Geology

of

Horn Plateau Reef

Fort Providence Area, N.W.T.

GEOLOGY

OF THE

HORN PLATEAU REEF

FORT PROVIDENCE AREA

NORTHWEST TERRITORIES

Prepared By

V. ZAY SMITH ASSOCIATES LTD.

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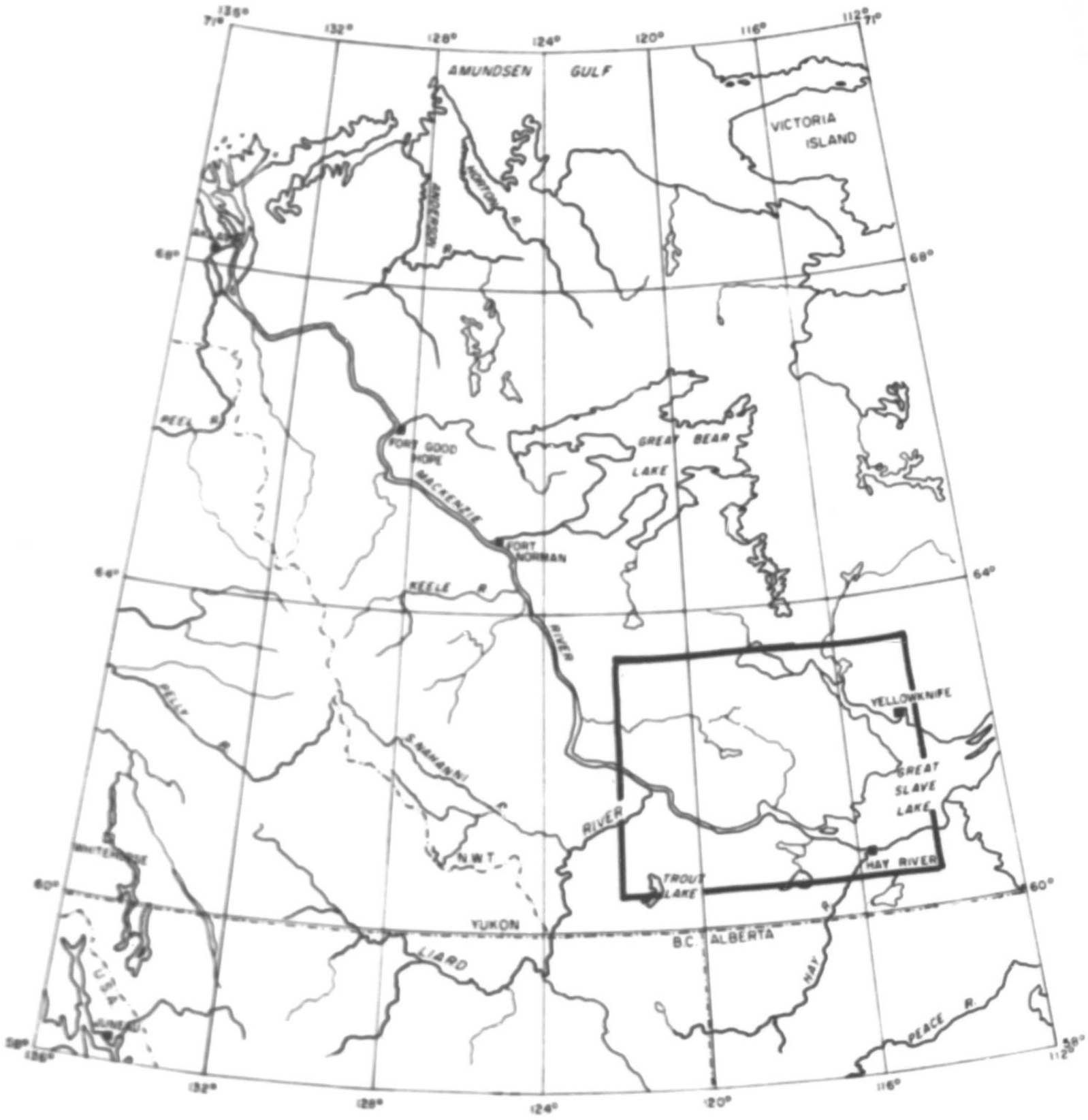


REGIONAL LOCATION MAP

OF THE

HORN PLATEAU AREA

SCALE: 1 inch to 140 miles

Project Boundary

V. ZAY SMITH ASSOCIATES LTD.

GEOLOGY

OF THE

HORN PLATEAU REEF

FORT PROVIDENCE AREA

NORTHWEST TERRITORIES

INTRODUCTION

Recent awareness of an unusual outcrop in the southern part of the Northwest Territories (Plate I) has created interest in potential new reef reservoirs. The exposure is located near Great Slave Lake, 55 miles due north of Fort Providence and immediately east of the Horn Plateau (see accompanying map). The outcrop is present on the flanks and crest of a dome-shaped hill. It is circular in plan, being 2,500 feet in diameter, and rises 88 feet above the level of the surrounding plain. The exposure occurs in an area of gently southwestward-dipping Devonian shales. The outcrop constitutes the only known occurrence of this reef facies which has been designated the Horn Plateau Formation by McLaren and Norris (1964).

A geological analysis of the Horn Plateau reef was begun in the late summer of 1965 and completed in the late fall. The purpose of the study was to establish the regional geologic setting of the reef, depict its physical dimensions, determine its lithologic character and depositional environment, and develop

ideas on its possible distribution in the subsurface of the Interior Plains of the southern Northwest Territories. This report also includes a brief review of the existing literature concerning the Horn Plateau Formation and discusses field and laboratory investigations and the maps and illustrations compiled during the study.

METHODS

Following a preliminary photogeologic study a field investigation of the Horn Plateau reef was conducted by V. Zay Smith Associates Ltd. in September, 1965. A fixed-wing aircraft was used for a reconnaissance survey and access for the purpose of ground study and sampling was provided by helicopter. A series of six samples was taken on the north face of the exposure at 5-foot intervals. These samples were studied in detail in the laboratory and are available for examination. Several color photographs were taken both on the ground and from the air.

The accompanying geologic map is drawn at a scale of 1 inch to 8 miles and is modified after geologic maps included in Geological Survey of Canada papers 58-11 (Douglas, 1959) and 59-11 (Douglas and Norris, 1960). A series of insets are included on the margin of the map sheet.

The formational nomenclature chart (Inset 1) illustrates the relationships of the more important geologic formations of the area.

Inset 2 shows the stratigraphic relationships in the subsurface by means of a diagrammatic geologic cross-section.

In order to depict the surface and near-surface configuration of the Horn Plateau reef, a structure contour map (Inset 3) with an interval of 25 feet was drawn on the surface of the reef body using a Kelsh photogrammetric plotter. This map is compiled at a scale of 1 inch to 500 feet.

A photogeologic study led to the preparation of the areal geologic map at a scale of I inch to 2,000 feet (Inset 4). It illustrates the geology and geomorphology of the area around the reef exposure.

Results of the sample studies were condensed in the form of a sedimentary environment diagram (Inset 5). This illustration depicts both the identification of the component fossil types and the sedimentary environment related to each sample.

The maps and illustrations incorporate information resulting from stereoscopic and geomorphic analyses utilizing topographic maps, airphotos and air photomosaics. Information from published sources, including wells, was also used.

REGIONAL GEOLOGY

GENERAL

The Horn Plateau reef is located at the east end of the Horn Plateau in southern District of Mackenzie. It forms a local dome-shaped hill, roughly circular in plan, which rises 88 feet above the surrounding terrain. It is 2,500 feet in diameter. The entire surface area is occupied either by areas of outcrop or near-surface bedrock obscured by thin mantle.

Although the exact age of the reef exposure is debatable, it is located at or near the Middle Devonian-Upper Devonian contact. The dominant lithology of the Devonian rocks flanking the reef outcrop is shale which provides only subdued topographic expression. These Devonian sediments dip southwesterly at rates ranging from 10 to 30 feet per mile. They are unconformably overlain by flat-lying, plateau-forming remnants of Cretaceous shales and sandstones. These more resistant Cretaceous outliers provide local relief sometimes exceeding 1,000 feet as in the case of the Horn Plateau.

Precambrian rocks of the Canadian Shield are exposed in the northeastern part of the project and are separated from the Devonian formations by a thin section of Ordovician rocks.

Bedrock in the low-lying areas is mantled by extensive glacial lake deposits. These extend northwest from Great Slave Lake to the Horn Plateau and south for a distance of 30 or more miles. Glacial drift also covers higher ground. At places drumlins are present and orientation of these glacial features is generally southwesterly with minor northwesterly trends.

STRATIGRAPHY

The igneous and metamorphic rocks of the Precambrian Shield in the northeast project area are overlain unconformably by Ordovician and possibly older Paleozoic strata. These reach a maximum thickness of 900 to 1,000 feet and include mainly dolomites, shales and sandstones.

Middle Devonian sediments exhibit complex facies changes in the vicinity of Great Slave Lake. East of the Horn Plateau the basal part is comprised of the Chinchaga Formation including mainly gypsum, limestone and dolomite with some salt and minor shale. The overlying Lonely Bay Formation includes about 120 feet of massive, slightly dolomitic and argillaceous limestone. The Lonely Bay is in turn overlain by the shales and limestones of the Horn River Formation which has a maximum thickness of slightly more than 300 feet.

Adjacent to the northwestern and southern shores of Great Slave Lake the stratigraphic position of the Lonely Bay and Horn River Formations are occupied by the Pine Point Formation overlain by local developments of Presqu'ile reef carbonates and Sulphur Point stromatoporoidal limestones with dolomite. On the northwest shore the Lonely Bay Formation is designated by Norris (1965) as the Lonely Bay Member of the Pine Point Formation. In the area of Pine Point development the shaly Horn River Formation undergoes a lateral change to a section consisting mainly of carbonates.

Massive, coarse-to fine-grained, vuggy dolomites of the Presqu'ile Formation crop out near the southern shore of Great Slave Lake and along the northwestern shore in the vicinity of Sulphur Bay where oil fills cavities in the dolomite. These reef developments pinch out about 20 miles north of Windy point. According to Douglas and Norris the limestone development of the Sulphur Point Formation undergoes an abrupt northward change from white stromatoporoidal limestone to brown and black shales of the Horn River Formation in the area west and north of Windy Point. Beds north of Sulphur Bay included by Cameron (1922) in the Slave Point Formation contain lower Upper Devonian fossils and are assigned by Norris (1965) to the Hay River Formation. He

considers the Slave Point Formation to be of late Middle Devonian age.

Norris (1965) also presumes the reefal beds of the Horn Plateau Formation to be of late Middle Devonian age and to occupy a stratigraphic position at the top of the Horn River Formation. He states that "some elements of the fauna range down into the Sulphur Point and Pine Point Formations, and some appear to be closely related to Upper Devonian forms".

Gussow (1965) believes that bioherm reefs and the off-reef shales associated with them are not of contemporaneous origin. He points out that reef growth requires crystal clear water and is therefore incompatible with the "muddy" water necessary for deposition of off-reef shales. According to this line of thinking the Horn Plateau Reef must be at least as old as the flanking Horn River shales and very likely older. Norris also states that the Horn Plateau Formation is overlain by Fort Simpson (Hay River) shale of early Upper Devonian age.

The Fort Simpson Formation consists of a sequence of greenish-grey to grey mudstones and shales which are approximately 1,800 feet thick in the Rabbit Lake area.

South of Mackenzie River the upper part of the Fort Simpson Formation includes a series of reefal limestones, shales and siltstones. In this area Norris maps the lower part of the Fort Simpson equivalent as Hay River Formation which includes two biostromal reef units near the top. For the purpose of this study the Fort Simpson terminology is retained south of Mackenzie River.

Near Kakisa Lake the Hay River Formation is overlain in sequence by the Alexandra, the "Upper Member" and the Tathlina. Both the Alexandra and "Upper Member" include reefal limestones while the overlying Tathlina is comprised of shales and siltstones. The latter is the uppermost Fort Simpson equivalent south of Mackenzie River.

Overlying the Fort Simpson Formation are, in ascending order, the Redknife, Kakisa and Trout River Formations. The Redknife consists mainly of sandstone, siltstone with some limestone. Both the Kakisa and Trout River Formations are comprised of sandy limestones and in some places the Kakisa limestones are reefal. The three formations have a combined thickness of more than 500 feet in Briggs Rabbit Lake No. 1. This does not include a total thickness of Trout River as the hole spuds in the Trout River Formation.

These southwesterly dipping Devonian sediments are unconformably overlain by about 1,000 feet of the Fort St. John Group of Lower Cretaceous age. It is made up mainly of grey concretionary shales. Youngest Mesozoic rocks present in the area are the sandstones and shales of the overlying Fort Nelson Formation, which form bedrock on the higher elevations of Horn Plateau and adjacent elevated areas. Cretaceous rocks are essentially flat-lying.

STRUCTURE

The area can be divided into two structural provinces: the Precambrian Shield and the Interior Plains. The complex Precambrian Shield occupies the northeastern corner of the map area north of Great Slave Lake. The Interior Plains are southwest of the Canadian Shield and are underlain by a relatively thin sedimentary veneer which dips gently away from the exposed edge of the Canadian Shield.

Structure in the Precambrian Shield consists of an intricate and complex system of folds and faults in metamorphic rocks and associated intrusives. A variety of fault trends are present. One dominant trend is southwesterly and a good example is the East Arm fault which parallels the south side of Great Slave Lake. Well developed southwesterly fault trends can be mapped in Precambrian exposures in the Canadian Shield along the southern shore of Great Slave Lake. In some places these faults can be

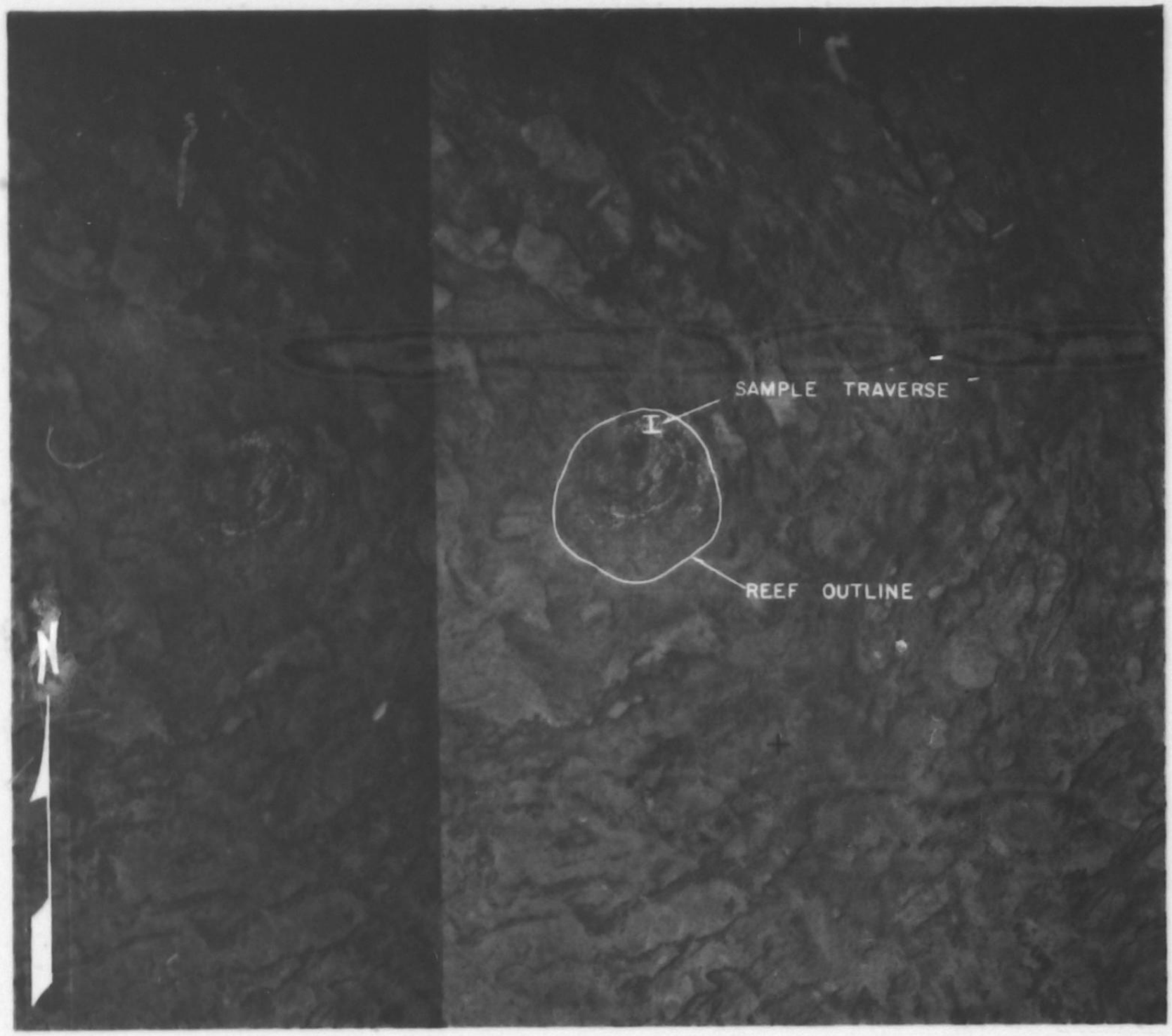
projected to the southwest beneath the sedimentary cover on the basis of aeromagnetic data. Two such inferred faults are indicated in the southeastern part of the map area. Another fault trend commonly observed in the Precambrian Shield is northwesterly.

Regional structure of the sedimentary rocks in the Interior Plains is essentially a gentle homocline. The beds strike northwesterly to westerly and dip southwesterly to southerly away from the Canadian Shield at rates ranging from about 10 to 25 feet per mile near the Shield to about 30 to 50 feet per mile in the southwestern part of the map area. Local structures in the Interior Plains are formed mainly by gentle to moderate folds and faults which tend to follow pre-existing trends developed in the basement. Southwesterly and northwesterly trending fractures, or "lineaments", were observed and mapped by Douglas and Norris (1960) in Ordovician beds northwest of Great Slave Lake. A few northerly oriented lineaments were also mapped. Closely spaced drill holes south of Pine Point indicate the presence of several gentle to moderate anticlines and synclines in Middle Devonian strata. The fold axes trend southwesterly, sub-parallel to basement faults. Dense mineral exploration drilling in the vicinity of Windy Point on the northwest shore of Great Slave Lake indicates some local folds and faults. The common orientation of lineaments is west-southwesterly to westerly according to Norris (1965). The Rabbit Lake fault mapped southwest of Fort Providence appears to offset Cretaceous beds and is probably of Laramide age. The fault trends southwesterly.

Several distinctive alignments were observed on air photographs, during the photogeologic study in the vicinity of the Horn Plateau reef. The dominant trend is southwesterly although some northwesterly trends were noted. Distinctive alignments are interpreted to represent fractures, faults or joints.

Several broad structures are present in the Interior Plains. One is the Fort Rae arch. It is a Precambrian arch trending from Rae Point southwesterly toward Mills Lake. Stratigraphic evidence for this arch is apparent from outcrops discussed by Douglas and Norris (1960).

They describe an abnormally thin section of Ordovician rocks in the vicinity of Rae Point. The Fort Rae arch appears to join with a basement high, the Tathlina Uplift, located southwest of the Mills Lake, Rabbit Lake, and Kakisa Lake area. This feature was introduced by Sikabonyi (1959) and discussed by Douglas (1959) and Norris (1965).



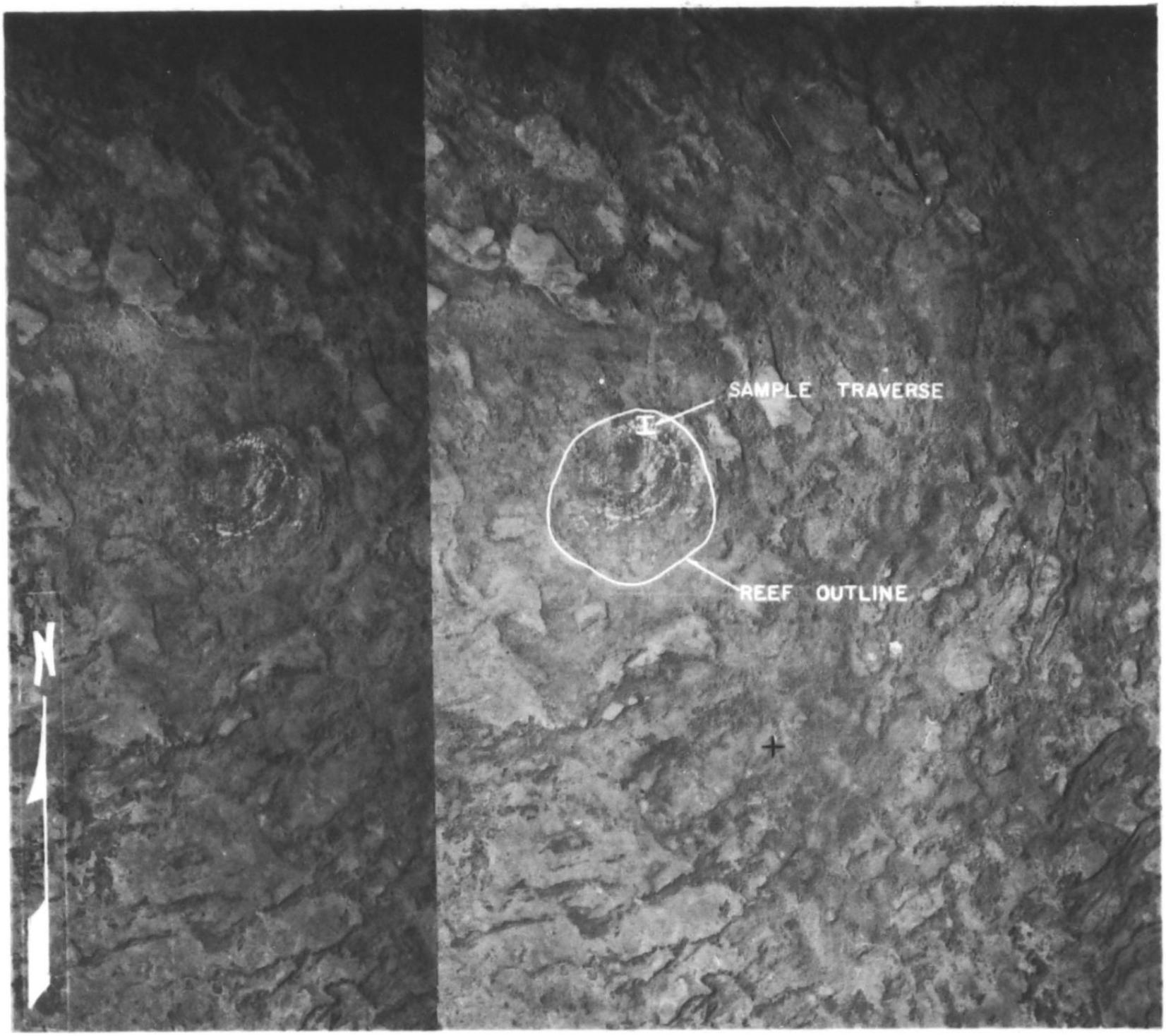
HORN PLATEAU REEF

VERTICAL AIRPHOTO STEREOSCOPIC PAIR

R.C.A.F. Photography Exposure No. A 11030 - 167 & 168

SCALE: 1 inch to 2750 feet

V. ZAY SMITH ASSOCIATES LTD.



HORN PLATEAU REEF

VERTICAL AIRPHOTO STEREOSCOPIC PAIR

R.C.A.F. Photography Exposure No. A 11030 - 167 & 168

SCALE: 1 inch to 2750 feet

V. ZAY SMITH ASSOCIATES LTD.

HORN PLATEAU REEF

The name Horn Plateau Formation was applied by McLaren and Norris (1964) to an incomplete section of about 40 feet exposed in a small circular hill located 55 miles north of Fort Providence. The section is described as a light to medium brown, thin to thick-bedded to massive, fine-to very coarse-grained bioclastic limestone. The lower part contains an exceedingly rich fauna consisting mainly of brachiopods, and the upper part contains numerous corals. One intriguing aspect is that most of the fauna have not been observed in the Devonian section elsewhere in the southern part of the Northwest Territories. The Horn Plateau reef appears younger than the Pine Point Formation and is probably correlative with or younger than the Sulphur Point, Presqu'ile, Slave Point and Kee Scarp Formations.

APPEARANCE

On vertical air photographs the Horn Plateau reef forms a well-defined dome-shaped hill which stands out in sharp contrast to the surrounding featureless tree-covered plain. The hill stands 88 feet high and is visible in profile from as far as 15 miles. If approached from a high altitude, it blends with the landscape and is almost indiscernible. In a close-up aerial view, reef exposures can be seen scattered over the hill. The best exposures occur on the north slope. Bedding is moderately expressed on the upper flanks of the hill and appears to be essentially flat. Some gentle dip away from the outer flanks can be seen, however, (Photogrammetric measurements compiled using a Kelsh plotter indicates an easterly dip in one place at the rate of 47 feet per mile).

HORN PLATEAU REEF LITHOLOGY and SEDIMENTARY ENVIRONMENT

Laboratory inspection of the Horn Plateau reef samples disclosed the presence of lithologies typically present in a reef environment. These include mainly calcilutites, calcarenites and calcirudites. Calcilutites are limestones or dolomites composed mainly of calcareous rock flour, commonly the result of a back reef shelf environment. Calcarenites are limestone or dolomite composed of coral or shoal sand or of sand derived from the erosion of older limestones. Calcarenites commonly are found on both the fore reef and back reef flanks of the reef wall. Calcirudites are limestones and dolomites consisting of fragments of coral or shells cemented with a calcareous cement. Interstices are often filled with calcite, sand or mud. This lithology is commonly found near the reef wall on both the fore reef and back reef sides. It is formed by the breaking off and reworking of fossiliferous fragments from the main reef wall followed by induration.

Little is known of the true nature of the contacts between the Horn Plateau Formation and the adjacent rocks of the Horn River and Fort Simpson Formations. Norris (1965) presumes the Horn Plateau Formation "to overlie the Horn River Formation and ... to be unconformably overlain by the Simpson shale (Hay River Formation) of early Upper Devonian age". He further states that the Horn Plateau Formation "presumably interfingers with, and pinches out within either the upper part of the Horn River Formation or shales mapped as the lower part of the Fort Simpson". If the reef does extend to depth it seems logical to expect it to have been deposited at least contemporaneously with, or probably prior to, the accumulation of the flanking shales. In this case, the age of the Horn Plateau Formation would be Middle Devonian or, in part, early Upper Devonian.

Rocks of the Horn Plateau Formation are commonly referred to as "reef" rocks or "organic reefs" in the geological literature. These reefs are distinctly different from the "organic shoals" or "shoals" which are bioclastic sand deposits essentially lacking in the rigid organic skeletal framework characteristic of reefs. The skeletal

framework of reefs, which commonly have an encrusting algal material in direct association with corals and stromatoporoids, is referred to as the "organic lattice" and constitutes the reef wall. The reef wall is therefore recognized by an abundance of reef building forms. These often are locally associated with remains of other organisms of a nonreefing origin, the first growing on, and then fossilized in, the shower of bioclastic material which is carried into the reef wall, across it and down the slopes on either side by the action of waves and currents.

If the reef wall changes position frequently due to the many alterations in environmental factors, then the reef wall and flank areas become intermingled resulting in a "reef complex". The organic lattice and clastics of the reef complex will in this case interfinger in the fore reef position with the clastic calcilutites or "pasty" carbonates of the shelf environment, and in the back reef position interfinger with the chemically precipitated calcilutites and pelleted and oolitic limestones of the lagoonal environment which is back reef.

The term "reef platform" refers to the more normal sediments, usually limestones, deposited prior to reef growth. During such deposition, usually under fairly stable uniform conditions in widespread shallow seas, environmental factors may become conducive to reefing, thus providing a platform on which the reef mass can grow.

Inset No. 5 on the accompanying map sheet portrays the sedimentary environments involved in the growth of the Horn Plateau reef as based on sample studies. The left side of the chart is a graphic representation of the lithofacies and biofacies of the Horn Plateau reef. The lithofacies indicated at the top of the chart represent environments ranging from a chemically precipitated limestone on the right to a marine shale on the left. The corresponding sedimentary environments indicated at the bottom range from an evaporitic environment on the right through the back reef environments, the reef wall, to the fore reef environments on the left. A generalized curve has been plotted showing the locus of the environment in

the Horn Plateau reef. It shows that the sedimentary environments represented by the present-day outcrop ranges from reef wall to lagoonal (back reef). The fauna are classified according to the type of fossil to which they are most similar; i.e. "Heliophyllum Tp" refers to a coral resembling Heliophyllum, and "Thamnopora Tp" a coral resembling Thamnopora. A detailed description of the fauna of the Horn Plateau Formation is presented by McLaren and Norris (1964). The fauna consist mainly of the Heliophyllum and Thamnopora types in association with brachiopod fauna and occasional beds of crinoid ossicles or stem plates. Stromatoporoid remains are rare. The corals are commonly infilled with bioclastics grading upward in grain size from coarse-grained calcarenites, to a calcirudite. The brachiopods are found in the bioclastics or in a cream-colored limestone with a pasty to finely crystalline texture. The latter has been produced by chemical precipitation. The pasty limestone is a calcilutite, and its association with a crystalline limestone of evaporitic or semi-evaporitic origin indicates that the calcilutite has been at least in part chemically precipitated. This is often indicative of a back reef "lagoonal" environment of sedimentation. The unfragmented nature of the brachiopod remains indicates that they were fossilized in an undisturbed state in quiet water conditions compatible with the concept of a sheltered back reef shallow lagoon. The bedded crinoid ossicles represent the remains of a fauna that flourished either in the back reef area at a time when relatively deep conditions prevailed or in a quiet portion of the fore reef shelf area. In the latter case the crinoid debris would have been carried into the back reef area by storms of exceptional violence at high tide, or transported there via surge channels in the reef wall. The sediments show no textural evidence of the strong current action normally associated with such surge channels, and therefore apparently none were present.

REEF CONFIGURATION and POSTULATED DISTRIBUTION

The reef environment studies indicate that the fore reef portions of the Horn Plateau reef are not present at the outcrop examined. They may be obscured by the shale surrounding the present outcrop or partly removed by erosion. Beds located on the periphery of the hill upon which the outcrop is situated dip outwards at rates ranging from 1 to 6 degrees. These are presumed to be initial dips.

The depth to which the Horn Plateau reef extends, and its present subsurface configuration can be surmised to a degree by observing surface features and geology and by comparison with the subsurface characteristics of nearby areas in which reefing patterns are better known.

Wave-cut terraces at the east end of Horn Plateau and the presence of widespread Quaternary lacustrine deposits indicate the former presence of the ancestral Great Slave Lake. At one time it covered a much larger area and was probably 300 to 400 feet deeper than at present. The relatively flat terrain surrounding the Horn Plateau reef is modified by the presence of a very gentle topographic ridge extending northwesterly from the reef outcrop (see Inset No. 4). The topographic rise may reflect a similar ridge of reef buildup in the subsurface. A more subtle topographic high of greater size is also indicated and is believed to be a possible reflection of the subsurface extent of the reef body. Thus, a reef mass with the length of 4 miles, and perhaps more, is indicated. A width of around 2 miles is also suggested.

Southeast of the reef outcrop a series of curvilinear features, roughly concentric and parallel to the reef outcrop, are probably old shoreline remnants reflecting the reef configuration in the subsurface of that area by differential compaction over it. These are especially well expressed in the east and southeast of the reef outcrop at distances up to 8,000 feet and more away from the outcrop.

Limestone capable of providing a platform for growth of the Horn Plateau reef are known to exist in the subsurface area. Douglas and Norris (1960) mapped limestone beds of the upper Horn River Formation, exposed on Horn

of northeastern British Columbia show a strongly pronounced northwest-northeast structural fabric, a pattern which coincides with visible fault trends in the Canadain Shield and in areas of Laramide deformation. That this fault pattern persisted through Laramide time indicates the probable rejuvenation of many Paleozoic fault and structure trends. Reef fronts in the Slave Point of northeastern British Columbia are often oriented in a north-northwesterly direction. This could be partly a result of the influence of these structural trends on depositional environments. Similar patterns are also seen in northwestern Alberta and southern District of Mackenzie.

The presence of the Fort Rae arch southeast of the Horn Plateau reef may also have influenced the direction of reef buildup trends by providing a southwesterly trending line of differential elevations. The existence of the Fort Rae arch may also have been partly responsible for the areal distribution of lithologies bordering the northwestern end of the Elk Point basin as illustrated in the "Geological History of Western Canada" (1965). The fringing carbonate bank of the Winnipegosis-Keg River, the Presqu'ile barrier reef and the anhydrite-carbonate contacts of the Dawson Bay Formation are all oriented in a southwesterly direction.

EXPLORATION

The Horn Plateau reef offers an attractive target for oil and gas exploration. Prospecting could be undertaken more effectively and efficiently if stratigraphic relationships could be firmly established. This could be accomplished by a shallow stratigraphic drilling program in the vicinity of the reef. The local topographic highs existing southeast of the Horn Plateau reef should also be drilled to determine their significance. Thereupon, a detailed stratigraphic and structural analysis based on well data, outcrop information, field observations and photogeologic mapping should be undertaken and co-ordinated with geophysical data. This work would aid seismic programs in the definition of oil and gas prospects for testing by the drill.

Plateau outcrop. These are described as medium grey, medium-to thick-bedded, richly fossiliferous, often nodular, limestones. They are approximately 100 feet lower in section than the lowermost outcrop of the Horn Plateau reef and in the subsurface may provide the platform on which the reef is situated. However, these limestones may be local in extent. It is possible that they are absent in the vicinity of the Horn Plateau Formation and that the carbonates of the Lonely Bay Formation act as a platform. Its depth in the vicinity of the reef is approximately 250 feet which would imply a similar vertical dimension of the Horn Plateau reef.

Several local topographic highs are located in an area of otherwise featureless topography southeast of the Horn Plateau reef outcrop. These may result from near-surface reefs similar to the Horn Plateau reef and are perhaps located in a similar position stratigraphically. Stereoscopic inspection of these topographic highs indicates that their presence is definitely due to the presence of resistant near-surface masses which are tabular or circular in character and are masked by a thin cover of glacial and/or lacustrine deposits. It is unlikely, although possible, that these knolls are accumulations of glacial debris.

Evidence indicates that offshore conditions would more likely occur to the northwest or southwest of any reefs existing in the area since transgressing seas in both Middle Devonian and Upper Devonian time spread southward and southeastward from the Arctic through the vicinity of the present Mackenzie River basin.

Generalized trends considered most favorable for reef development are indicated on the areal geologic map. These are oriented in a northwesterly, southwesterly and southeasterly direction from the Horn Plateau reef in accordance with what appears to be the dominating lithologic and structural trends. Shoreline trends existing during the deposition of Horn River and Fort Simpson Formations, although located farther northeast, probably paralleled the edge of the present-day Canadian Shield of the Great Slave Lake area. Pre-Middle Devonian faulting in northeastern British Columbia and southern District of Mackenzie may have exerted a strong influence on sedimentary environments during the geologic history of the area. Stratigraphic maps

of northeastern British Columbia show a strongly pronounced northwest-northeast structural fabric, a pattern which coincides with visible fault trends in the Canadian Shield and in areas of Laramide deformation. That this fault pattern persisted through Laramide time indicates the probable rejuvenation of many Paleozoic fault and structure trends. Reef fronts in the Slave Point of northeastern British Columbia are often oriented in a north-northwesterly direction. This could be partly a result of the influence of these structural trends on depositional environments. Similar patterns are also seen in northwestern Alberta and southern District of Mackenzie.

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CONCLUSIONS

The southern part of the Northwest Territories is worthy of intense exploration. In addition to other potential reservoirs, the Horn Plateau Formation itself offers an attractive target which can be sought by conventional exploration techniques at reasonable drilling depths. Pipelines are, or soon will be, within 75 to 150 miles of the area. Future exploration and development will bring them into the southern Northwest Territories.

The outcrop of the Horn Plateau reef appears to be a product of pre-Pleistocene and Recent differential erosion having exposed a biohermal reef of Devonian age. It seems very unlikely that the unusual faunal assemblage is entirely unique to one isolated outcrop in the southern Northwest Territories. Greater areal distribution should be expected. Extensions of the Horn Plateau Reef can most logically be expected along southwesterly and northwesterly trends as shown on the accompanying geologic map.

If the distribution of the Slave Point and Pine Point carbonates in the Great Slave Lake area is controlled partly by post-Slave Point, pre-Fort Simpson erosion in contrast to lateral facies changes, as suggested by some workers, it is possible that the unusual outcrop of the Horn Plateau reef represents an erosional remnant formed at that time and subsequently exhumed by pre-Pleistocene and Recent erosion. However, one should expect its distributional pattern to follow the southwesterly and northwesterly trends resulting from basement control.

Respectfully submitted,

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REGIONAL GEOLOGIC SETTING OF THE HORN PLATEAU REEF

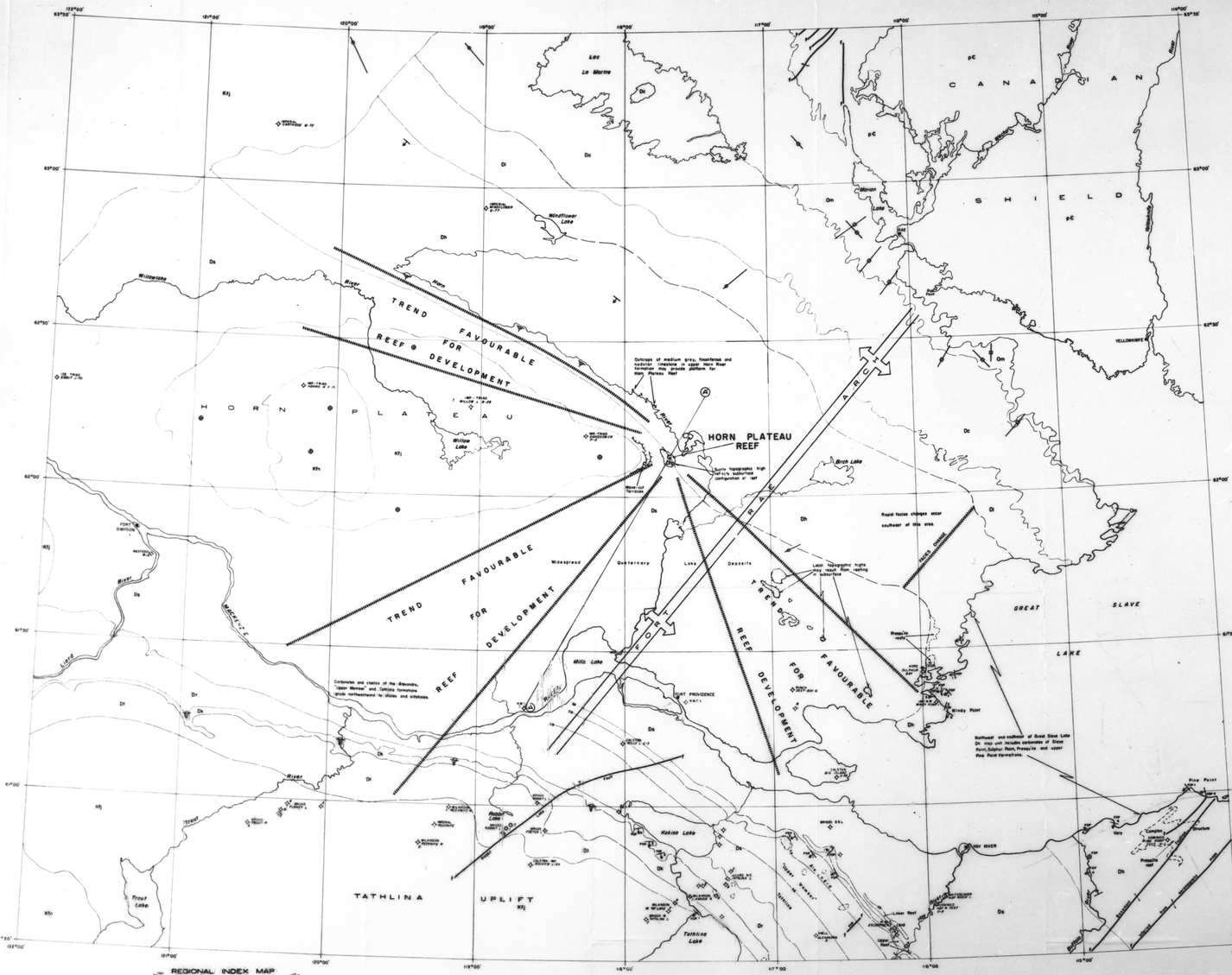
SCALE: 1 INCH TO 8 MILES

Geology modified after G.S.C. Papers 58-11 and 59-11 and G.S.C. Memoir 322

— Prepared by —

V. ZAY SMITH ASSOCIATES LTD.

NOVEMBER 1965



REGIONAL INDEX MAP

LEGEND

AGE	SYMBOLS	FORMATION
QUATERNARY	Q	Quaternary and recent alluvium, glacial debris etc.
CRETACEOUS	Kfn	Fort Nelson Formation - sandstone
	Kfj	Fort St John Group - shale
UPPER DEVONIAN	Dt	Trout River - limestone
	Dh	Kakisa - limestone, reefs
	Dr	Red Knife - sandstone, limestone
	Ds	Ref Simpson - shale (Carbonates and shale south of Mackenzie River), reefs
	Dhp	Horn Plateau - limestone, reef
MIDDLE DEVONIAN	Dh	Horn River - shale, limestone
	Dl	Landy Bay - limestone
	Dc	Chinchaga - evaporites, carbonates
ORDOVICIAN	Om	Mirage Point - dolomites, evaporites
PRECAMBRIAN	pC	Precambrian rocks undivided - igneous, metamorphic rocks

GEOLOGIC SYMBOLS

- Field observed published dip
- Recognizable dip if or less
- Bedding appears horizontal on photographs
- Contact
- Glacial limestone indicating direction of ice movement
- Distinctive alignment, possible structural significance
- Fault
- Fracture or joint
- Stratigraphic break
- Reef outcrop

WELL SYMBOLS

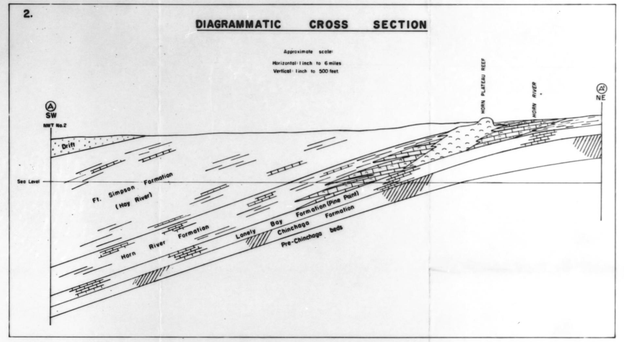
- Well location or drilling well
- Abandoned location
- Oil well
- Abandoned oil well
- Gas well
- Oil and gas well
- Suspended location
- Dry and abandoned test

INSETS

1. FORMATIONAL NOMENCLATURE

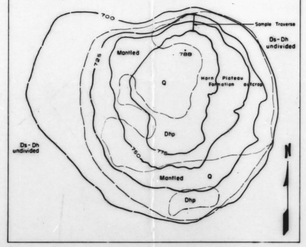
	BISTCHO LAKE AREA NORTHWEST ALBERTA		HORN PLATEAU AREA SOUTHERN DISTRICT OF MACKENZIE	
UPPER DEVONIAN	OVERLYING BEDS			
	FORT SIMPSON	HAY RIVER	FORT SIMPSON	
MIDDLE DEVONIAN	SLAVE POINT		HORN PLATEAU	
	WATT MOUNTAIN		HORN RIVER	
	SULPHUR POINT	PRESQU'ILE		
	MUSKEG	PINE POINT	LONELY BAY	
	KEG RIVER			
	CHINCHAGA			
ORDOVICIAN AND OLDER	PRE-CHINCHAGA (MIRAGE POINT)			
	PRE-CAMBRIAN			

2. DIAGRAMMATIC CROSS SECTION



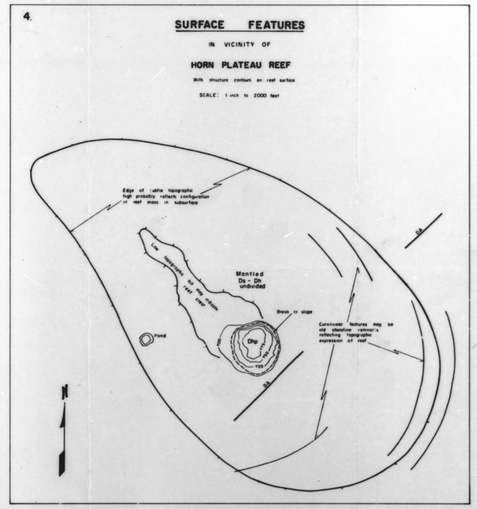
3. STRUCTURE CONTOUR MAP ON THE SURFACE OF HORN PLATEAU REEF

SCALE: 1 inch to 500 feet
CONTOUR INTERVAL: 25 feet
DATUM: Sea level (approximate)
Compiled photogrammetrically using a Kelsh plotter



4. SURFACE FEATURES IN VICINITY OF HORN PLATEAU REEF

With structure contours on reef surface
SCALE: 1 inch to 2000 feet



5. SEDIMENTARY ENVIRONMENT DIAGRAM