The Geologic Evaluation
of
Exploratory Permits 5492 - 5501
in the
Keller - Mahony Lakes Area
Northwest Territories

GEOLOGIC EVALUATION

of

EXPLORATORY PERMITS 5492 - 5501

in the

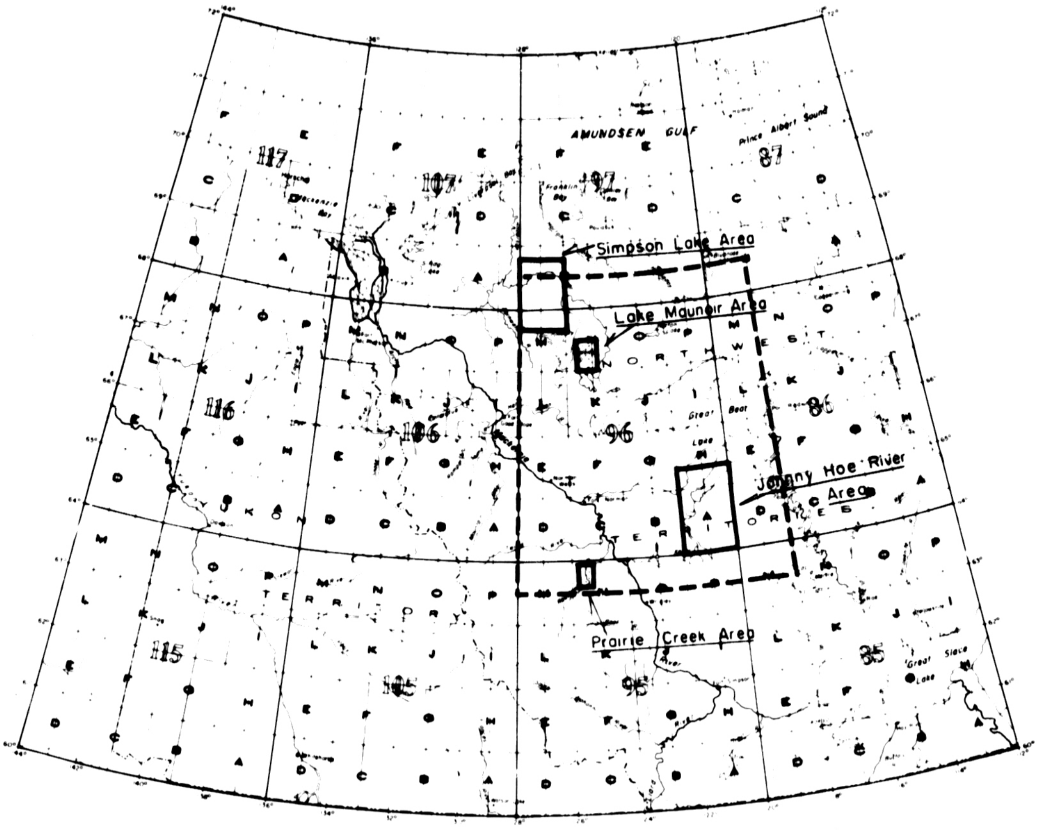
KELLER - MAUNOIR LAKES AREA, N.W.T.

Prepared by

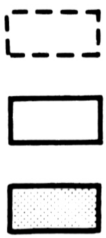
V. ZAY SMITH ASSOCIATES LTD.

1968

ILLUSTRATIONS



REGIONAL LOCATION MAP



Regional map area
Scale 1" to 10 miles

Detail map area
Scale 1" to 4 miles

Detail map area
Scale 1" to 1 mile

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INTRODUCTION

This report concerns an evaluation of the oil and gas prospects of exploratory permits 5492 - 5501 inclusive. The permits were acquired by The Canada Trust Company in April, 1967 and total approximately 503,608 acres.

The evaluation was based on regional geologic analysis, detailed photogeologic mapping, preparation of structure contour maps, geologic observations and work done by a geologic party operating in the field, and subsurface geology. Published information has also been reviewed and analyzed in making the evaluation.

The permit acreage lies in four scattered areas: namely the Johnny Hoe River, Prairie Creek, Lac Maunoir, and Simpson Lake areas. See Figure 3., Regional Location Map.

Consequently, a regional geologic map (Figure 1.) was prepared at the scale of 1" to 10 miles to cover a vast area lying between lat. 63° 30' N. and lat. 68° 30' N. and the Canadian Shield on the east and Cordilleran Belt on the west. A geologic cross-section was prepared to illustrate the geology from the Cordilleran Belt through the Interior Plains to the Canadian Shield. It appears on Figure 1.

A series of detailed geologic maps were prepared to cover the permit acreage in each of the specific areas outlined above. They are displayed on Figure 2. The mapping was based on detailed photogeologic evaluation, geologic field observations and structure contour work which was compiled photogrammetrically.

A surface geologic party was in the field during July, 1967 to examine the permit areas and study exposures of potential reservoir rocks which are exposed off the permit acreage but expected to be buried in the subsurface within the permits. Some of the field stratigraphic data is plotted on stratigraphic logs which accompany this report.

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

STATUS of PERMITS

The permits were issued on April 14th, 1967. Permits located south of lat. 65° N. have an initial term of 3 years. Permits located between lat. 65° - 68° N. have an initial term of 4 years. Permits located between lat. 68° - 70° N. have an initial term of 6 years. Thus, permits 5492 - 5498 have an initial term of three years; permit 5499 has an initial term of 4 years, and permits 5500 and 5501 have initial terms of 6 years. The term of the permits may subsequently be renewed for an overall life ranging from 9 years in the south to 12 years in the north.

The subject permits have been grouped. Permits 5492-5498 are registered under Group 319; permits 5499-5501 form Group 320. Therefore, any allowable expenditure made on any permit area within a group can be applied to any or all of the grouped permits. Work commitments require an expenditure on exploration work at the rate of $0.05 per acre during the first 18-month period of the original term and $0.15 per acre for the following period of the original term. In the northern permits having a 6-year original term, the remaining period is divided into two parts consisting of 30 months in each part. Work commitments are in the order of $0.15 per acre for the first 30 months and $0.20 per acre for the second 30 months of the remaining period of the original term.

ACCESSIBILITY

Norman Wells is the principle settlement within the map area. It lies along the Mackenzie River adjacent to the Norman Wells oilfield in the western part of the project. (See Figure 1). It is serviced by a regularly scheduled airline which travels from Edmonton to Norman Wells and return three times a week. During the summer the Mackenzie River serves as a main line of transportation when it is ice free for at least three months. Equipment and supplies are usually barged into the country from Hay River on Great Slave Lake to the southwest. (See Index Map on Figure 1). A winter road system is maintained during the winter months by Calgary Exploration Services Limited, and it extends from Fort Providence north along the Mackenzie River to Norman Wells. Although the permit acreage can only be reached by aircraft, the permits are readily accessible and serviceable from base camps established either at Norman Wells or along Great Bear Lake.

GEOLOGIC FIELD WORK

Geologic field work was done during parts of July and August, 1967. A principle base camp was set up at Sawmill Bay on Great Bear Lake. Geologist W. Brown acted as party chief and was supported by one geologist and two geological assistants, a cook and aircraft personnel. A helicopter served to move the geologic field parties from the base camp to work areas. Fixed-wing float-equipped aircraft maintained liason between the base camp and Yellowknife. Thus, a study was undertaken in the Great Bear Lake - McVicar Arm - Hottah Lake area in order to evaluate the stratigraphic potential of reservoir rocks buried downdip beneath permits 5493 to 5498. In addition, air reconnaissance was made of permits 5499 - 5502 in the Lac Maunoir - Simpson Lake areas, and the results have been incorporated in the detailed maps on Figure 2.

REGIONAL GEOLOGIC SETTING

PHYSIOGRAPHY

Parts of three main physiographic provinces are covered by the project: the Canadian Shield, Interior Plains and Cordilleran Belt. The Mackenzie River forms the principle drainage and occupies a broad northwesterly trending valley located in the Cordilleran region. The Interior Plains is dominated by Great Bear Lake which is a remnant of a vast proglacial lake which was once much more extensive. It forms one of a series of such lakes lying near the boundary between the Interior Plains and the Canadian Shield from the Great Lakes of Ontario to Great Bear Lake of the Northwest Territories.

The Canadian Shield is a vast region of low-lying terrain displaying gently undulating topography. Only a very small portion of it is covered by the project in the east central part. The Canadian Shield is poorly drained; lakes and ponds are unbelievingly numerous. At most places within the project the terrain stands at elevations ranging from about 800 to 1,000 feet. However, some abrupt local changes occur in places where the land rises several hundred feet above the general level. Rock exposures are comparatively numerous but are restricted mainly to knolls forming the higher parts of the undulating terrain.

The Interior Plains form a vast area of low relief lying between the Canadian Shield on the east and the Cordilleran Belt on the west. Elevations within the project area range from as low as 175 feet in the valley of Hare Indian River near the western part of the project to as much as 2,300 feet in some plateaus in the central part of the project in the vicinity of Great Bear Lake. However, at most places the land stands at elevations ranging from 600 to 1,000 feet. At most places the Interior Plains is underlain by flat-lying to gently dipping beds which are mantled by a variable thickness of glacial drift. Outcrops are rare and occur mainly along streams which have incised through the glacial cover. Other outcrops are exposed in some other higher terrain and ridges that are present. A series of plateaus rising several hundred feet above the level of the plain are situated in the area surrounding Great Bear Lake. These broad features are interpreted to be erosional remnants of flat-lying to gently dipping Cretaceous strata. A series of narrow, linear ridges are present in the Colville-Lac Belot - Lac Maunoir areas in the northwestern part of the Interior Plains. The topographic form of these ridges is controlled by differential erosion of narrow, elongate anticlines and synclines. Thus, the landscape consits of a stream-dissected varied plains and low-lying plateau region that had reached the late mature stage in the erosional cycle prior to the Pleistocene Epoch. Subsequently, it was subjected to multiple continental glaciation. Much of the area has been reverted to the initial stage and is being subjected to light to moderate erosion.

The Cordilleran Belt in the project covers parts of three physiographic subdivisions of the major province: the Mackenzie and Franklin Mountains and the Mackenzie Plain. The Mackenzie and Franklin Mountains form belts of rugged, mountainous topography which parallel the intervening area of low relief, the Mackenzie Plain. The Mackenzie River flows through the valley occupied by the Mackenzie Plain. Summit elevations in the McConnell and Norman Ranges, which comprise the Franklin Mountains within the project, and in the Mackenzie Mountains to the west range from 3,000 to 3,500 and 4,500 to 5,500 feet respectively. Topographic relief in the order of 1,000 to 3,500 feet is present. Rock exposures are plentiful, especially at the higher elevations. Topographic trend is to the northwest and it was produced by erosion guided by structural control.

The Mackenzie Plain forms an area of comparatively low to moderate relief lying between the Mackenzie and Franklin Mountains. It trends northwesterly parallel to the geologic grain of the area. Although elevations range from as low as 200 feet along the Mackenzie River to more than 3,000 feet in some places, the general level of the plain stands at about 500 to 1,500 feet. At places bedrock is made up of soft clastics of Cretaceous, Upper Devonian and Tertiary age. Bedrock at many places is concealed beneath extensive deposits of glacial drift. Outcrops are relatively scarce. At a few places resistant Paleozoic rocks have been uplifted along structural lines and form conspicuous topographic features rising 1,000 feet above the plain.

The Cordilleran Belt consists of a complex mountain region which had reached the late youthful to early mature stage in the erosional cycle before being subjected to multiple Pleistocene glaciation. It is now being vigorously eroded by streams.

FIGURE 4

AGE		CORDILLERAN BELT: PRAIRIE CREEK AREA	CORDILLERAN BELT: MACKENZIE MOUNTAINS	CORDILLERAN BELT: FRANKLIN MOUNTAINS	INTERIOR PLAINS: WESTERN: SIMPSON LAKE – LAC MAUNOIR AREA	INTERIOR PLAINS: EASTERN: JOHNNY HOE RIVER AREA
QUATERNARY		Recent alluvium, hillwash and Pleistocene glacial drift				
TERTIARY			clastics	clastics		
CRETACEOUS		sh & ss	sh & ss	sh & ss	shale and sandstone	shale and sandstone
DEVONIAN	Upper	Ft SIMPSON sh	IMPERIAL sh	IMPERIAL sh		
	Middle	HORN RIVER sh	HARE INDIAN sh / KEE SCARP reef ls	KEE SCARP reef ls / HARE INDIAN sh	HARE INDIAN sh	HORN RIVER sh / Reef ls
		HUME (NAHANNI) ls	HUME ls	HUME ls	HUME	LONELY BAY ls
		FUNERAL sh, ls	BEAR ROCK dol, ls, gyp	BEAR ROCK dol, ls, gyp	BEAR ROCK dol, ls	CHINCHAGA evap, dol
		ARNICA dol				
	Lower	CAMSELL dol & ls				
SILURIAN		DELORME dol & ls	RONNING			
ORDOVICIAN	Upper	WHITTAKER dol & ls	GROUP dol	MT KINDLE dol	MT KINDLE and FRANKLIN MTN EQUIVALENTS dol	CHEDABUCTO LAKE dol
	Middle			FRANKLIN MTN		LAMATRE FALLS
	Lower	SUNBLOOD dol, sh, ss				sh, dol, ss
CAMBRIAN	Upper	Dolomite shale and sandstone	MACDOUGAL GROUP sh, ls, gyp	SALINE RIVER sh & gyp	MACDOUGAL and KATHERINE GROUPS EQUIVALENTS sh, evap, ss	
	Middle			MT CAP sh		OLD FORT ISLAND ss
	Lower		KATHERINE GR qtz	MT CLARK ss, qtz		
PRECAMBRIAN		Clastics & carb	Clastics & carb	Clastics & carb	Clastics and/or igneous and metamorphics	Qtz, dol and diabase / Granite and metamorphics

STRATIGRAPHIC CORRELATION CHART

STRATIGRAPHY

Sediments of Proterozoic, Paleozoic, Mesozoic and Cenozoic age are present in the project. Strata of probable Precambrian age are present in the east-central part of the area at the northeastern end of McVicar Arm. The Paleozoic sequence is represented by Cambrian, Ordovician, Silurian and Devonian carbonates, clastics and evaporites. Shale and sandstone of Cretaceous age comprise the Mesozoic assemblage. The Cenozoic sequence is made up of Tertiary coarse and fine clastics and Quaternary alluvium, terrace deposits and glacial drift. A significant gap in the geologic record exists during the interval from Devonian to Cretaceous. Uplift and erosion produced a significant break in the stratigraphic succession.

Details of the stratigraphy have been presented in the literature by many geologists who have worked in the area in the past years. For a detailed discussion one may refer to the pertinent publications listed in the Selected Bibliography that appears at the end of this report. In the paragraphs that follow an attempt is made to summarize the stratigraphy on a regional basis and to trace the stratigraphic development in the project area as based on an analysis of the geologic mapping, field observations, well control and literature. The age, correlation and lithology of the stratigraphic units are shown in Figure 4, the Stratigraphic Correlation Chart.

The stratigraphic sequence in the project reveals cycles of subsidence, deposition, uplift and erosion. Sediments accumulated in two main depositional patterns which have persisted since Cambrian time. The Cordilleran geosyncline lay to the west where miogeosynclinal conditions persisted in the present locus of the Cordilleran Belt. Relatively stable shelf conditions were present in the Interior Plains. Carbonates and evaporites with some clastics layed down in a dominantly marine environment characterized deposition during the Paleozoic era. Mesozoic sedimentation was characterized by the accumulation of mainly marine shale and sandstone derived from uplifts in the geosyncline to the west and partly from the Canadian Shield to the east.

The sedimentary sequence over the stable shelf is comparatively thin; the preserved stratigraphic section is in the order of 2,000 to 4,500 feet thick. In contrast a thick sedimentary succession accumulated in the miogeosynclinal belt, the total sedimentary sequence exceeding 20,000 feet in thickness.

Paleozoic sedimentation probably began in the Cordilleran region as the miogeosyncline began to subside. As the sea gradually encroached on the shelf and advanced toward the Canadian Shield, well sorted coarse clastics were layed down under shallow water marine conditions. Subsidence continued at a very slow rate on the shelf where interbedded clastics, carbonates and evaporites accumulated in a marine shallow water, restricted environment. The area was emergent at times and vast tidal flats developed. Meanwhile, thick beds of clastics, evaporites and carbonates were being deposited in the miogeosyncline to the west. Conditions changed during Upper Ordovician and Silurian time. Warm, open marine, well aerated waters existed and persisted into the Silurian period. At places widespread marine organic life flourished. Reefs developed in various places. The depositional environment persisted into Lower Devonian time in the Cordilleran geoysncline. However, the shelf emerged and was tilted gently toward the geosyncline and subjected to widespread erosion, which truncated the stratigraphic succession progressively toward the Canadian Shield. Renewed subsidence in Middle Devonian time effected further sedimentation. Three sedimentary environments developed at first. From east to west, a shallow evaporitic basin was present over the stable shelf lying east of the Cordilleran Belt. A transition zone between the evaporite basin and a carbonate depositional basin to the west coincided with the present location of the Franklin Mountains and Mackenzie Plain. Areas were emergent at certain places resulting in development of karst topography along the transition zone. Renewed subsidence permitted the invasion of warm, open marine, well circulated waters in which carbonates were deposited. Conditions were satisfactory for the prolific development of marine life. Reefs grew at many places. However, some very fine clastics accumulated at times. A change from dominantly carbonate sedimentation to clastic deposition began during Upper Devonian time. A thick sequence of fine clastics accumulated in a fairly rapidly subsiding trough; sediments probably were derived from uplift within the geosyncline to the west and from the shield area to the east. Subsidence and additional deposition probably continued in the Mississippian, Pennsylvanian and Permian periods. However, the stratigraphic record of these systems has been lost within the project area due to an important and widespread period of uplift, deformation and erosion. The crustal movements were probably in harmony with the Hercynian orogeny in Pennsylvanian time. The orogeny affected many parts of northern Canada.

The earliest preserved indications of Mesozoic sedimentation in the project suggest that marine seas encroached upon the area during Lower Cretaceous time. Subsidence continued through Upper Cretaceous time with the accumulation of mainly marine shales and sandstones. Sediments were derived mainly from uplift within the Cordilleran Belt to the west. The Canadian Shield served as a complementary source. The Cretaceous period finally culminated in the Laramide orogeny. During and following the orogeny thick deposits of clastics were deposited in a subsiding basin under continental conditions during the Tertiary period. Subsequently, the area was extensively and actively eroded by streams until the Pleistocene when it was subjected to multiple continental glaciation. Erosion has been renewed in Recent times.

STRUCTURE

The project covers parts of three main structural provinces and they correspond closely to the physiographic divisions: the Canadian Shield on the east, the Interior Plains in the central part and the Cordilleran Belt to the west.

CANADIAN SHIELD

Structure in the Canadian Shield is complex and intense. The crystalline and metamorphic rocks have been subjected to a long and complicated geologic history. Among the numerous structures present fractures and faults form a conspicuous part. One of the dominant structural fracture trends is southwesterly and a reflection of this trend is present in the project area northwest of Hottah Lake. In this area a narrow linear belt of Precambrian strata projects southwesterly into the Interior Plains. It can be traced at the surface for a distance of 50 miles. Photogeologic mapping and field observations indicate that the Precambrian igneous and metamorphic rocks have been upthrown essentially in the structural form of a horst.

INTERIOR PLAINS

The Interior Plains structural province forms a broad area of low to moderate structural intensity lying between the Canadian Shield to the east and the more mobile belt in the Cordilleran region to the west. This area has been relatively stable since Precambrian time. On a regional basis Paleozoic strata dip very gently to the southwest and west towards the Cordilleran Belt. Rates of dip range from 15 to 20 feet per mile near the edge of the Canadian Shield to 1° to 3° in the western part of the Interior Plains. Over vast parts of the Interior Plains the Paleozoic strata are unconformably overlain by flat-lying to gently dipping Cretaceous beds. Some gentle folds and flexures are present in various parts of the Interior Plains. In addition, some narrow, linear, elongate structures of moderate intensity are present in the Lac Belot - Colville - Lac Maunoir areas in the northwestern part of the Interior Plains. Axes of the folds are shown on the accompanying geologic map. Structural trend is variable and it ranges from northwesterly to northeasterly. The origin of the folds is probably related to basement faults. Further evidence of basement control of structure in overlying sediments is present along the southern shores of Great Bear Lake. In the Keith and McVicar Arms area significant changes in strike and dip occur locally in Paleozoic strata, probably in response to movements associated with basement faults.

A study of the stratigraphic and structural fabric of the area suggests that the present structural setting has resulted from three main structural conditions: 1. Tectonic features such as faults and folds which in places probably involve basement rocks, 2. Compaction structures developed over irregularities within the stratigraphic sequence, and 3. Solution-collapse structures.

The Interior Plains appear to have been subjected to three main periods of deformation. Study of the stratigraphic record shows that the area was uplifted and mildly warped during the post-Silurian, pre-Middle Devonian interval. A more pronounced period of uplift, deformation and erosion occurred during the post-Devonian, pre-Cretaceous interval. Much of the present areal distribution and regional structural setting was developed at that time. However, the most recent and intense structural movements probably accompanied the Laramide orogeny

CORDILLERAN BELT

The Cordilleran region is an area of moderate to very intense deformation which was produced mainly during the Laramide orogeny. The area had been subjected to pre-Laramide crustal movement. These periods of deformation, uplift and erosion correspond to those that affected the Interior Plains during the Paleozoic era. Regional structural trend in the Cordilleran Belt of the present is northwesterly. Locally it ranges from north to northwesterly to westerly. Numerous folds and faults are present and they range from simple to complex and moderate to intense. That part of the Cordilleran Belt included by the project covers parts of three sub-provinces: the Franklin and Mackenzie Mountains and the Mackenzie Plain. The Franklin Mountains form the eastern leading edge of the Cordilleran Belt. In the project area the McConnell and Norman Ranges comprise the Franklin Mountains subdivision. They form an elongate structurally high area characterized by folds and faults developed mainly in strata of Cambrian through Middle Devonian age. Some major northwesterly trending thrust faults are present. They tend to give a sense of motion to the north-east towards the Interior Plains.

Only a small part of the Mackenzie Mountains are included in the project and they are located in the very southwestern part. In this area structural trend is regionally to the northwest and a series of moderate folds and faults are present. Within the project area the effective dip in the Mackenzie Mountains is to the northeast towards the Mackenzie Plain.

The Mackenzie Plain forms a structural valley between the Mackenzie Mountains on the west and the Franklin Mountains on the east and northeast. The Mackenzie Plain is a north-westerly trending elongate synclinorium. It ranges in width from about 30 to 50 miles in the project area. Much of the Mackenzie Plain is characterized by gently to moderately and locally, intensely folded and faulted structures whose trend is parallel to the regional. From the standpoint of oil and gas prospects, it is one of the most favorable areas in the Cordilleran Belt because Middle Devonian and other reservoirs are buried in the subsurface at most places.

LOCAL GEOLOGIC SETTING

of the

PERMIT ACREAGE

The permit acreage lies in four scattered areas within the project. These are referred to as the Johnny Hoe River, Prairie Creek, Lac Maunoir and Simpson Lake areas. A series of detailed geologic maps were prepared to cover the permit acreage in each of the specific areas, and these are displayed on Figure 2. Each area is discussed in detail in paragraphs that follow.

PRAIRIE CREEK AREA: Permit 5492

Permit 5492 lies mainly in the Mackenzie Plain near the front of the Mackenzie Mountains. Elevations range from approximately 1,500 feet to as high as 3,500 feet. However, most of the land stands at elevations ranging from 1,500 to 2,500 feet. The terrain is rough but would be accessible along the valley of the Redstone River which leads to the Mackenzie River about 45 miles to the northeast. It is a main transportation route during summer months.

Exposed bedrock consists mainly of Upper Devonian clastics. A thick sequence of Paleozoic rocks underlie the permit. These are represented by the Anticipated Stratigraphic Section shown on the detailed map covering the Prairie Creek Area on Figure 2.

A quantitative structural analysis formed part of the evaluation of permit 5492. A structure contour map was prepared photogrammetrically to portray configuration of structure by means of controlled contours. They show the shape and size of the fold.

Permit 5492 straddles a northwesterly trending, moderately folded, slightly asymmetric, closed anticline. Defining dips on the flanks range from about 5° to 25° at most places. As much as 5,000 feet of structural relief is present on the anticline and more than 3,000 feet of closure exists. The apex of the fold is located just two miles east of the eastern boundary of permit 5492. The oldest rocks exposed along the crest of the structure in that area are the Bear Rock Formation of Middle Devonian age. Study of stratigraphic sections exposed in the mountains to the west and east, and in wells drilled on the Mackenzie Plain indicates thick porous zones are present in Ordovician, Silurian and Devonian strata. These beds are probably involved in the folding and thus form a structural trap in the permit acreage. Calculations indicate that more than 10,000 acres of the permit has structural closure involving the reservoirs. Thus, the oil and gas prospects for permit 5492 are considered excellent.

JOHNNY HOE RIVER AREA: Permits 5493 - 5498

The permits lie in the Interior Plains physiographic province. They form a linear belt stretching from the south-western end of McVicar Arm southeasterly to lat. 64° 10' N, long 120° 15' W. The low lying terrain stands at elevations ranging from about 500 feet to 1,400 feet. Local relief is measured at most places in a few tens of feet and rarely exceeds 100 feet. Bedrock is covered by glacial drift and no outcrops were observed within the permit acreage during the field work.

The terrain presents no real accessibility problems. Moreover, supplies could be barged into the area from the railhead at Great Slave Lake to the south by way of the Mackenzie River upstream along Great Bear River and through Great Bear Lake to the permit acreage.

During the summer of 1967 field work was conducted in the region south of Great Bear Lake and west of the Precambrian Shield to study exposures of Paleozoic and Precambrian(?) sediments which dip regionally westward and may underlie the Johnny Hoe River permit acreage. The field party consisted of party chief W. Brown, who was assisted by one geologist, two student assistants, a cook, helicopter pilot and engineer.

Operations were conducted with helicopter and fixed-wing support. Foremost among the problems encountered was the lack of exposures due to a widespread cover of glacial debris and heavy forest cover. Good outcrops of these sediments lie mainly within 20 miles of the Precambrian Shield and good exposures were not seen in the area to the west.

Cretaceous sandstones and shales unconformably overlie the Paleozoic sediments forming low-lying hills southeast of McVicar Arm. The maximum known thickness of Cretaceous rocks in the area occurs on Grizzly Bear Mountain, where 2,000 feet of sandstones and shales can be observed. Southeast of McVicar Arm the poorly defined basal contact of the Cretaceous beds makes it extremely difficult to accurately delineate their areal extent.

A monotonous succession of quartzites with some dolomites and occasional sandstones and shales were observed in the field northwest of a southwesterly trending ridge formed of Precambrian rocks. The trend projects from the shield out into the Interior Plains. (See Figure 1.) The assemblage dips gently to the northwest disappearing beneath increasingly heavy mantle of glacial debris in the northwestern part of Leith Peninsula. These rocks form a broad, relatively flat hill which rises to over 1,600 feet in the central part of the peninsula. In the lower part they are intruded by thick sills of diabase which form northwestward-facing dip slopes and bold cliffs adjacent to the gneisses and granites west of Yen Lake. In this area the sill is underlain by quartzites which occupy the lower portion of the cliffs beneath the diabase exposures and appear to directly overlie the crystalline rocks. Although the quartzites are not exposed in the lower part, their thickness is in excess of 100 feet.

A composite stratigraphic section was compiled using measurements from scattered, and often widely separated outcrops, located northwest of the uplifted ridge of crystalline rocks. The section indicates that up to 2,500 feet of Precambrian (and Cambrian?) quartzites, sandstones, shales and dolomites are present. The quartzites are overlain by a grey to brown and greenish grey dolomite breccia considered to be the basal beds of the Chedabucto Lake Formation of Ordovician age. The section measured in the field is plotted as composite stratigraphic section, McVicar Arm, which accompanies this report.

Southeast of the crystalline ridge, broad mantled areas separate the occasional outcrops of the Ordovician La Martre Falls Formation from which composite stratigraphic section Hottah Lake was constructed. Good exposures were seen only in widely-spaced, gently west-to southwest-dipping flat-topped hills located west and north of Hottah Lake and in stream cuts southwest of the lake.

The stratigraphic section lying beneath the permits is relatively thin and is illustrated by the Anticipated Stratigraphic Section shown on the detailed map dealing with the Johnny Hoe River Area in Figure 2. The Paleozoic section is represented by strata of Cambrian, Ordovician and Middle Devonian age. It is unconformably overlain by a thin veneer of Cretaceous shale and sandstone. Glacial drift mantles bedrock. Potential reservoirs exist in porous basal sands of Cambrian age referred to as the Old Fort Island Formation. Distribution of the Old Fort Island sandstone is controlled to a marked degree by the configuration of the Precambrian basement. The sands tend to be thick in erosional lows and become thin and pinchout over topographic highs. Another potential reservoir may be found in the Chedabucto Lake dolomites of Upper Ordovician age. Correlatives of these beds exposed to the west in the McConnell Range have porous zones, and some porosity was noted in the samples of the Shell Blackwater Lake G-52 and Imperial Lac Tache C-35 wells drilled in the Interior Plains to the south and southwest down dip from the permit acreage. Correlatives are exposed along the edge of the Precambrian Shield updip to the northeast from the permits where they appear to be hard, tight and dense. Thus, one can visualize the possibility of stratigraphic traps in the Interior Plains at the updip edge of porous zones within the formation or where they rise to the post-Silurian, pre-Middle Devonian unconformity. The Lonely Bay Formation is a limestone of Middle Devonian age. It correlates with the Keg River of northern Alberta. In places it is finely porous and sandy. It is believed present beneath the southern part of the permit acreage. Stratigraphic studies to the south indicate that the formation could serve as a platform for development of biohermal reefs growing vertically several hundred feet and surrounded by a Middle Devonian shale sequence. The southern permits (5496, 5497 and 5498) hold some potential for such stratigraphic developments. Moreover, these permits straddle the southwestern projection of the structural zone present northwest of Hottah Lake. (Refer to Figure 1). This structural zone has been periodically active in the geologic past. If one favours the concept of structural control of reef growth, the permits appear to be favorably located in this regard.

Regional considerations suggest that the Paleozoic beds in the permit acreage probably dip southwesterly at a very gentle rate less than 100 feet per mile. However, it is possible that a significant change in strike occurs in response to structural movements along southwesterly trending basement faults such as the one that may extend beneath the Interior Plains as a projection from the structural zone present northwest of Hottah Lake.

In summary, oil and gas prospects vary beneath the permits in the Johnny Hoe River area. They range from poor at the north in permit 5493 where Ordovician strata are exposed to good in permits 5495 - 5498 to the south. In the latter permits Middle Devonian strata are buried in the subsurface straddling a structural trend which could have effected reef development in Ordovician and Middle Devonian time. Thus, potential stratigraphic traps could be anticipated in the Old Fort Island sandstone of Cambrian age, Ordovician dolomites and Middle Devonian carbonates.

<u>LAC MAUNOIR AREA</u>: Permit 5499

In the Lac Maunoir area the Interior Plains form an area of gently undulating, low-lying terrain where bedrock is covered by deposits of glacial drift. However, permit 5499 straddles a narrow, elongate north-northwesterly trending ridge. It rises abruptly nearly 1,000 feet above the surrounding plains. The form of the ridge is structurally controlled. Although bedrock in the vicinity of the permit is mantled by glacial drift, outcrops of the Siluro-Ordovician sequence are present at places along the flanks and crest of the anticlinal ridge.

The permit was visited during the field work in 1967. Dolomites of Ordovician age were examined within permit 5499 and also to the northeast, southeast and west. Porosity was noted in some places. No complete section of Lower Paleozoic beds is available either in exploratory wells or at the outcrop in the Lac Maunoir area. Consequently the anticipated stratigraphic section as shown on the detailed map dealing with the Lac Maunoir area in Figure 2 is based in part on exposures located to the east and southeast of the permit. A porous basal Cambrian sand is interpreted to overlie metasediments, and it may be as much as 250 feet thick. It is overlain by shales of Cambrian and Ordovician age. The clastic section is succeeded by an assemblage which may be about 2,000 feet thick. It consists of Ordovician dolomites believed to be equivalents of the Mount Kindle and Franklin Mountain Formations of the Norman Wells area. Where correlatives of the dolomites were viewed in outcrops, they are typically porous and locally contain vuggy porosity with vugs up to 2 inches in diameter. Some beds display abundant evidence of organic remains usually replaced by chert. Recognizable forms include colonial and solitary corals, stromatoporoids and brachiopods.

Regional structure in these Interior Plains consist of Paleozoic beds dipping very gently to the west. However, the gentle structure is interrupted at places by elongate belts of moderate to intense deformation. The belts are probably related to movement along basement faults over which folds developed in Paleozoic strata. The age of deformation is not definitely known. Although it may be related to the Hercynian orogeny in late Pennsylvanian time, some evidence is available elsewhere to show that some deformation occurred during the Laramide orogeny.

In order to demonstrate the geologic setting of the permit acreage, a structural contour map was prepared. It was based on photogeologic mapping co-ordinated with photogrammetric techniques. Moreover, the interpretation was checked and verified in the field. The contours depict quantitatively the form and magnitude of the structure present in permit 5499. It consists of a narrow, elongate northwest trending moderately deformed, faulted anticline. Subsidiary flexures are present. Defining dips at most places on the flanks range from 5° to 25° Structural relief in excess of 2,250 feet is present. Quantitative mapping indicates that the magnitude of closure within the permit acreage attains 750 feet, the apex being located near the centre of the permit. Within the permit acreage the structure is approximately 12 miles long and the width of the closed part of the structure at most places ranges from 1-1/2 to 2 miles.

Permit 5499 covers a definite oil and gas prospect where a trap could be effected by a structural closure. If the stratigraphic section contains porous reservoir beds in the subsurface as anticipated, oil and gas prospects are good.

<u>SIMPSON LAKE AREA:</u> Permits 5500 and 5501

The permits in the Simpson Lake area lie in the Interior Plains. They cover a hummocky terrain displaying moderate relief. Glacial drift covers bedrock completely and the drainage has been disoriented by the multiple glaciation that affected the area. Consequently, numerous lakes are present. At a few places 4 to 5 miles west and north of the permit area streams have incised through the veneer of glacial drift and outcrops are exposed in the stream cuts.

The permits were visited in the field during the 1967 field season. No outcrops were observed during a series of closely spaced helicopter flights over the permits. However, exposures of Devonian shale and carbonates are available for study along the Anderson River a few miles north of the permit acreage. The formations exposed are, in ascending order: the Bear Rock, Hume and Hare Indian River Formations. The lower 2 feet of the Hare Indian River shale, the entire Hume Formation and the upper part of the Bear Rock Formation are discontinually exposed in cutbanks and cliffs. The Bear Rock Formation is characterized by grey laminated dense petroliferous dolomites at exposures northeast of permit 5501. The overlying Hume Formation is about 200 feet thick along the Anderson River and consists of argillaceous limestone. It forms the upper carbonate unit of the Middle Devonian Series and is abundantly fossiliferous and locally biohermal.

The stratigraphic section anticipated beneath permit 5501 is illustrated diagrammetrically on that part of Figure 2 dealing with the Simpson Lake area. It is anticipated that nearly 4,500 feet of sediments ranging in age from Cambrian to Recent or present. Potential reservoir rocks exist in basal Cambrian sandstone, Ordovician and Silurian dolomites, and possibly the lower part of the Bear Rock Formation. Although younger strata are present within the permit acreage, study of the areal geologic maps shows that they are exposed in the immediate vicinity and cannot be considered reservoirs within the permit acreage. They would provide adequate cover for the deeper zones.

On a regional basis Paleozoic strata dip very gently to the west at a rate of less than one degree. However, local gentle folds were observed in the field at outcrops along the Anderson River north of the permit acreage. These folds appear to trend northerly. Elsewhere bedrock is covered by glacial drift and delineation of structure by photogeologic and field surface techniques is difficult. Thus, a geomorphic analysis was undertaken to supplement the standard mapping techniques. This involved the study of physiography, drainage, glacial geology, in fact, -all aspects of landscape, in an attempt to outline some geomorphic anomalies. A geomorphic anomaly is simply a surface feature defined by geomorphic analysis. It is interpreted to be indicating an underlying positive structural or stratigraphic element. These anomalies are shown on the Simpson Lake map area.

The precise nature of the stratigraphic section lying beneath the permits is not known. No wells have been drilled in the vicinity. However, regional considerations indicate execellent porosity can be anticipated in the Ordovician and Silurian sequence. The beds would be buried in the subsurface. Geologic field work showed that gentle structures are present in the area. These may be indicated by geomorphic anomalies mapped within the permit acreage. Thus, oil and gas prospects in permits 5500 and 5501 are moderate to good: porous reservoirs could be folded to form structural traps.

Respectfully submitted,

V. ZAY SMITH ASSOCIATES LTD

George M. Collins, P. Geol.

William Brown, Senior Geologist

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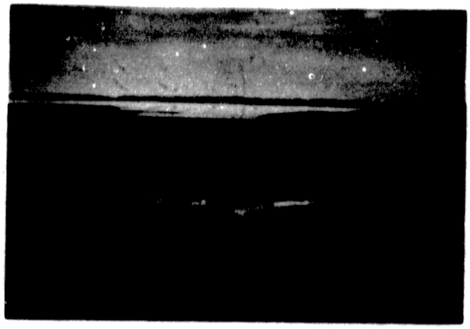

Plate 1 ·

Great Bear Lodge on Sawmill Bay.
View east toward Canadian Shield.

Plate 2

Exposures of La Martre Falls Formation of Ordovician age in stream cuts west of Hottah Lake.

Plate 1

Great Bear Lodge on Sawmill Bay
View east toward Canadian Shield

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Exposures of La Martre Falls Formation of Ordovician age in stream cuts west of Hottah Lake

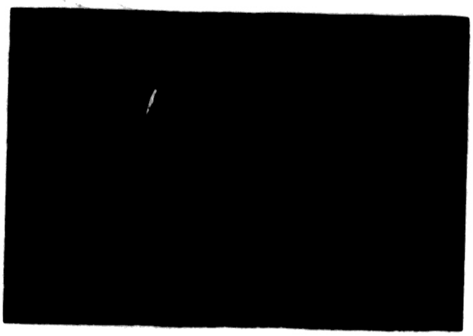

Plate 3

Algal mass in La Martre Falls Formation

Plate 4

Stromatoporoid in Chedabucto Lake dolomite of Upper Ordovician age.

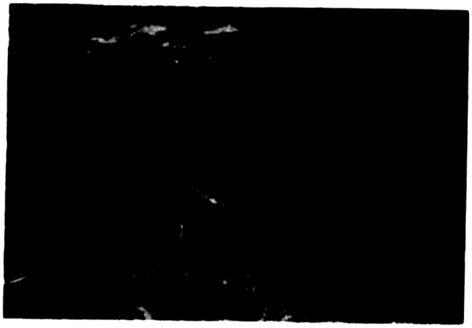

Plate 3

Algal mass in La Martre Falls Formation

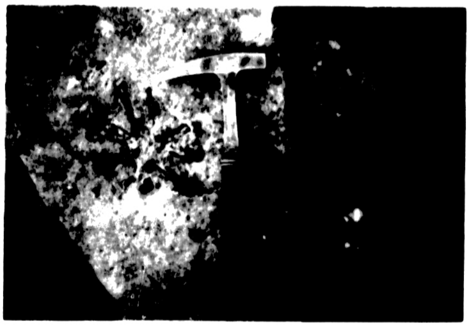

Plate 4

Stromatoporoid in Chedabucto Lake dolomite of Upper Ordovician age.

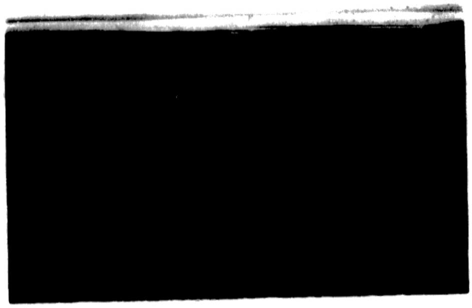

Plate 5

Exposure of Ordovician dolomites on anticline in permit 5499, Lac Maunoir area.

Plate 6

Stromatolite replaced by chert in Ordovician dolomites. Note vugs. Outcrop located east of permit 5499 in Interior Plains.

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Exposure of Ordovician dolomites on anticline in permit 5499, Lac Maunoir area

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Stromatolite replaced by chert in Ordovician dolomites. Note vugs. Outcrop located east of permit 5499 in Interior Plains

Plate 7

Exposure of Bear Rock limestone along Anderson River 12 miles, north of permit 5501.

Plate 8

Outcrops of mainly Hume limestone and Hare Indian shale high in stream cuts along Anderson River northwest of permit 5 01.

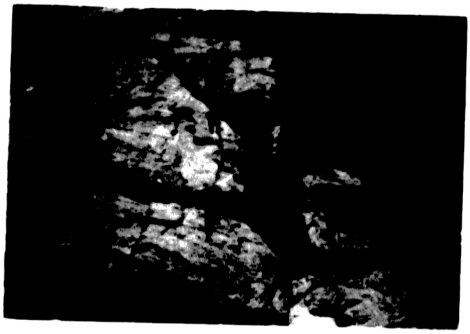


Plate 7

Exposure of Bear Rock limestone along Anderson River 12 miles, north of permit 5501.

Plate 8

Outcrops of mainly Hume limestone and Hare Indian shale high in stream cuts along Anderson River northwest of permit 5501.

V. Zay Smith Associates Ltd.

COMPOSITE

STRATIGRAPHIC SECTION

LOCATION: Hottah Lake Area

TOTAL: 700 ft.

INTERVAL:

Lower Chedabucto Lake Fm.
La Martre Falls Fm.
Precambrian crystalline rocks

LEGEND

- LIMESTONE
- SANDSTONE
- SHALE
- DOLOMITE
- GYPSUM OR ANHY
- SALT
- QUARTZITE
- IGNEOUS
- CHERT
- OOLITES
- IRONSTONE
- DOLOMITIC
- CALCAREOUS

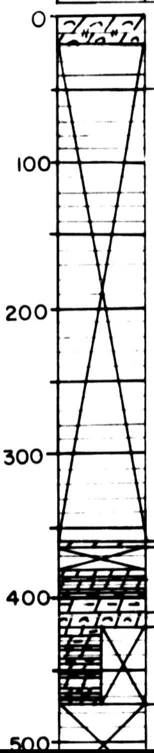
DESCRIBED BY: W. Brown

DATE: Summer 1967

REMARKS: Section constructed from widely scattered exposures north and west of Hottah Lake using representative regional dips in calculating projected thicknesses

SCALE: 1 inch to 100 feet

LITHOLOGY	DESCRIPTION



CHEDABUCTO LAKE FM. Top covered

Dol, gry, wthrs bf, v fn grnd, hard, v foss Paleofavosites, Catenipora, crinoids, etc.

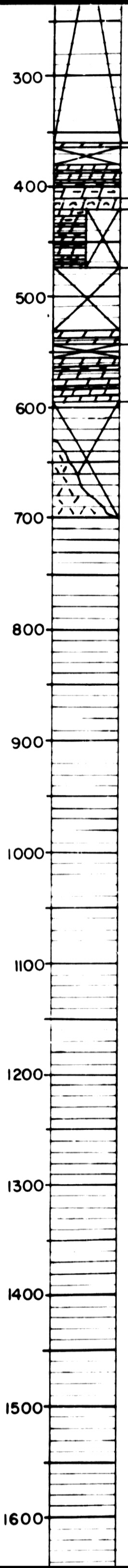
? LAMARTRE FALLS FM.

Covered. Contact placed near base of expos. above.

Dol, gry to bf, wthrs bf w/ occ blk Mn stain, aphan, hard, thn bdd.

Dol & sh, interbdd. Dol, gry, bf, yellowish maroon, hard, aphan to fn grnd, thn bdd. Sh, grn to gry & maroon, platy & lam, mottled in part. 3' bed ss in mid of int, grnsh gry, fn to med grnd, arg & dol, thn bdd.

Dol, med gry, aphan, algal masses up to 5'



Dol, gry to bf, wthrs bf w/ occ blk Mn stain, aphan, hard, thn bdd.

Dol & sh, interbdd. Dol, gry, bf, yellowish maroon, hard, aphan to fn grnd, thn bdd. Sh, grn to gry & maroon, platy & lam, mottled in part. 3' bed ss in mid of int, grnsh gry, fn to med grnd, arg & dol, thn bdd.

Dol, med gry, aphan, algal masses up to 5' diam. Exp at top of falls.

Dol & sh, beneath lip of falls. Appear similar to sxn above falls.

Dol, gry & brnsh gry, aphan to med. xln, hard, mass to med bdd. Foss?

Dol, dk gry to blk, wthrs rdsh brn, crinkly on wthrd surf, thn to med bdd w/ arg partings.

Covered. Prob sh, dol, ss. Deposited on irregular surf of p€ crystallines

V. Zay Smith Associates Ltd.

COMPOSITE

STRATIGRAPHIC SECTION

LOCATION: Mc Iver Arm Area, N.W.T

TOTAL: 2660ft.

INTERVAL:

Lower Chedabucto Lake Fm.
Unnamed Cambrian(?)-Precambrian clastics and carbonates
Precambrian igneous and metamorphic complex

DESCRIBED BY: W. Brown

DATE: Summer 1967

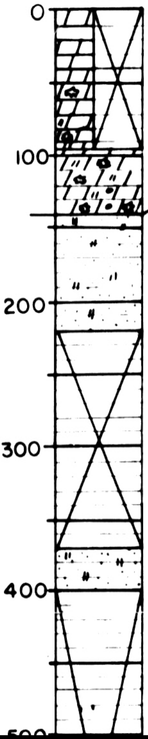
REMARKS: Section constructed from scattered exposures south and east of Mc Iver Arm of Great Bear Lake using representative regional dips in calculating projected thicknesses.

SCALE: 1 inch to 100feet

LEGEND

- LIMESTONE
- SANDSTONE
- SHALE
- DOLOMITE
- GYPSUM OR ANHY
- SALT
- QUARTZITE
- IGNEOUS
- CHERT
- OOLITES
- IRONSTONE
- DOLOMITIC
- CALCAREOUS

LITHOLOGY	DESCRIPTION



ORDOVICIAN

Chedabucto Lake Fm.
Dol, as below. Mainly covered. Top not exposed.

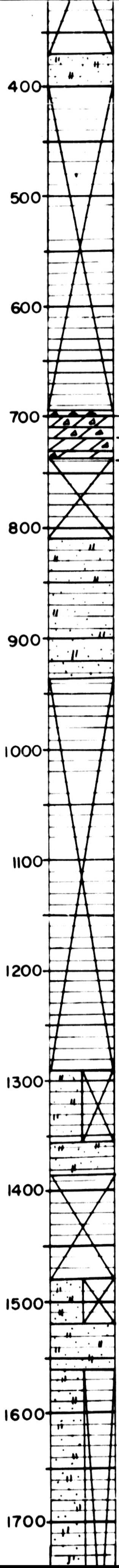
Dol, gry to brn, & grnsh gry, brecc & conglic, ang to sub ang frags to 3". Vry fn grnd matrix. Siliceous, calc.

PRECAMBRIAN

Frags of lt gry rndd qtzt & ang dk gry sltstn. Thn coating calcite on fracs. Foss.

Qtzt, gry to pnksh gry, fn grnd, well srtd. In upper part crser grnd w/ thin discontinuous dol partings & Cu staining.

Qtzt, lt buff, wthrs pnk to buff, mass / well srtd. Green lichen cover.



mass

Qtzt, lt buff, wthrs pnk to buff, / well srtd. Green lichen cover.

(turquoise?) stn.
Chert w/ Fe stn & green/

Chert & chert brecc w/discontinuous beds & masses dol.

Dol, white to buff, vry fn grnd, paper thn to med bdd (8") w/ nod chert.

Qtzt, fn grnd, lt gry to pnk, wthrs pnk, blocky, x-bdd.

Ss, rdsh brn to pnk, vry fn grnd, non-calc, platy, lt tan to pnk mottling.

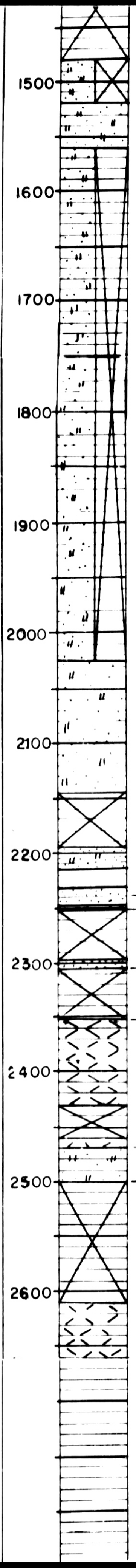
Qtzt, as below. Scattered outcrops.

Qtzt, pnk to gry, med to crs grnd, jntd & x-bdd.

Qtzt, as below. Scattered outcrops

Qtzt, pnk to buff & purplish, vry crs grnd, mass.

Qtzt, as above, largely covered.



Qtzt, as below. Scattered outcrops

Qtzt, pnk to buff & purplish, vry crs grnd, mass.

Qtzt, as above, largely covered.

Qtzt, pnk to buff, crs grnd, well sorted, green lichen cover.

Qtzt, as above

Ss, rdsh brn, thick bdd to mass.

Ss, grysh brn, fn grnd, arg, vry thn bdd (festooned). Underlain by mass brn ss.

Ss, tan to rdsh brn, mottled, vry fn grnd, well srtd, non-calc, thn bdd. Silicified, patches qtzt.

FAULT

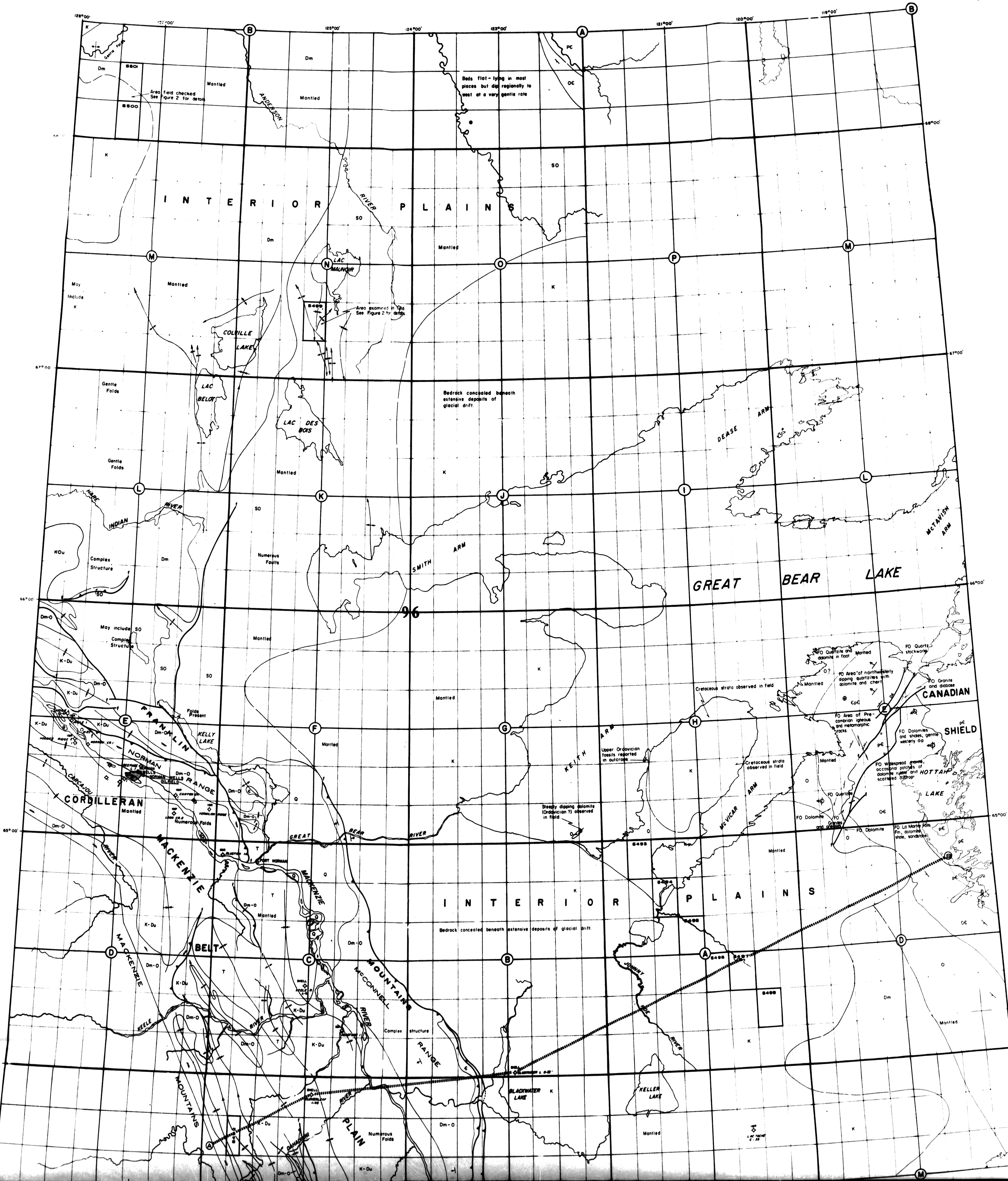
Diab , dk gry to grnsh blk, med grnd, hnblnd, aug (?), orth & plag fldspr.

Diab, as above but fn grnd.

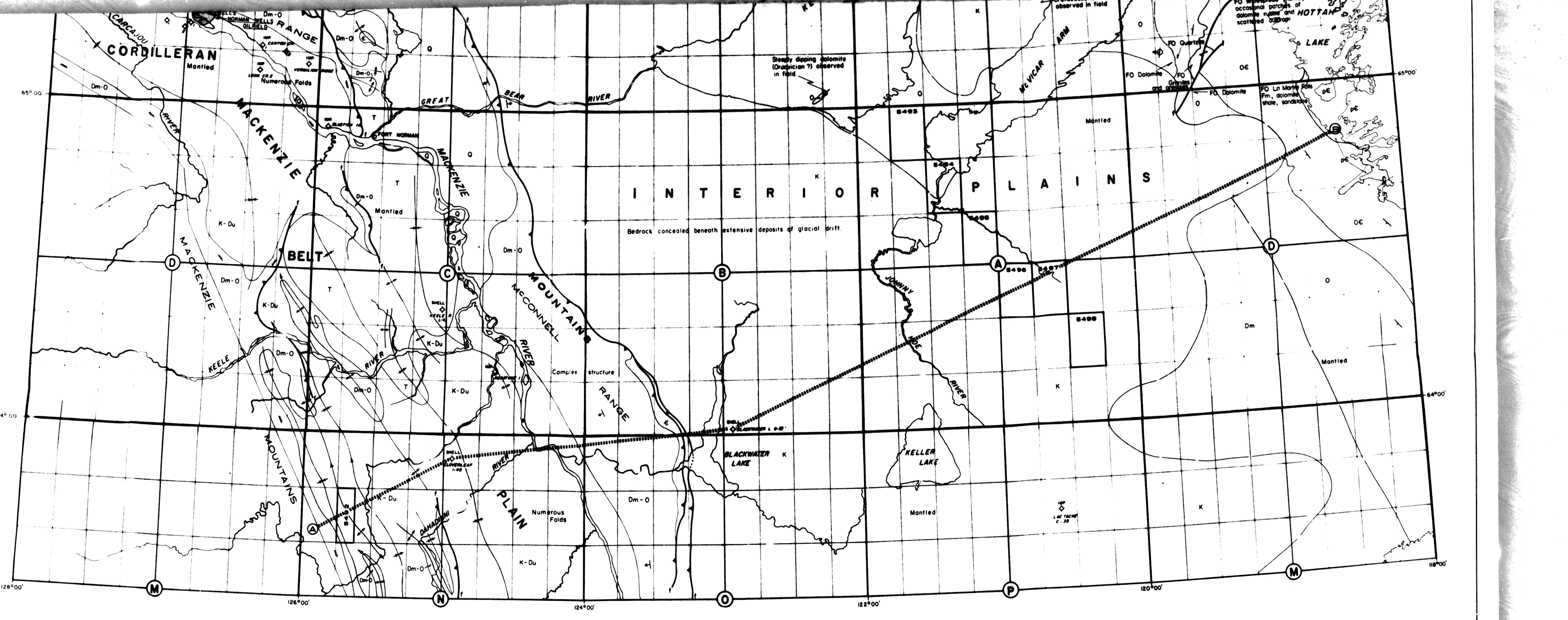
Qtzt, tan to pnk, fn grnd, well srtd, ripple marks, colum jntng.

Granite, gran gneiss, gran fldspr schist, hornfels.

FIGURE 1

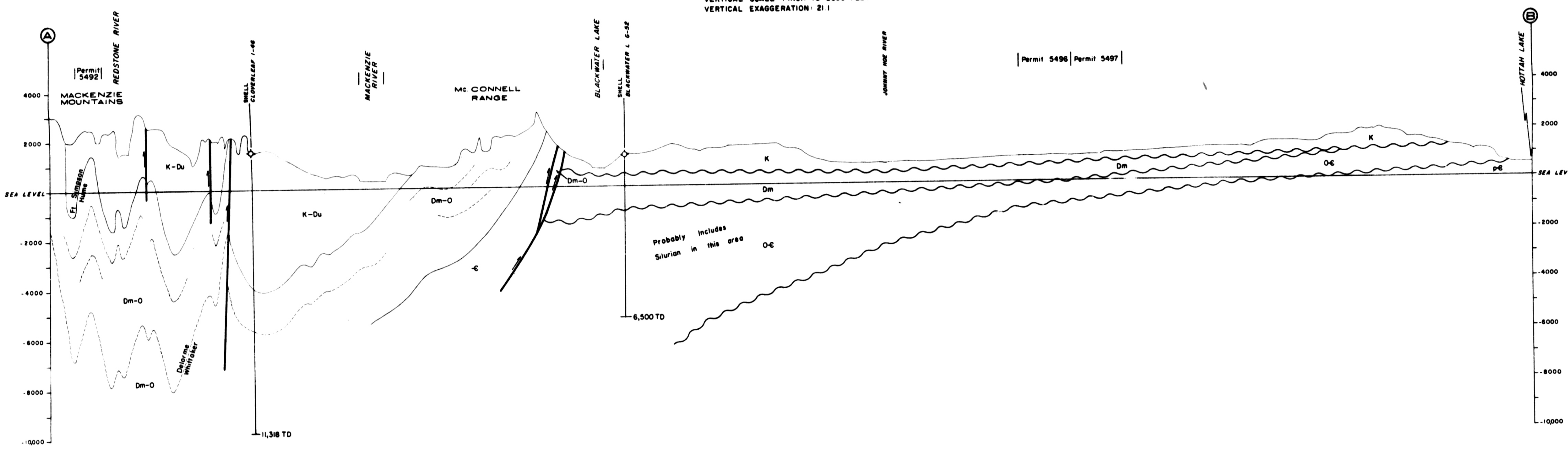


INTERIOR PLAINS
ANDERSON RIVER
Beds flat-lying in most places but dip regionally to west at a very gentle rate
Area field checked See Figure 2 for details
Area examined in field See Figure 2 for details
LAC MAUNOIR
COLVILLE LAKE
LAC BELOT
LAC DES BOIS
Gentle Folds
May include K
Bedrock concealed beneath extensive deposits of glacial drift.
DEASE ARM
HARE INDIAN RIVER
Complex Structure
Numerous Faults
SMITH ARM
GREAT BEAR LAKE
McTAVISH ARM
May include SO
Complex Structure
Folds Present
KELLY LAKE
FRANKLIN
NORMAN RANGE
CARCAJOU
CORDILLERAN
Numerous Folds
KEITH ARM
Upper Ordovician fossils reported in outcrop
Steeply dipping dolomite (Ordovician ?) observed in field
Cretaceous strata observed in field
McVICAR ARM
CANADIAN SHIELD
HOTTAH LAKE
GREAT BEAR RIVER
FORT NORMAN
MACKENZIE RIVER
MACKENZIE
BELT
INTERIOR PLAINS
Bedrock concealed beneath extensive deposits of glacial drift.
MACKENZIE MOUNTAINS
McCONNELL RANGE
MOUNTAINS
RIVER
Complex structure
JOHNNY HOE RIVER
KELLER LAKE
BLACKWATER LAKE
PLAIN
Numerous Folds
96



CROSS SECTION A–B

HORIZONTAL SCALE: 1 INCH TO 10 MILES
VERTICAL SCALE: 1 INCH TO 2500 FEET
VERTICAL EXAGGERATION: 21:1



LEGEND

AGE	SYMBOL	FORMATION		
QUATERNARY	Q	Mainly Recent alluvium, terrace deposits and glacial drift		
TERTIARY	T	Mainly gravel, sandstone, mudstone		
CRETACEOUS	K	Cretaceous shale and sandstone undivided		
CRETACEOUS through UPPER DEVONIAN	K-Du	Cretaceous through Upper Devonian shale and sandstone undivided		
MIDDLE DEVONIAN	Dm	Middle Devonian carbonate, shale, and evaporite undivided	Dm-O	Middle Devonian through Ordovician rocks undivided
SILURIAN and ORDOVICIAN	SO	Silurian and Ordovician carbonates, evaporites and clastics undivided		
ORDOVICIAN	O	Mainly Ordovician dolomite		
ORDOVICIAN and CAMBRIAN	O€	Ordovician and Cambrian carbonate, shale and sandstone		
CAMBRIAN	€	Mainly Cambrian clastics, carbonates and evaporites	€p€	Cambrian and Precambrian undivided
PRECAMBRIAN	p€q	Mainly Precambrian quartzite		
	p€	Precambrian crystalline rocks		

5500 — Exploratory permits held by Canada Trust Co.

GEOLOGICAL SYMBOLS

- Bedding appears horizontal on photographs
- Recognizable dip or less
- Dip group 1
- Dip group 2
- Dip group 3
- Dip group 4, 25° to 45°
- Dip group 5, 45° to nearly vertical
- Bedding appears vertical on photographs
- Overturned bedding
- General dip of beds having subordinate folds
- Dip and strike. Amount of dip cannot be estimated on photographs
- Dip component
- FO Field observed
- Field observed dip or component
- Field observed published dip
- Photo estimated dip
- PDS Possible dip slope
- SR Strike line of prominent ridge or bedding. Direction of dip cannot be determined on photographs.
- Fracture or joint
- DA Distinctive alignment, possible structural significance
- Fault, dotted where extended through Quaternary deposits
- Fault, position indefinite
- Fault, inferred
- Thrust fault, triangles on thrust sheet
- Trace of bedding in stream cut appears horizontal. May represent flat lying beds or strike
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- Anticline and syncline, position indefinite
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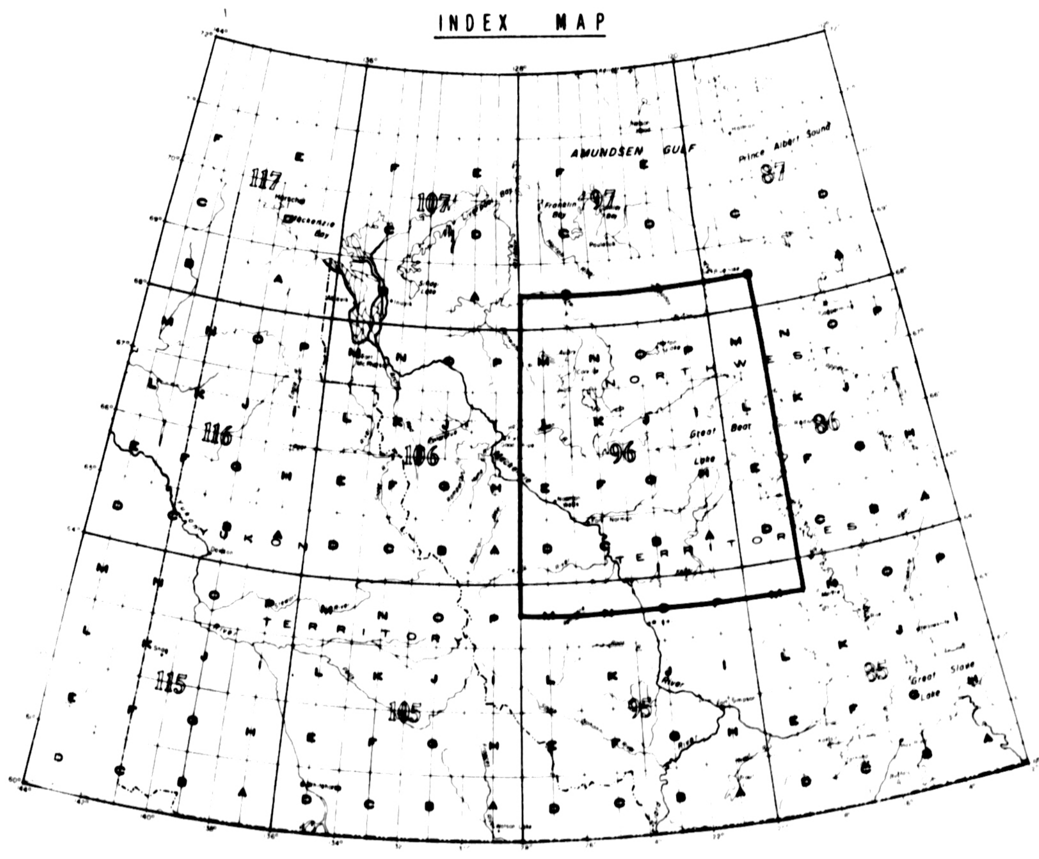
- Apparent unconformable contact
- Contact, dashed where indefinite
- Contact, inferred
- Key bed
- SB Stratigraphic break
- x Outcrop area
- x? Possible outcrop area
- Prominent scarp or steep slope
- Minor scarp or slope
- Glacial lineation indicating direction of ice movement

WELL SYMBOLS

- Well location or drilling well
- Dry and abandoned test
- Oil well
- Capped oil well
- Gas well
- Capped gas well
- Oil and gas well
- Capped oil and gas well

INDEX MAP



Project Area

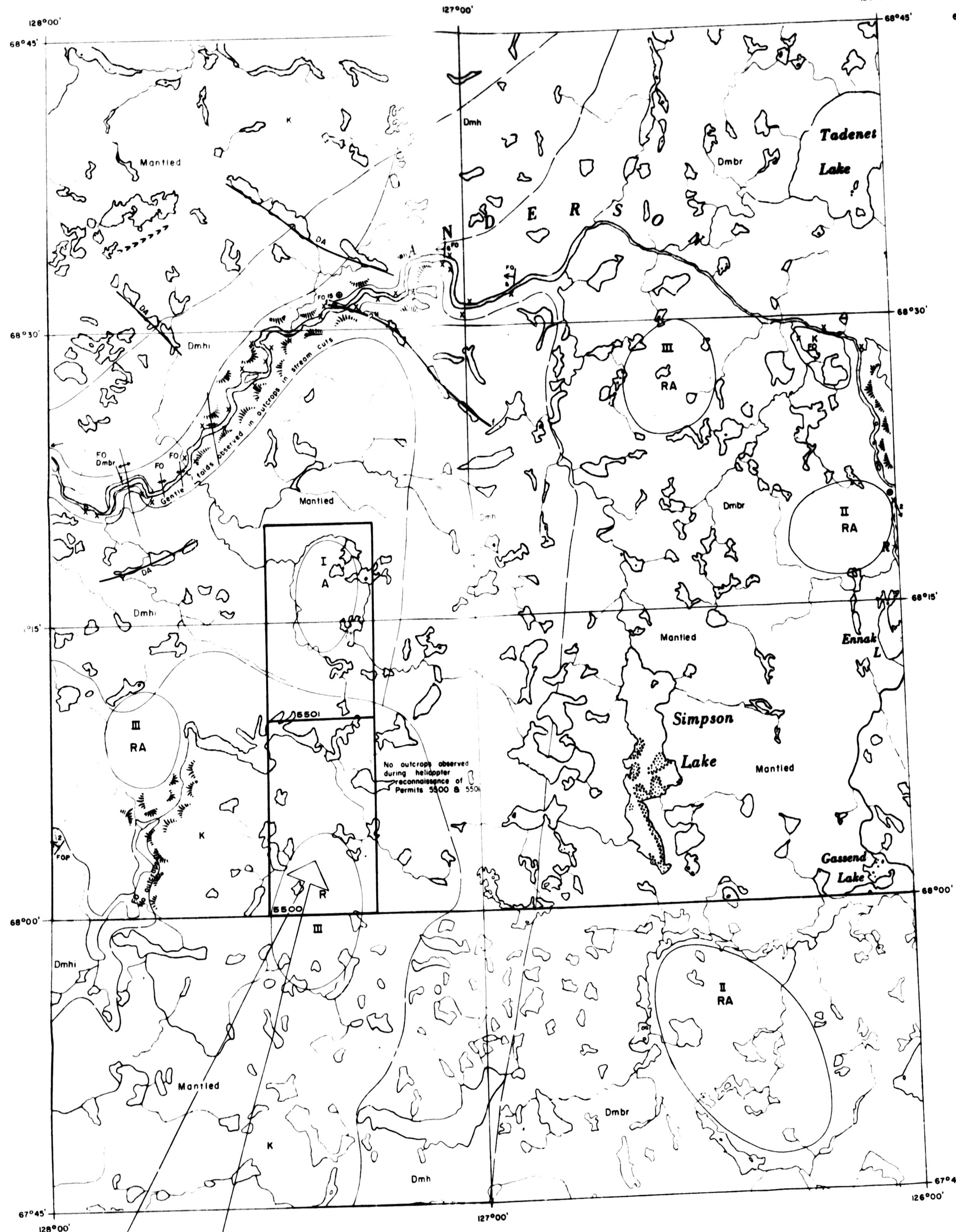
REGIONAL GEOLOGIC MAP OF THE

KELLER - MAUNOIR LAKES AREA

NORTHWEST TERRITORIES
COVERING PERMITS
5492 — 5501

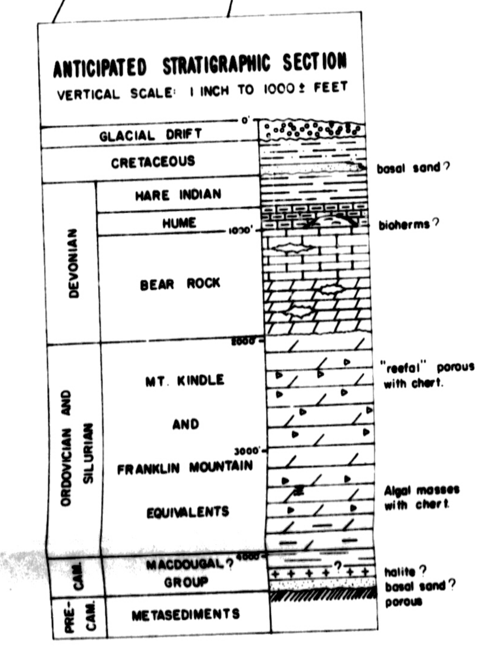
SCALE: 1 INCH TO 10 MILES

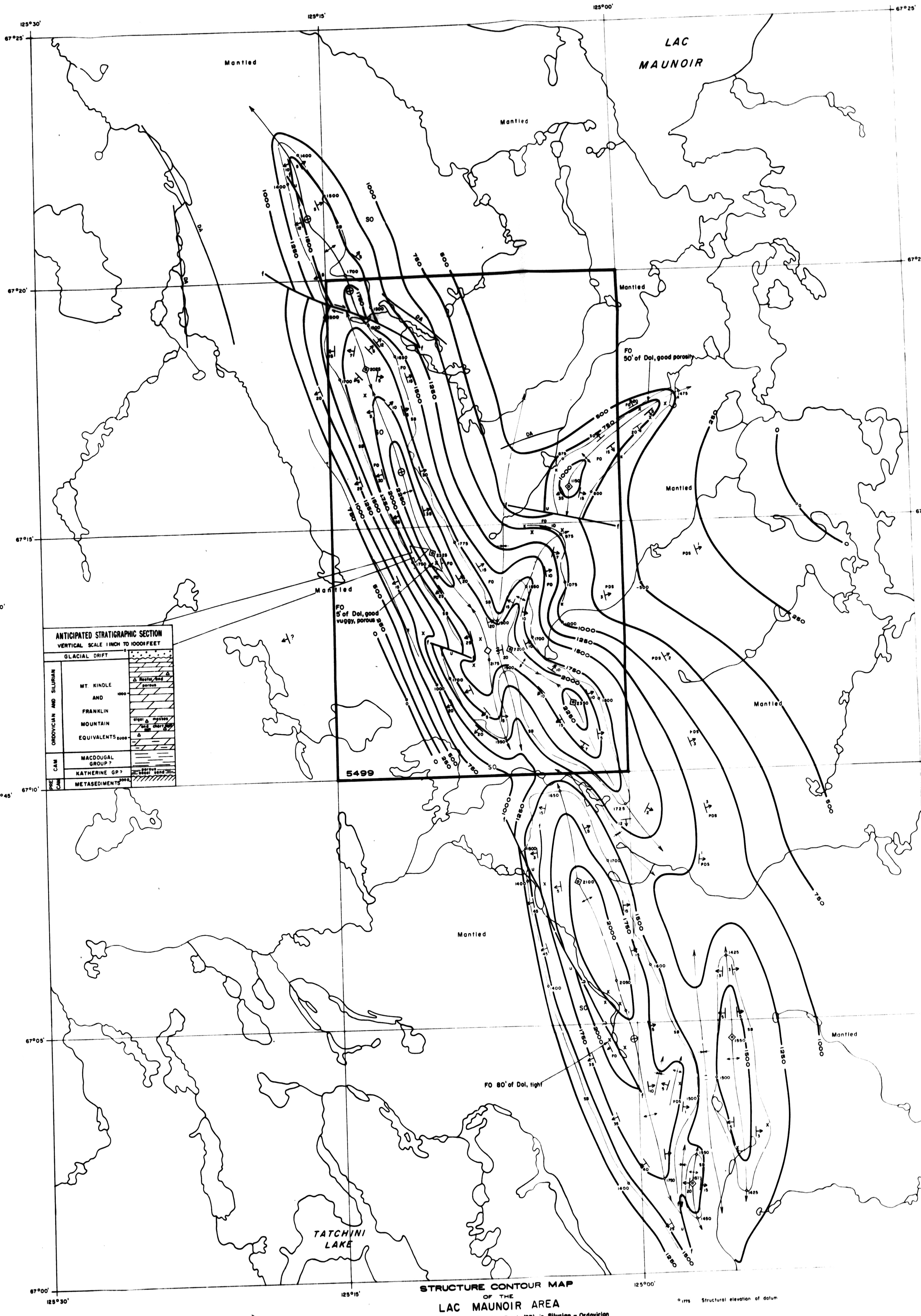
— Prepared by —
V. ZAY SMITH ASSOCIATES LTD.
CALGARY, ALBERTA
1968



SIMPSON LAKE AREA

SCALE: 1 INCH TO 4 MILES





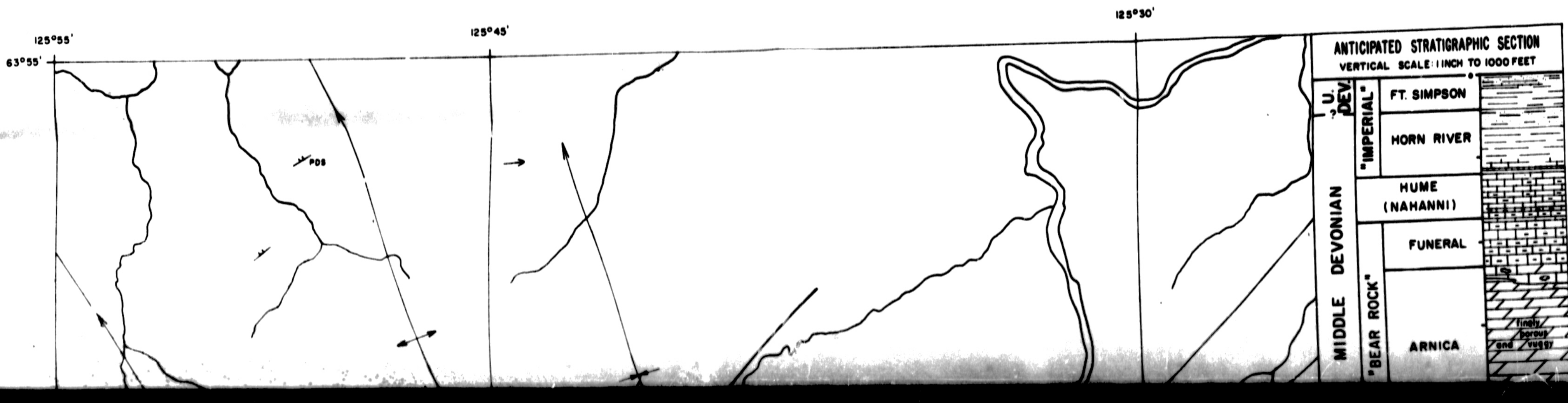
STRUCTURE CONTOUR MAP OF THE LAC MAUNOIR AREA

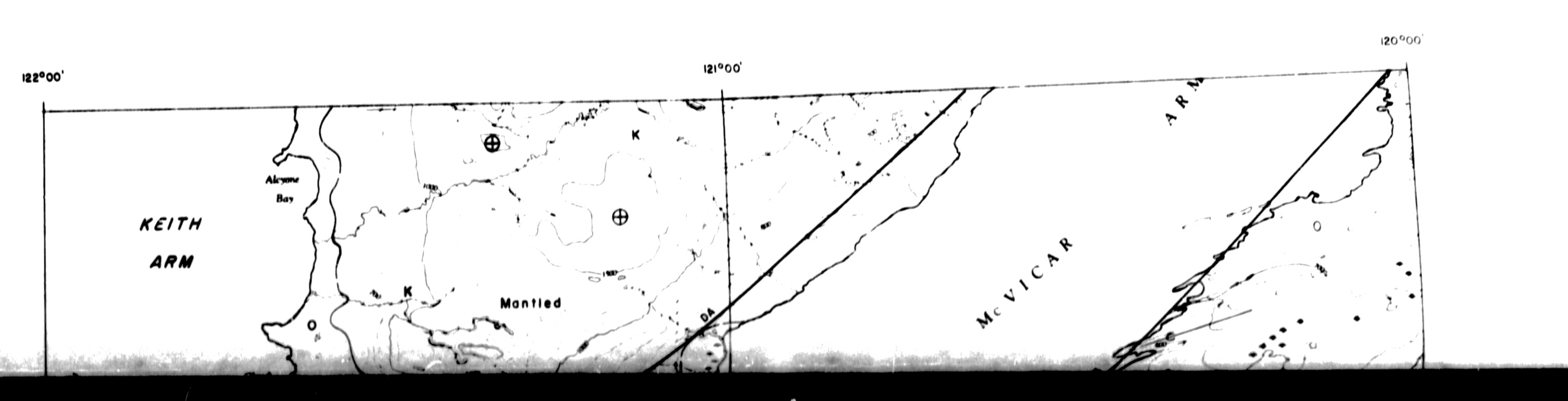
STRUCTURAL DATUM: Stratigraphic Break (SB) in Silurian – Ordovician

CONTOUR INTERVAL: 250 FT

SCALE: 1 INCH TO 1 MILE

◦1775 Structural elevation of datum





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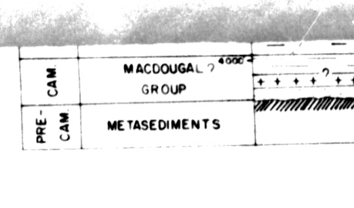

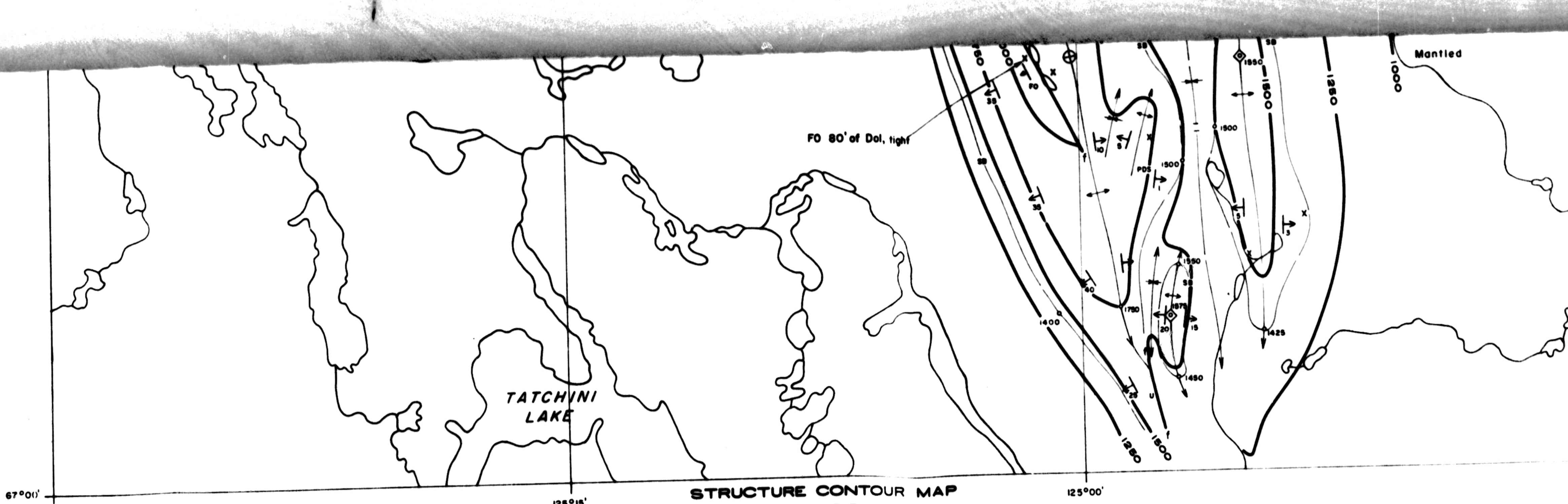

STRUCTURE CONTOUR MAP
OF THE
LAC MAUNOIR AREA
STRUCTURAL DATUM: Stratigraphic Break (SB) in Silurian – Ordovician
CONTOUR INTERVAL: 250 FT
SCALE: 1 INCH TO 1 MILE

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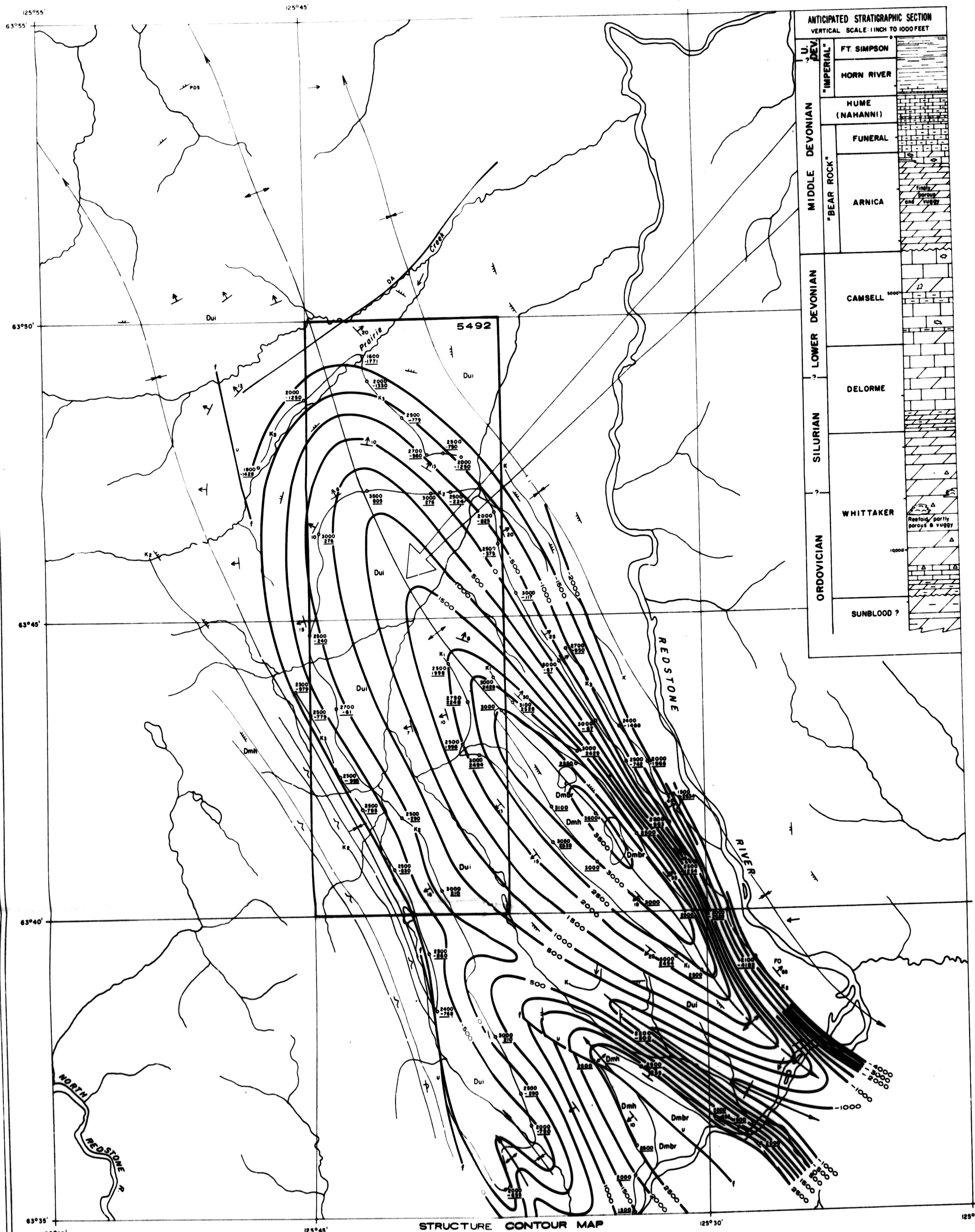
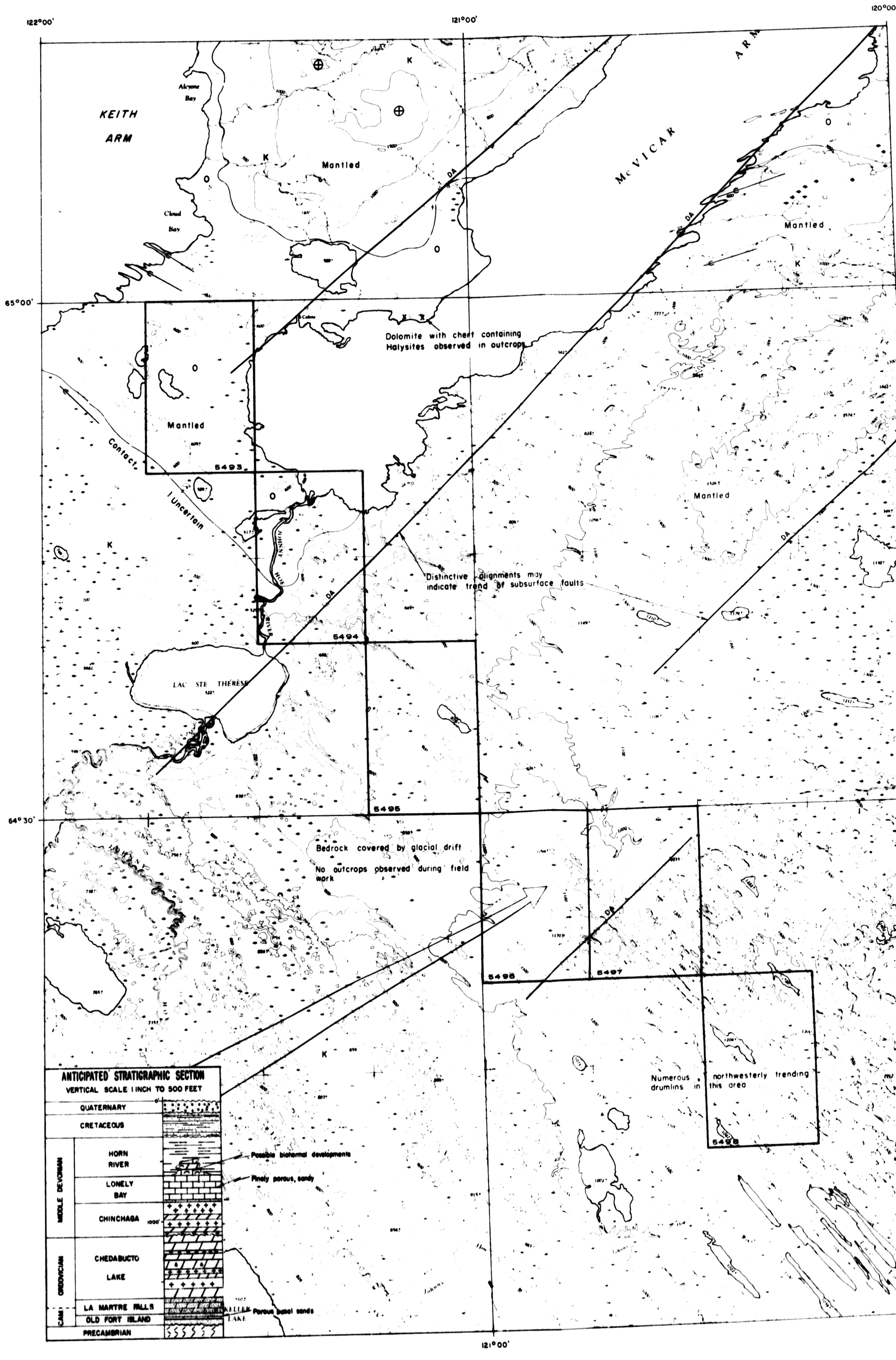


STRUCTURE CONTOUR MAP
OF THE
PRAIRIE CREEK AREA
STRUCTURAL DATUM: Top of the Hume Fm.
CONTOUR INTERVAL: 500 FT
SCALE: 1 INCH TO 1 MILE

• 3000 Ground elevation of structural control point
2429 Structural datum elevation



JOHNNY HOE RIVER AREA
SCALE 1 INCH TO 4 MILES

LEGEND

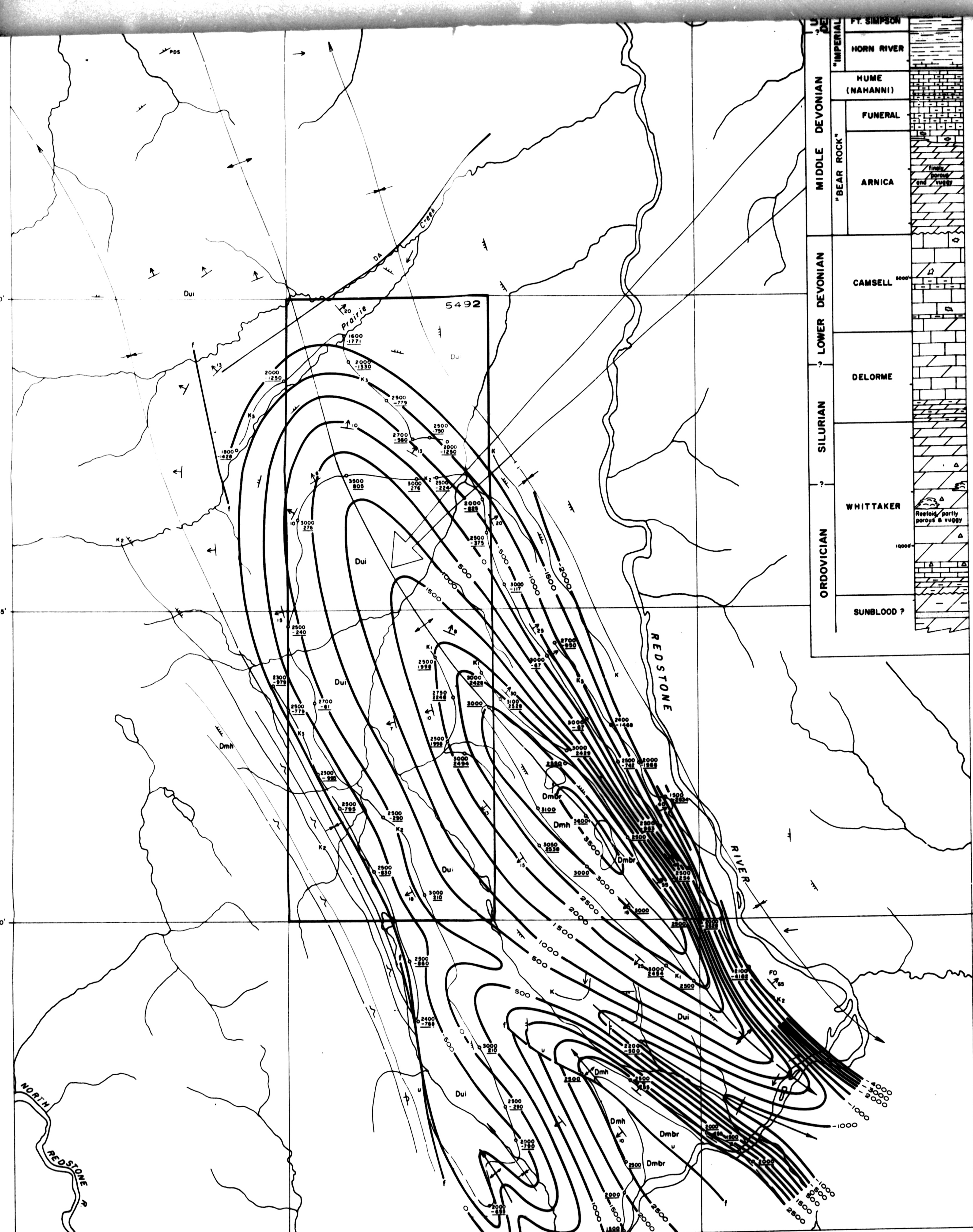
FORMATIONS

CRETACEOUS	K	Cretaceous, shale and sandstone undivided
	Dui	Imperial Formation, shale, sandstone. Includes Ft. Simpson and Horn River Formations
	Dmhi	Hare Indian Formation, shale

GEOLOGICAL SYMBOLS

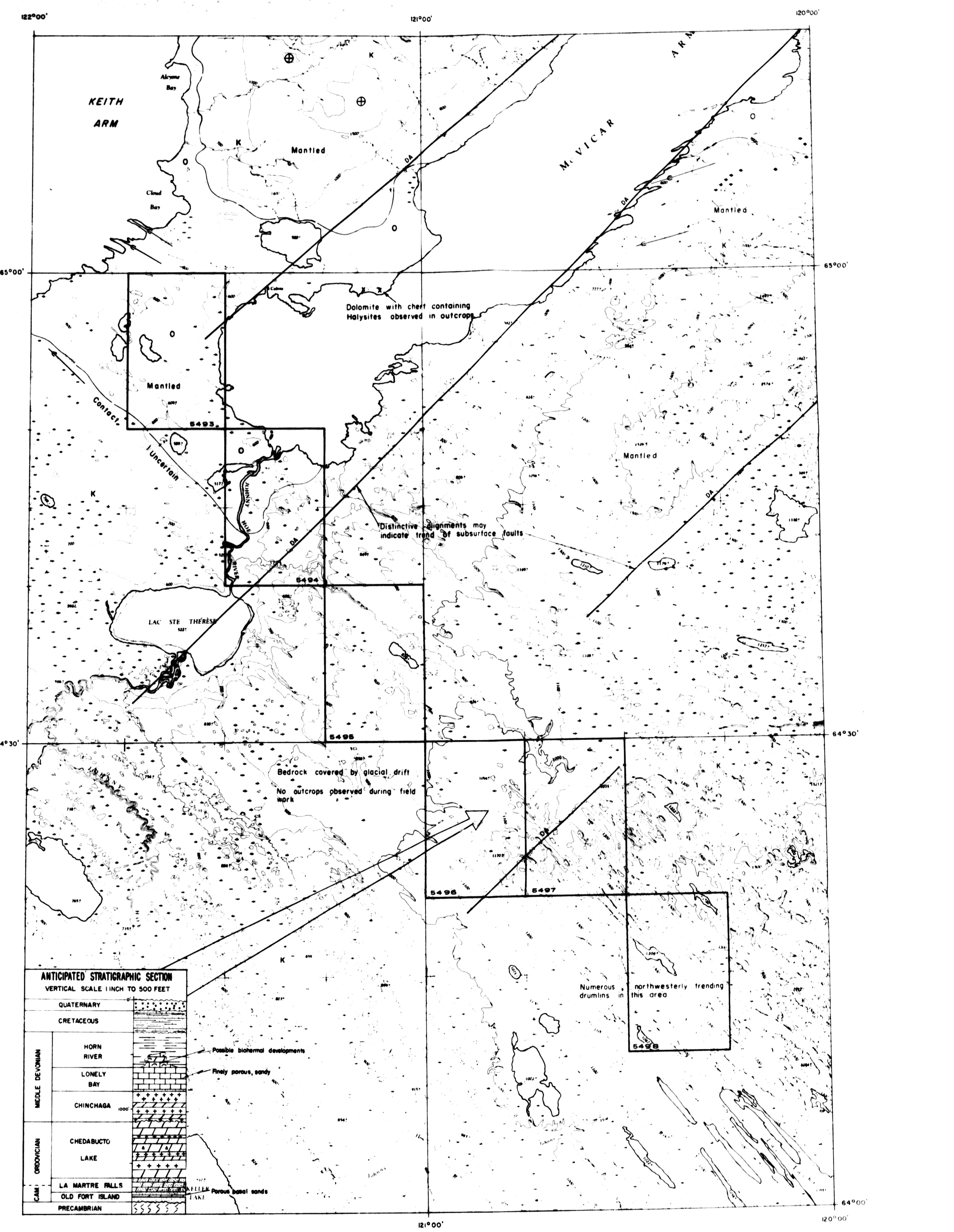
- ⊕ Bedding appears horizontal on photographs
- Dip group 1, 1° to 3°
- Dip group 2, 3° to 10°
- Dip group 3, 10° to 25°
- Dip group 4, 25° to 45°
- Dip group 5, 45° to nearly vertical

DETAILED GEOLOGIC MAPS
COVERING PERMITS 5492 - 5501
IN THE



STRUCTURE CONTOUR MAP
OF THE
PRAIRIE CREEK AREA
STRUCTURAL DATUM: Top of the Hume Fm.
CONTOUR INTERVAL: 500 FT.
SCALE 1 INCH TO 1 MILE

• 3000 Ground elevation of structural control point
2428 Structural datum elevation



JOHNNY HOE RIVER AREA
SCALE 1 INCH TO 4 MILES

LEGEND

FORMATIONS

CRETACEOUS	K	Cretaceous, shale and sandstone undivided
DEVONIAN	Dui	Imperial Formation, shale, sandstone. Includes Ft. Simpson and Horn River Formations
	Dmhi	Hare Indian Formation, shale
	Dmh	Hume Formation, limestone (Nahanni)
	Dmbr	Bear Rock Formation; carbonate (includes Funeral and Arnica Formations in Prairie Creek Area)
SILURIAN and ORDOVICIAN	SO	Silurian and Ordovician; carbonate, undivided
ORDOVICIAN	O	Mainly Ordovician, dolomite

LITHOLOGIC SYMBOLS

- Limestone
- Sandstone
- Shale
- Dolomite
- Gypsum or anhydrite
- Salt
- Coal
- Igneous
- Chert
- Dolomitic
- Calcareous
- Brecciation
- Algal masses

GEOLOGICAL SYMBOLS

- Bedding appears horizontal on photographs
- Dip group 1, 1° 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
- Photo-estimated dip or component; FO indicates field observed
- Possible dip slope
- DA 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
- FO Field observed
- X Outcrop area
- Contact, dashed where indefinite
- SB Stratigraphic break
- G Glacial lineation
- K Key bed; subtended letter or number indicates local correlation

5500 Exploratory permits held by Canada Trust Co.

GEOMORPHIC SYMBOLS

Geomorphic Anomaly: a surface feature defined by geomorphic analysis and interpreted to have possible structural and/or stratigraphic significance

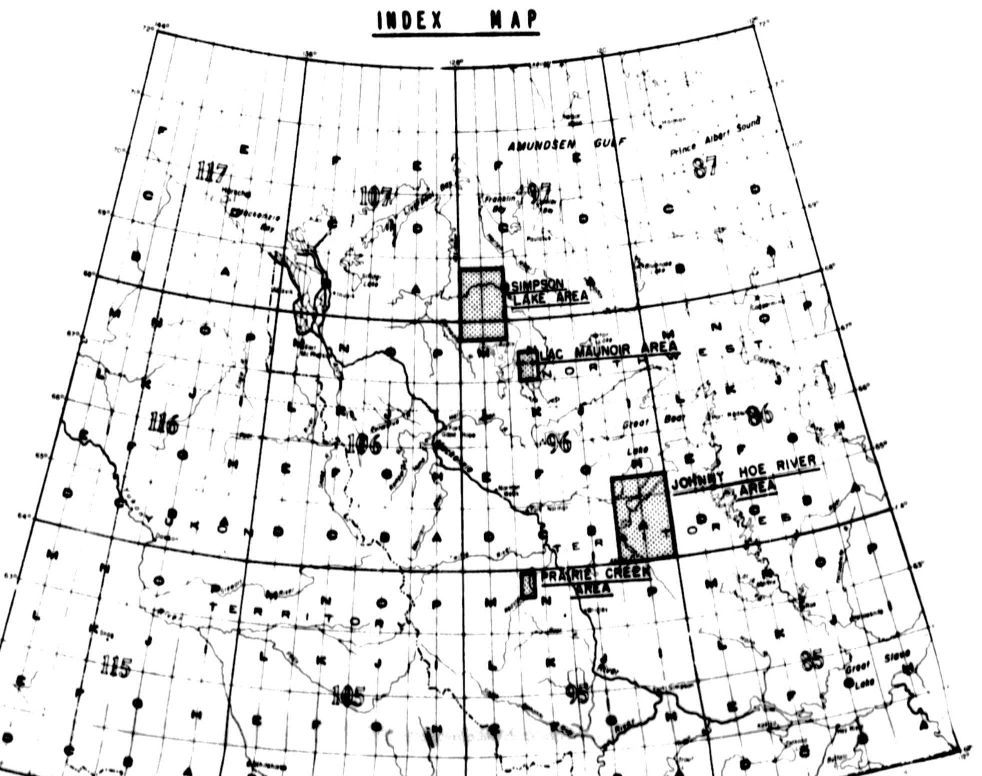
R II

- R Radial Drainage Anomaly
- A Annular Drainage Anomaly
- I Very well defined by geomorphic evidence
- II Well defined by geomorphic evidence
- III Moderately defined by geomorphic evidence

WELL SYMBOLS

- Well location or drilling well
- Dry and abandoned test
- Oil well
- Capped oil well
- Gas well
- Capped gas well
- Oil and gas well
- Capped oil and gas well

INDEX MAP



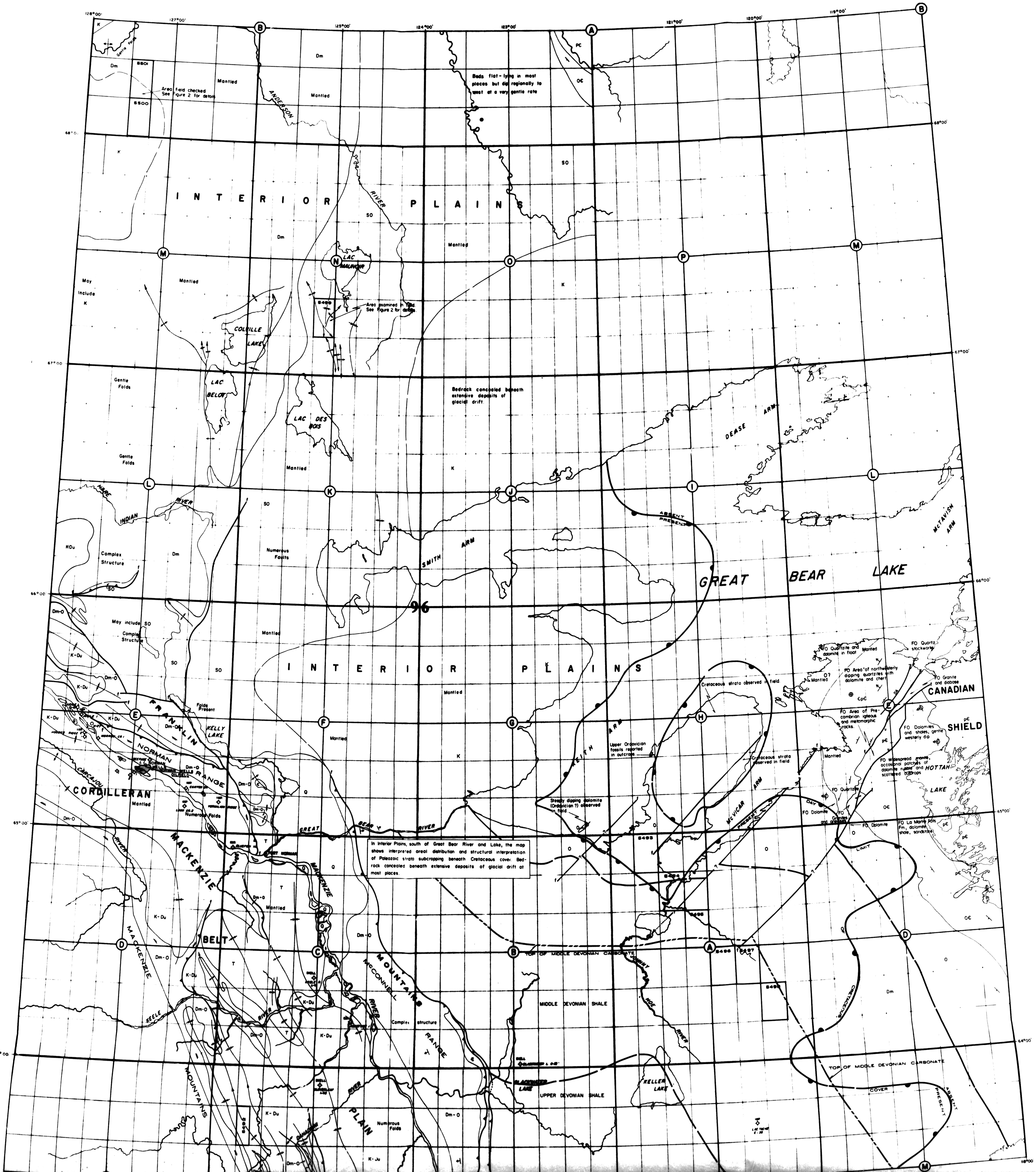
DETAILED GEOLOGIC MAPS
COVERING PERMITS 5492 - 5501
IN THE
PRAIRIE CREEK - JOHNNY HOE RIVER - SIMPSON LAKE - LAC MAUNOIR AREAS
NORTHWEST TERRITORIES

— Prepared by —
V. ZAY SMITH ASSOCIATES LTD.
1968

3 of 3

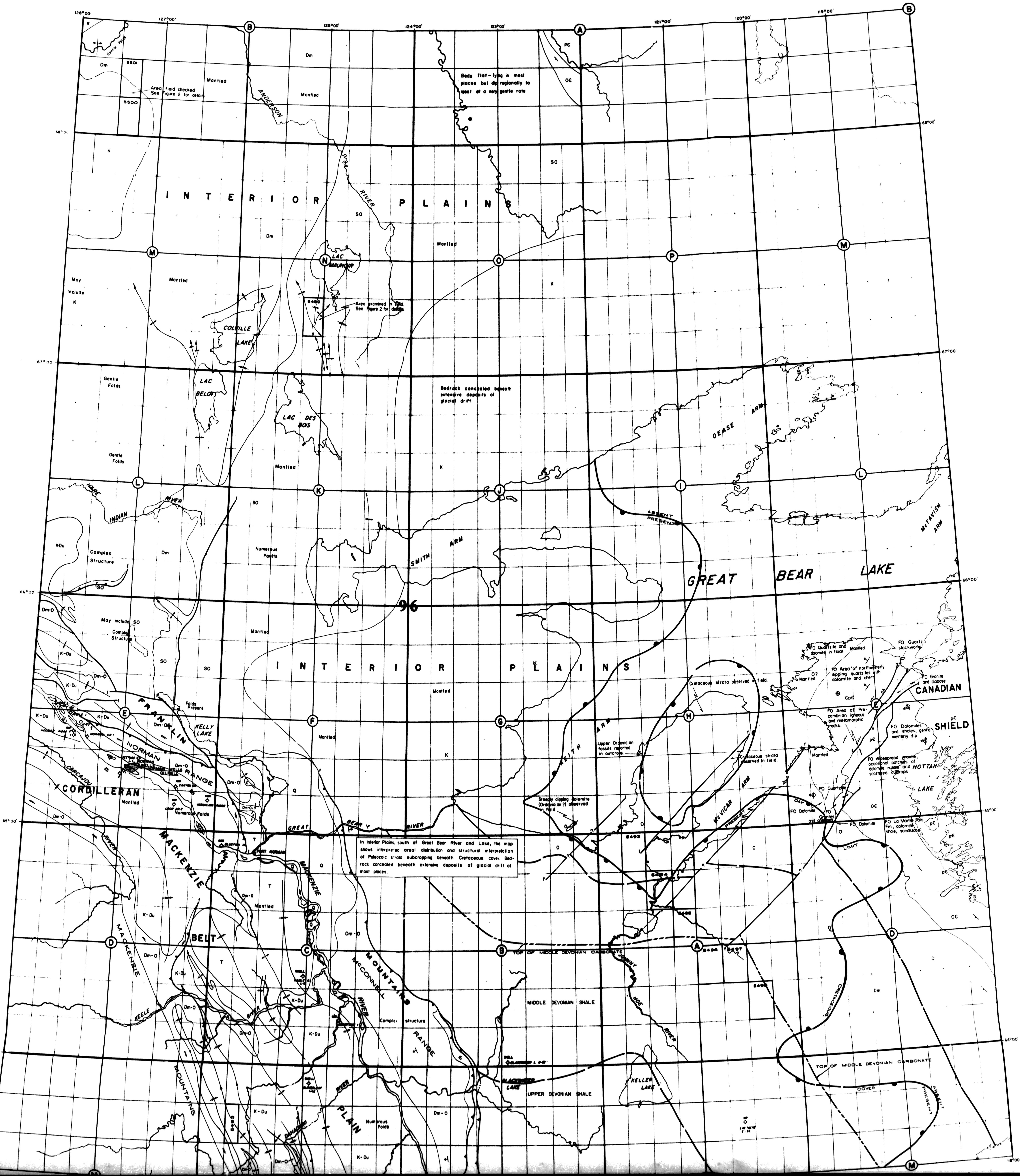
FIGURE 2.

FIGURE 1A



1 of 2

FIGURE 1A



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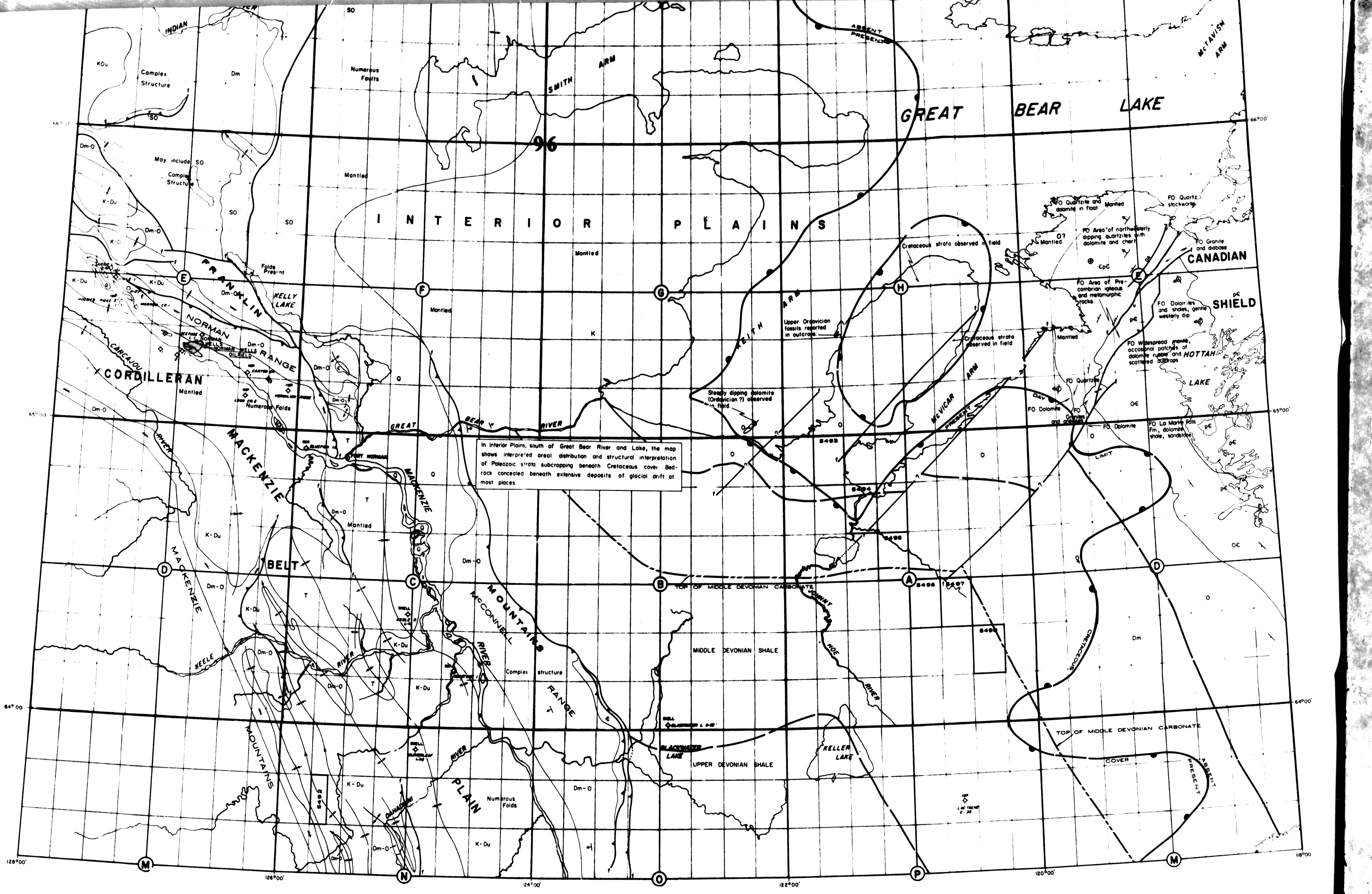

LEGEND

AGE	SYMBOL	FORMATION		
QUATERNARY	Q	Mainly Recent alluvium, terrace deposits and glacial drift		
TERTIARY	T	Mainly gravel, sandstone, mudstone		
CRETACEOUS	K	Cretaceous shale and sandstone undivided		
CRETACEOUS through UPPER DEVONIAN	K-Du	Cretaceous through Upper Devonian shale and sandstone undivided		
MIDDLE DEVONIAN	Dm	Middle Devonian carbonate, shale, and evaporite undivided	Dm-O	Middle Devonian through Ordovician rocks undivided
SILURIAN and ORDOVICIAN	SO	Silurian and Ordovician carbonates, evaporites and clastics undivided	Dm-O	Middle Devonian through Ordovician rocks undivided
ORDOVICIAN	O	Mainly Ordovician dolomite	Dm-O	Middle Devonian through Ordovician rocks undivided
ORDOVICIAN and CAMBRIAN	O€	Ordovician and Cambrian carbonate, shale and sandstone	Dm-O	Middle Devonian through Ordovician rocks undivided
CAMBRIAN	€	Mainly Cambrian clastics, carbonates and evaporites	€p€	Cambrian and Precambrian undivided
PRECAMBRIAN	p€q	Mainly Precambrian quartzite	€p€	Cambrian and Precambrian undivided
PRECAMBRIAN	p€	Precambrian crystalline rocks		

5500 Exploratory permits held by Canada Trust Co

GEOLOGICAL SYMBOLS

- Bedding appear horizontal on photographs.
- Recognizable dip 1° or less
- Dip group 1, 1° 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
- Bedding appears vertical on photographs
- Overturned bedding
- General dip of beds having subordinate folds
- Dip and strike. Amount of dip cannot be estimated on photographs
- Dip component
- FO Field observed
- FO S Field observed dip or component
- FOP S Field observed published dip
- S Photo estimated dip
- PDS Possible dip slope
- SR Stroke line of prominent ridge or bedding Direction of dip cannot be determined on photographs.
- Fracture or joint
- DA Distinctive alignment, possible structural significance
- Fault, dotted where extended through Quaternary deposits
- Fault, position indefinite
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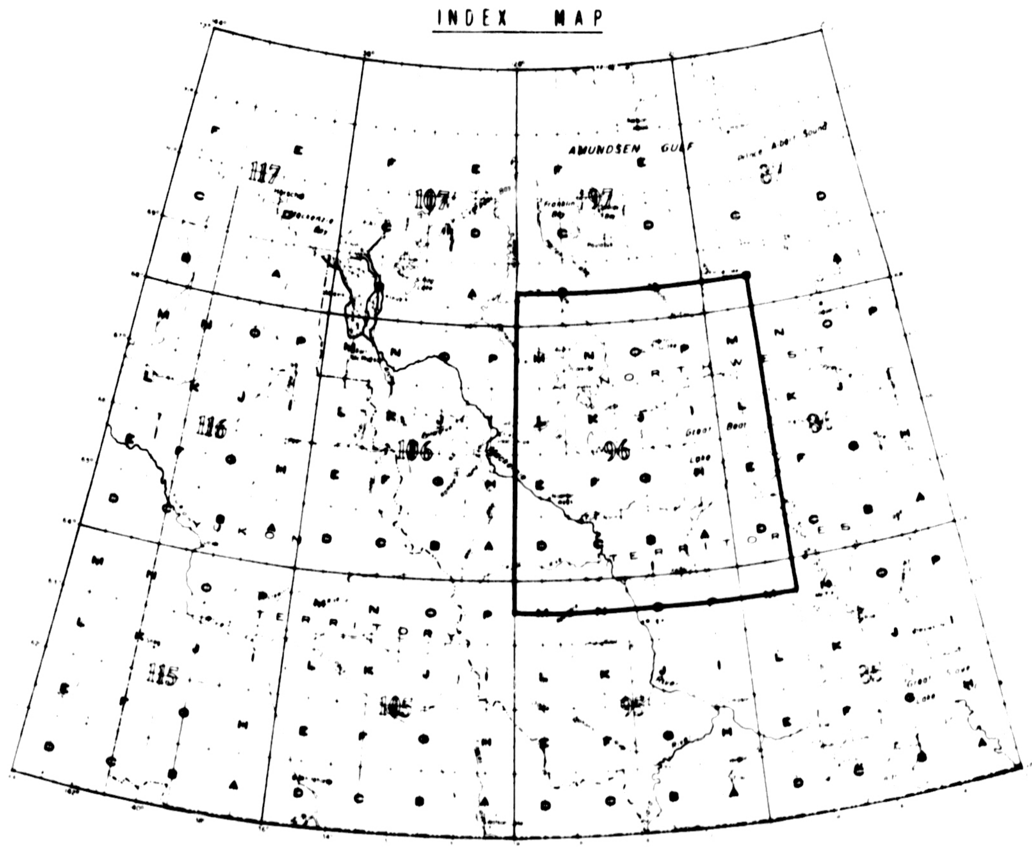

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SCALE 1 INCH TO 10 MILES

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