond Lake west of the project area. The basal Cretaceous sandstone is saturated with oil on the west side of Belot Ridge in the project and was visited in the field. Rock samples were collected. Oil sands have

also been reported by Patterson and Kirker along the western shore of Lac Des Bois. Oil bearing Quaternary sands have been found at two locations 8 miles northeast and northwest respectively of Tchentferri Lake.

No wells have been drilled within the boundaries of the map area. However, several wells have been drilled to the west and to the south. Although no commercial discoveries have been made other than that at Norman Wells, oil and gas shows have been reported from various parts of the stratigraphic column. Moreover, some zones in the Hume, Bear Rock and Siluro-Ordovician sequences have shown indications of excellent porosity at places.

Because of the several indications of oil and gas present in the general area, the porous and reefal nature of some of the sediments and the structural setting, some of the permit acreage held by Siebens Oil & Gas Ltd. is considered to hold prospects for the accumulation of hydrocarbons. Potential reservoirs are considered to be clastics of the Cambrian succession and porous beds and reefal developments in the Siluro-Ordovician sequence. Potential traps would lie at relatively shallow depths and have a thin sedimentary cover.

The western block of permit acreage in the Lac a Jacques-Hare Indian River area appears to be the most favorable for oil and gas prospects. The stratigraphic section is thicker, potential reservoirs of Cambrian and Ordovician age are buried in the subsurface and structures are present to effect a trap. Study of the accompanying geologic data shows that permits 5134, 5135, 5138 and 5139 cover a broad, gentle south-westerly trending closed anticline.

Very little can be said concerning the precise oil and gas prospects of the permit acreage in the Mahony Lake - Smith Arm areas. Over much of this area the surface expression of bedrock is concealed beneath Cretaceous and Quaternary cover, and structural details are lacking. However, in one part of the acreage (permits 5254, 5255 and 5256) west of Smith Arm, a broad anticlinal structure is present and could effect a structural reversal to effect a structural trap in Cambrian clastics and Ordovician dolomites buried in the subsurface at relatively shallow depths.

Recommendations

The next step in further evaluation of the permit acreage should be the drilling of a stratigraphic test well having a favorable structural location. We believe it is fundamental to determine the nature of the stratigraphic section in the subsurface in order to more fully evaluate the oil and gas potential of the permit acreage. If possible, such a test should be located in permit 5134.

Respectfully submitted,

V. ZAY SMITH ASSOCIATES LTD.



George M. Collins, P. Geol.

SELECTED BIBLIOGRAPHY

ALBERTA SOCIETY PETROLEUM GEOLOGISTS, 1960,
"Lexicon of Geologic Names in the Western Canada
Sedimentary Basin and the Arctic Archipelago",
Symposium, Alberta Soc. Petrol. Geol.

ALBERTA SOCIETY OF PETROLEUM GEOLOGISTS, 1964
"Geological History of Western Canada", Atlas, edited
by R.G. McCrossan and R.P. Glaister.

ALBERTA SOCIETY OF PETROLEUM GEOLOGISTS,
in press, "Tectonic Map of Western Canada Sedimentary
Basin", Tectonic Map Committee (pre-publication copy
of manuscript).

BASSETT, H.G., 1961, "Devonian Stratigraphy, Central
Mackenzie River Region, N.W.T., Canada", in
Geology of the Arctic, Proceedings of the First
International Symposium on Arctic Geol. Univ. Toronto
Press, Vol. 1, pp. 481-498.

BELL, W.A. 1959, "Stratigraphy of Middle Ordovician and
Older Sediments in the Wrigley-Fort Norman Area,
Mackenzie District, N.W.T.", Can. Mining Met.
Bull. Vol. 52, No. 561, pp. 3-18.

BORDEN, R.L., 1956, "An Upper Ordovician Coral Fauna,
Lower Mackenzie River Area, Northwest Territories",
M.Sc. Thesis, Univ. of Alberta.

DOUGLAS, R.J.W. and NORRIS, D.K., 1963, "Dahadinni and
Wrigley Map-Areas, Dist. of Mackenzie, N.W.T.",
Geol. Surv. Canada, Paper 62-33.

DOUGLAS, R.J.W., NORRIS, D.K., THORSTEINSSON, R.
and TOZER, E.T., 1963, "Geology and Petroleum
Potentialities of Northern Canada", Geol. Surv.
Canada, Paper 63-31.

GEOLOGICAL SURVEY of CANADA, 1960, Geology North-
Central District of Mackenzie, N.W.T. Map 16-1960.

HUGHES, R.D., 1959, "Petroleum Geology of a Portion of Mackenzie District, N.W.T.", Rept. to Minister Department of Northern Affairs & Natural Resources by Union Oil Co. of California, open file, Calgary.

HUME, G.S., 1954, "The Lower Mackenzie River Area Northwest Territories and Yukon", Geol. Surv., Canada, Memoir 273.

HUME, G.S., and LINK, T.A., 1945, "Canol Geological Investigations in the Mackenzie River Area, N.W.T. and Yukon", Geol. Surv., Canada, Paper 45-16.

KINDLE, E.M. and BOSWORTH, T.O., 1921, "Oil-Bearing Rocks of Lower Mackenzie River Valley, Northwest Territories", Geol. Surv., Canada, Summ. Rept. 1920, pt. B., pp. 37-63.

LENZ, A.C., 1959, "Devonian Stratigraphy and Paleontology of Lower Mackenzie Valley, N.W.T.", Thesis: Princeton University 1959.

LENZ, A.C., 1961, "Devonian Rugose Corals of the Lower Mackenzie Valley, Northwest Territories", in Geology of the Arctic, Proc. Internat. Sympos. Arctic Geology, 1961, Vol. 1, pp. 500-514.

LINK, T.A., 1921, in an unpublished report of the Northwest Company a subsidiary of Imperial Oil Limited, on the geology of the northeastern Mackenzie Mountains.

PATTERSON, A.M., and KIRKER, R.J., 1958, "Geology of the Rond Lake Area, N.W.T.", Rept. to Minister, Dept. Northern Affairs Nat. Resources by Western Decalta Petrol. Ltd., open file, Calgary.

SMITH, V.ZAY ASSOCIATES LTD., 1964, "Geologic Report of the Fort Norman Area, N.W.T.", on open file, Calgary, Dept. Indian Affairs and Northern Development.

SPROULE, J.C., and ASSOCIATES LTD., 1959a, "Geological Reconnaissance Report, Aubry Lake Area", Report to Minister, Dept. Northern Affairs Nat. Resources, by Colville Lake Explorers Ltd., open file, Calgary.

SPROULE, J.C. and ASSOCIATES LTD., 1959b,
"Geological Reconnaissance Report Fort Norman
- Kelly Lake Area, N.W.T.", Report to Minister,
Dept. Northern Affairs Nat. Resources by Placid
Oil Co., open file, Calgary.

WARREN, P.S., and STELCK, C.R., 1962, "Western
Canadian Givetian", Jour., Alta. Soc. Petrol.
Geol., Vol. 10, No. 6, pp. 273-291.



Plate 1

Oil-stained cross-bedded sandstone of Cretaceous age which overlies the Bear Rock Formation at Field Section #5 near Lac Belot.

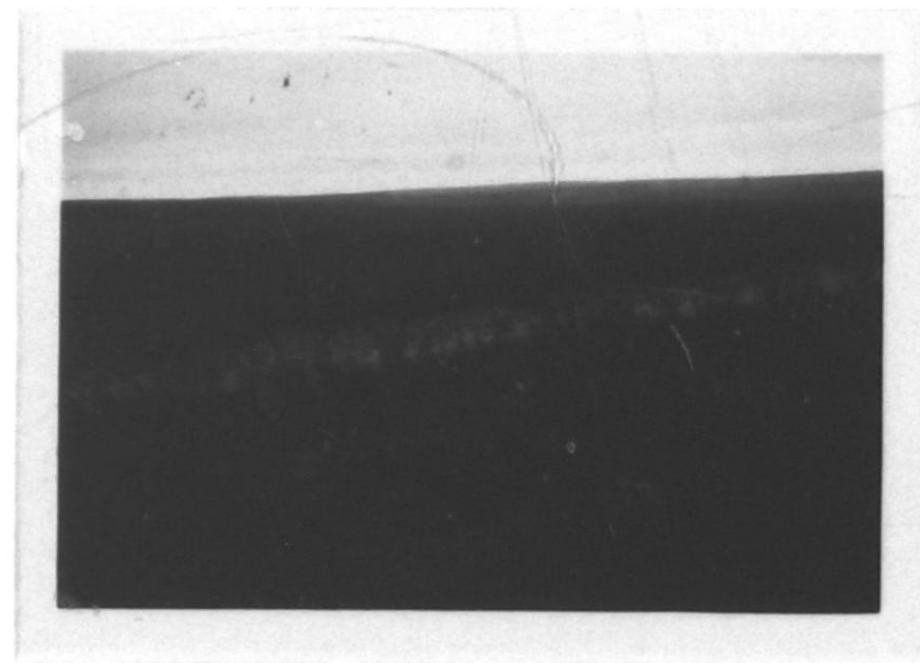


Plate 2

View east from Lac à Jacques showing fossiliferous limestone of Hume Formation.



Plate 3

Exposure of Hume Formation at Field Section #8,
north of Lac à Jacques.



Plate 4

View west at Field Section #1 showing Bear Rock
Formation.



Plate 5

Field Section #2 showing Hume - Bear Rock contact.



Plate 6

Exposure of Bear Rock Formation at Field Section #8.



Plate 7

Exposure of Bear Rock Formation at Field Section #8.



Plate 8

Porosity in Siluro-Ordovician strata at Field Section #1.

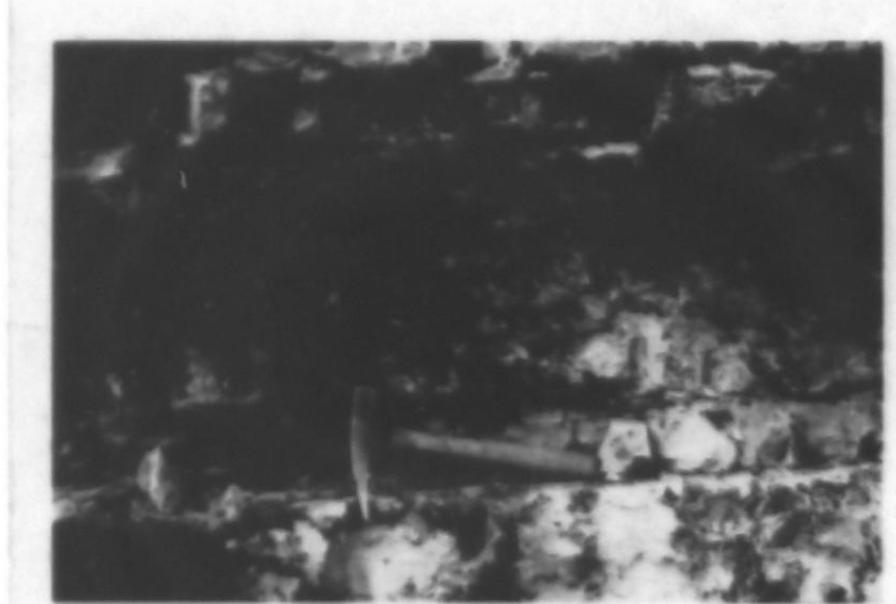


Plate 9

Siluro-Ordovician at Field Section #4



Plate 10

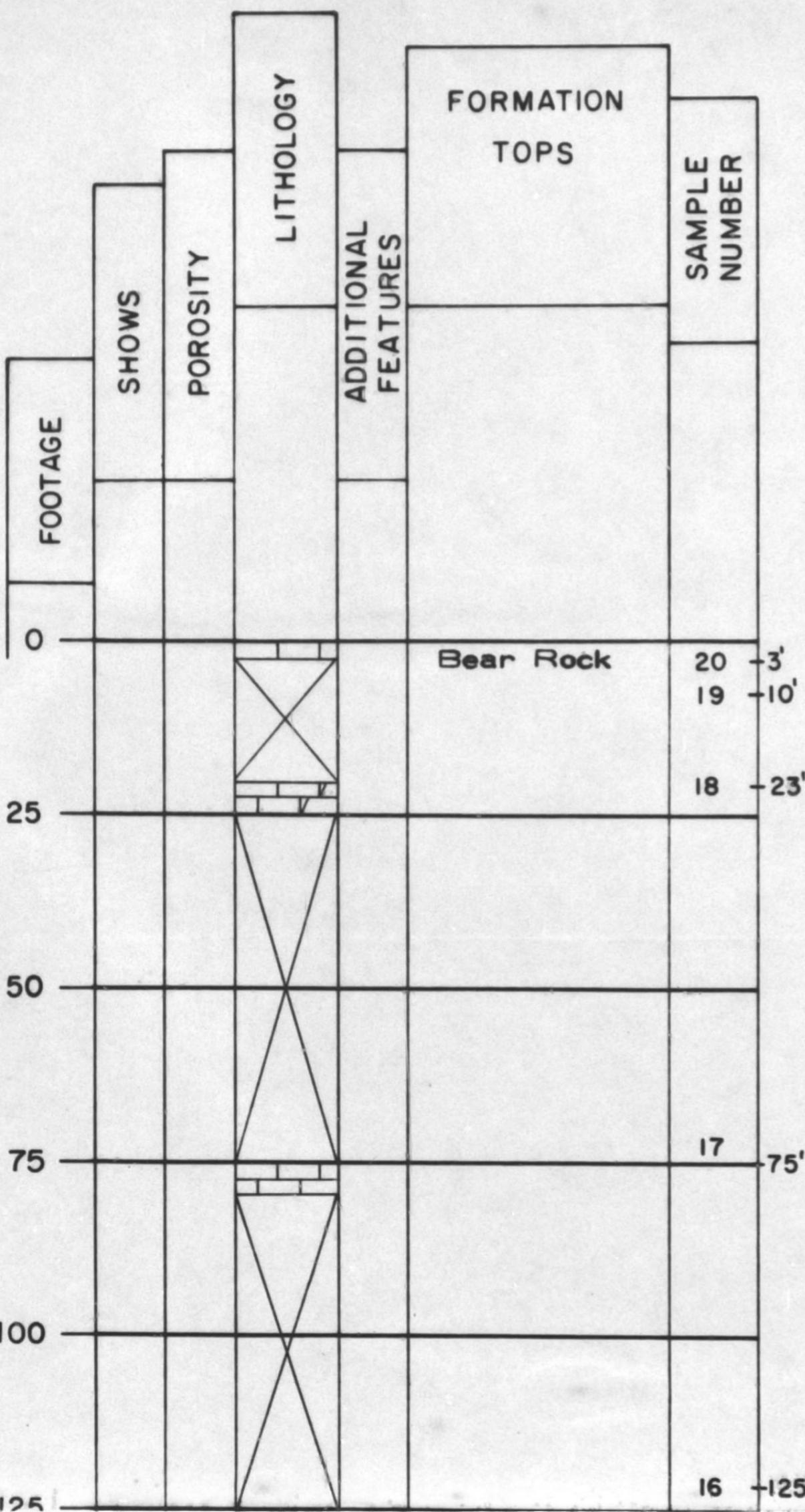
Siluro-Ordovician at Field Section #12.

Jacques Ridge: Field Section IVERTICAL SCALE 1" = 25'REMARKS:

3 miles south of Lac à Jacques
latitude 66° 03' N., longitude 127° 28' W.

Section consists of Bear Rock (Devonian) overlying rocks of Ordovician age. The contact is picked at a point 340' above the base of the exposure (in a covered interval).

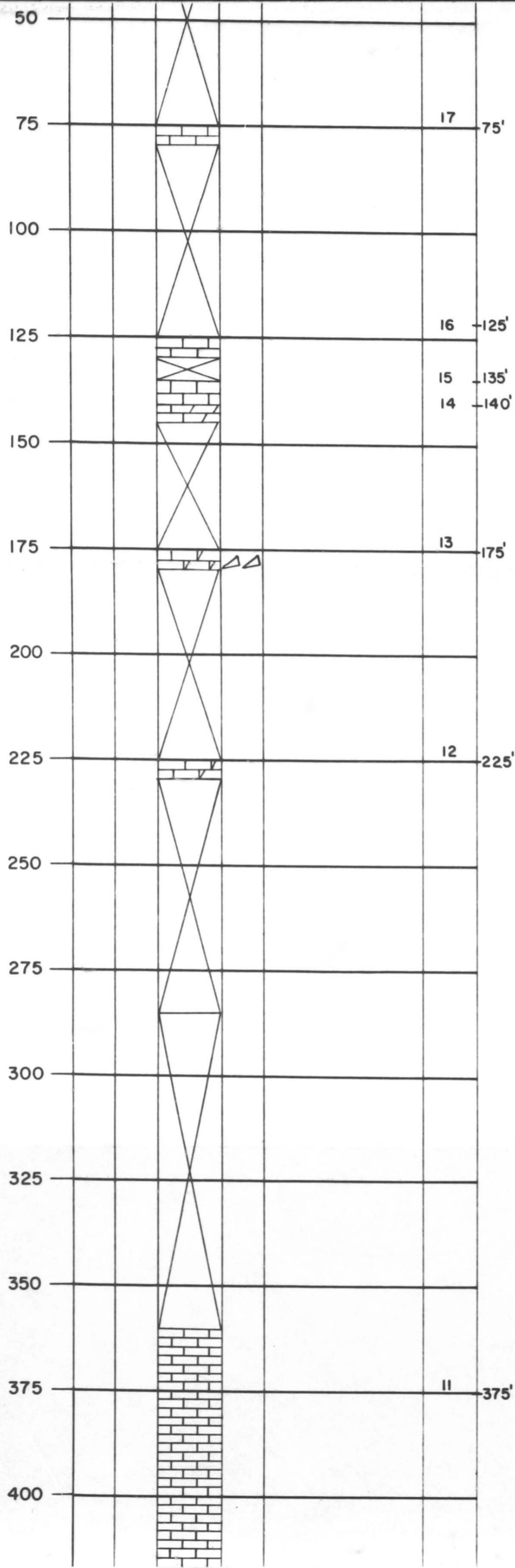
The section shifts 1/2 mile to the NE at a point 690' above the base (see field note summary).

SECTION PLOTTED FROM FIELD NOTESFIELD MEASURED THICKNESS 825 feet

LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHY
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (10x)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	OS OIL STAINING
	DO DEAD OIL
	GS GAS SHOW
	TR TRACE (AMOUNT)
	G GOOD
	F FAIR
	P POOR
	RHOMBIC CARBONATE
	U UNCONSOLIDATED GRAINS
	BRECCIATED
	S SLICKENSIDED
	F FRACTURED
	# PYRITE or PYRITIC
	COVERED INTERVAL

FIELD NOTE SUMMARY

<u>Limestone</u> (0-5') drk brown, dense, concoidal fractures <u>Talus</u> (5-20') Ls II. buff, very dolomitic. no visible porosity
<u>Talus</u> (25-75')
<u>Limestone</u> (75 - 80') brown, dense, No visible porosity
<u>Talus</u> (80-135')
<u>Limestone</u> (125-130') buff-brwn, dense, pin-point porosity. Strom



Limestone (75 - 80') brown, dense, No visible porosity

Talus (80-135')

Limestone (125-130') buff-brwn, dense, pin-point porosity. Strom

Talus (130-135')

Limestone (135-140') brown, dense, pin-point porosity.
(At 135' go about 1/2 mile NE to the SW side of a saddle -Talus slope to top of section)

Limestone: brown, dense, dolomitic

Talus

Limestone (175-180)(1) dark brown, dolomitic mottled, brecciated
(2) buff, dense, earthy, pin-point porosity.

Talus

Talus

Limestone (225' -230') buff, dense, pin-point porosity

Talus

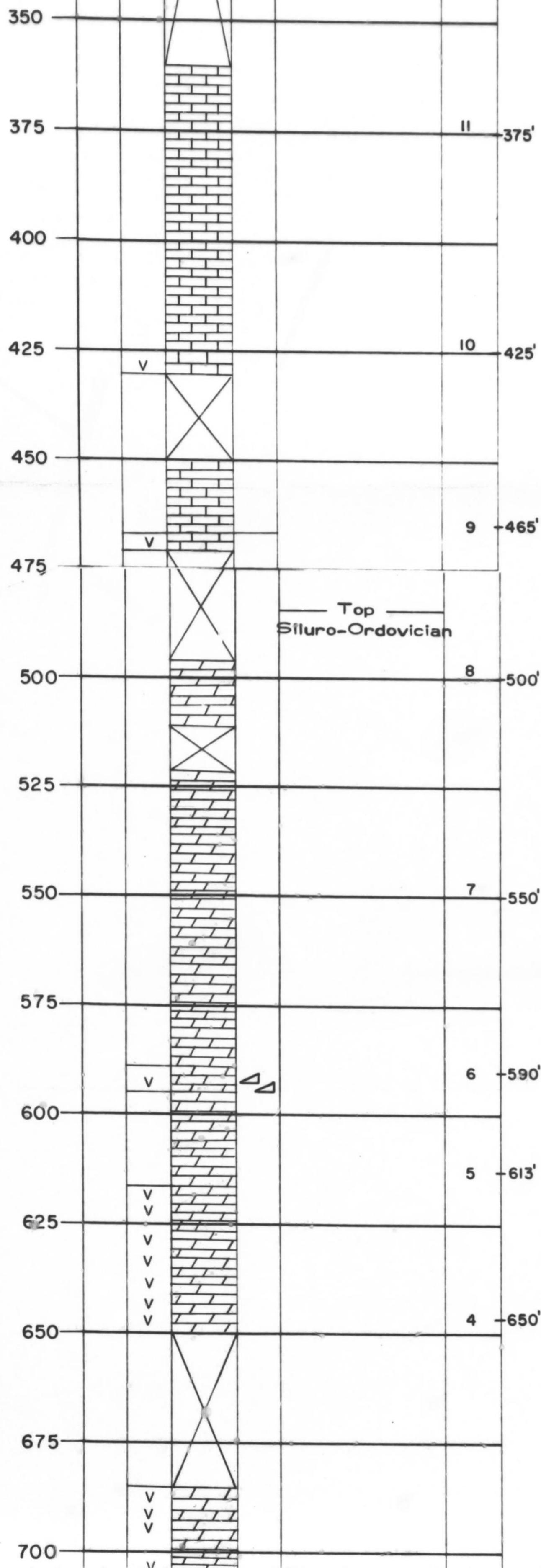
Talus

Covered-Trees (285-360')

Limestone (360-380') light buff weathering (brown), earthy, very porous. Fossils on fresh surfaces

Limestone (380-420') very light buff, scattered outcrops (rubble)

Limestone (420-430') very light buff



Limestone (360-380') light buff weathering (brown), earthy, very porous. Fossils on fresh surfaces

Limestone (380-420') very light buff,
scattered outcrops (rubble)

Limestone (420-430') very light buff
weathering, very porous

Limestone (425') mottled light grey, buff
brown-dense, vugular, porous

Covered (430-450')

Limestone (450-470') light buff weathering,
very porous

Limestone (465') vugular, coarsely porous
, also pin-point
porosity.

Covered (470-495') (SO-Bear Rock contact is in this covered interval)
Dolomite (495-510') buff weathering massive

Covered (510-520')

Dolomite (520-530) massive

Dolomite (530'-570') thin-bedded, no visible porosity

Dolomite (550) light grey to mottled buff,
dense

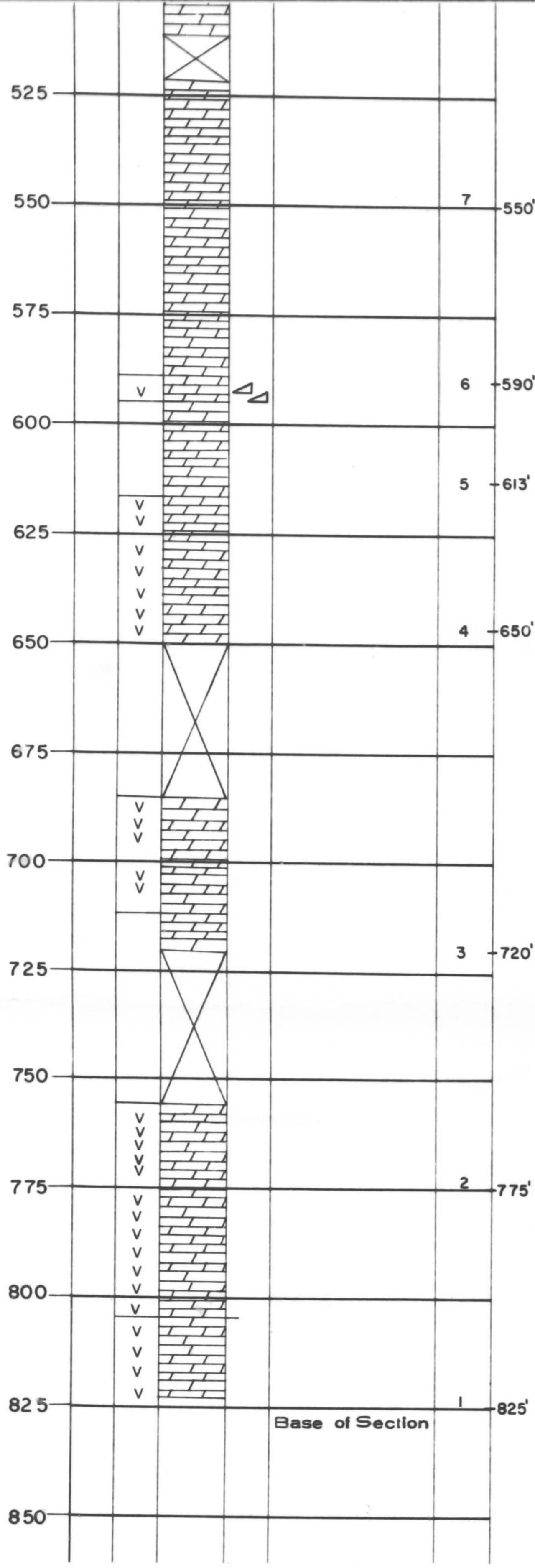
Dolomite (570-605') buff-weathering
massive

Dolomite (590') buff, vuggy porosity common, brecciated

Dolomite (605-615') buff, thin-bedded, dense
No visible porosity.

Dolomite (615-650') buff-weathering, massive, dense, vuggy porosity

Covered (650-6851)



Covered (510-520')
<u>Dolomite</u> (520-530) massive
<u>Dolomite</u> (530'-570) thin-bedded, no visible porosity
<u>Dolomite</u> (550) light grey to mottled buff, dense
<u>Dolomite</u> (570-605') buff-weathering massive
<u>Dolomite</u> (590') buff, vuggy porosity common, brecciated
<u>Dolomite</u> (605-615') buff, thin-bedded, dense No visible porosity.
<u>Dolomite</u> (615-650') buff-weathering, massive, dense, vuggy porosity
Covered (650-685')
<u>Dolomite</u> (685-720') buff-weathering, vuggy porosity
Covered (720-755')
<u>Dolomite</u> (755-805') buff-weathering, massive, vuggy porosity
<u>Dolomite</u> (805-825') buff-weathering, massive, vuggy, porosity. Corals (Catenipora)

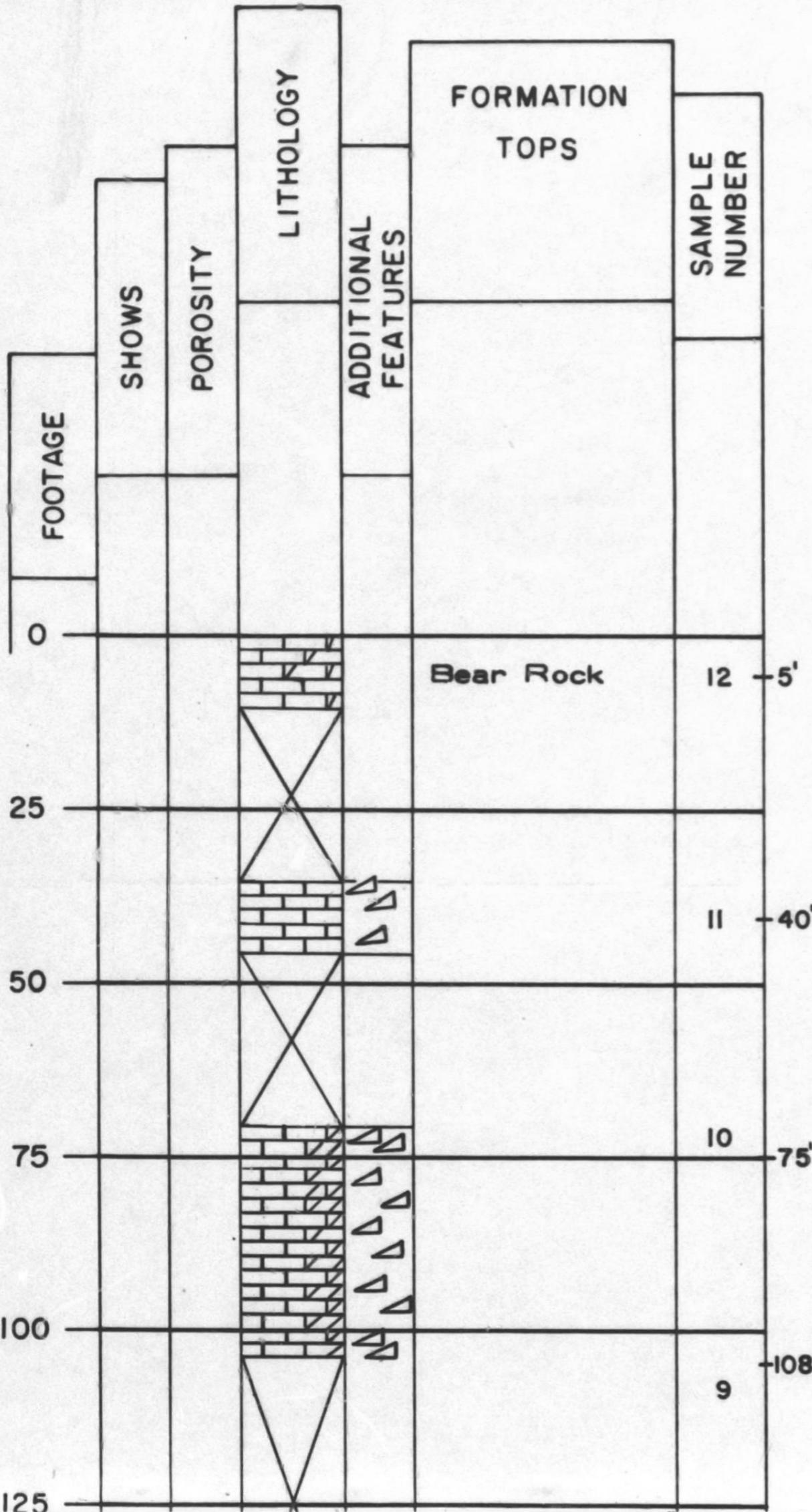
Hare Indian River: Field Section 2

VERTICAL SCALE 1" = 25'

REMARKS:

Hare Indian River 20 miles NE of Lac a Jacques

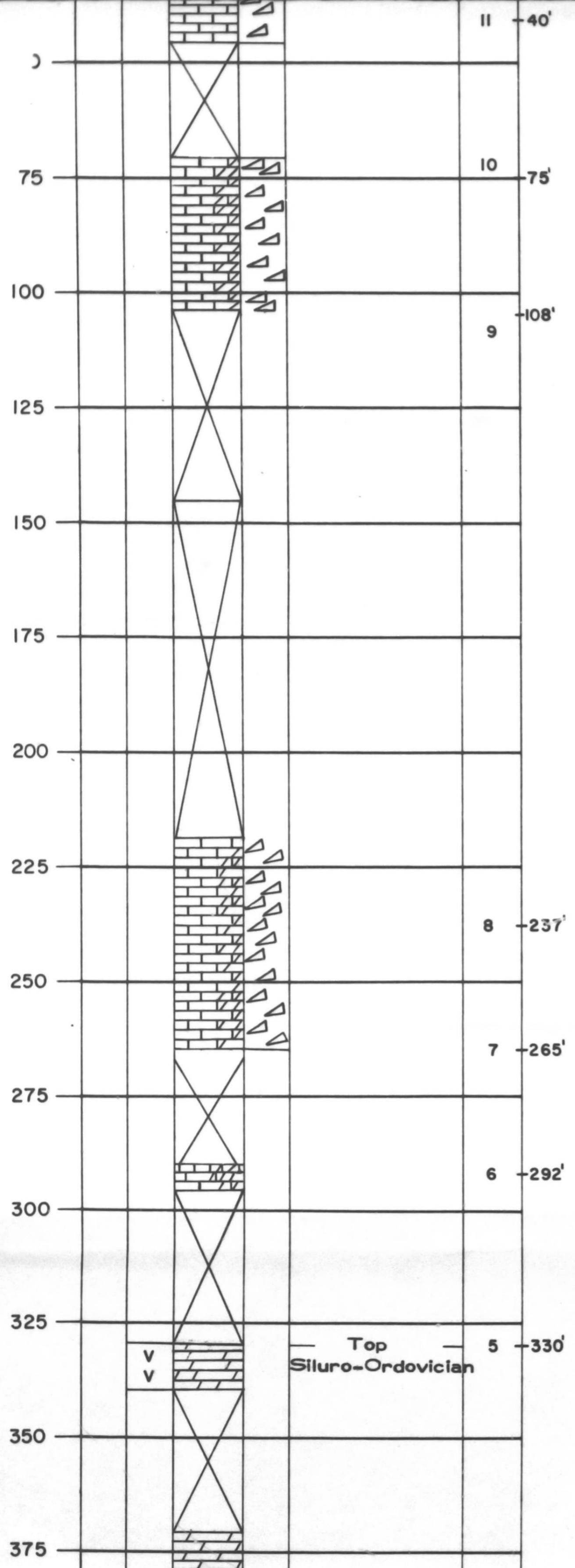
latitude 66° 25' N., longitude 126° 45' W.

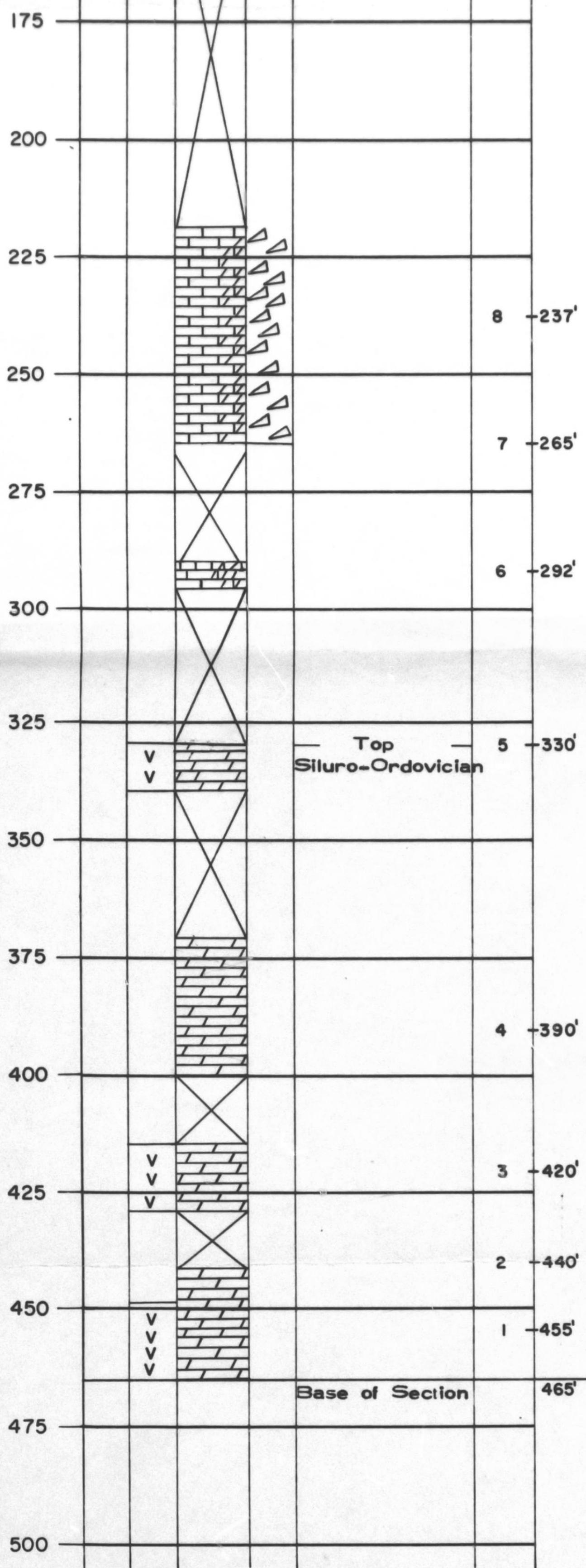
Stratigraphic section consists of Bear Rock overlying
Ordovician (?)SECTION PLOTTED FROM FIELD NOTESFIELD MEASURED THICKNESS 465 feet

LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHY
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (10X)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	oil STAINING
	DEAD OIL
	GAS SHOW
	TRACE (AMOUNT)
	G GOOD
	F FAIR
	P POOR
	RHOMBIC CARBONATE
	UNCONSOLIDATED GRAINS
	BRECCIATED
	SLICKENSIDED
	FRACTURED
	# PYRITE or PYRITIC
	COVERED INTERVAL

FIELD NOTE SUMMARY

Limestone: (0-10') brown massive, very dolomitic. Not very porous. No fossils.
Rubby (Covered) (10'-35')
Limestone (35'-45') buff (light creamy grey) dense brecciated. Not very porous. No fossils.
Covered (45'-70')
Limestone: (70'-110') brown, dolomitic, brecciated. Not very porous. No fossils.
Rubby (110'-145')





Limestone: (215'-265') brown, dense dolomitic brecciated. Not very porous. No fossils.

Rubbly (265'-290')

Limestone: (290-295') brown, massive, dolomitic, no visible porosity. no fossils.

Covered (295-330')

Dolomite: (330-340') buff, slightly calcareous.

Covered (340-370')

Dolomite: (370-400') light brownish grey, dense, massive. No visible porosity. no fossils.
(Partially Covered)

Covered (400-415')

Dolomite: (415-430') Buff thin-bedded, dense scattered vugs. No fossils.

Covered (430-440')

Dolomite: (440-448') buff thin-bedded, dense No fossils. No visible porosity.

Dolomite: (448-465') buff, dense, scattered vugs (calcite veins)

Hare Indian River: Field Section 3

VERTICAL SCALE 1" = 25'

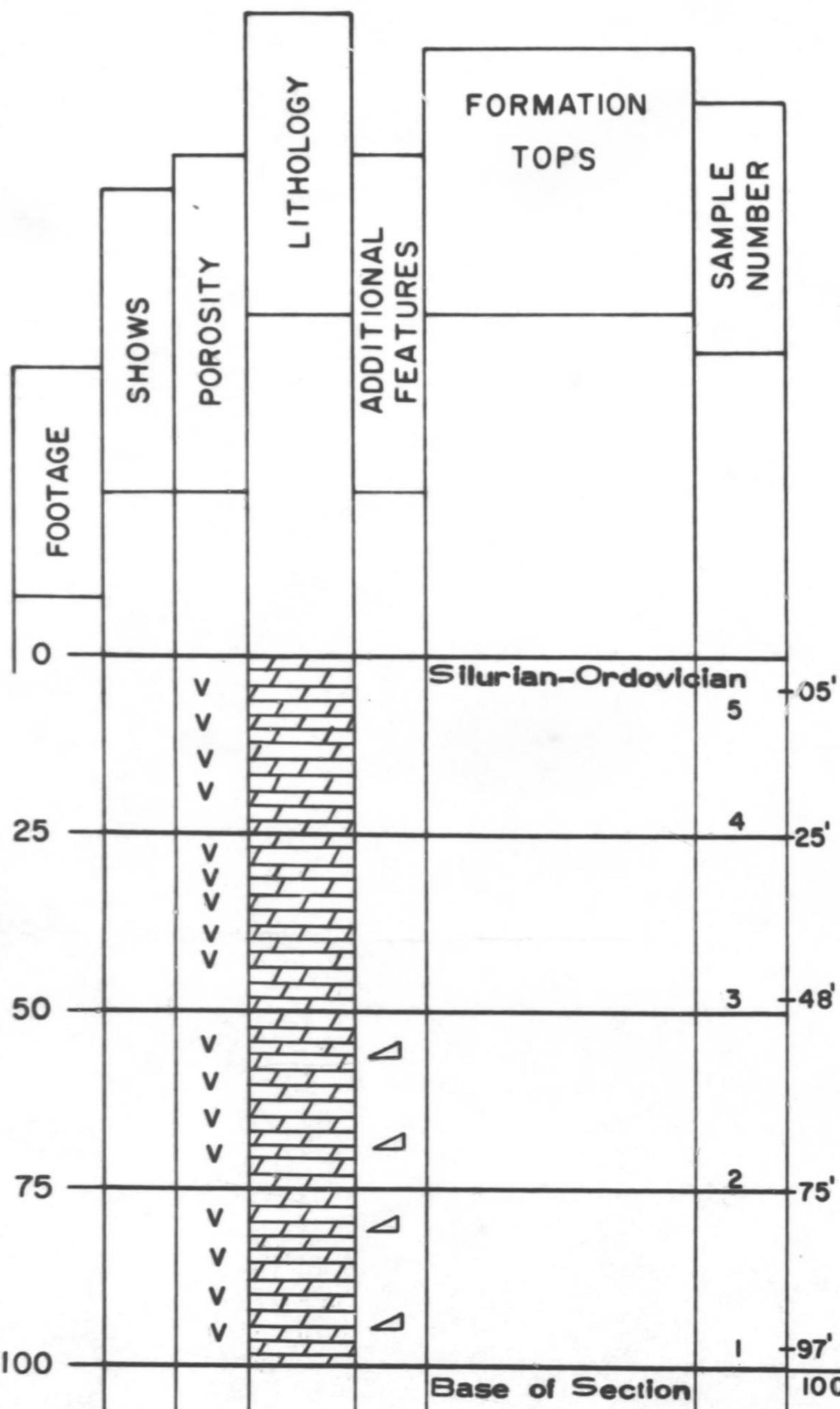
REMARKS:

The section is situated 27 miles NE of Lac à Jacques
latitude 66° 23' N., longitude 126° 23' W. in cliff
along the river.

At 100' could not continue up the section
Top of section was not reached. All Silurian-Ordovician

SECTION PLOTTED FROM FIELD NOTES

FIELD MEASURED THICKNESS 100 feet



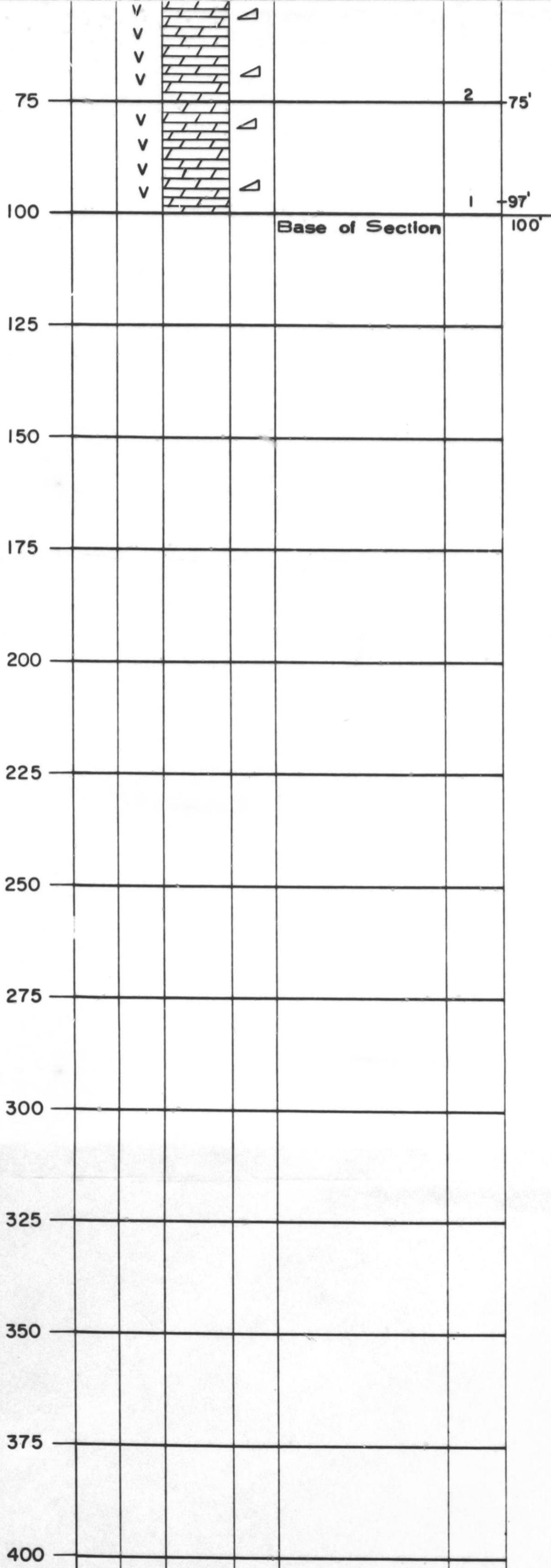
LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHY
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (IOX)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	OS OIL STAINING
	DO DEAD OIL
	↑ GAS SHOW
	TR TRACE (AMOUNT)
	G GOOD
	F FAIR
	P POOR
	RHOMBIC CARBONATE
	U UNCONSOLIDATED GRAINS
	BRECCIATED
	S SLICKENSIDED
	F FRACTURED
	# PYRITE or PYRITIC
	COVERED INTERVAL

FIELD NOTE SUMMARY

Dolomite (0-50') buff weathering to brown,
massive, dense, vuggy with crystalline
quartz linings

Dolomite (50-100') buff-weathering, light
creamy to light brownish grey, dense,
partly porous, brecciated.
No fossils.

10



Dolomite (50-100') buff-weathering, light creamy to light brownish grey, dense, partly porous, brecciated. No fossils.

Hare Indian River: Field Section 4

VERTICAL SCALE 1" = 25'

REMARKS:

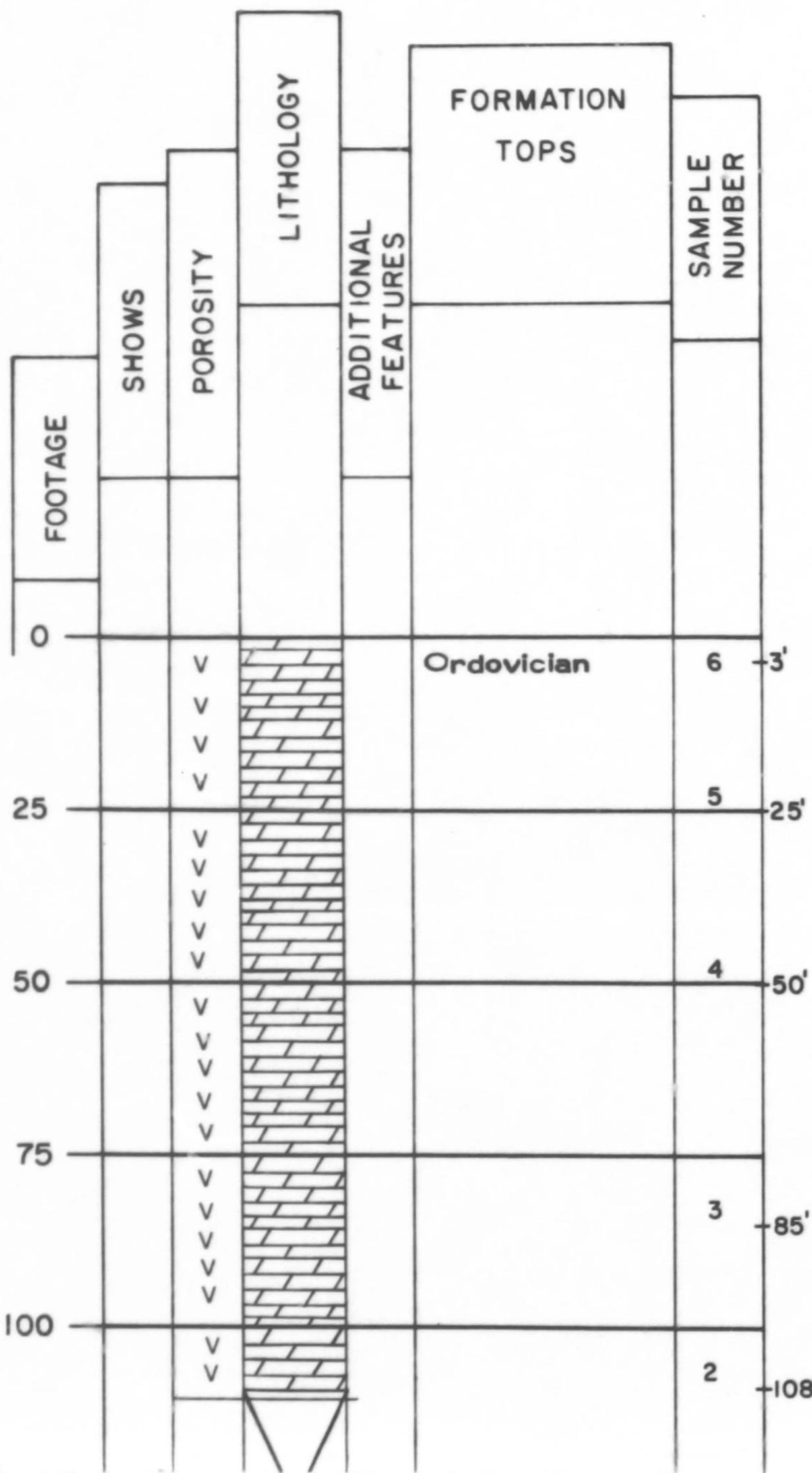
25 miles East of Lac à Jacques

latitude 66° 17' N., longitude 126° 24' W.

The section consists of 145' of Siluro-Ordovician dolomite

SECTION PLOTTED FROM FIELD NOTES

FIELD MEASURED THICKNESS 145 feet



LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHYD
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (IOX)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	OS OIL STAINING
	DO DEAD OIL
	↑ GAS SHOW
	TR TRACE (AMOUNT)
	G GOOD
	F FAIR
	P POOR
	RHOMBIC CARBONATE
	U UNCONSOLIDATED GRAINS
	△ BRECCIATED
	S SLICKENSIDED
	F FRACTURED
	# PYRITE or PYRITIC
	☒ COVERED INTERVAL

FIELD NOTE SUMMARY

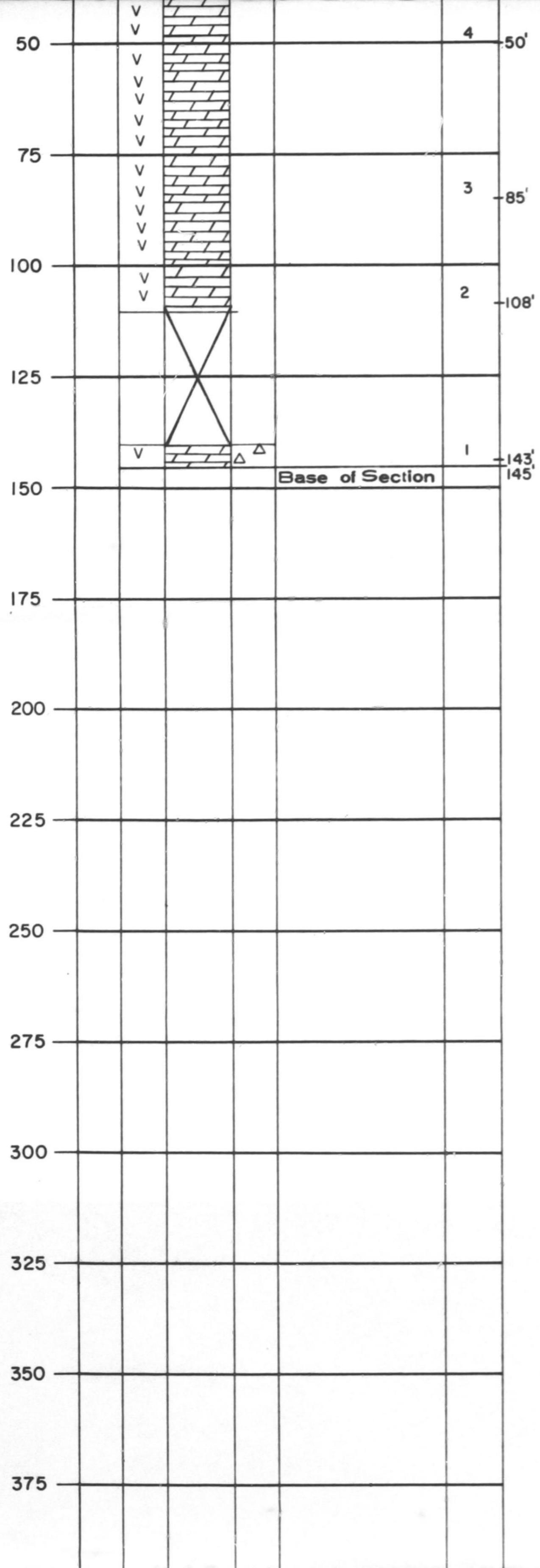
Dolomite (0-45') buff-weathering (light creamy grey), massive, dense, vugular, porosity very pronounced. No fossils.

(At 45' move S.SW to continue with this section.

Dolomite (45-110') buff to light creamy grey massive, thin-bedded, dense, some good vugular porosity. No fossils.

Dolomite (at 85') buff to medium grey, dense good vuggy porosity; calcite crystals in vugs.

Dolomite (at 108') buff to dark grey, dense, vuggy porosity; calcite crystals in vugs.



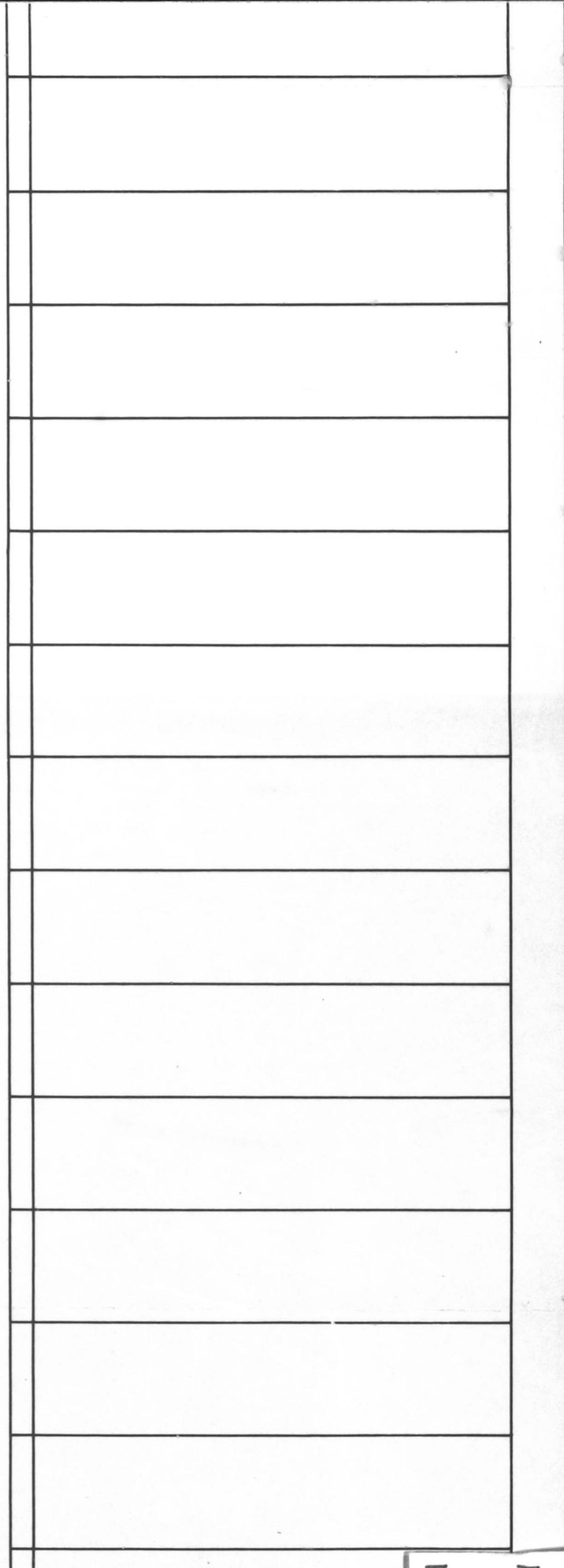
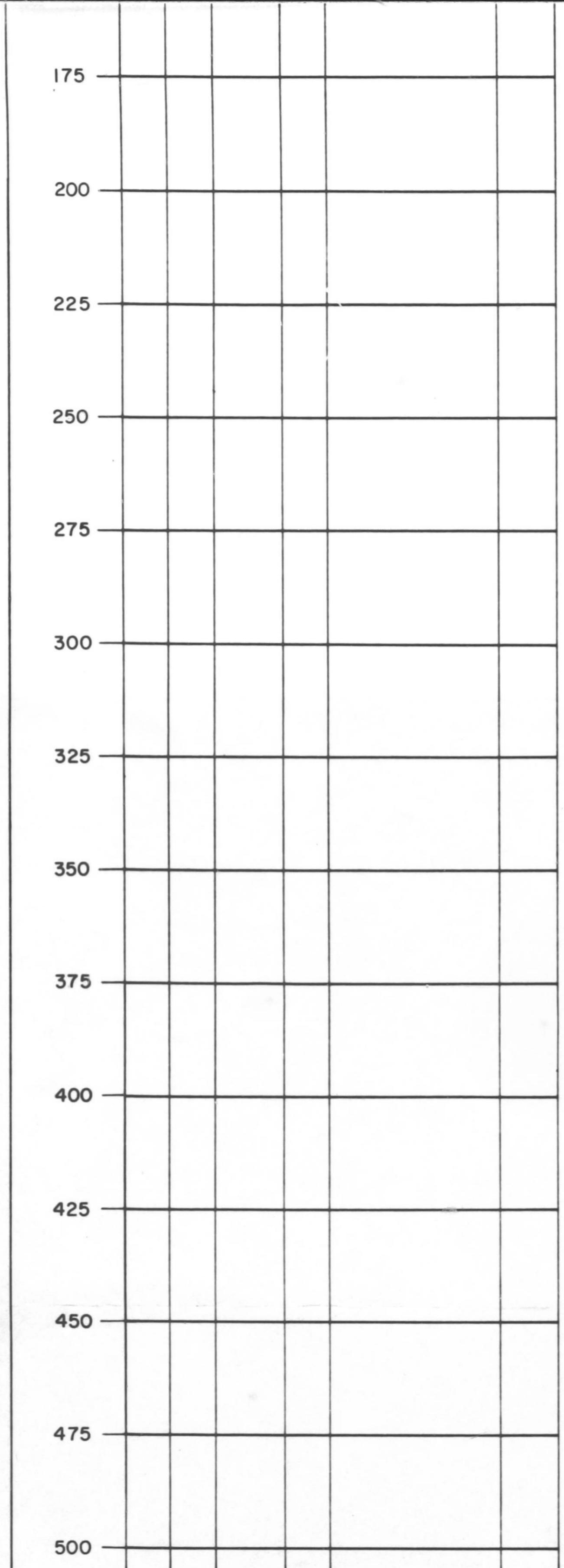
massive, thin-bedded, dense, some good vugular porosity. No fossils.

Dolomite (at 85') buff to medium grey, dense good vuggy porosity; calcite crystals in vugs.

Dolomite (at 108') buff to dark grey, dense, vuggy porosity; calcite crystals in vugs.

Dolomite (140-145') buff to light creamy grey, massive dense, scattered vuggy porosity, cherty in part. No fossils.

2



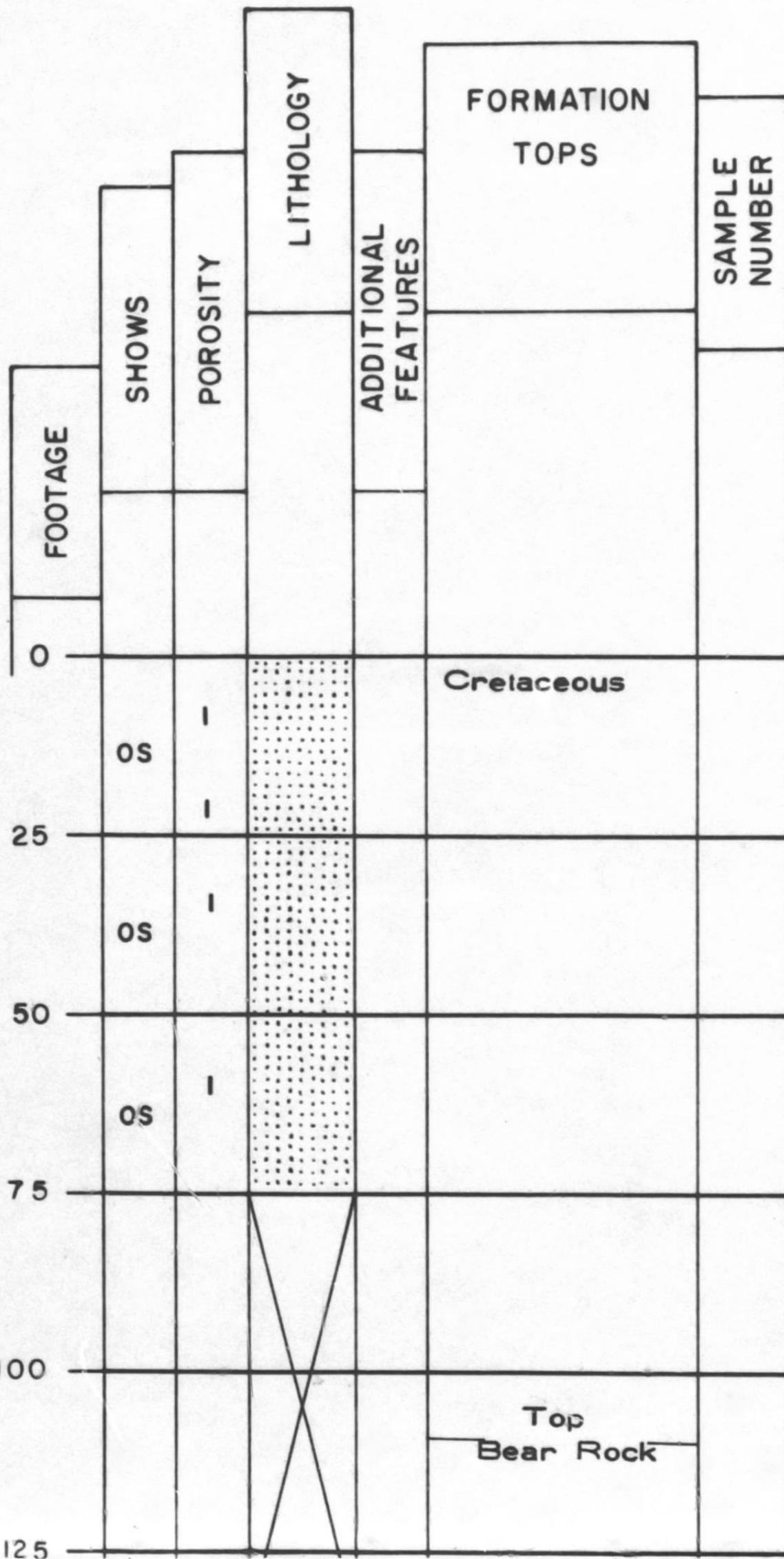
Lac Belot: Field Section 5VERTICAL SCALE 1" = 25'REMARKS:

1 mile west of center of Lac Belot.

latitude 66° 53' N. longitude 126° 28' W.

SECTION PLOTTED FROM FIELD NOTESFIELD MEASURED THICKNESS

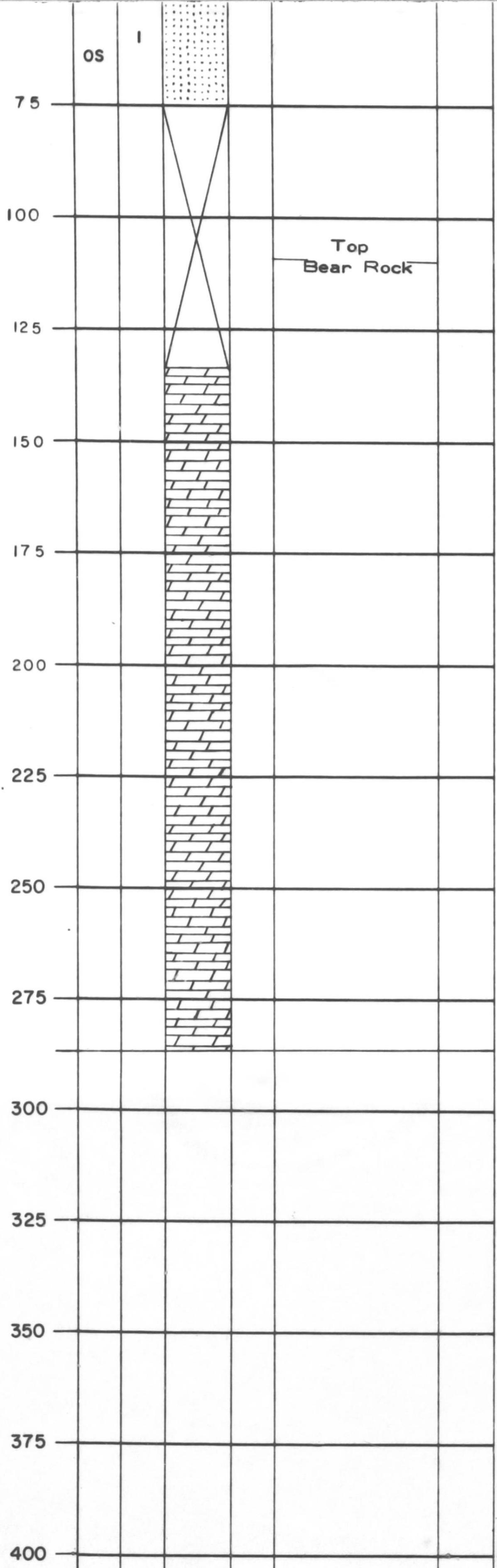
285 feet

LEGEND OF LOGGING SYMBOLS

	LIMESTONE		MACROVUGGY
	SANDSTONE		MICROVUGGY (IOX)
	SHALE		PINPOINT
	DOLOMITE		INTERGRANULAR
	GYPSUM OR ANHY		INTERCRYSTALLINE
	SALT		OS OIL STAINING
	COAL		DO DEAD OIL
	IGNEOUS		↑ GAS SHOW
	CHERT		TR TRACE (AMOUNT)
	DOLOMITIC		G GOOD
	CALCAREOUS		F FAIR
			P POOR
			□ RHOMBIC CARBONATE
			U UNCONSOLIDATED GRAINS
			△ BRECCIATED
			S SLICKENSIDED
			F FRACTURED
			# PYRITE or PYRITIC
			■ COVERED INTERVAL

FIELD NOTE SUMMARY

	Sandstone: brown, friable, fine-grained oil saturated, petroliferous, soft highly porous, massive, highly x-bedded, finely laminated.
	Covered Interval probably contains fault



Covered Interval probably contains fault

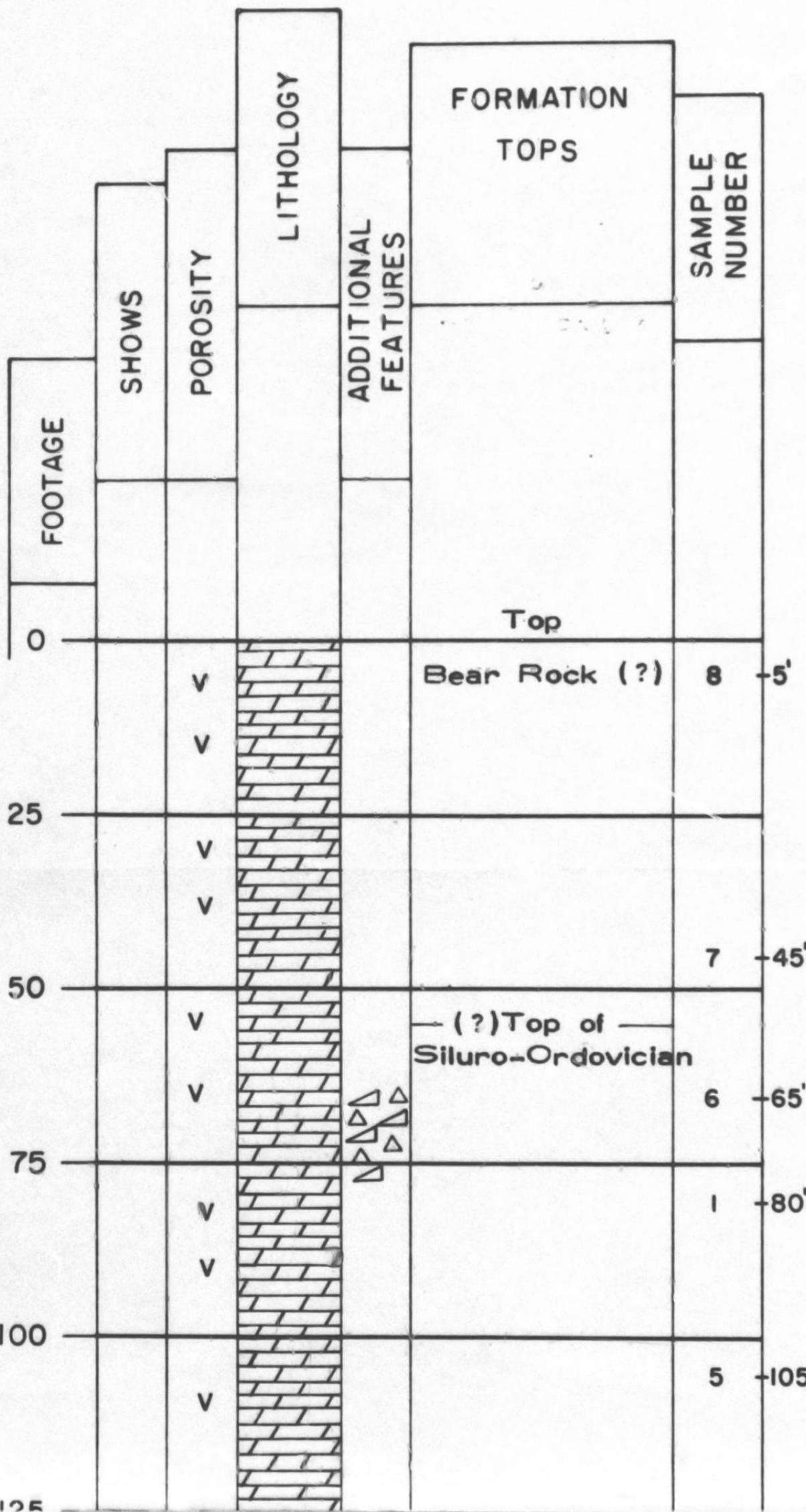
Dolomite: brown, fetid, dense, massive, laminated in part, brecciated in part, calcareous.

Belot Ridge: Field Section 6VERTICAL SCALE 1" = 25'REMARKS:

On ridge three miles NW of Lac Belot

latitude 67° 02' N., longitude 126° 29' W.

Section partly exposed

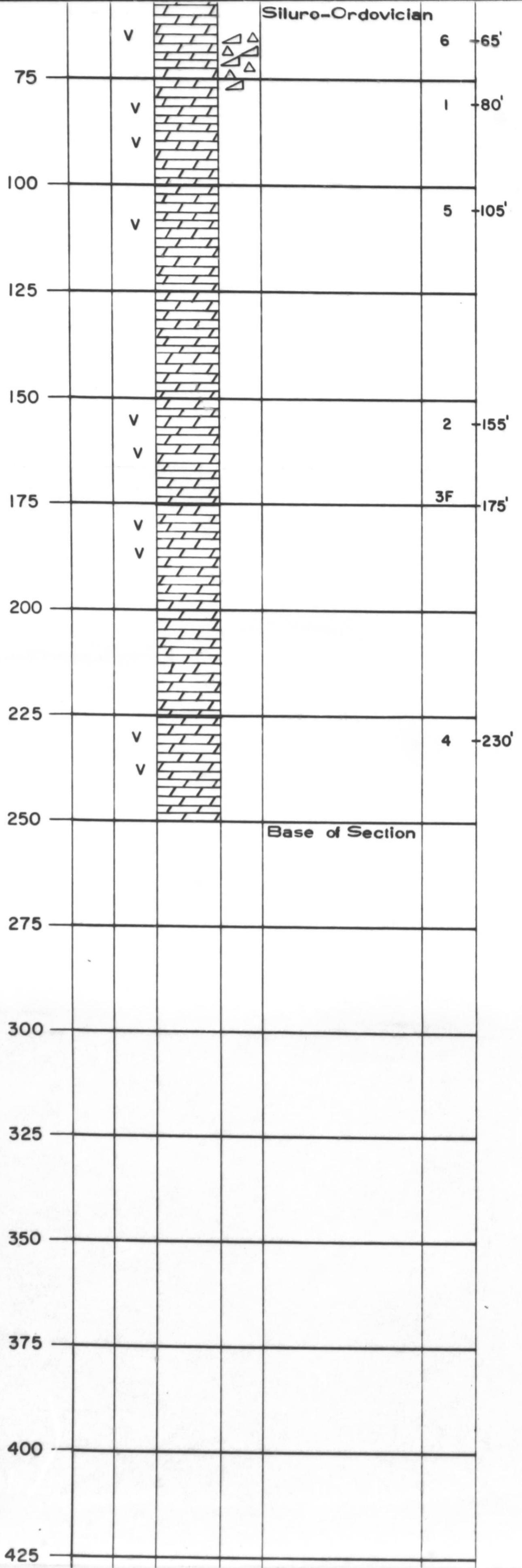
SECTION PLOTTED FROM FIELD NOTESFIELD MEASURED THICKNESS 250 feet

LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHY
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (10x)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	oil STAINING
	DEAD OIL
	GAS SHOW
	TRACE (AMOUNT)
	GOOD
	FAIR
	POOR
	RHOMBIC CARBONATE
	UNCONSOLIDATED GRAINS
	BRECCIATED
	SLICKENSIDED
	FRactured
	PYRITE or PYRITIC
	COVERED INTERVAL

FIELD NOTE SUMMARY

Dolomite: dark grey, dense, vuggy (bitumen) (calcite crystals), platy, laminated (Samples #8 and #7 may be of Ordovician or of Devonian (Bear Rock) age.)
Dolomite: light grey to greyish-white to light yellowish grey, vuggy, dense, laminated, platy, massive, black-speckled (bitumen)
Dolomite: light grey (weathers buff-light yellowish grey) dense, fine and medium crystalline, vuggy (crystals) medium thick-bedded and massive, brecciated in part.
Dolomite: white, silicified-streaked replacement (strom), vuggy, crystalline, porous, streaked with black bitumen in voids.
Dolomite: light grey (weathers to buff yellowish grey to medium grey dense dolomite).

1 of



yellowish grey) dense, fine and medium crystalline, vuggy (crystals) medium thick-bedded and massive, brecciated in part.

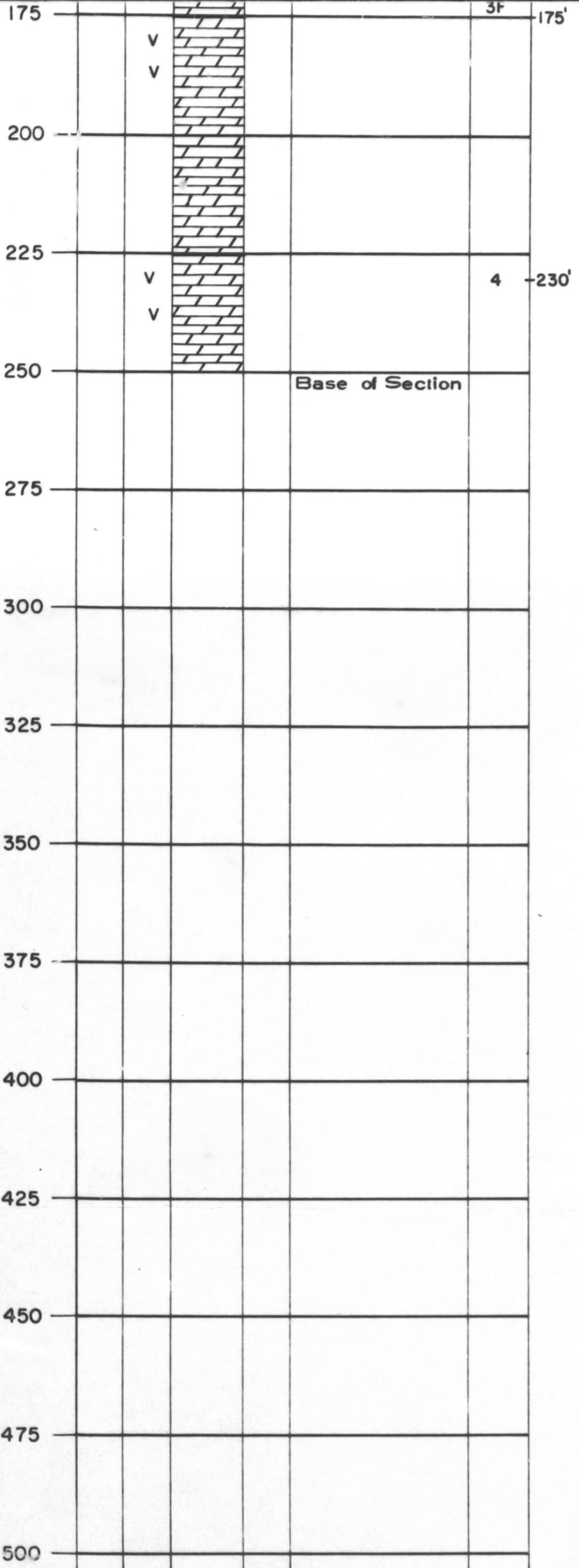
Dolomite: white, silicified-streaked replacement (strom), vuggy, crystalline, porous, streaked with black bitumen in voids.

Dolomite: light grey (weathers to buff yellowish grey to medium grey dense dolomite.

Dolomite: light grey to yellowish-buff, dense vuggy porosity common.

Dolomite: light grey, dense, abundantly fossiliferous, vuggy, (coralline) white to pinkish

Dolomite: buff (yellowish-grey) dense, vuggy, micro-crystalline, to fossiliferous



Dolomite: light grey, dense, abundantly fossiliferous, vuggy, (coralline) V 4' - 230'

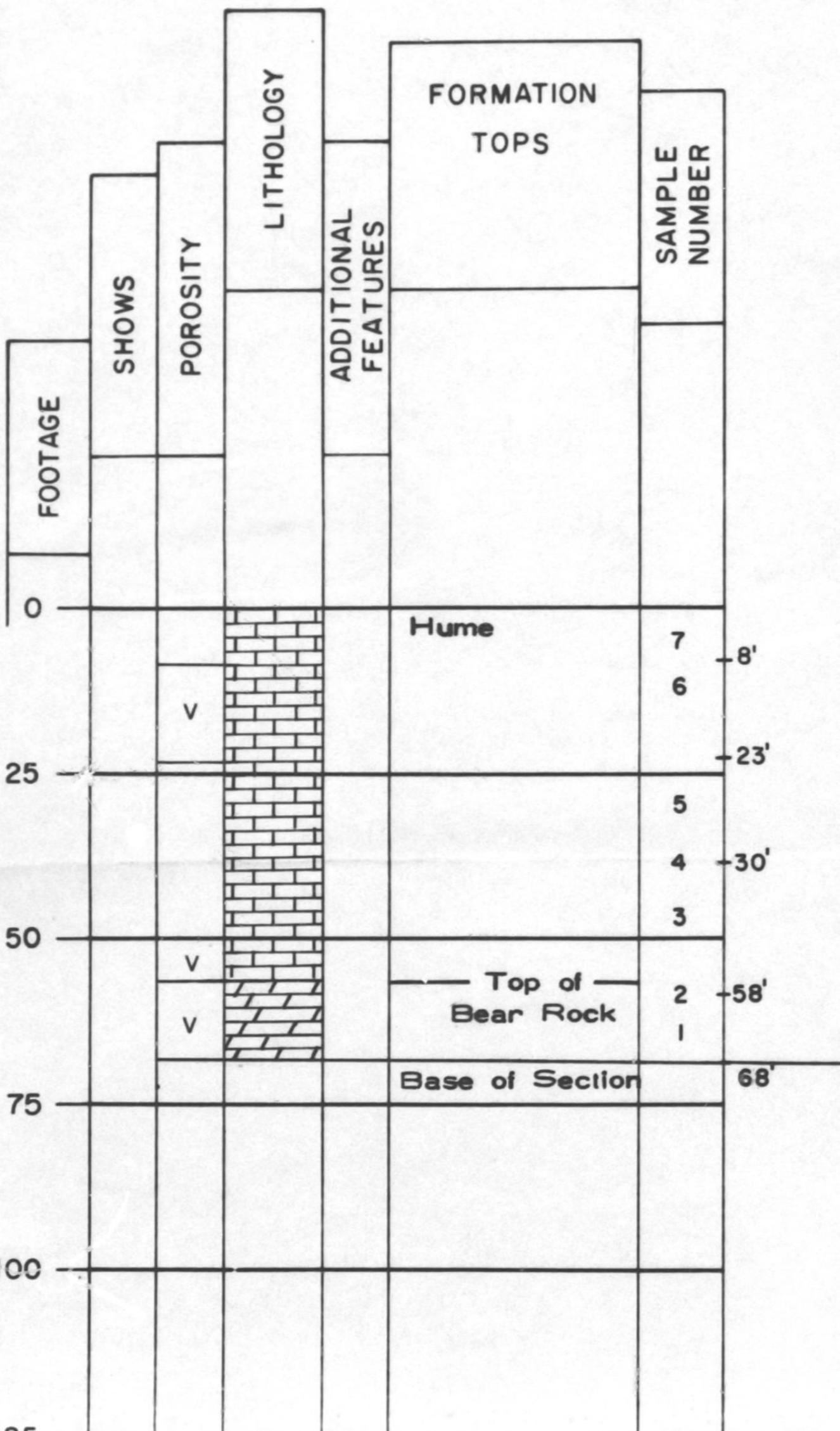
Dolomite: buff (yellowish-grey) dense, vuggy, micro-crystalline, to fossiliferous

Hare Indian River: Field Section 7

VERTICAL SCALE 1" = 25'

REMARKS:

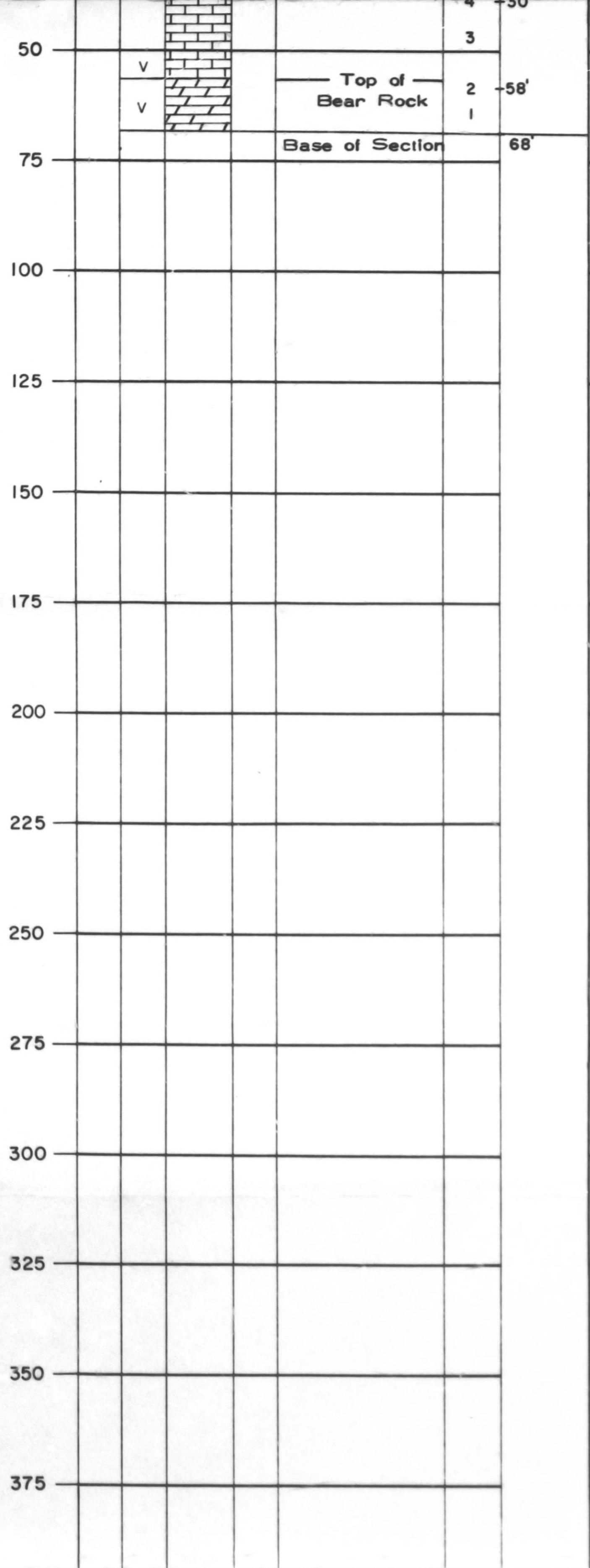
Hare Indian River North of Camp
 latitude $66^{\circ} 20' N.$ longitude $127^{\circ} 16' W.$
 Hume and Bear Rock Formations (Devonian)

SECTION PLOTTED FROM FIELD NOTESFIELD MEASURED THICKNESS 68 feet

LEGEND OF LOGGING SYMBOLS	
	LIMESTONE
	SANDSTONE
	SHALE
	DOLOMITE
	GYPSUM OR ANHYD
	SALT
	COAL
	IGNEOUS
	CHERT
	DOLOMITIC
	CALCAREOUS
	MACROVUGGY
	MICROVUGGY (IOX)
	PINPOINT
	INTERGRANULAR
	INTERCRYSTALLINE
	OS OIL STAINING
	DO DEAD OIL
	↑ GAS SHOW
	TR TRACE (AMOUNT)
	G GOOD
	F FAIR
	P POOR
	RHOMBIC CARBONATE
	UNCONSOLIDATED GRAINS
	BRECCIATED
	S SLICKENSIDED
	F FRACTURED
	# PYRITE or PYRITIC
	COVERED INTERVAL

FIELD NOTE SUMMARY

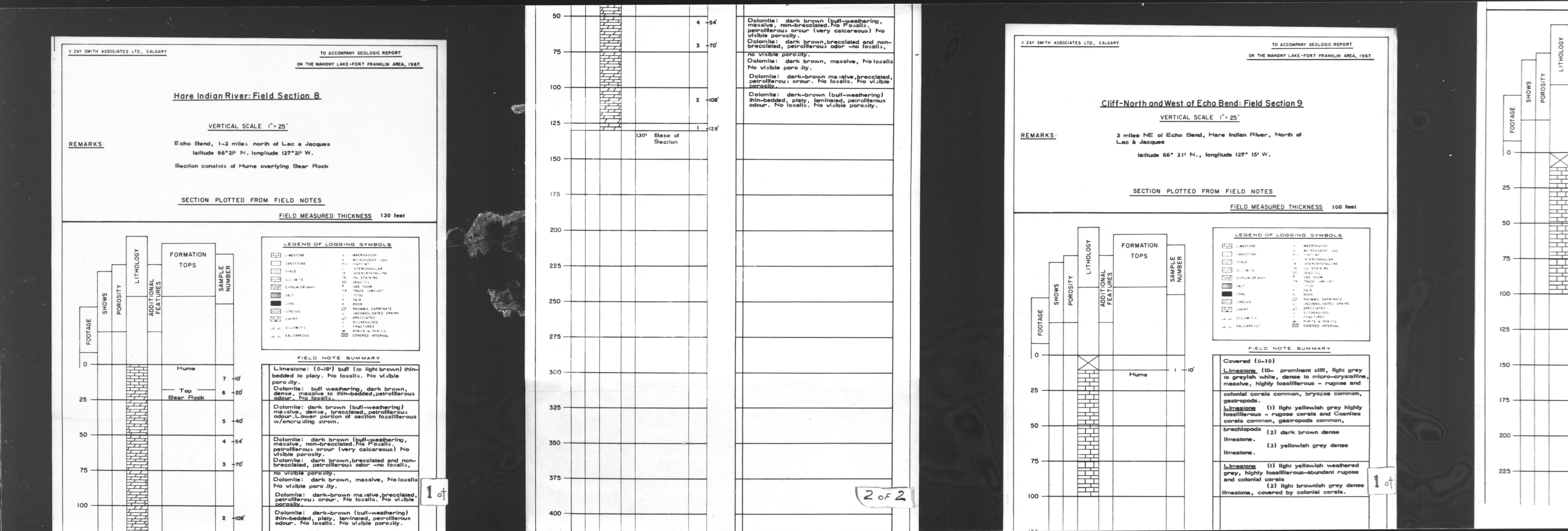
Limestone (0-8') dark brownish grey, dense, massive, nodular, fossiliferous-brachio-pods, crinoids (Forms low bench of wide areal distribution)
Limestone (8-23') dark brownish grey, dense, micro-vuggy, platy black-speckled (bitumen), gastropods.
Limestone (23-38') dark brownish grey, dense, platy, partly laminated.
Limestone (38-58') (1) dark brownish grey, dense, partly laminated. (2) brownish grey, vuggy (calcite), dense
Calcite abundant; large calcite crystals
Limestone (58') (parallel platy structure), dark brown dense layers; limestone inter-fingered with coarse calcite crystals zone
Dolomite (58-68') dark brownish grey, dense, massive, laminated, micro-vuggy to partly macro-vuggy, field odour



Limestone (50-58') (1) dark brownish grey, dense, partly laminated. (2) brownish grey, vuggy (calcite), dense

Calcite abundant; large calcite crystals
 Limestone (58') (parallel platy structure), dark brown dense layers; limestone inter-fingered with coarse calcite crystals zone
 Dolomite (58-68') dark brownish grey, dense, massive, laminated, micro-vuggy to partly macro-vuggy, fetid odour

98-4-15-6 Report on



on the Geology of the M...

TO ACCOMPANY GEOLOGIC REPORT
MAHONY LAKE-FORT FRANKLIN AREA, 1967.

Section 9

North of

Measured Thickness 100 feet

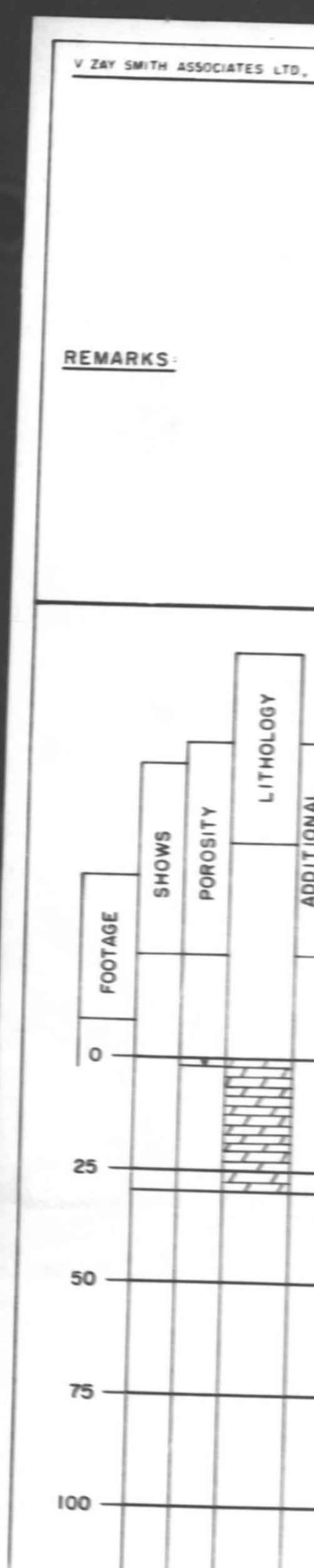
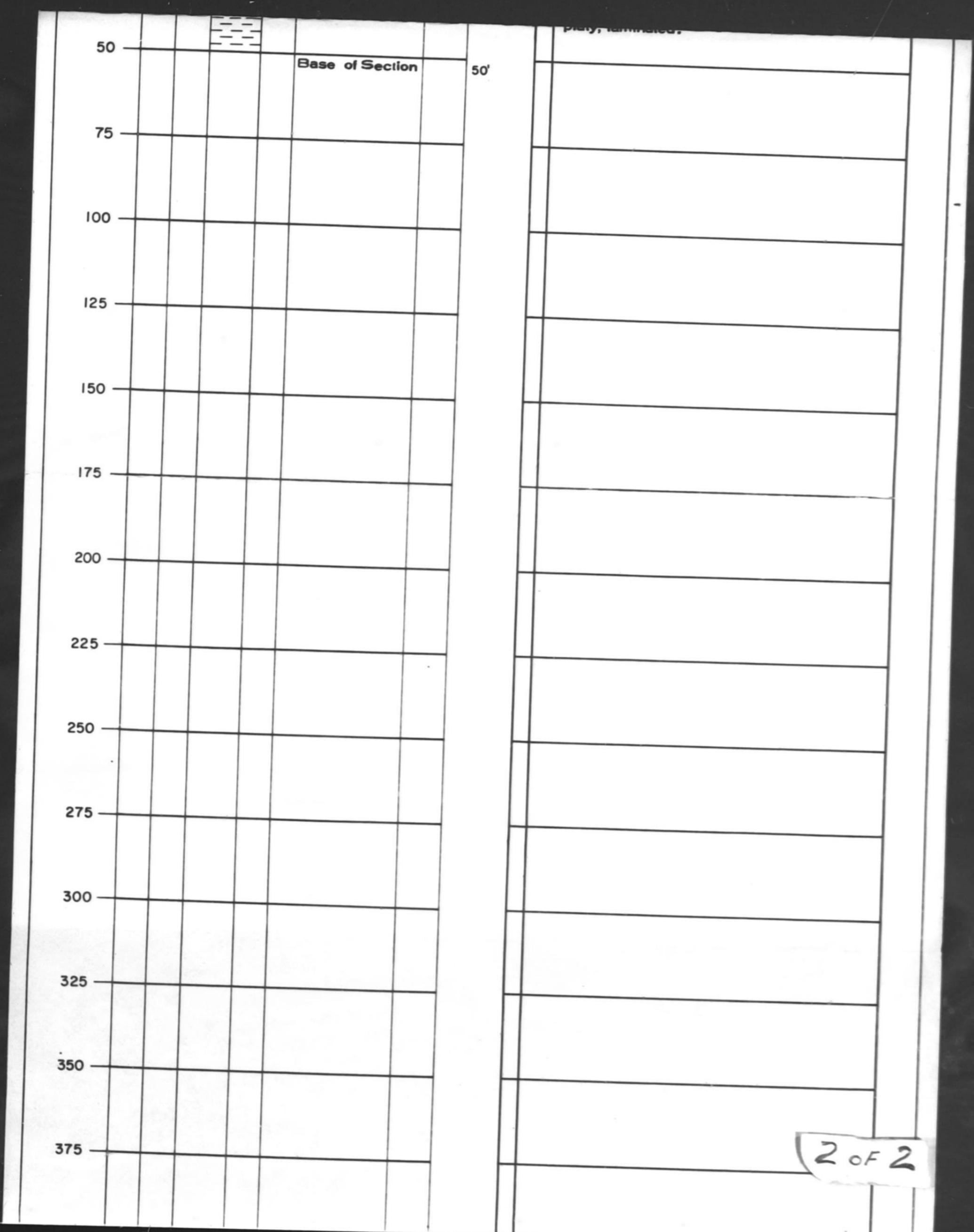
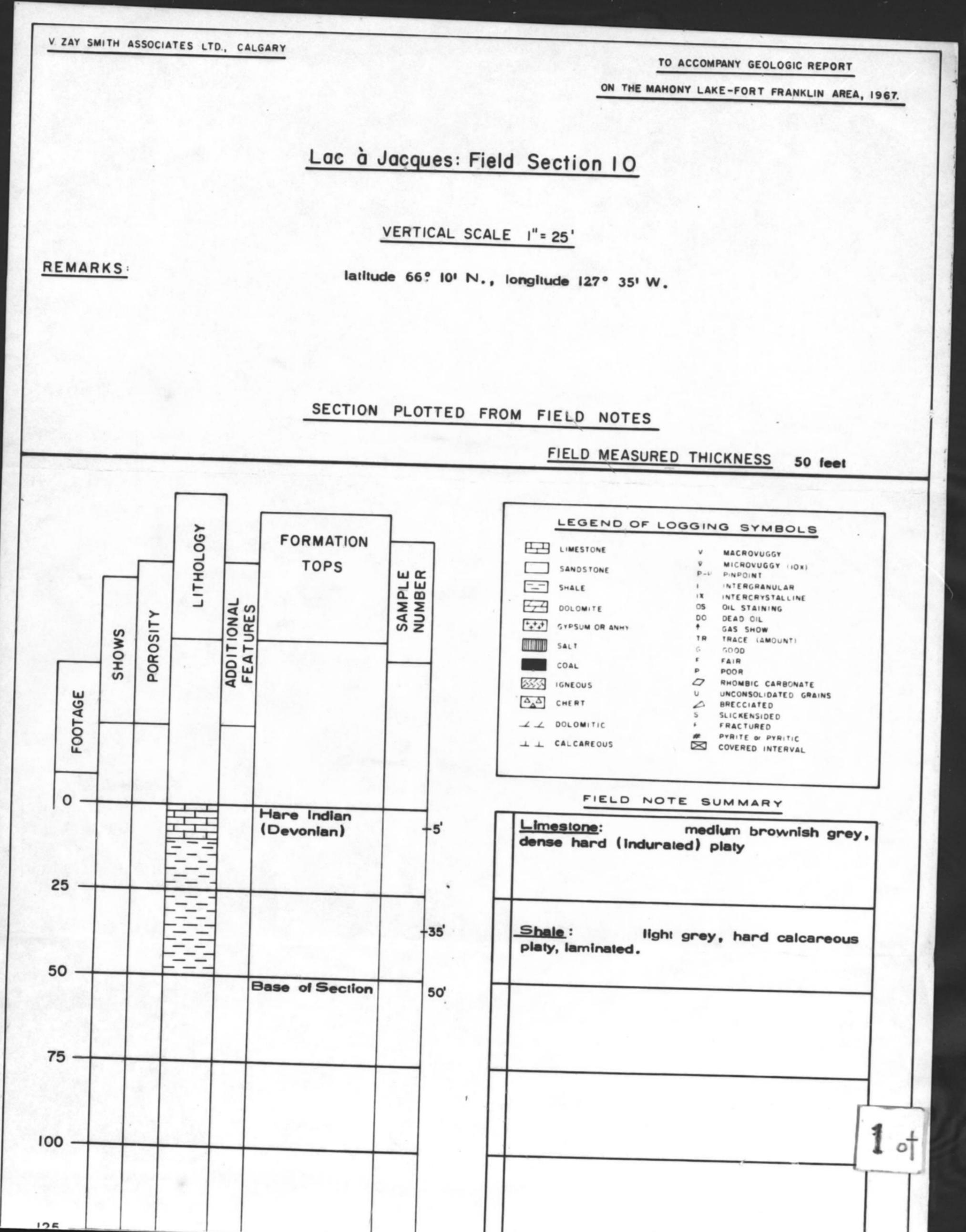
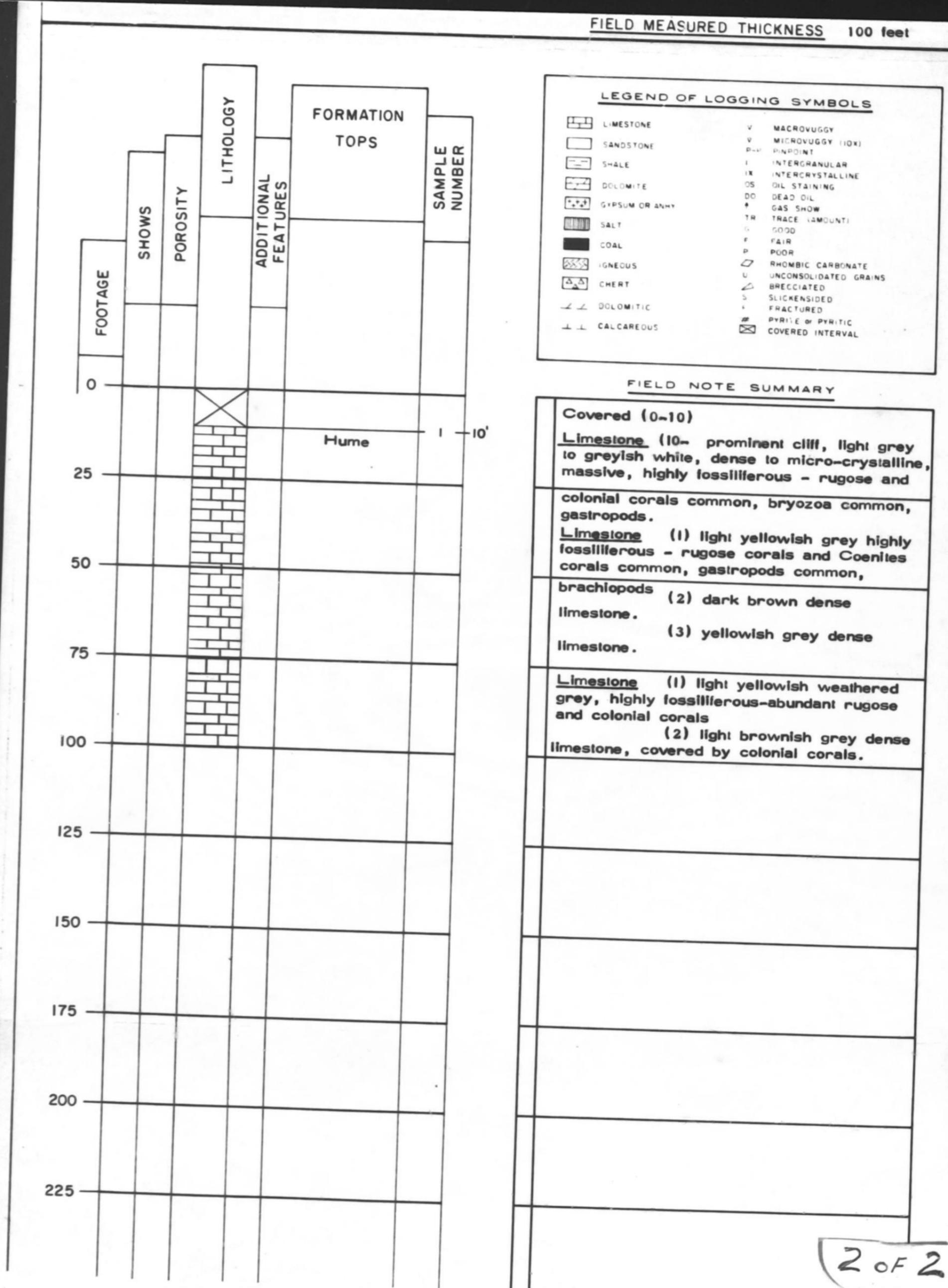
LOGGING SYMBOLS

- MACRODOLY
- MICRODOLY (10)
- INTERGRANULAR
- INTERCRYSTALLINE
- DEAD OIL
- TRACE AMOUNT
- 5000
- FAIR
- GOOD
- RUGOSE CARBONATE
- UNCONSOLIDATED GRAINS
- UNCONSOLIDATED
- FARE
- PHATE & PHATIC
- COVERED INTERVAL

NOTE SUMMARY

- prominent cliff, light grey, dense to micro-crystalline, fossiliferous - rugose and common, bryozoa common, light yellowish grey highly rugose corals and Coenites corals common, gastropods common, dark brown dense yellowish grey dense
- light yellowish weathered siliferous-abundant rugose
- light brownish grey dense and by colonial corals.

1 of 1



Lake at Head of Hare Indian River: Field Section 12

VERTICAL SCALE 1" = 25'

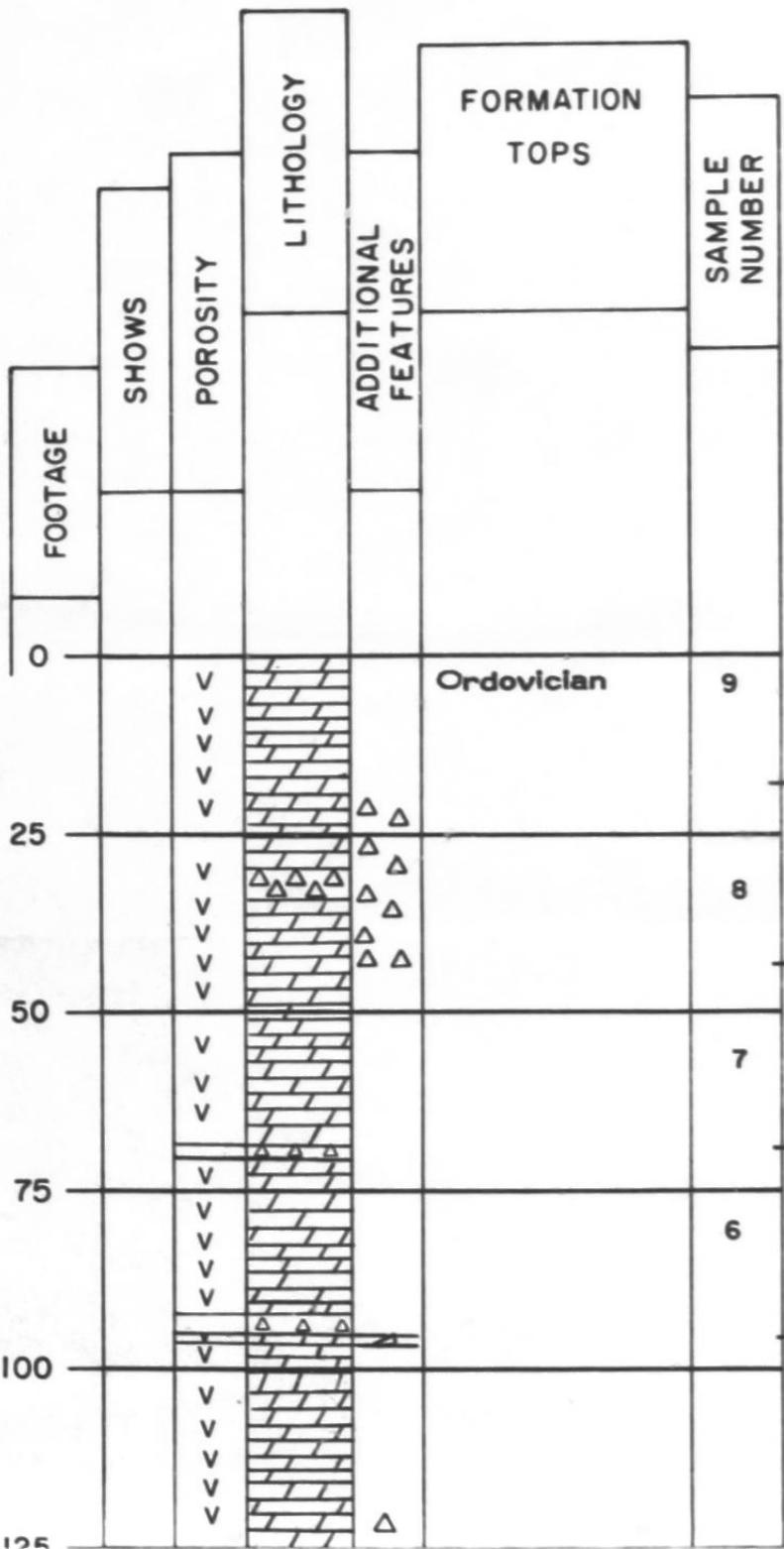
REMARKS:

latitude 66° 03' N., longitude 125° 19' W.

Siluro-Ordovician section situated on the south end of a lake formed by the Hare Indian River not far from Great Bear Lake.

SECTION PLOTTED FROM FIELD NOTES

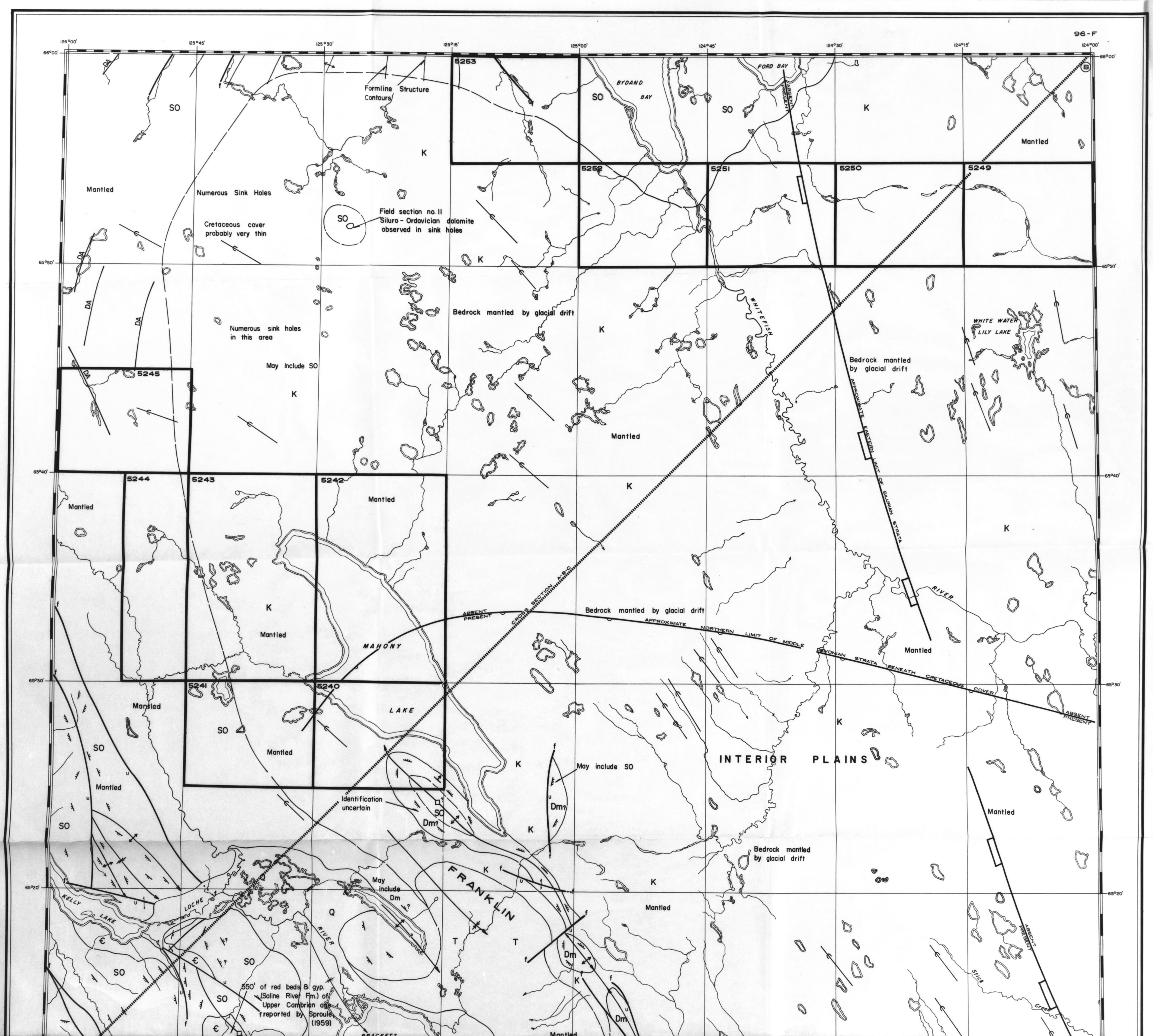
FIELD MEASURED THICKNESS 268 feet

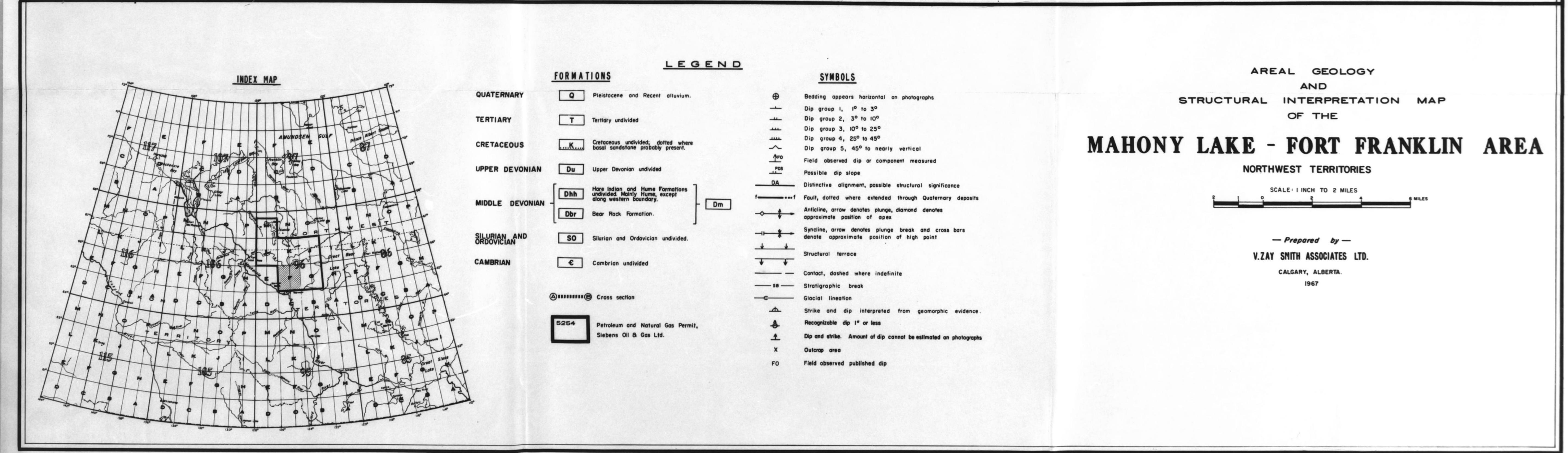
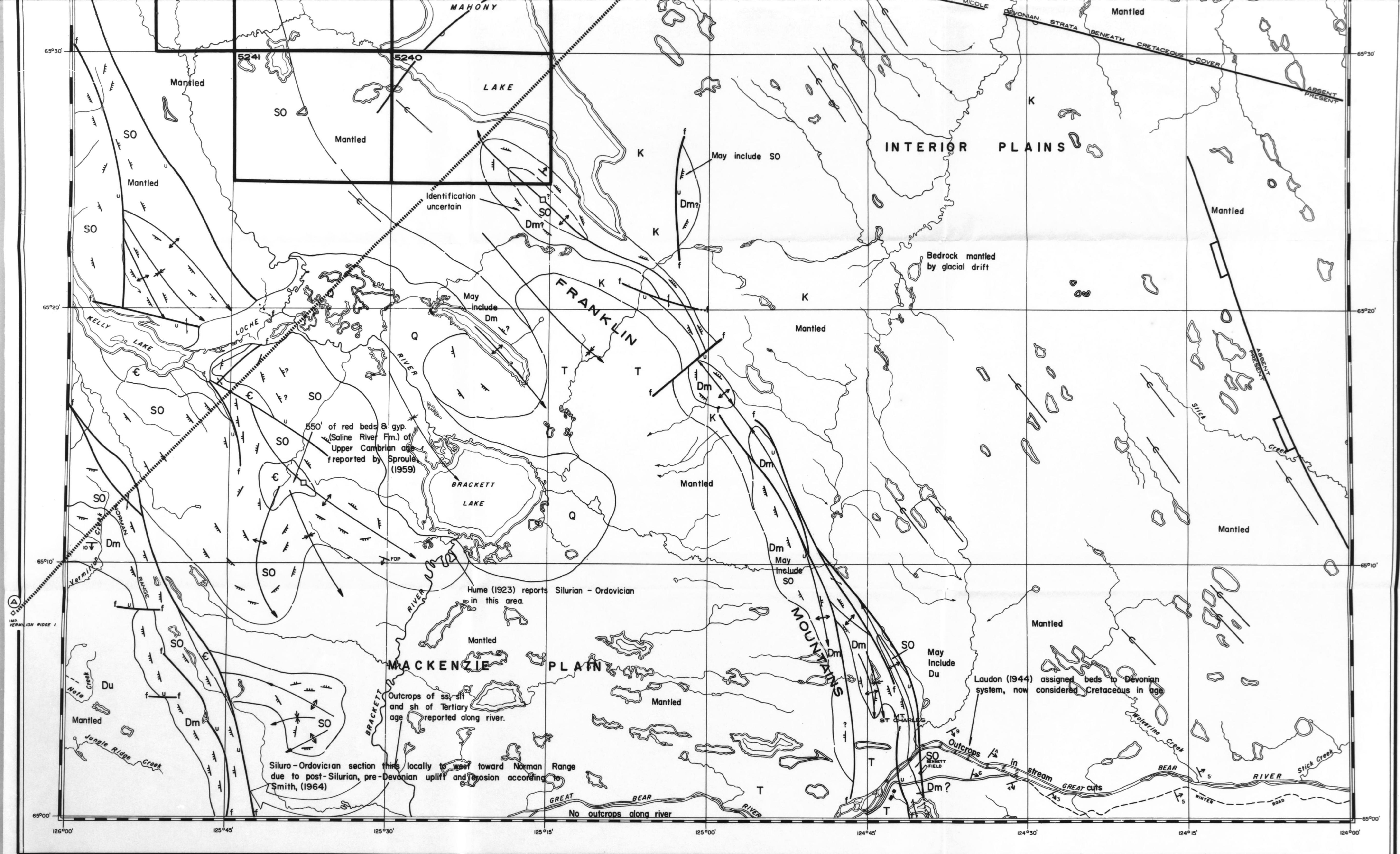


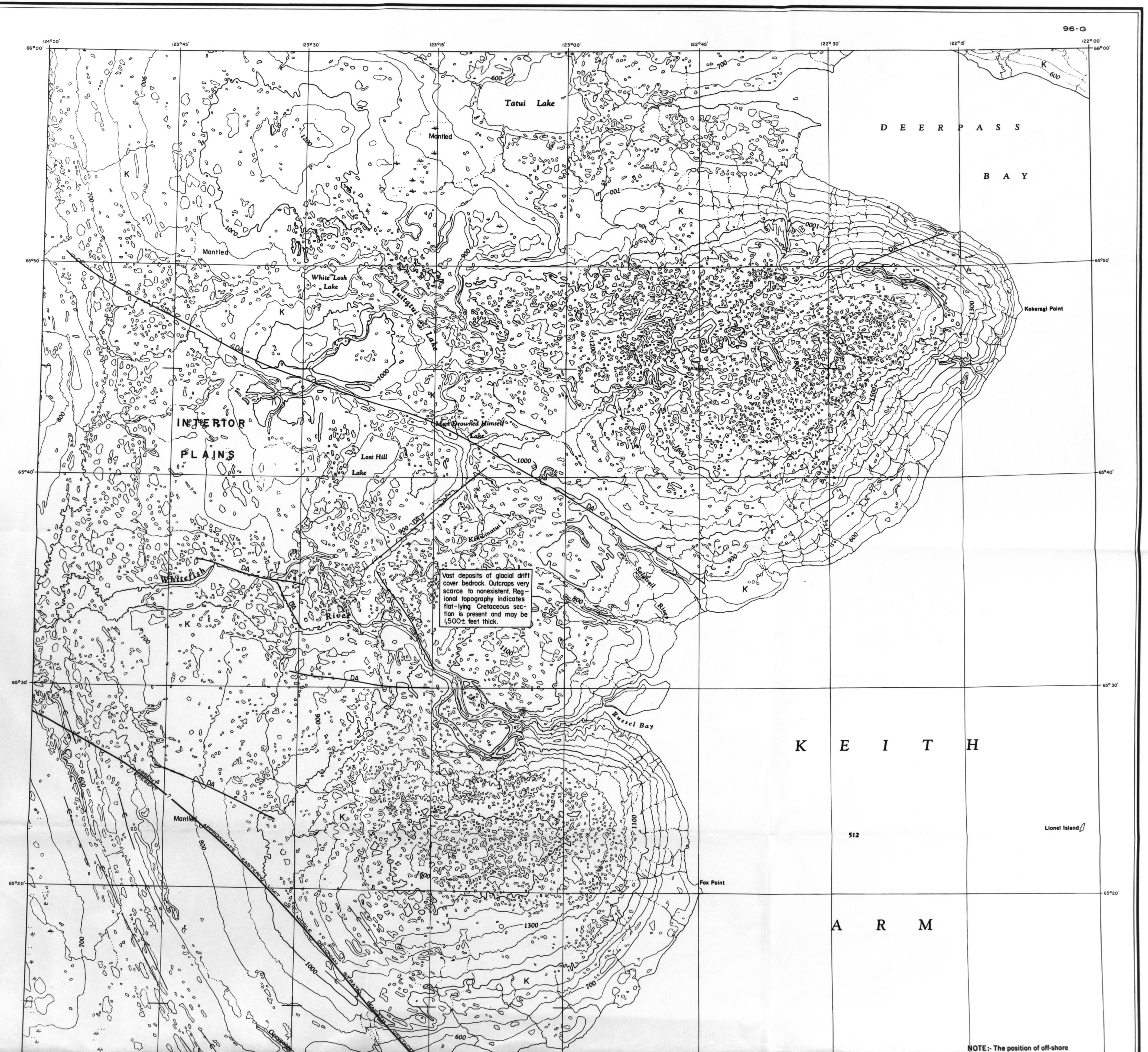
LEGEND OF LOGGING SYMBOLS	
L	LIMESTONE
S	SANDSTONE
SH	SHALE
D	DOLOMITE
GY	GYPSUM OR ANHYDITE
SALT	SALT
C	COAL
IG	IGNEOUS
CH	CHERT
DO	DOLOMATIC
CA	CALCAREOUS
V	MACROVUGGY
v	MICROVUGGY (OK)
P	PINPOINT
I	INTERGRANULAR
IC	INTERCRYSTALLINE
OS	Oil STAINING
DC	DEAD OIL
*	GAS SHOW
TR	TRACE (AMOUNT)
G	GOOD
F	FAIR
P	POOR
R	RHOMBIC CARBONATE
U	UNCONSOLIDATED GRAINS
B	BRECCIATED
S	SLICKENSIDED
F	FRACTURED
#	PYRITE or PYRITIC
■	COVERED INTERVAL

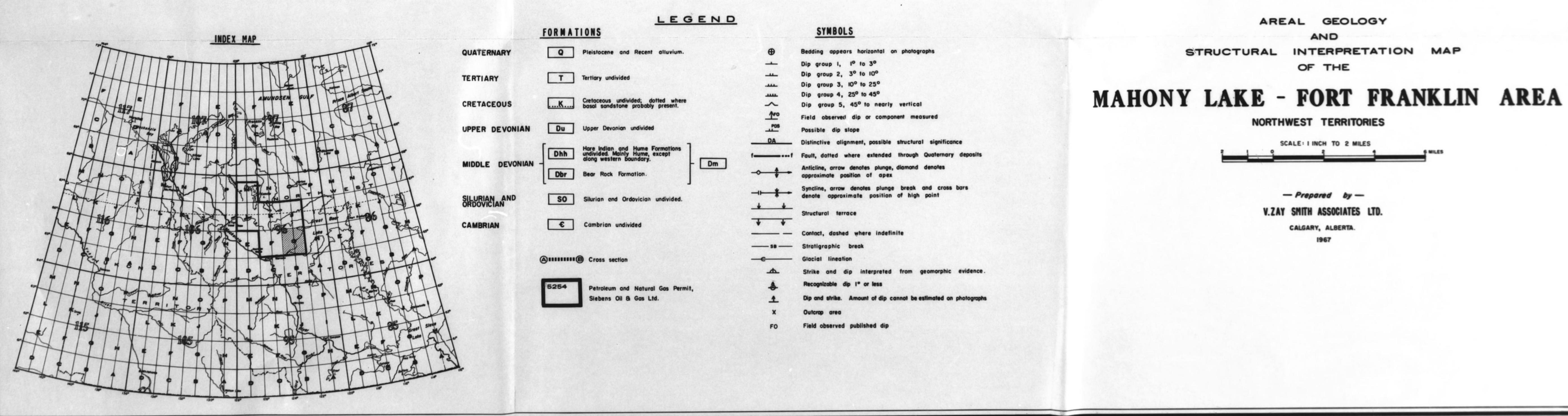
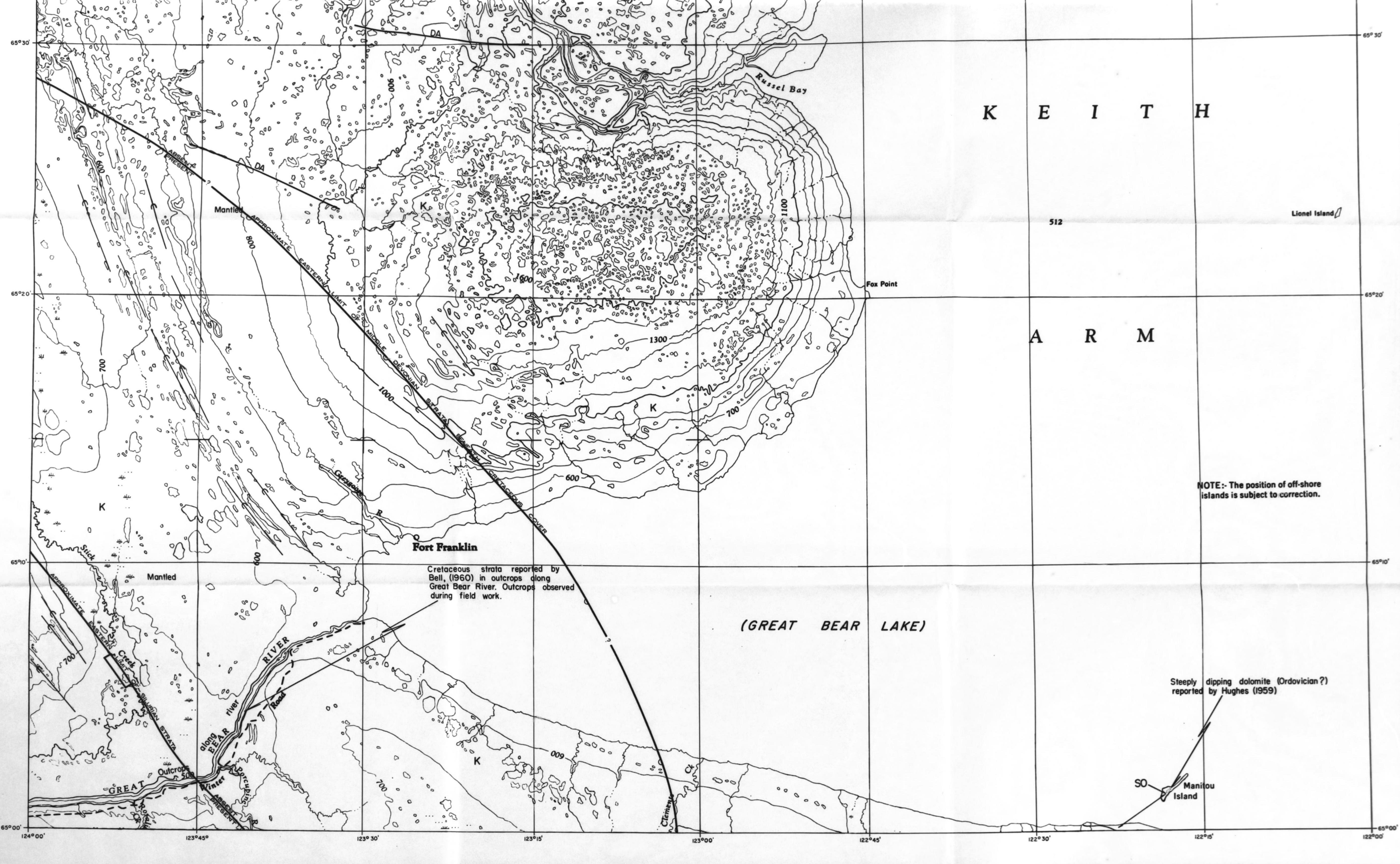
FIELD NOTE SUMMARY	
Dolomite (0-18')	light to medium grey, dense, massive, scattered vugs, abundant chert.
Dolomite (18-31')	medium grey, dense, scattered vugs, chert, massive.
Chert (31-35')	massive, laminated, replacing stroms and/or algae
Dolomite (35-43')	medium grey, dense.
Dolomite (43-68')	light grey, massive, crystalline abundantly vuggy (bitumen) (good potential reservoir)
Chert (68-70')	massive, laminated.
Dolomite (70-92')	light grey, massive, crystalline, vuggy
Chert (92-94')	massive, algal replacement, laminated
Dolomite (94-96')	brecciated, vuggy, crystalline.
Dolomite (96-143')	light grey to pale brownish grey, crystalline, vuggy porosity, white chert layers

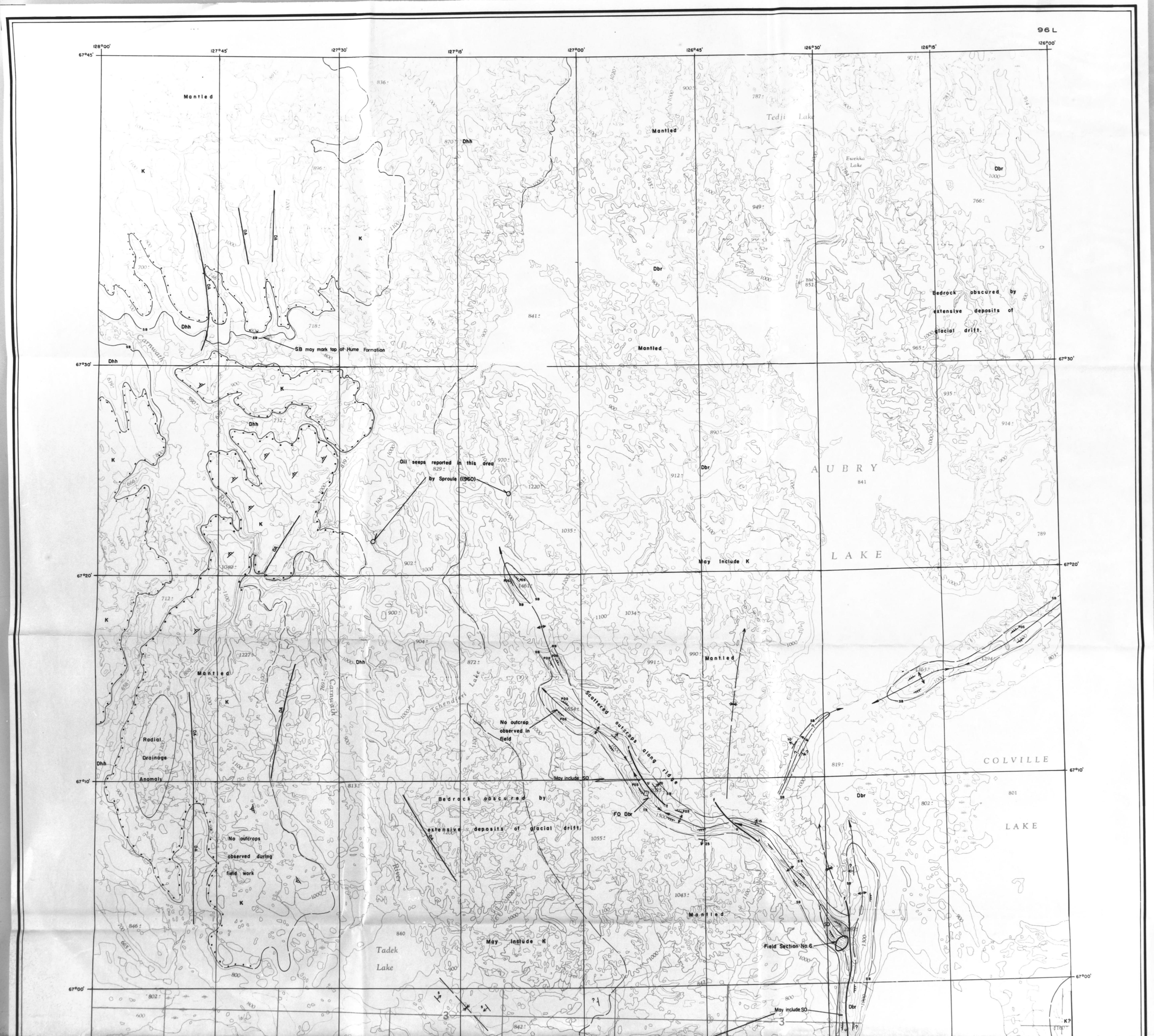
50	V V V V	△△	18-43'	Dolomite (43-68') light grey, massive, crystalline abundantly vuggy (bitumen) (good potential reservoir) Chert (68-70') massive, laminated.
75	V V V V V		43'-68'	Dolomite (70-92') light grey, massive, crystalline, vuggy Chert (92-94') massive, algal replacement, laminated Dolomite (94-96') brecciated, vuggy, crystalline.
100	V V V V V	△△△	68'-96'	Dolomite (96-143) light grey to pale brownish grey, crystalline, vuggy porosity, white chert layers
125	V V V V V	△		Dolomite (143-168') grey, crystalline, laminated in part, vugs prominent in certain zones. patch porosity, fetid odour, silicified stroms.
150	V V V V V		143'-168'	Dolomite (168-193') pale brownish grey, crystalline, laminated, scattered vugs, patch porosity, white chert inclusions.
175	V V V V V	△△ △△ △△ △	168'-193'	Dolomite (193-206') grey, crystalline laminated, scattered vugs, patch porosity, fetid odour.
200	V V V V		193'-218'	Dolomite (206-209') massive chert, laminated algal material Dolomite (209-217') medium grey, crystalline patchy Interxalline porosity, massive, grey chert inclusions. Dolomite (217-218') massive chert
225	V V V V	△△△ △△ △△ △△ △△	218'-243'	Dolomite (218-220) massive chert, laminated, replacing algal material Dolomite (220-234') As above, brecciated and vuggy (220-224') irregular stringers of chert (220-222') Dolomite (234-236') ditto, chert, massive gray
250	V V V V	△△ △△ △△ △△	243'-268'	and white laminated-represents replacement of algal structures. Dolomite (236-243') as above, inclusions of grey chert Dolomite (243-268') brownish, speckled to brownish grey, dense, brecciated, scattered vugs, white chert replacements of stroms.
275		Base of Section		
300				
325				
350				
375				

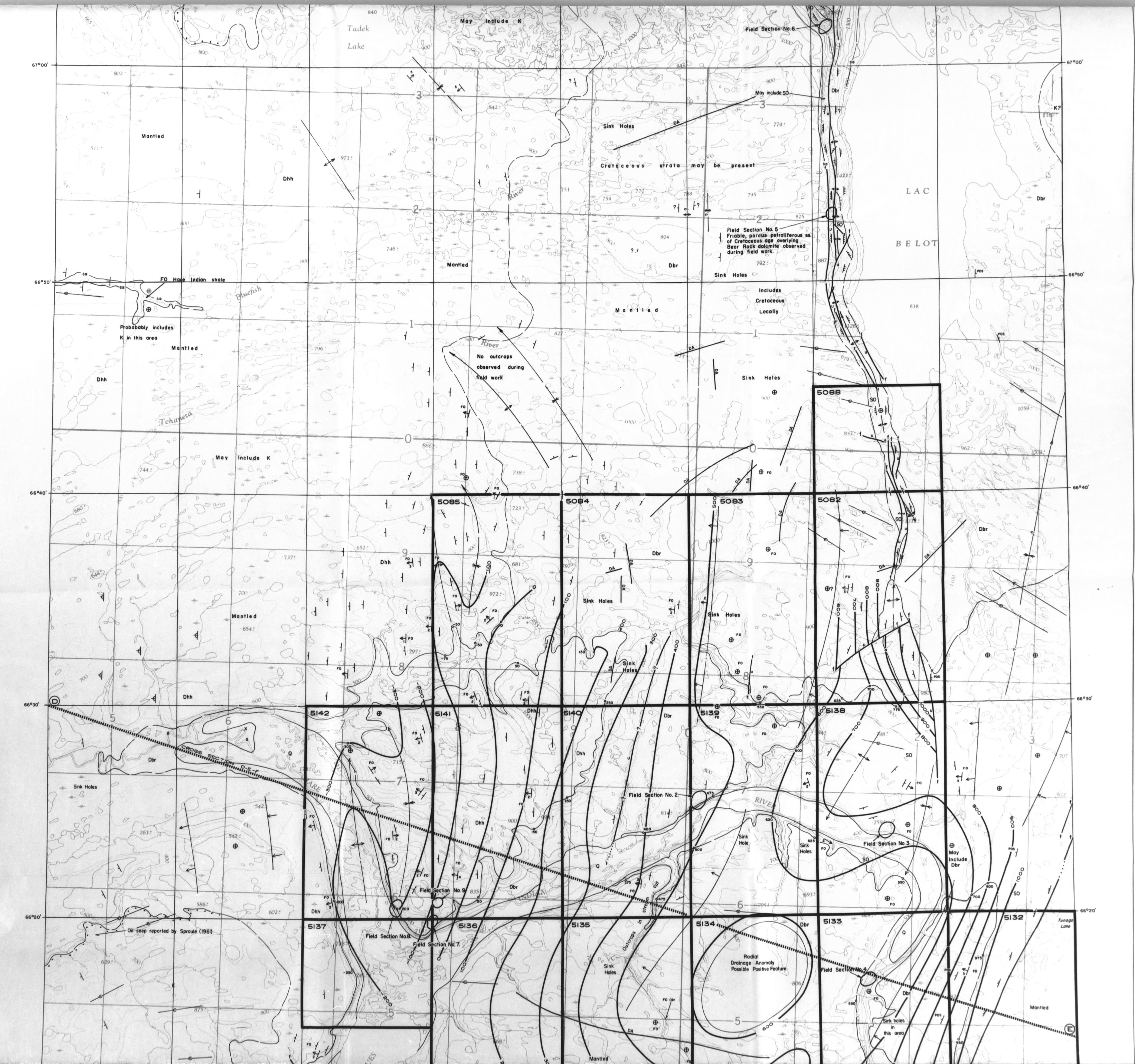


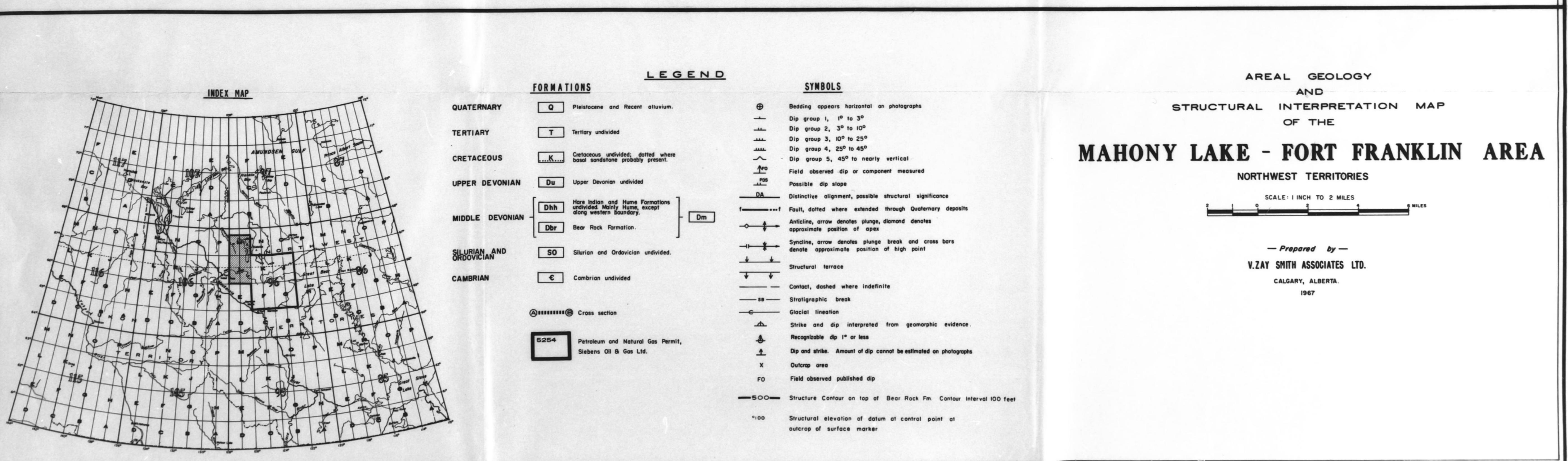
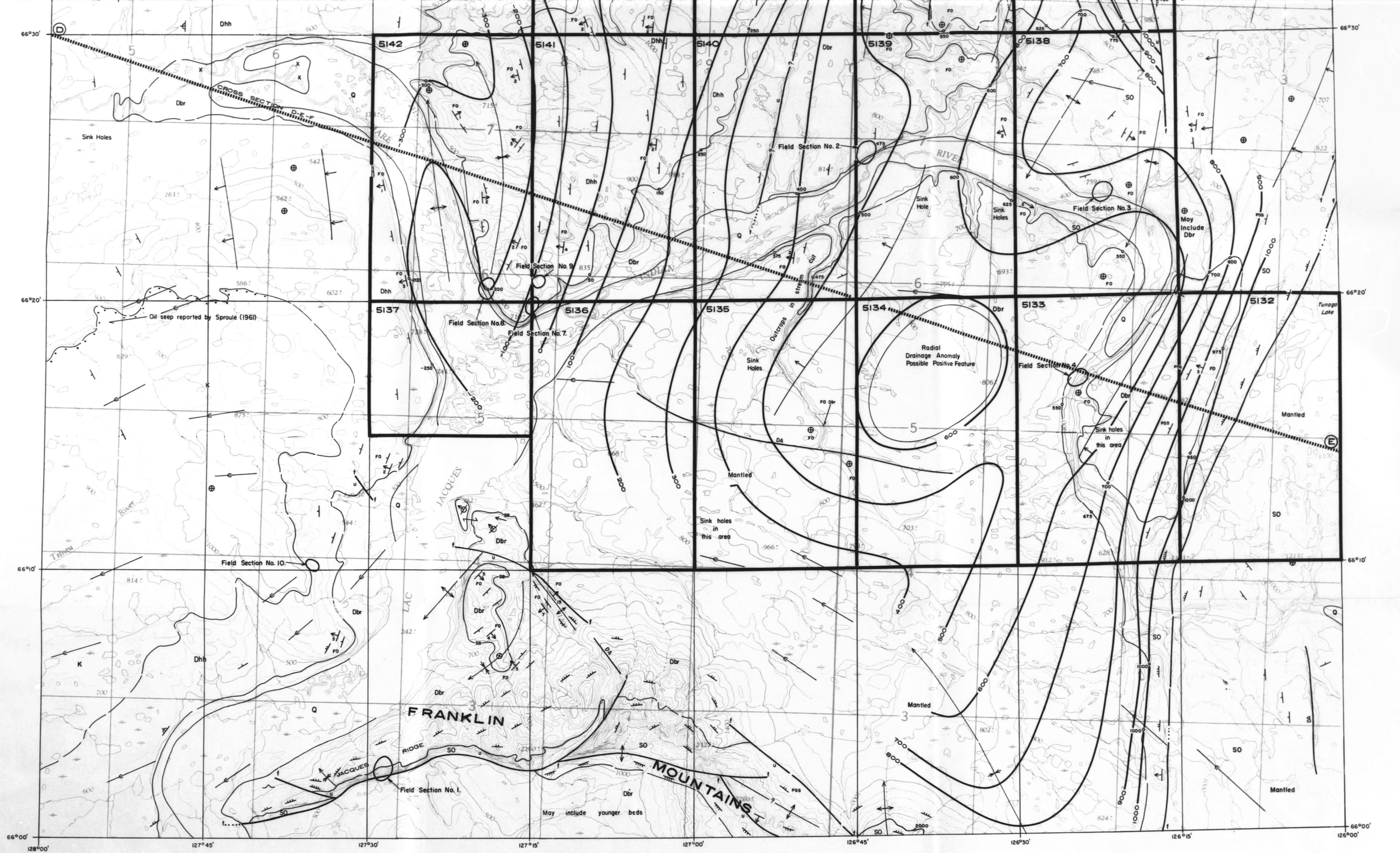


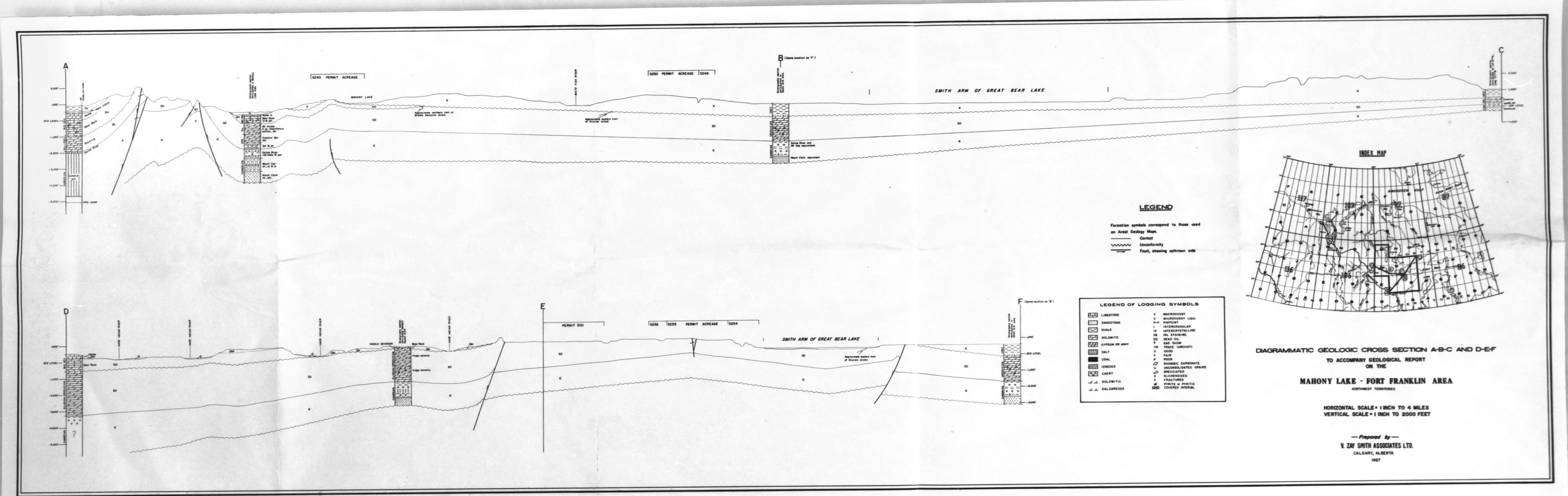




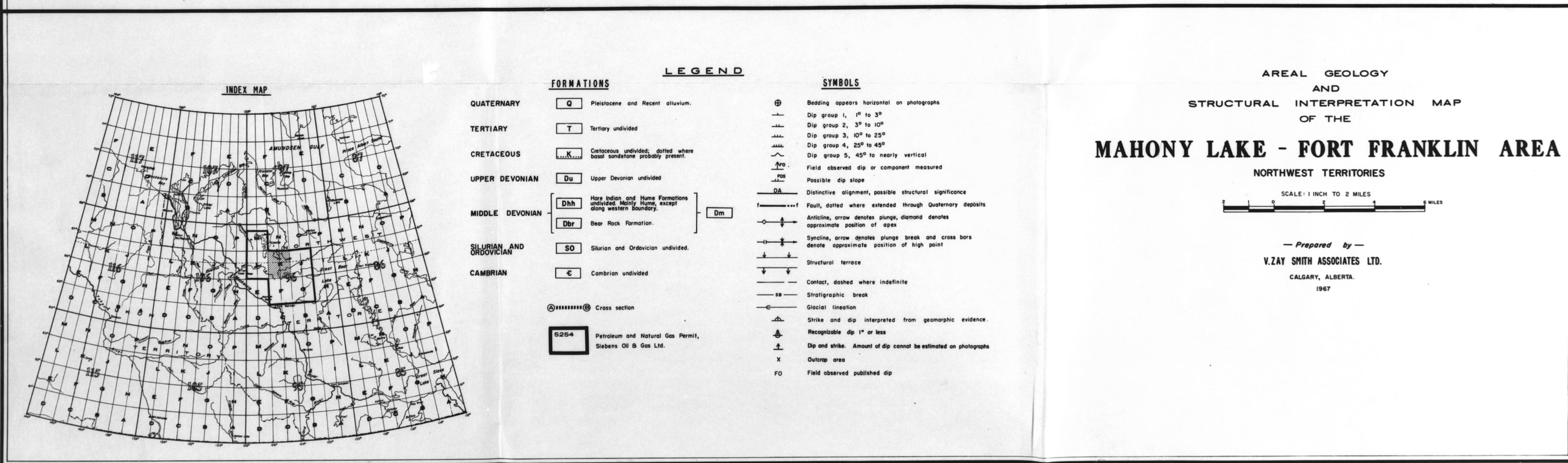
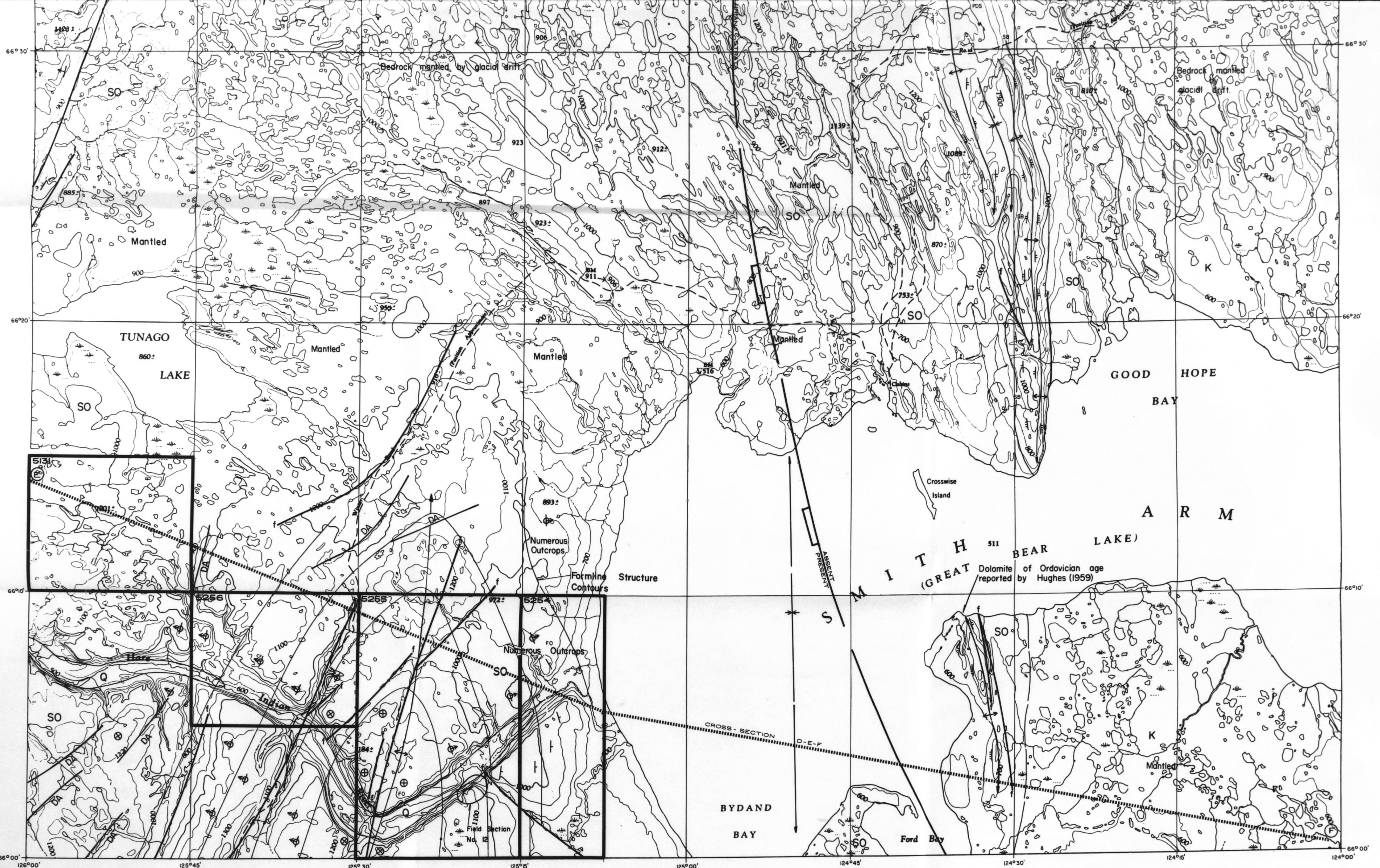




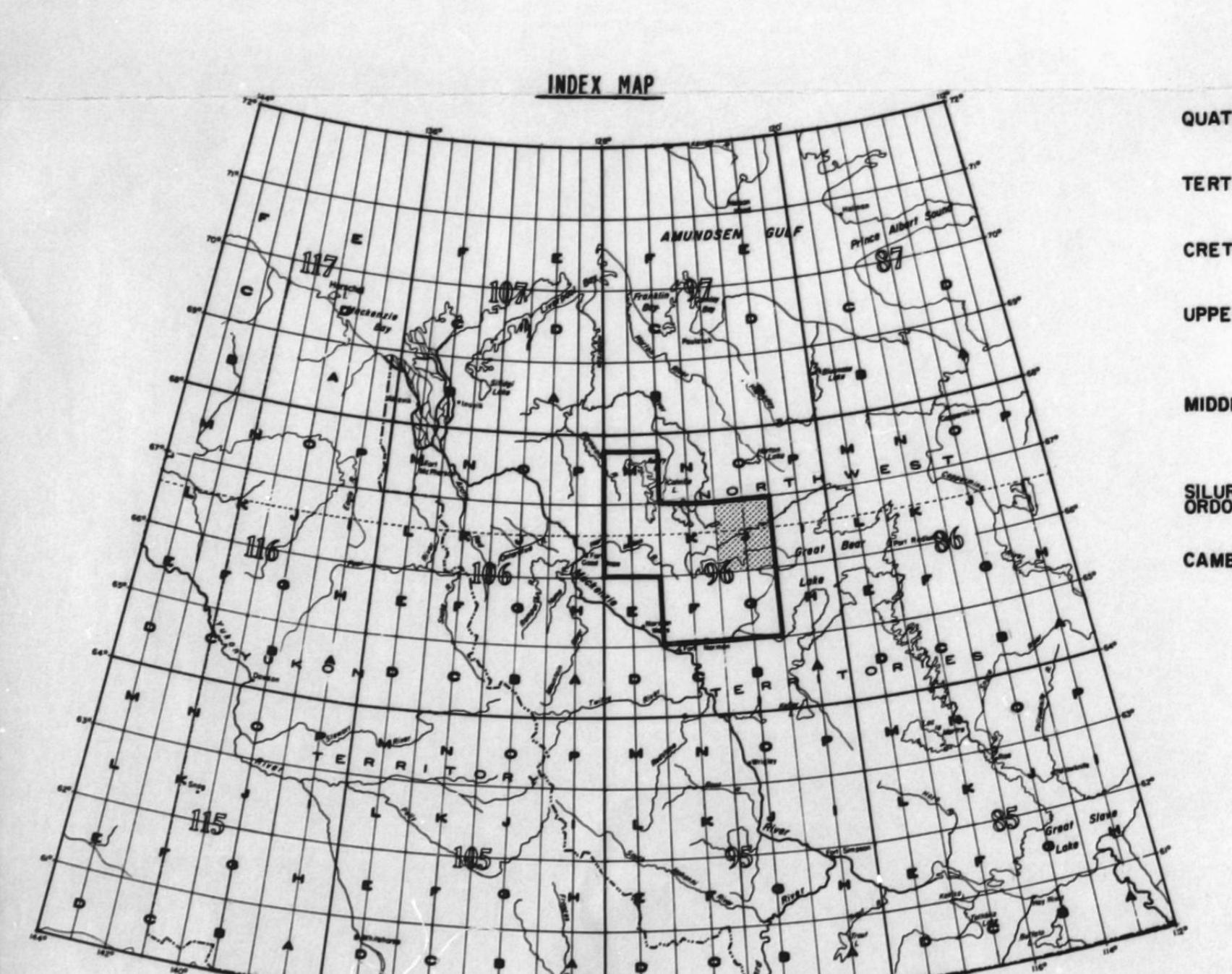
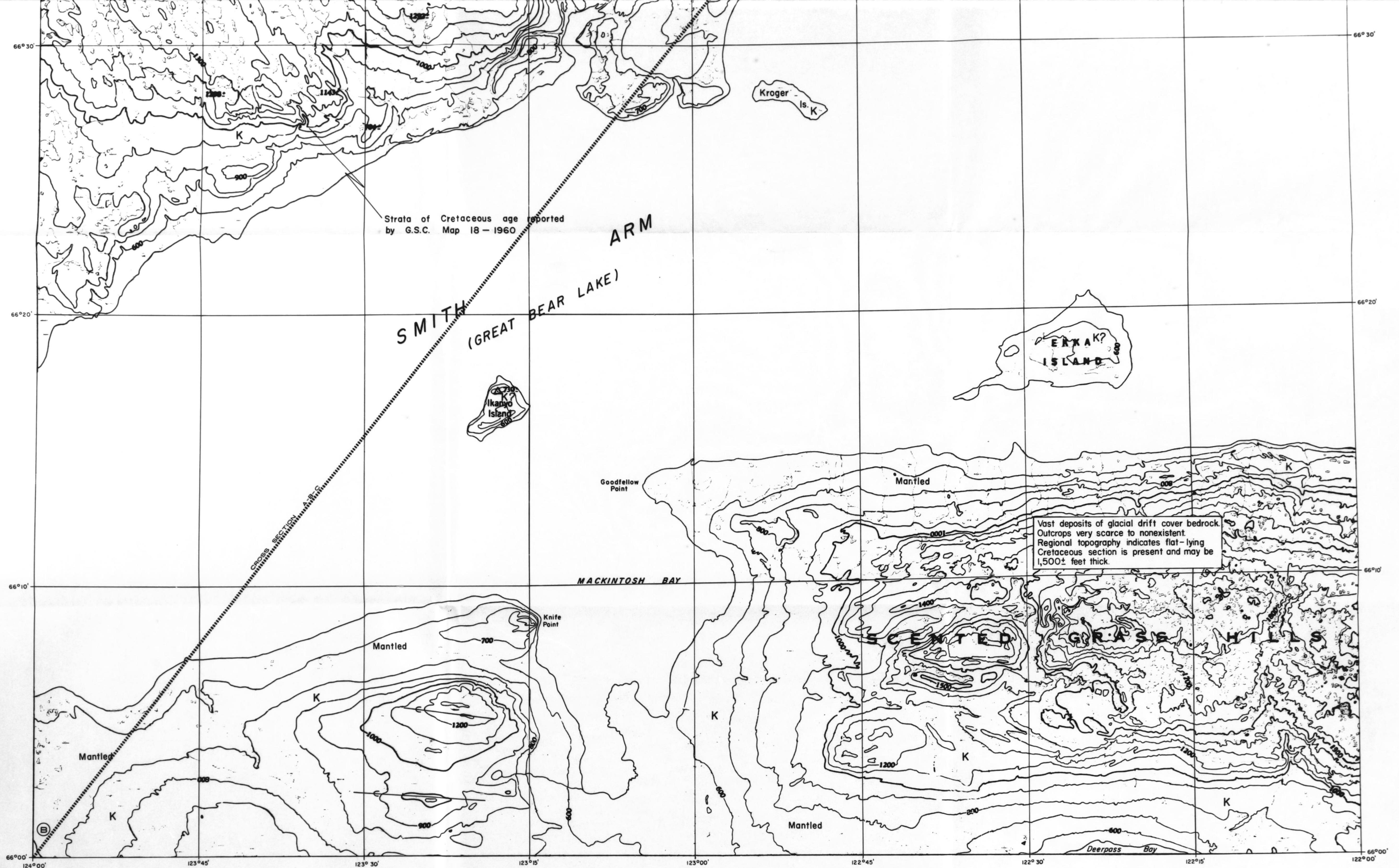












LEGEND

FORMATIONS

Q	Pleistocene and Recent alluvium.
T	Tertiary undivided
...K...	Cretaceous undivided; dotted where basal sandstone probably present.
Du	Upper Devonian undivided
Dhh	Have Indian and Hume Formations except along western boundary.
Dbr	Bear Rock Formation.
SO	Silurian and Ordovician undivided.
C	Cambrian undivided

CROSS SECTION

5254 Petroleum and Natural Gas Permit, Siebens Oil & Gas Ltd.

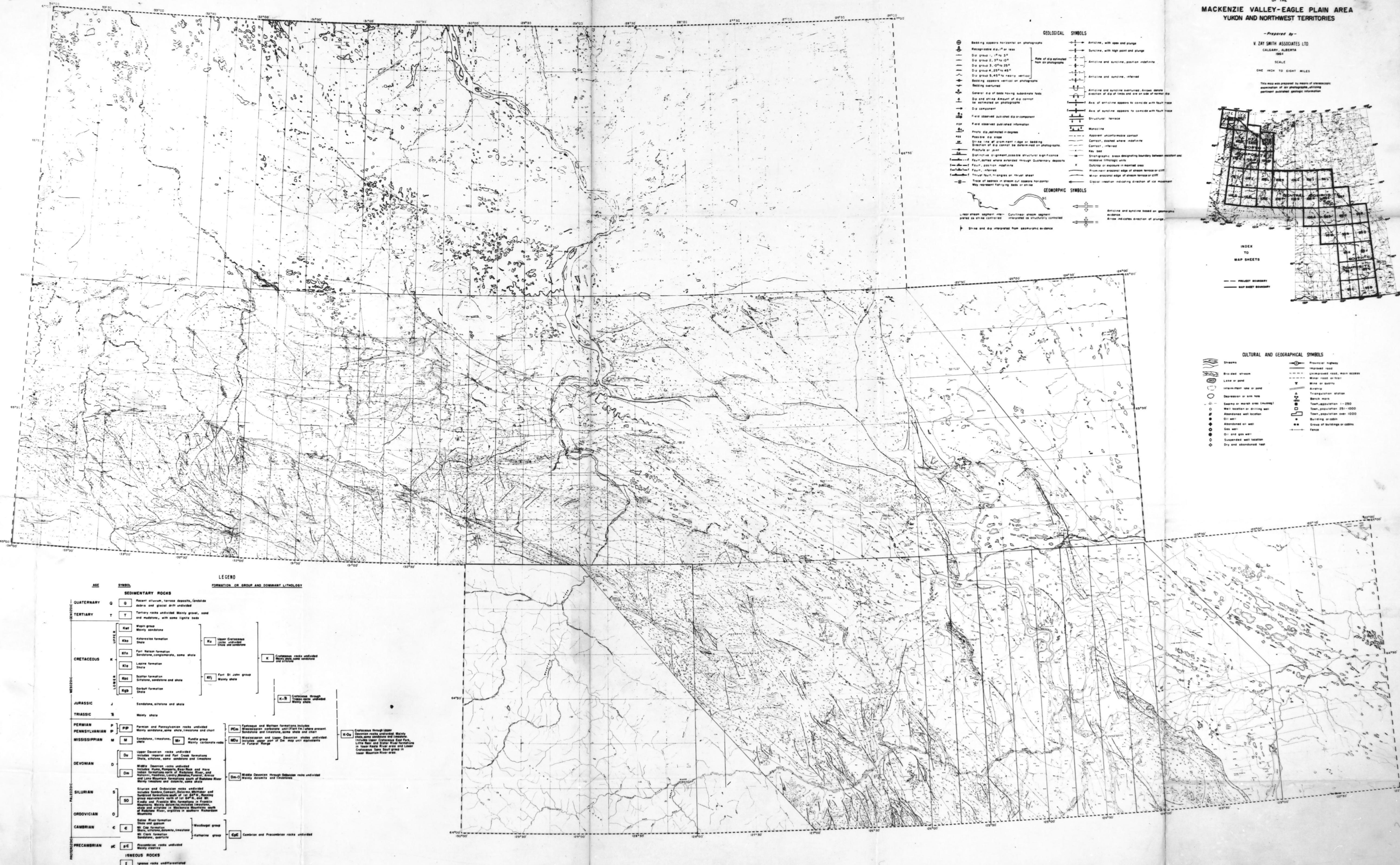
SYMBOLS

⊕	Bedding appears horizontal on photographs
—	Dip group 1, 0° to 3°
—	Dip group 2, 3° to 10°
—	Dip group 3, 10° to 25°
—	Dip group 4, 25° to 45°
—	Dip group 5, 45° to nearly vertical
—	Field observed dip or component measured
—	Possible dip slope
—	Distinctive alignment, possible structural significance
—	Fault, dotted where extended through Quaternary deposits
—	Anticline, arrow denotes plunge, diamond denotes approximate position of apex
—	Syncline, arrow denotes plunge break and cross bars denote approximate position of high point
↓	Structural terrace
—	Contact, dashed where indefinite
—	Stratigraphic break
—	Glacial lineation
△	Strike and dip interpreted from geomorphic evidence.
—	Recognizable dip 1° or less
—	Dip and strike. Amount of dip cannot be estimated on photographs
X	Outcrop area
FO	Field observed published dip

AREAL GEOLOGY
AND
STRUCTURAL INTERPRETATION MAP
OF THE
MAHONY LAKE - FORT FRANKLIN AREA
NORTHWEST TERRITORIES

SCALE: 1 INCH TO 2 MILES

Prepared by
V.ZAY SMITH ASSOCIATES LTD.
CALGARY, ALBERTA.
1967



March 1975

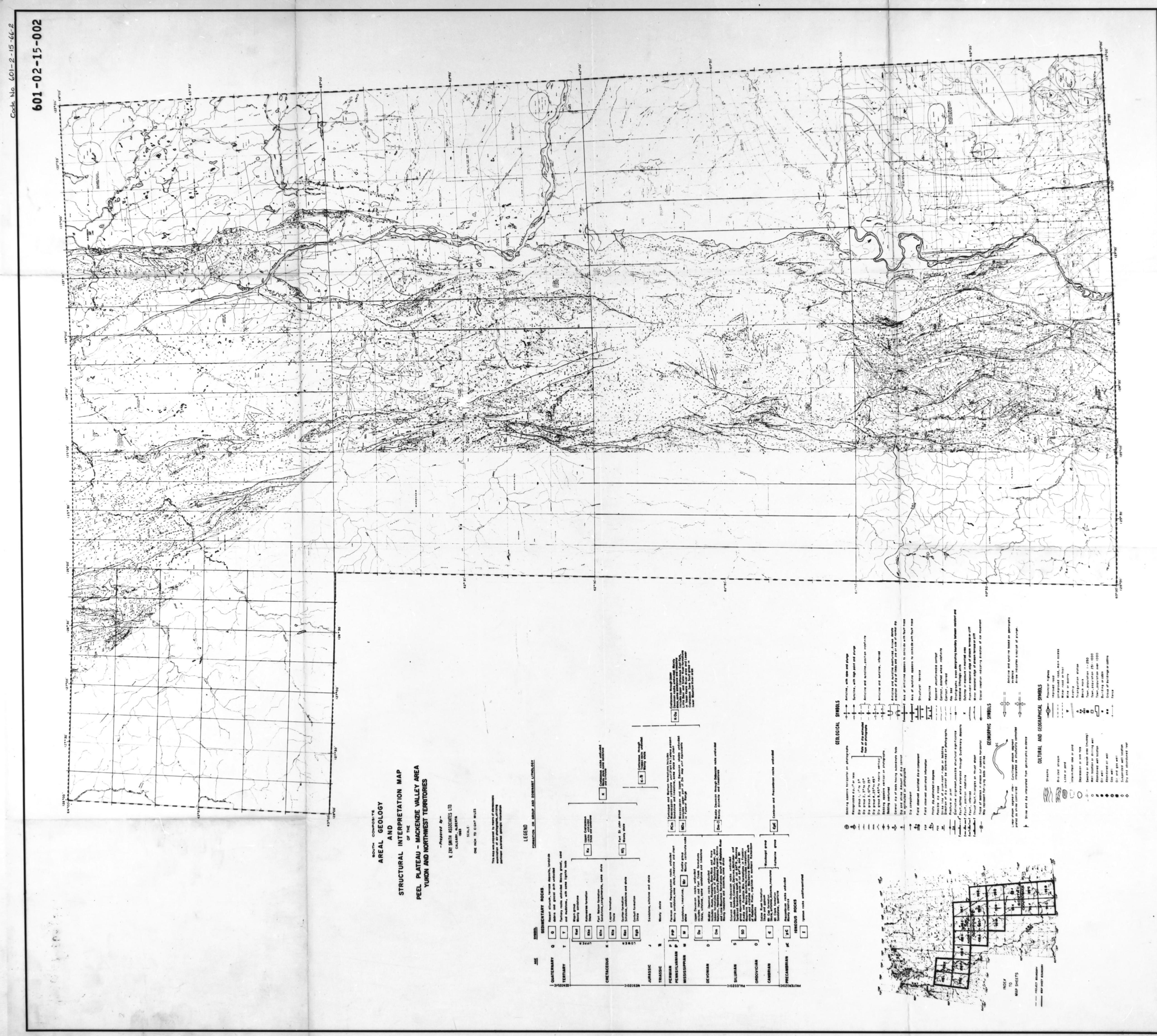
10

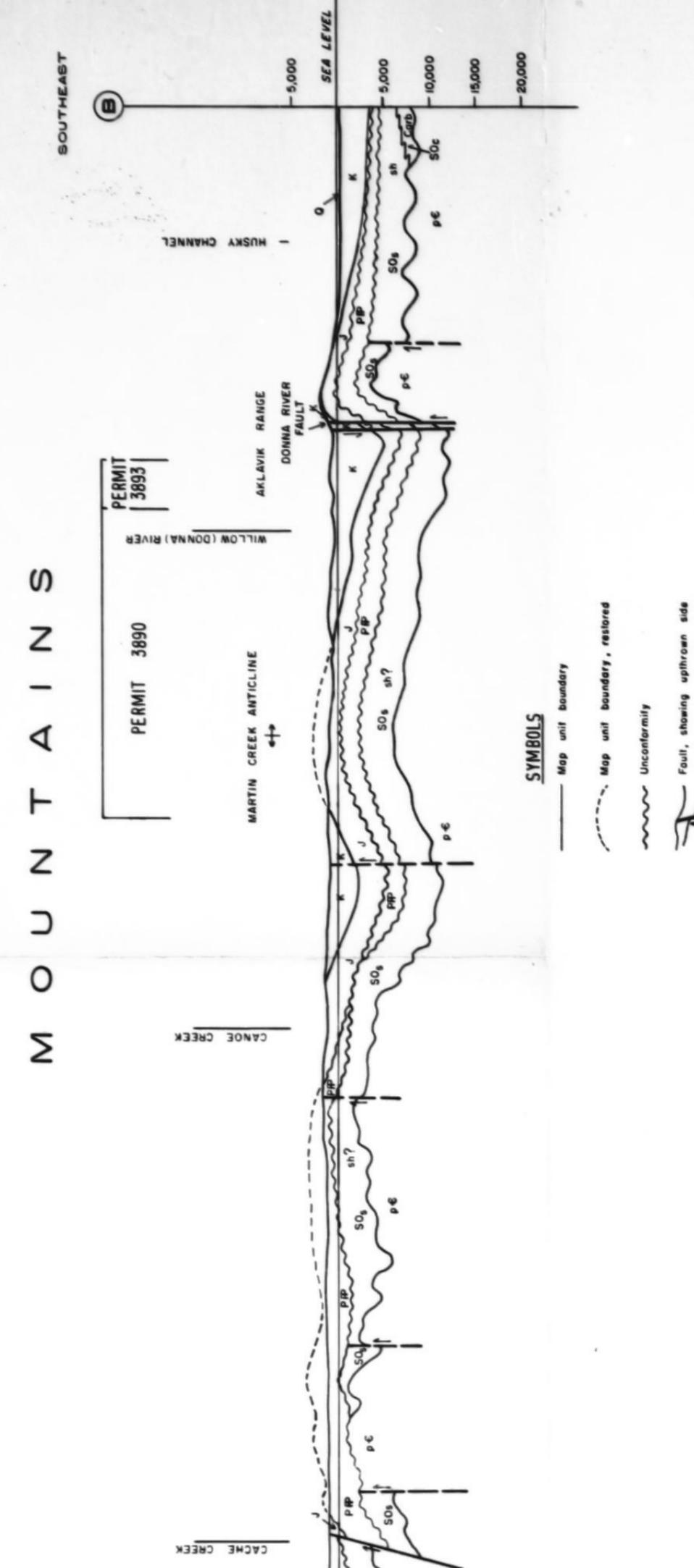
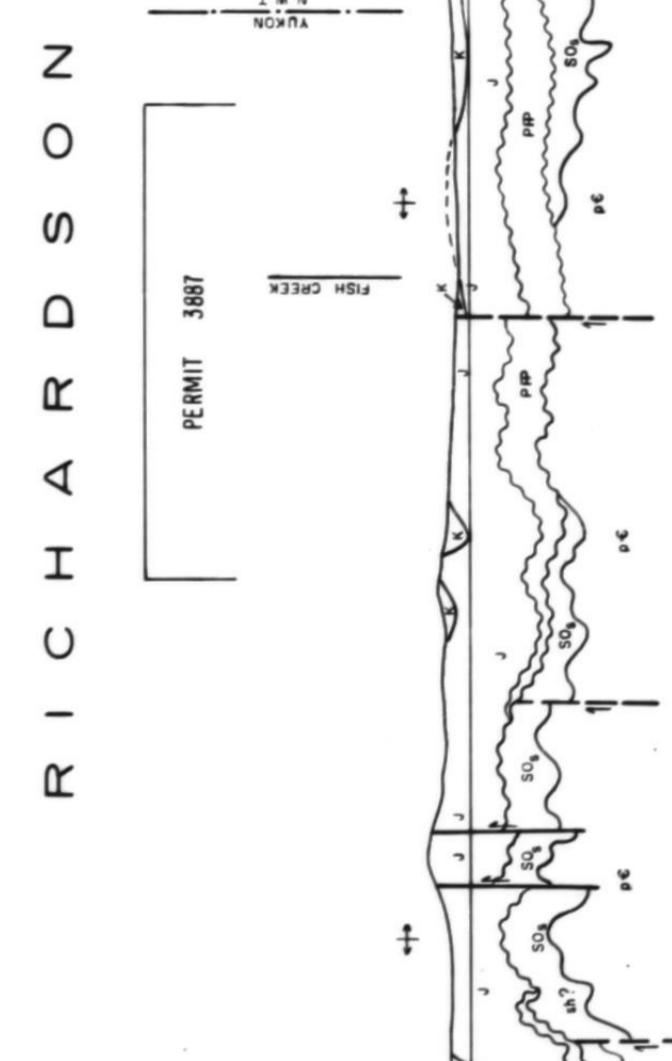
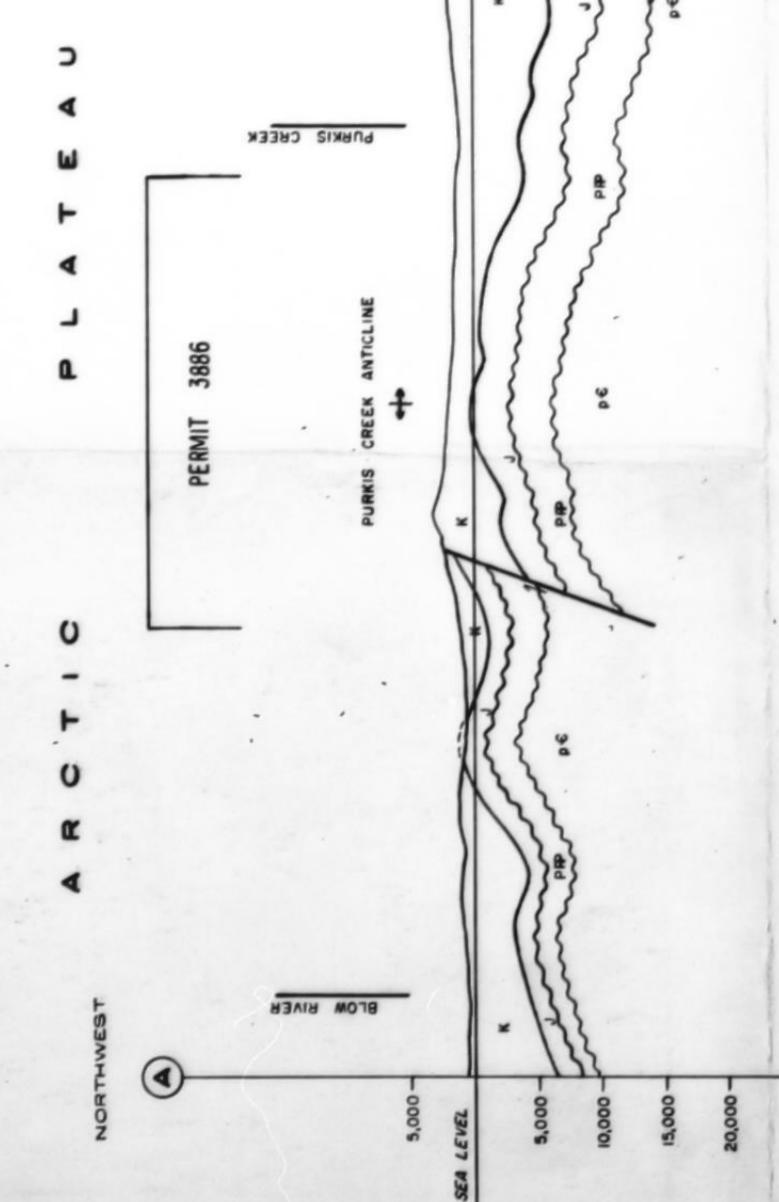
MICROMAT

105 M.M.

WEST CANADIAN GRAPHIC INDUSTRIES LTD.
810 - 5th Avenue S. W. CALGARY 1, ALBERTA
Phone 263-2553

301-02-15-002





AREAL GEOLOGY
AND
RECONNAISSANCE STRUCTURAL CONTOURS
OF THE
DAHADINNI RIVER AREA
NORTHWEST TERRITORIES

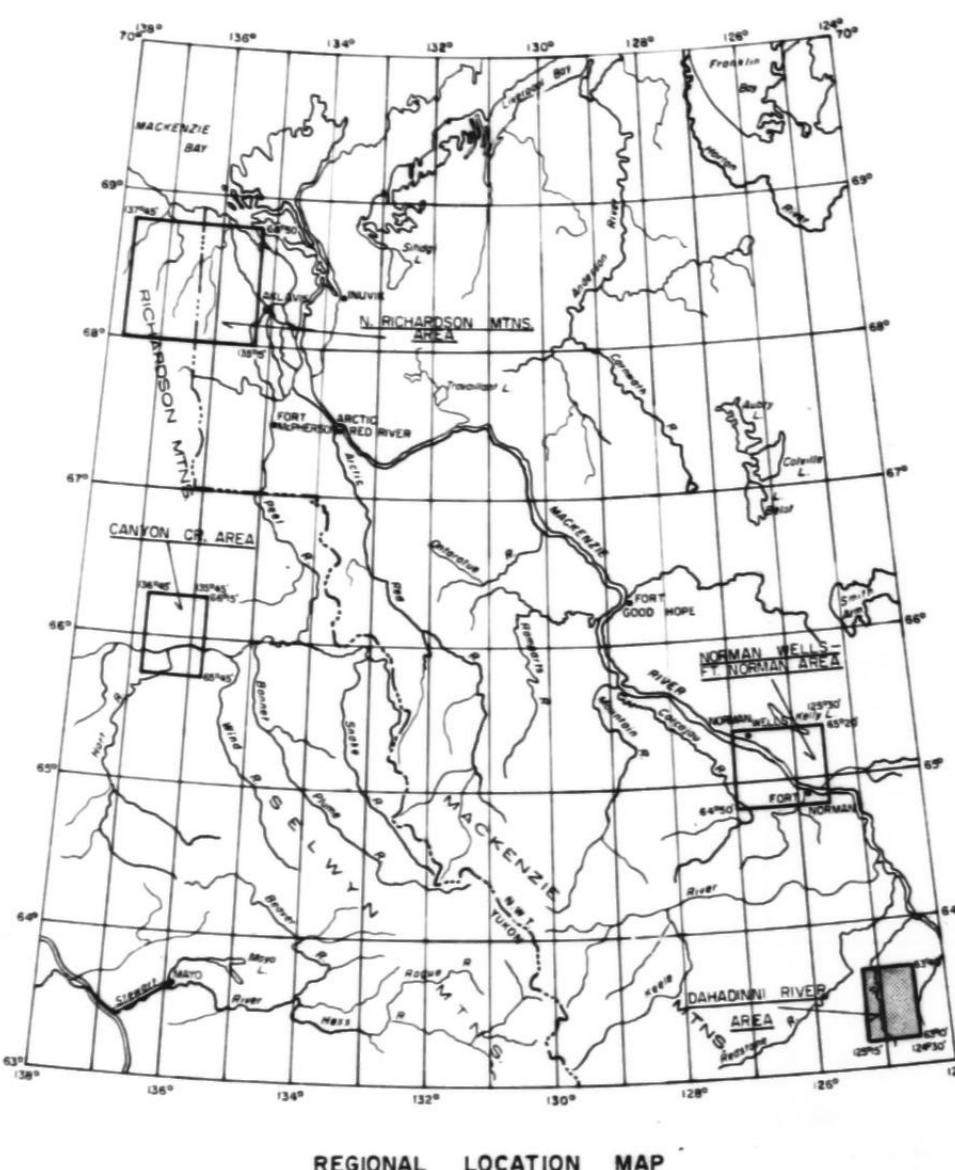
SCALE
One inch to one mile
5000 10000 20000 30000 40000 50000 FEET

CONTOUR INTERVAL: 1000 FEET
STRUCTURAL DATUM: TOP OF MIDDLE DEVONIAN CARBONATE (HUME F.M.)
"RESTORED" WHERE OLDER ROCKS ARE EXPOSED

—Prepared for—
TERRITORIAL HYDROCARBONS LTD.
FEBRUARY, 1966.

—by—
V. ZAY SMITH ASSOCIATES LTD.
CALGARY, ALBERTA.

This map was prepared by the stereoscopic examination of air photographs, using pertinent published and open file geologic information. Contours are semi-convoluted or inferred. They are positioned from elevations along generalized cross sections, outcrop elevations, strikes and dips.



REGIONAL LOCATION MAP

Project Areas

LEGEND

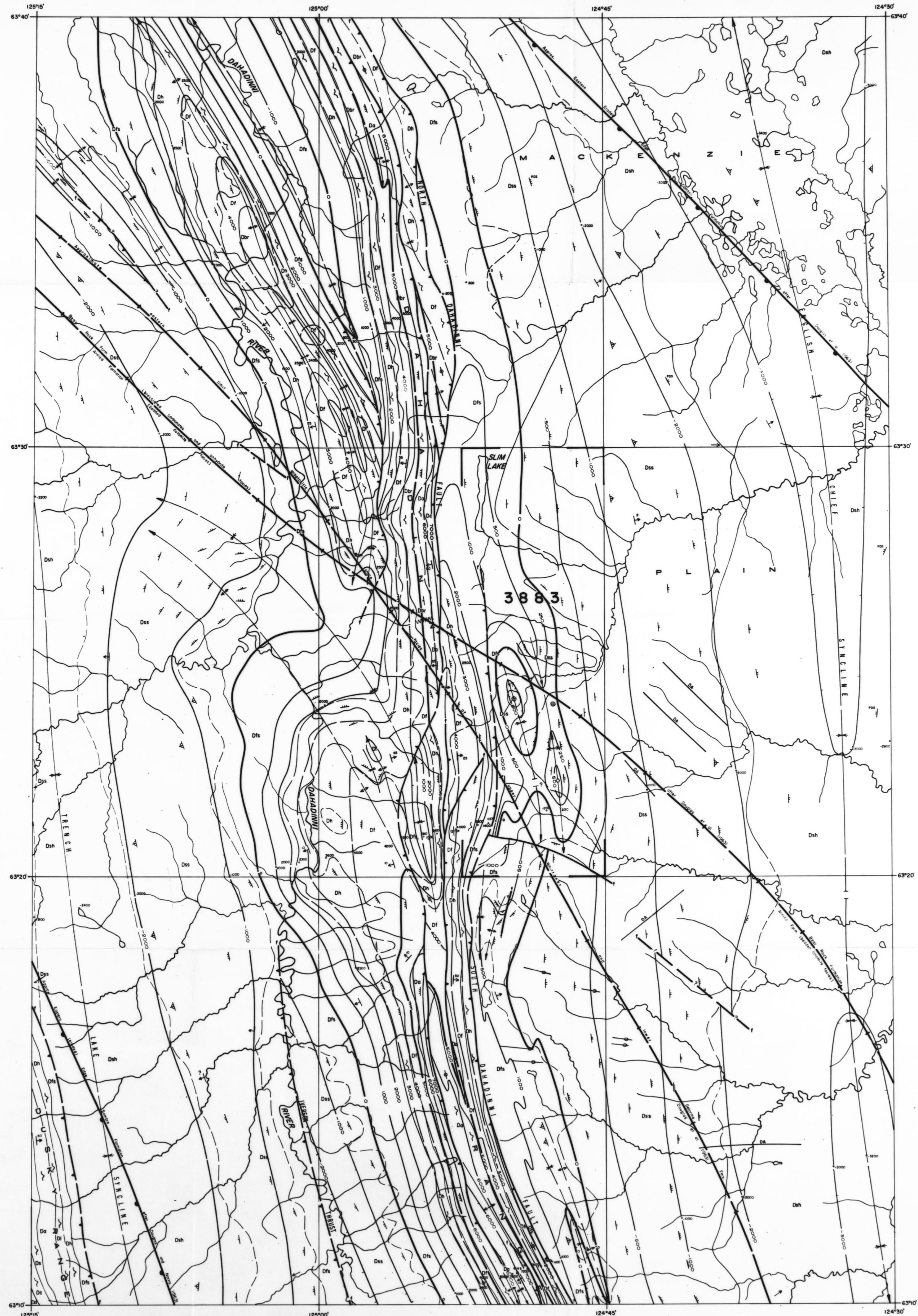
AGE	SYMBOL	FORMATION OR LITHOLOGY
CRETACEOUS	Dsh	Shale, sandstone and conglomerate
UPPER DEVONIAN	Dss	Sandstone and siltstone unit (resistant)
	Dfs	Fort Simpson and Horn River, shale
MIDDLE DEVONIAN	Dh	Hume and Headless, limestone
	DI	Lindley (sh) (resistant)
	Da	Funeral (sh) (resistant)
	Df	Bear Rock, limestone breccia
LOWER (?) DEVONIAN	Ds	Arco, dolomite
	Dc	Sombre, dolomite
	Dd	Comell, limestone-breccia
	Dd	Delorme, ls & dol
SILURIAN		Whistler, dol & ls, reefal (?)
ORDOVICIAN		Mr. Kindle, dolomite, reefal (?)
		Franklin Mtn., dol & sh

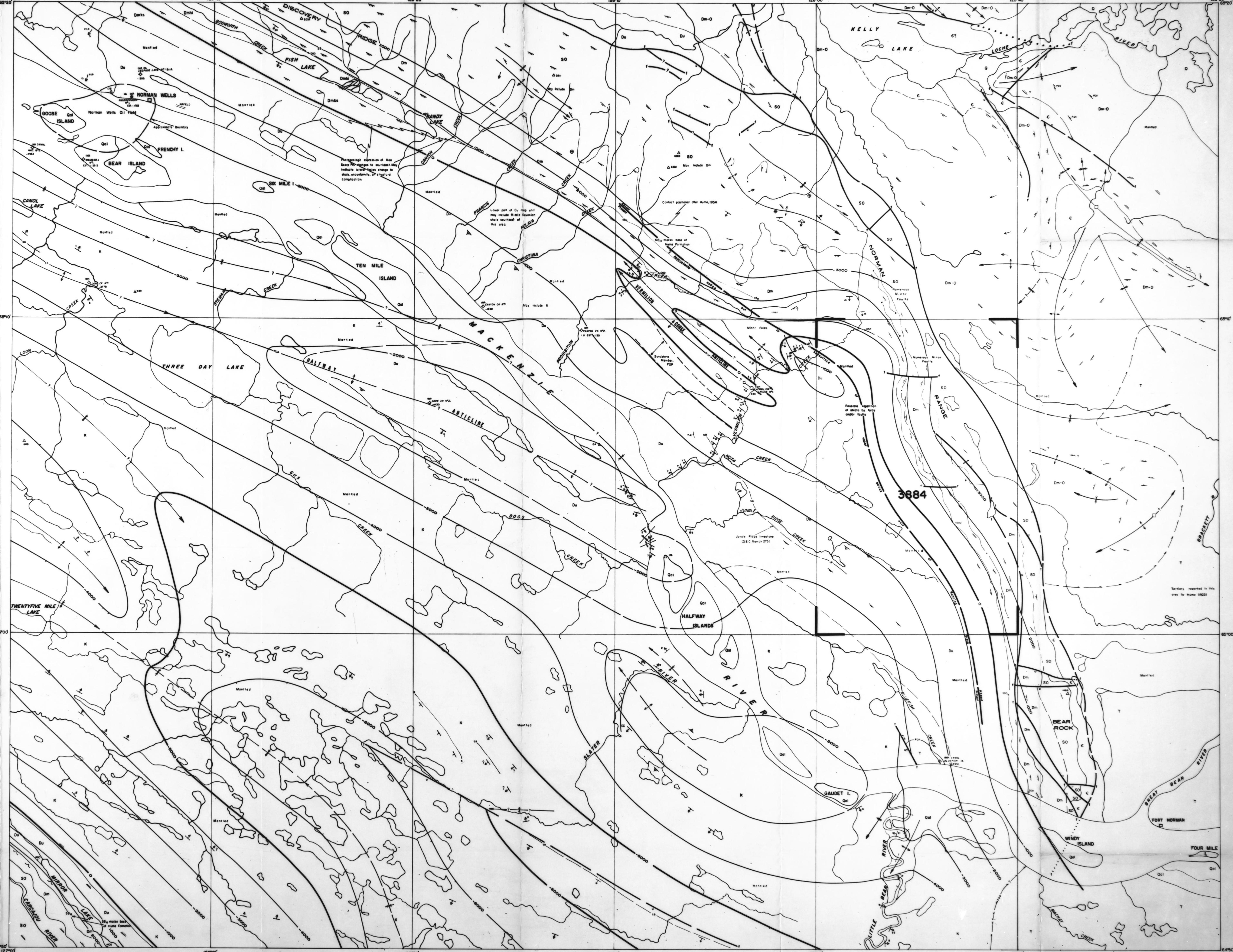
STRUCTURAL SYMBOLS

*-1000 Structural elevation of datum
— 2000 Structural contour in feet

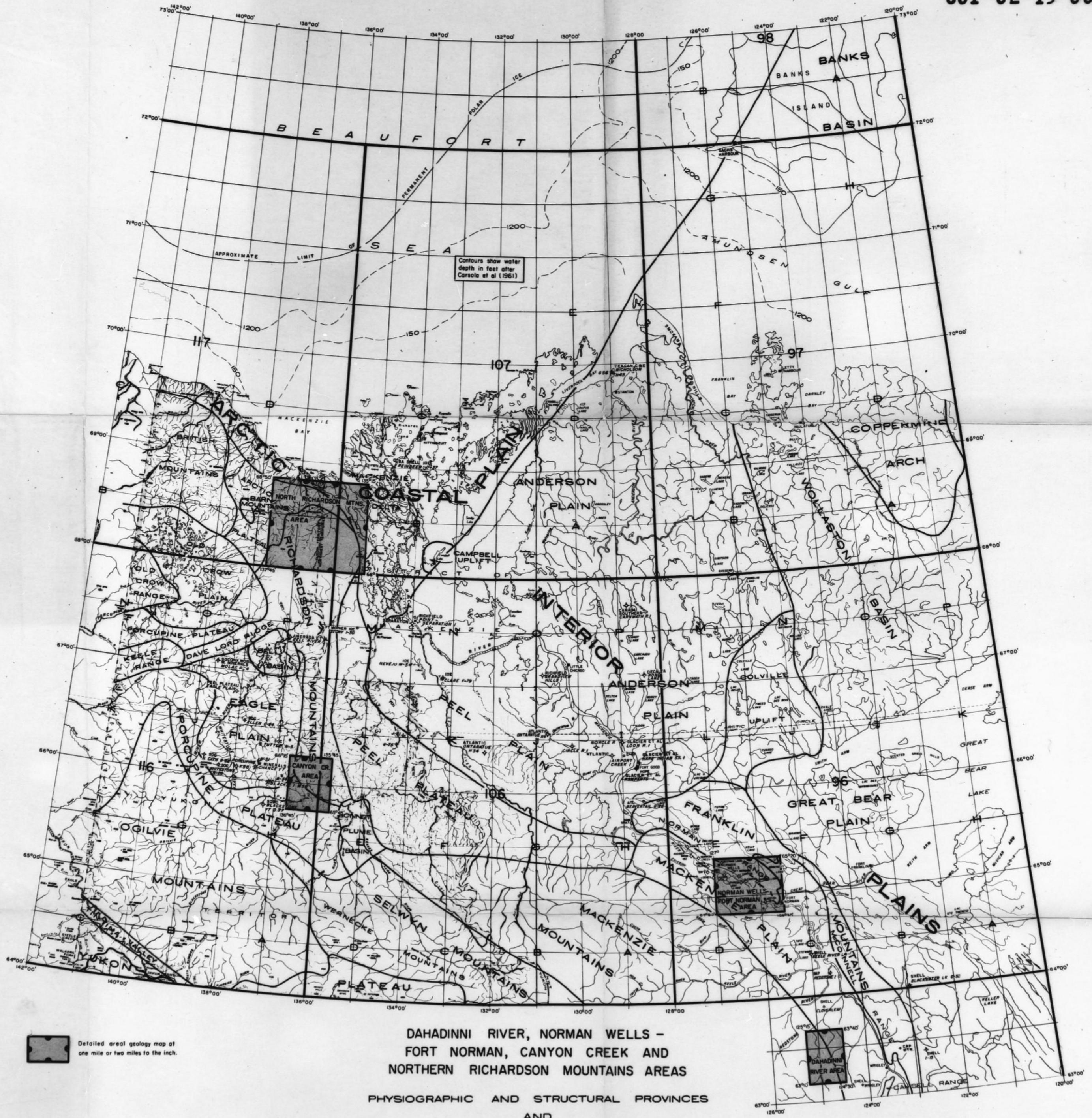
GEOLOGICAL SYMBOLS

Bedding appears horizontal on photographs	— Anticline, Arrow denotes plunge Diamond denotes approximate position of apex
Recognizable dip 1° or less	— Syncline, Arrow denotes plunge Breaks and cross bars denote approximate position of high point
Dip group 1, 1° to 5°	— Anticline and syncline, position indefinite
Dip group 2, 5° to 10°	— Anticline and syncline, position indefinite
Dip group 3, 10° to 25°	— Anticline and syncline, inferred
Dip group 4, 25° to 45°	— Anticline and syncline, inferred
Dip group 5, 45° to nearly vertical	— Anticline and syncline, inferred
Bedding appears vertical on photographs	— Anticline and syncline overturned. Arrows denote direction of dip of limbs and are on side of normal dip
Overturnd dipping	— Axis of anticline appears to coincide with fault trace
General dip of beds having subordinate folds	— Axis of syncline appears to coincide with fault trace
Dip and strike. Amount of dip cannot be estimated on photographs	— Structural terrace
Dip component	— Monocline
Field observed dip or component, measured	— Apparent unconformable contact
Trace of bedding in stream cut appears horizontal	— Contact, dashed where indefinite
May represent flat-lying beds or strike	— Contact, inferred
Possible dip slope	— Stratigraphic break
Strike line of prominent ridge or bedding	— Outcrop area
Direction of dip cannot be determined on photographs	— Possible outcrop area
Fracture or joint	— Prominent scarp or steep slope
Distinctive alignment, possible structural significance	— Minor scarp or slope
Fault, dotted where extended through Quaternary deposits	— Glacial lineation
Fault, position indefinite	— Facies change
Fault, inferred	
Thrust fault, triangles on thrust sheet	





601-02-15-002



March 1975

11X

MICROMAT

WEST CANADIAN GRAPHIC INDUSTRIES LTD.
810 - 5th Avenue S.W. CALGARY 1, ALBERTA

601-02-15-002

601-02-15-002