STUDY OF PRE-MESOZOIC STRATIGRAPHY AND STRUCTURE OF TUKTOYAKTUK PENINSULA

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CONTENTS

Illustrations

Tables

CONTENTS

Illustrations

Tables

INTRODUCTION

The Tuktoyaktuk Peninsula lies to the northeast of the Mackenzie Delta in the Northwest Territories, between 68° 20' and 70° 20' northern latitude and 129° and 135° western longitude. Cenozoic and Mesozoic clastic sequences are underlain by Paleozoic and Proterozoic clastic and carbonate strata. Differential uplift and subsidence by faulting and possibly folding has produced a complex formational subcrop pattern beneath the pre-Mesozoic unconformity. A GSC seismic deep-reflection line crosses the southwest part of the peninsula parallel to the edge of the Mackenzie Delta; refraction lines are being shot in the area. Initial interpretation of the seismic data indicates potential major pre-Mesozoic deformational foreshortening (Cook et al., in prep.). A thorough understanding of the pre-Mesozoic geology of the Tuktoyaktuk area is fundamental in verifying and understanding such deformation.

Objective of Study.

A two-phase geological study of borehole data has been initiated, to obtain a better founded concept of the Pre-Mesozoic geology of this area. **Phase 1**, was a pilot project designed to acquire a reconnaissance description of the Pre-Mesozoic stratigraphy and map patterns in the vicinity of the reflection line and is completed with this report. **Phase 2** will be an expansion of the Phase 1 study to the entire Tuktoyaktuk Peninsula and will include a detailed study of all available logs, and selected cuttings and cores from all wells in the area.

Previous work

Most of the previous work dealing with the pre-Mesozoic sequences was limited in scope. Paleontological age determinations have been published by Brideaux et al.(1975) and Brideaux et al. (1976). Glaister and Hopkins (1974) presented evidence from cores of Nuvorak O-09 for turbidity current flows. Norris and Calverley (1978) reported on exposed rocks in the Campbell Uplift, and Young and Norris(1978) published a structural cross-section through Campbell Uplift and southwest Tuktoyaktuk Peninsula. An overview and some seismic lines of this and adjacent areas have been presented by Lerand (1973). Mesozoic and Cenozoic successions were described by Dixon (1982, 1986).

STRATIGRAPHY

Regional Stratigraphy

To establish a reference framework of the stratigraphy in the study area, a brief description of the pre-Mesozoic formations present in the adjacent Anderson Plain is necessary. The strata are described in some detail by Tassonyi (1969), Pugh (1983) and Aitken et al. (1973).
The Anderson Plain sedimentary sequence can be divided into a Precambrian and a Paleozoic suite.

Precambrian Suite

A tremendous thickness of Precambrian supracrustal rocks underlies the Anderson Plain. COGLA seismic reports show 8-12 km of layered sequences beneath an angular sub-Cambrian unconformity. Beneath this supracrustal succession is a seismically transparent zone assumed to be the crystalline basement. There are neither northern Cordilleran outcrops of these basement strata, nor are they penetrated in wells north of 64°

latitude.

Supracrustal, Precambrian aged successions outcrop in the Mackenzie Mountains (Aitken et al., 1982), in the Brock Inlier on the Coppermine Arch (Balkwill and Yorath, 1970) and nearby Banks and Victoria Islands (Thorsteinsson and Tozer, 1962; Miall, 1976). In the subsuface the Precambrian succession was only in a few wells penetrated. Once penetrated, it was usually drilled for a few tens of metres, and thus it is difficult to correlate the subsurface to the better understood outcrop areas. From seismic sections, large scale folding (wave lengths of a few kilometres) and faulting (offsets of a few hundred metres) are evident below the sub-Cambrian unconformity.

The Precambrian comprises a wide variety of lithologies. A general subdivision for the subsurface was proposed by Pugh (1983). He distinguished from older to younger a. **Shale**; b. **Dolomitic**; c. **Argillitic**; and d. **Orthoquartzitic** units. These units resemble those of the Shaler Group (Thorsteinsson and Tozer, 1962) and the Mackenzie Mountains Supergroup (Aitken, 1981) on the basis of lithology.

The **Shale** unit comprises a section of over 200m of interbedded dark grey and some brown siliceous shale, siltstone and orthoquartzite.

The **Dolomitic** unit is over 250m thick and refers to varicoloured cherty dolomite. The colours range from pink to yellow, green or white, locally with characteristic red streaks. Locally, black shale or siltstone is present. The dolomite has features in common only with the unnamed unit H1 in the Mackenzie Mountains (as suggested by Aitken, (1979) in: Pugh, 1983, p.6), and not with the dolomite of the Little Dal Formation.

The **Argillite** unit consists of over 800m of black, siliceous argillite.

Some varicoloured chert and orthoquartzite may be present in the section. It overlies the Dolomite unit with a sharp contact.

The rocks in the **Orthoquartzite** unit are composed of quartzose, coarse siltstones and fine sandstones, and are over 160m thick. The upper part of the unit may grade into a siliceous dolomite.

Paleozoic Suite

The Paleozoic suite is divided into lower clastics, carbonate and upper clastics units on the basis of lithology.

Lower clastic unit

The lower clastic unit consists entirely of Cambrian clastic sequences. At the base are white, clear quartzose sandstones of the **Old Fort Island Formation**. In the middle are varicoloured shales, interbedded with siltstones and dolomites, the **Mount Cap Formation**, and overlying them varicoloured shales and evaporites of the **Saline River Formation**.

Carbonate unit

A thick succession of carbonates overlies the clastic unit. Near the base, the carbonate contains a fair amount of interbedded shale.

In ascending order, there are:

The **Franklin Mountain Formation**, which consists of cream white to pale brown, micro- to coarse crystalline dolomite with white and dark coloured chert and euhedral quartz crystals in its upper part;

The **Mount Kindle Formation**, which contains very fine to medium crystalline dolomite and some white chert and quartz crystals;

The **Peel Formation**, which is composed of pale grey to buff microsucrosic dolomite, locally silty or argillaceous;

The **Tatsieta Formation** (Pugh, 1983), a pale buff limestone with interbedded green shales and usually one or more intraformational conglomeratic beds. It overlies the Peel Formation with sharp contact. The Tatsieta is equivalent to Tassonyi's Lower Limestone Member of the Gossage Group. Mackenzie (1974) and Aitken et al. (1982) included the Tatsieta in the underlying SD unit. No age determinations are available for this formation. In its total, the Tatsieta represents an unconformity unit with many internal gaps, and the conglomerate may represent an important phase in the sub-Devonian transgression (G.K. Williams, and D. Morrow, pers. comm., 1987);

The **Arnica Formation**, consisting of brown, fine crystalline dolomite;

The **Landry Formation**, a brown aphanitic limestone with pellets, fossil debris and usually crinoid ossicles with twin canals. The contact with the Arnica may be sharp or very gradual, whereby the dolomite content increases in variable amounts, and is diachronous. The Landry and Arnica Formations form the **Gossage Group;**

The **Hume Formation** consists of dark-grey coloured argillaceous, bioclastic and fossiliferous limestones and interbedded shales. The contact with the underlying Landry is very sharp on wireline logs. The top marks the end of carbonate deposition in this area, where the younger Ramparts Formation is absent. The Franklin Mountain, Mount Kindle and Tatsieta Formations form the **Ronning Group**. Separation of the carbonate formations within the Ronning Group on the basis of wireline logs is very difficult in the area north of the 68th parallel, because they consist of a very similar and monotonous succession of lithologies.

These carbonates change facies towards to the Richardson Trough, where they change into shales of the Road River Formation (Pugh,1983).

Upper clastic unit

The base of the upper clastic unit is a succession of basinal shales of the **Hare Indian Bluefish Member** (Pugh, 1983). **Hare Indian** shales and siltstones may be present above the Bluefish Member and beneath the basinal shales of the Canol formation. The **Canol Formation** consists of radioactive, black siliceous shales, whose high organic content makes them an excellent potential source rock. The youngest Paleozoic formation in most of the area is the **Imperial Formation** (Braman, 1981; Williams, 1986), which consists of marine interbedded shales and siltstones with minor sandstone. Carboniferous and Permian clastics are only present at the northeastern edge of the Richardson Mountains and in the Eagle Plain.

Unconformities

Three major unconformities are recognized in the subsurface Paleozoic suite: the sub-Cambrian, the sub-Devonian (Tatsieta) and the major sub-Mesozoic unconformity, which marks the end of the suite. In the literature, other unconformities are described or inferred from the surface or subsurface. One important unconformity is found between the Mount Kindle and Franklin Mountain Formation (Norford and Macqueen, 1975), but it is difficult to recognize in the subsurface Ronning Group of the area.

PRE-MESOZOIC STRATIGRAPHY OF THE TUKTOYAKTUK AREA

All wells on Tuktoyaktuk Peninsula with pre-Mesozoic penetrations were examined to obtain a regional overview. The results are displayed by plotting generalized lithologic columns for each well on a 1:500 000 scale base map (Fig. 2; numerical information regarding depth, thickness, etc. is given in Tables 1 through 4).

The stata underlying the sub-Mesozoic unconformity can be grouped into four large and three smaller areas, each being characterized by similar rock types (Fig. 1,2).

1. Trending obliquely across the peninsula is an area of white, very well indurated quartzites, which have been penetrated in a number of wells. Seismic evidence indicates they occupy a pre-Mesozoic horst structure, which will be referred to herein as the "**Quartzite ridge**".

2. To the southeast of the Quartzite ridge are shales, with interbedded siltstones, sandstones and conglomerates present. Wells with deeper penetrations encountered a sequence comparable to the normal Paleozoic section found in the Anderson Plain area.

3. Northwest of the Quartzite ridge is an area mainly of carbonates. The majority consists of dolomites and shales rich in chert, but some wells were completed in limestones.

4. In the southwestern part of the Mackenzie Delta is an area of clastics with some interbedded carbonates. The carbonates are mainly limestones rich in chert, whereas the clastics may contain varicoloured shales and chert beds.

5. The Campbell Uplift southwest of Inuvik exposes carbonates with minor clastics unconformably overlying Precambrian argillites and sandstones. North of Inuvik, the Inuvik D-54 well has a similar section with carbonates overlying argillites and sandstones.

6. Close to the southeastern edge of the Quartzite ridge, near its northern end on the peninsula, are dolomites with varying amounts of interbedded shales in three wells.

7. A significant succession of over 100m of volcanic rocks overlying brecciated dolomite is present in Eskimo J-07. A few metres of

volcanics, in situ or detrital, have been found in Inuvik D-54; detrital volcanic material has been observed in the East Reindeer wells. These minor occurrences are not included in this group.

Correlation of lithological groups to the stratigraphy of the Anderson Plain.

The lithology of the **Quartzite Ridge** is atypical of Paleozoic strata in both the Anderson Plain and surrounding area: Nothing is known about the underlying beds and the maximum penetration is only about 30 m. White quartzites are absent in the Paleozoic upper clastic suite. White, clear, quartzose, mature, typically friable sandstones of the Old Fort Island Formation are well cemented in some of the wells around the Tedji Lake area in Anderson Plain, and are potential candidates for lithological correlation. These sands, however, pinch out not far to the west of that area. Thus, unless the Cambrian strata reappear beneath the Tuktoyaktuk Peninsula, they are unlikely equivalents of these quartzites. The extreme hardness of the quartzites is also a factor to be considered: Drilling times of up to 6 hrs/m while coring these rocks are mentioned in the drilling reports. This degree of induration suggests high levels of diagenesis or low grade metamorphism, indicating a Proterozoic age. Exact correlation can only be guessed at, but they are, for example, similar to quartzites of the Reynolds Point Formation of the Hadrynian Shaler Group (Thorsteinsson and Tozer, 1962) or the Helikian Katherine Group (Aitken et al., 1982).

The clastics of the second group, **southeast of the Quartzite ridge**, closely match the description of the Imperial Formation. Exceptions are the carbonate-clast and chert-clast conglomerates encountered in several wells. These conglomerates, together with an unusually large proportion of sandstone, indicate a proximal source. Because the conglomerates are carbonate and chert rich, the Paleozoic "carbonate unit" is the most likely source. Structures north of the Quartzite ridge, or Ronning carbonates which formerly overlay the ridge, are likely sources. The wells with deeper penetration record an undisturbed section of rocks into formations as old as the Franklin Mountain Formation. A similar sequence was encountered in the offshore well Killanak A-77, north of the peninsula.

If the unit penetrated in these wells is the Imperial Formation, then this area is geologically similar to a large part of Anderson Plain, where Mesozoic strata rest directly upon the Imperial Formation over most of the northeastern part of the area.

The limestone strata in the **carbonate group to the northwest of the Quartzite ridge** are similar to those of the Landry Formation. Crinoid ossicles with twin canals have been found in some wells, dating the rocks as Early to Middle Devonian, the age of the Landry Formation. The remaining chert-rich dolomites and shales may belong to the Paleozoic Ronning Group or to the Proterozoic H1. The presence of limestones of Gossage age, favours correlation of the chert-rich dolomites in this area to the Ronning Group. The presence of white chert is considered a characteristic of the Cherty Member of the Upper Franklin Mountain Formation to the south (Tassonyi, 1969). In the Anderson Plains, however, white chert is usually also present in the overlying Mount Kindle Formation. To the west, in the Beaverhouse Creek H-13 well, large amounts of chert are also present in what appears to be the Arnica Formation. All of this indicates that the chert is not a useful marker in the carbonate.

The cherty dolomites are therefore correlatable only with the Ronning Group in general.

In a number of the Parsons wells the large volumes of shale interbedded with chert and carbonate may represent facies transitional into the Road River Formation of the extended Richardson Trough (or Franklinian geosyncline).

The fourth group, in the **southwestern Mackenzie Delta** (Aklavik area) consists of varicoloured shales with interbedded limestones and cherts. They match the complex lithologies as described for the Carboniferous and Permian rocks in outcrop (Bamber and Waterhouse, 1971). A few Permian palynological ages mentioned in well-history reports corroborate this lithologic correlation.

In the **Campbell Uplift** the youngest carbonate unit contains crinoid ossicles with twin canals; in addition conodont determinations pinpoint the age as late Early Devonian (Norris and Calverley, 1978). The lower contact is a fault. The underlying dolomites were assigned by Norris and Calverley (1978) to the Vunta, of Ordovician to Early Devonian age, but no fossil ages were reported. The contact of these dolomites with the underlying Proterozoic strata is covered, and from dip measurements appears to be unconformable.

The Proterozoic rocks exposed in the Campbell Uplift are a succession of interbedded, varicoloured argillite, quartzite and dolomite. A paleomagnetic study found the geomagnetic dipole here corresponding to an age of approximately 1000 Ma on the mean polar wandering curve for North American Precambrian rocks (Norris and Black, 1964). This would correlate them with the Shaler Group (ibid). According to Norris and Calverly (1978), the interval including the Vunta and Proterozoic rocks, which is covered by Quaternary deposits at the surface, is represented in the nearby well

Inuvik D-54 by red and green shales and sandstones, which "may represent the lower Cambrian Old Fort Island Formation". Although they do not indicate the exact interval, it probably lies between 4600' and 4700' (1400m-1430m) depth. Above these depths, at 4100' (1250m) depth, indications have been observed of weathered volcanics similar to those in the well Eskimo Lakes J-07. If these volcanics are of Late Proterozoic age (see below), it could place the top of the Proterozoic at the level of the volcanics. The white, clear quartzose sandstone directly above it, may be equivalent to the Cambrian Old Fort Island Formation; and the shales overlying them in turn would be equivalent to those of the Mount Cap or Saline River Formations, requiring deposition of those rocks in a localized basin. Problematic are ostracods mentioned by C. Yorath on the GSC litholog at 4260' (1298m) and 4300- 4320' (1311m-1317m), because no additional information could be found about them (i.e. are they really ostracods?; are they in place?), their stratigraphic value is unknown. If these ostracods are in situ, the rocks would be of Ordovician age or younger.

The stratigraphic position of the dolomites with interbedded shales near the **southeastern edge of the Quartzite ridge** is unclear; they could belong to the Ronning Group or to the Proterozoic. In one well, Kannerk G-42, the shales are red and green with some interbedded siltstone. In the other two wells the dolomite is described as orange to yellow and pink. All these colours are atypical of in the Ronning Group. Pugh (1983) described the Mount Cap section, which has a sequence similar to that of well G-42. In his section the dolomites are much less abundant. Therefore the dolomites here are tentatively considered to be of Proterozoic age. If, on the other hand, they are of Ronning or Cambrian age, down-to-the-south normal faults would have to be present on the southeastern side of the Quartzite ridge.

There is no absolute age available yet for the volcanics in Eskimo J-07. Basic igneous rocks are present in the Mackenzie Mountains as sills and dikes intruded at levels as high as the Grainstone member of the Proterozoic Little Dal Formation; as flows in the Proterozoic Copper Cycle (Aitken, 1981); in the Lower Cambrian of the British Mountains in the Northern Yukon (Norris, 1981); and in the Paleozoic Marmot Formation, Mackenzie and Selwyn Mountains (Cecile, 1980). In the Coppermine area, and especially on Victoria Island, similar volcanic rocks are found in the upper part of the Proterozoic, as the Natkusiak Formation (Young, 1981; Jefferson et al., 1985). The Natkusiak has been dated at about 700 Ma (Rb-Sr, Baragar and Loveridge, 1982). Thus, the age of the clastics derived from any volcanics is likely younger than the Little Dal formation or 700Ma.

Wells close to the reflection line.

A number of wells lie in proximity to the seismic reflection line (Figs. 1 and 2). A stratigraphic cross-section (Fig. 3) has been constructed to illustrate relationships of wells close to this line and to tie them to the Anderson Plain area (Fig. 3). The sub-Mesozoic unconformity was selected as a datum, and thus shows the structural and stratigraphic relationships of the pre-Mesozoic formations at the onset of the Mesozoic sedimentation.

On the section, going from east to west, the first two wells are **Wolverine H-34** and **Kugaluk N-02** on the Anderson Plain. They have normal sequences. The unusually thin Imperial Formation that subcrops under the sub-Mesozoic unconformity in both wells, demonstrates significant post-

Imperial and pre-Mesozoic erosion in this area. The thickness of the Imperial Formation increases westerly in the direction of the dip of the Paleozoic formations in a homocline. This suggests pre-Mesozoic tilting, and erosion of the strata of Imperial age and older.

Kugaluk N-02 was cored from 818' (249m) to total depth of 8045' (2452m). In this well the upper 30m of the Imperial Formation were studied. The following observations may be significant:

- plant remains and carbonaceous flakes are present;
- the sand and siltstone have a salt and pepper appearance, mainly caused by the presence of detrital biotite;
- the shales are indurated, but not enough to keep them from splitting in the core box;
- the sands contain cross bedding but soft sediment deformation is rare;
- laminations are usually argillaceous beds;
- no evidence for burrowing was found in the sands;
- scouring features are present, as well as Bouma sequences in the shalier parts;
- the sand beds are usually thicker than in the cores of the East Reindeer wells.

Also in Kugaluk N-02, conodonts from the deeper dolomites between 5590'-5614' (1704m-1711m) depth and at 5819' (1774m) were recovered and indicate a Silurian age. Between 6111'-6126 (1863m-1867m) and at 6491' (1978m) depth conodonts indicate a late Middle Ordovician to Late Silurian age, the Mount Kindle Formation (Norford et al., 1973).

The **Inuvik D-54** well, to the west of the previous two wells, is peculiar and may indicate a Cambrian or Proterozoic history for the

Campbell Uplift area.

The Mount Kindle subcrops immediately below the Mesozoic unconformity. Its boundary with the underlying Franklin Mountain Formation is picked mainly on the basis of the wireline gamma ray log pattern. Samples taken for conodonts in the Ronning interval between 2334'-2360' (711m-719m) depth proved barren.

It should be noted that the lithology of the Ronning Group is atypical here in that there is an abundance of sandstone in both formations, whereas chert in both formations is relatively sparse. The shaly and sandy dolomites near the bottom of the carbonate section between 3500' and 3780' (1067m-1152m) depth, are typical of the widely recognized shaly basal Franklin Mountain Formation. The abundance of sandstone in this well and not in others, suggests the possibility that it is a local accumulation, perhaps associated with a lower Paleozoic positive area, a structural precursor to the Campbell Lake Uplift.

The interval with shales and some interbedded sandstones between 3780' and 4080' (1152m-1244m) is considered to be Cambrian in age, based upon the volcanics found near 4100' (1250m) depth. At present a Proterozoic age is assumed here for these volcanics, as has been discussed previously, and they may mark the top of the Precambrian. The presence of a Cambrian section contrasts with the Anderson Plain area, where the Cambrian thins westward and essentially pinches out. The interval below 4100' (1250m) contains from top to bottom a section of black slightly dolomitic shales, a package of white quartzites, a section of red and green shales and a thick sequence of white quartzites. This sequence does not fit easily into one of Pugh's (1983) four Precambrian units, but it is similar to either the Shaler Group (Kilian or Reynolds Point Formations (Young, 1981)) or the Upper Tsezotene Formation (Aitken, 1981). The supposed ostracods found just below the volcanics have been ignored here.

A core through the sands at 5120' (1561m) depth contains a clear, white, well cemented, immature sandstone, with a few heavy mineral grains. No cross bedding is evident and only a few thin, straight, argillaceous bands are present.

From Inuvik D-54, the section changes direction to the north. Direct correlation to the next well, **East Reindeer P-60**, is impossible. The succession in P-60 consists of nearly 1000 metres of green-grey shales, with interbedded siltstones and conglomerates, on top of cherty dolomites near the bottom of the well. The clastic sequence is reminiscent of the Imperial Formation, and the dolomites have been correlated to the Silurian- Ordovician on Can-Strat lithologs. There are, however, a number of characteristics of these clastics that are atypical of the Imperial Formation: Plant remains, carbonaceous flakes and mica are absent. The amount of sand is unusually large, although this may be explained by a proximity to the source, as is indicated also by the conglomerates. In core the shales are far more indurated than is usual in the Imperial Formation and contain extensive (vertical) fractures cemented by quartz. In core, the shales show evidence of distal source turbiditic sequences with DE sequences and extensive soft sediment deformation. A fair number of the pebbles in the conglomerate are composed of weathered, amygdaloidal, ophitic volcanic rocks. Samples were taken throughout the cores for palynology. No palynomorphs were found (GSC Rep. 3-JU-87), only a few black fragments. To determine the nature of these black fragments, additional larger samples were processed. The resulting few black fragments showed no reaction to oxidising, which indicates that the fragments are not coal, and are probably inorganic. The total absence of palynomorphs and carbonaceous material is highly unlikely for the Imperial Formation. The sequence is therefore tentatively assumed to be Cambrian or Precambrian. The Cambrian Slats Creek Formation of the Richardson Trough (Fritz, 1974) is similar in lithology and bedding style. Pugh's (1983) Argillite unit is another potential correlative unit. However, this succession contains volcanic beds and volcanics are only present in formations younger than Pugh's Precambrian units. If equated to the Slats Creek Formation, they may have been deposited as a clastic wedge in a northern extension of the Richardson Trough, somewhat like a wedge of Cambrian clastics found in the northwestern Misty Creek Embayment (Cecile, 1980).

Connection with the next well, **Ogeoqeoq J-06**, is again difficult. Here a succession of interbedded white and grey sandstone, red and grey shales and grey dolomite has been penetrated. These lithologies suggest a Precambrian or possibly Cambrian (Mount Cap?) age.

The northwesternmost well in the section, **Parsons P-53**, has rocks similar to the Road River Formation or transitional to basin facies: some dolomite with interbedded dark shales and large amounts of chert. Other Parsons wells may contain cherty dolomite only, suggesting that the area is close to the shale-out edge of the Paleozoic carbonates. The subcrop of Paleozoic in these wells indicates their penetration of the downfaulted blocks to the northeast of the Quartzite ridge.

Structural Implications - Evidence for Ellesmerian Orogenesis

The pre-Mesozoic subcrop-geological map (Fig. 1), which uses the sub-Mesozoic unconformity as a datum, shows a complex pattern of rock units of

Precambrian to Late Devonian age. Regardless of the exact nature of the deformation that produced this pattern, it requires a major structural event(s) of post-Devonian and pre-Cretaceous age.

In the area underlain by Palaeozoic carbonates, northwest of the Quartzite ridge, there appears to be an alternating pattern of subcropping Ronning Group (Cambrian - Silurian) dolomites and Devonian limestones (Gossage Group). Contacts between these alternating carbonate subcrop areas trend north or possibly northwest (Fig. 1). This pattern could be produced in three ways: by folding, thrust faulting, or normal faulting (Fig. 4). It is interesting to note that Ellesmerian structures in the Barn Mountains (Dyke, 1974; Norris and Young, 1981), which are potentially of the same age as the Tuktoyuktuk sub-Mesozoic structures, also trend northerly. The Ellesmerian structures are compressional and therefore folding and thrusting are favoured as options for the structures north of the Quarzite ridge.

The contact of these structures with the Quartzite ridge is problematic. They are either abruptly truncated against a northeast trending fault or change trend abruptly to swing in parallel to the ridge.

Rocks to the southeast of the Quartzite ridge are Imperial Formation, and this abrupt, consistent change in stratigraphic position appears best explained by faulting (Fig. 5). This southeastern fault could be a strike-slip fault, a normal fault or a thrust fault. The presence of conglomerates with chert and carbonate clasts in the nearby Imperial Formation suggests that whatever the nature of the fault, movement on it was in part contemporaneous with deposition of the Imperial Formation.

The peculiar nature of units in the Inuvik D-54 well suggests the possibilty of a Paleozoic high in the area of the Campbell Uplift. The anomalous abundance of sandstones in the carbonates in this well, but not in other wells of the area, suggests that they may be locally derived. The reappearance of Cambrian sandstones is also a significant anomaly.

In the Anderson Plains area to the south, Lower and Middle Cambrian rocks thin westward towards a northern extension of the Lower Paleozoic Mackenzie Arch, and are absent on it; west of the Arch a thick succession of Cambrian sandstones reappears in the Richardson Trough. If this situation is in any way analogous to the Inuvik area it would explain the reappearance of the Cambrian sandstones, while the abundant sandstone in the Ronning carbonates could be derived from erosion on the crest of this inferred high.

Thus, although the present day exposure of the Campbell Uplift is the product of Mesozoic tectonism, it is entirely possible that earlier Paleozoic structures played a major role in controlling the location and character of the younger uplift.

Conclusions

From this **Phase I** study, a pattern of regional lithology groups is defined. Tentative correlations to formations in the Anderson Plains and surrounding areas are given. The main feature to emerge from this study is the presence of complex pre-Mesozoic structures (Ellesmerian?) involving Paleozoic and Precambrian rocks. Paleozoic rocks are present on both sides of the Quartzite ridge. Permian rocks appear to be present near the southwest side of the Peninsula, under the Mackenzie Delta. The juxtaposition of groups of wells with Ronning and Gossage age rocks to the northwest of the Quartzite ridge has structural implications, no matter how the pattern is explained. More study will be required to obtain a better understanding and correlation. The only way to answer this problem appears to be through a thorough study of the sample material available for each of the groups mentioned above. Additional information such as fossil age determinations will be crucial, but most of the Lower Paleozoic and older formations penetrated on the Peninsula are not very fossiliferous. Therefore, tools like geochemistry, dipmeter logs etc. may provide some assistance, and all information that can be acquired should be examined carefully in a complex area like this.

Recommendations

1. Expand the study area to include the complete Tuktoyaktuk Peninsula.
2. Selectively study the sample material available for each well. Wells with similar lithology, grouped as outlined above, should be studied together, to investigate any similarities or dissimilarities. (There are 55 wells with 19,000 m penetration in total).
   Emphasis should be on correlation of units, based on lithology, mineralogy, sedimentary structure, etc. Duplication of existing lithologs is not intended; therefore only spot checks should be made of similar lithological successions in each well.
3. Construct stratigraphic and structural cross-sections: Two NW-SE sections at locations in addition to the one of Fig. 3 and one NE-SW section to tie them all together.
4. Tie the NE-SW section to the Arctic Islands Devonian sections presently being studied at the G.S.C by Dr. Q. Goodbody (i.e. Banks Island via Killanak A-77).

5. Study the applicability of dipmeter data of each well for the study area.
6. Sample available core or ditch cuttings where necessary to obtain fossil or absolute ages, and for thin sections.
7. Sample promising core material to investigate if the organic maturity increases abruptly across the sub-Mesozoic unconformity. Organic maturation values should give an estimate of the amount of material removed by erosion in pre-Mesozoic time or later.
8. Construct a subcrop map indicating which rocks and formations are present below the sub-Mesozoic unconformity.
9. Review COGLA seismic reports, to investigate structure NW of the Quartzite ridge.
10. Apply Landsat imagery to identify surface penetration of faults and lineaments.
11. If time permits, expand the study area to include the wells with possible Permian and deeper penetrations to the southwest of the Tuktoyaktuk Peninsula in the Mackenzie Delta area. There are twelve of these wells, with 9050 m of section in total.
12. Obtain an absolute age for the volcanics in Eskimo J-07.

APPENDIX

Appendix 1

Cores from wells near the Inuvik-Tuktoyaktuk seismic line.

All available cores from wells near the seismic reflection line were studied. A short description of pertinent features of each is given along with a short interpretation.

East Reindeer A-01 (9532'-9543'; 2905m-2909m)

The core represents a section of shale with centimetre scale interbeds of fine grained sandstones and siltstones. All beds dip about 40^{o}-45^{o}. Laminations are very fine and wavy or broken and recemented. Beds are thinner than 2 cm, and always disturbed (Plate Ic). Soft sediment deformation, on a scale from millimetres to decimetres, is extensive throughout and appears in places to be enterolithic (Plate Ic). The shale is black, phyllitic, glossy and slickensided. Vertical fractures throughout were recemented by quartz. The sand stringers are indurated to hard quartzites. Noteworthy is the large amount of detrital biotite at 9540' (2908m). No evidence of bioturbation was observed. Characteristics of the Imperial Formation are absent. The amount of pyrite and extent of soft sediment deformation, caused by load and slumping, is much larger here than in the other East Reindeer wells. The lithology here is very similar to the that observed in East Reindeer P-60. As discussed in the Chapter "Wells close to the reflection line" a tentative Precambrian age was assigned to these rocks. By analogy, a Precambrian age is suggested for the rocks described in the core above.

East Reindeer C-38 (4724'-4746'; 1440m-1447m).

This core is characterized by well indurated, dark shale with some thin siltstone stringers in fining upward sequences and contains a fair amount of pyrite. The highly contorted stringers show evidence of small and large scale soft sediment deformation. After induration, extensive fracturing took place. While some cracks were wide enough to be filled with silica cement, others are nearly invisible. Evidence of bioturbation is absent again.

5805'-5828' (1769m-1776m).

This core is similar to the one above. Around 5824' (1775m) the sediment has been broken up after induration, part of it was rotated (Plate Ia) and recemented. Soft sediment deformation on a centimetre to decimetre scale is common elsewhere in this core.

Both of these cores are lithologically very similar to the East Reindeer P-60 core, but there is evidence of more deformation. Characteristics for the Imperial Formation are absent.

6342'-6365' (1933m-1940m).

The upper part of the core consists of a 3m thick light-grey to buff limestone bed with extensive calcite filled fractures (Plate Ib). The fine laminations are the result of variations in argillaceous content; pyrite grains parallel the laminations. The limestone is well indurated, and has no burrows, mottling or fossils. Fine laminations and fine grain size indicate low energy deposition. during turbiditic sedimentation. No conodonts could be recovered from it (sampled between 6349'-6352' (1935m-1936m), GSC Rep. 18 TTU -86).

Underlying the limestone are green-grey shales with interbedded conglomerates, sand- and siltstones. They contain fining upward sequences, with thicknesses ranging from centimetres to decimetres. Some of the sandstones have ripple marks. Scouring features are present near the bottom of the conglomerate beds. Thin section study shows that in the conglomeratic beds the pebbles consist of chert and weathered, vesicular, doleritic rock.

8052'-8065' (2454m-2458m).

The main part of this core is a debris flow with clasts larger than 5 cm. In thin-section, the clasts are rounded chert pebbles and weathered vesicular volcanic rocks, which are suspended in a coarse, unsorted matrix composed of the same material. Proximity to a source similar to that of other wells is suggested.

General comment: Strata in this well were extensively disturbed after induration in two or more phases, as is indicated by silica filled cracks, broken and offset by younger fractures also cemented by silica.

The lithology of the described sequence is similar to the one of A-01, or P-60, which will be described next. As has been discussed in the "Cross-section" text, a Proterozoic age is suggested for P-60, and a similar age is proposed for cored strata of this well.

East Reindeer P-60 (4560'-4593'; 1390m-1400m).

The upper 3 metres of this core consist of coarse conglomerates. It overlies a 45m thick succession of green-grey, well indurated shales with interbedded sand- and siltstones.

The conglomerate contains both angular and rounded clasts of up to 15 cm. Part of the rock is clast supported (Plate IIa). Some of the angular clasts were still fairly soft during deposition, as is shown by their indentation (Plate IIa). Thin section study shows that the clasts are composed of carbonate, rounded chert pebbles or greenish, weathered, vesicular, ophitic volcanics. One large very irregular clast (Plate IIb) has the appearance of travertine, with encrustation and enduration.

The matrix is very fine shale, except in the areas protected by the corners of the angular clasts, where it is coarse sandstone. In the fine matrix, soft sediment deformation by loading is evident, on a centimetre to decimetre scale.

The underlying succession is composed of laminated, very fine clastics, with fining upward sequences on a centimetre scale, and the occasional sand-pebble layer. Bouma DE sequences indicate a distal source for the fine material. Slumping and load deformation of the soft sediment has left its marks throughout. No evidence was observed of bioturbation.

5183'-5201' (1580m-1585m).

A debris flow containing angular and rounded clasts of up to 7 cm (Plate IIc), forms the main part of this core. The clasts are suspended in a matrix of coarse unsorted sandstone. Thin section study indicates that both the clasts and matrix are composed of chert, carbonate and weathered vesicular, ophitic volcanics.

The paraconglomerate overlies fractured shales with some centimetre thick interbedded sand siltstones containing Bouma DE sequences and soft sediment deformation reflecting loading and slumping. No evidence was found for bioturbation.

General comment

Strata in these cores are the product of occasional influxes of coarse clastics into a distal, deep water environment, likely through deep water currents or turbidity flows. Clastic strata in the East Reindeer wells, containing significant amounts of igneous material, may all have had the same source. Some of these clastics, as observed in the upper part of the first core, were already partially consolidated conglomerates reactivated by large slides or debris flows. The induration of the shales, the presence of quartzites, the absence of the Imperial Formation characteristics and of palynomorphs or coaly material, make a Precambrian or possibly Cambrian age more probable than an Imperial one. The argument that the sequence is turbiditic cannot be used as a criterion to distinguish between the two possibilities here, because the Imperial Formation is largely turbiditic in this part of the basin. (Williams, 1986).

If the Precambrian strata were the source of the volcanics, 700+ Ma volcanics are a likely source: Major sills, with radiometric ages of 770 Ma (Armstrong et al., 1982) are intruded up into the Grainstone Formation of the Little Dal Group; the volcanics at the base of the Copper Cycle (Aitken, 1981), northern Mackenzie Mountains; the Natkusiak basalts on nearby Victoria Island are dated 700 Ma by Baragar and Loveridge (1982), The Natkusiak Formation overlies the Kilian formation of the Shaler Group. Another possible source are Lower Paleozoic volcanics. Thick accumulations of Cambrian volcanics are found in the nortwestern Yukon (British Mountains; Norris, 1981), and a single bed of volcaniclastic sandstone was found in outcrops of the Ordovician Road River Formation in the Richardson Mountains (M.P. Cecile, pers. comm., 1987). Volcanics in the East Reindeer C-38 well gave an Ordovician whole-rock K-Ar age (A. Embry, pers. comm. 1987). Also, volcanic rocks in the Inuvik D-54 well may be of Cambrian age (see discussion in this report).

Inuvik D-54 2334'-2360' (711m-719m)

The dark grey to brown, sucrosic dolomite in this core from the Ronning Group has a vuggy porosity, with the vugs near the top larger than 2cm and in the deeper part smaller than 1 cm; they are partially filled with large sparry dolomite crystals. Some mottling is visible near the top of the core, but is less apparent deeper in the section. After induration, the dolomite was extensively fractured and recemented with two generations of dolomite (Plate IId). The first phase is represented by brown, the second by white dolomite cement. Samples taken from the core contained no conodonts (GSC Report MP7-TTU72). The rock probably originated as a featureless limemud with some bioturbation.

5115'-5126' (1559m-1562m)

A cream, well cemented sandstone composed of clear and milky quartz and some heavy minerals. Sand grains are of uniform size and have crystal faces. A few thin argillaceous laminae are the only variation from this pattern. Bed thicknesses sizes may be larger than 10cm; no crossbedding is evident.

Appendix 2

General description of the pre-Mesozoic lithologies of wells near the Inuvik-Tuktoyaktuk seismic line.

A short description of the main lithologic units, taken from the available lithologs, is given for the wells located close to the seismic line. Age correlations will be discussed only for intervals, which have not been described before in this report. The wells will be divided into areal groups.

1. Inuvik group

Inuvik D-54.

Clear quartzose sandstones with interbedded green shales and brown to red dolomites directly underlie the sub-Mesozoic unconformity in the interval between 1050' to 1300' (320m-396m). They overlie a section of grey to brown dolomite interbedded with some sandstone (even quartzites) and shale inclusions, down to 3780' (1152m) depth. The dolomite contains black and white chert. The argillaceous content increases near the bottom of this interval.

Beneath this succession is a 60m thick package of black shales and below the shales, a clear quartzose sandstone down to the 4080' (1244m) level. Weathered and fresh volcanic material is present between 4080' and 4100' (1244m-1250m) interval. Under this is a black, 122m thick shale sequence containing a few thin sandy and dolomitic beds. This shale overlies a clear quartzitic sandstone succession, the bottompart of which (near 4650'; 1417m), contains a few dolomitic beds. This lower dolomite/sandstone unit gradationally overlies 50m of red and green coloured phyllitic shales, which in turn gradationally overlie another clear quartzitic sandstone. This quartzite unit begins at 4820' (1469m) and continues until Total Depth of 5126' (1562 m).

Ogeoqeoq J-06:

The Mesozoic is underlain by 52m of coarse, siliceous, grey sandstone with interbeds of grey and red shales and some dolomite. Bed thicknesses are in the order of metres. This type of succession with dolomite and red shales has been described only in Cambrian or Precambrian rocks, either age is possible for this succession.

2. The East Reindeer group

East Reindeer P-60

The sub-Mesozoic unconformity lies at 3250' (990m) depth. The succession immediately below the unconformity is 915m of grey green, interbedded sandstones, siltstones and shales with conglomerates at some levels, as described in Appendix 1. Unit thicknesses vary from 1 to 30m, whereby the sandstones tend to be concentrated in several intervals of up to 200m thick. The sands are fine to medium grained. An occasional thin dolomite or limestone bed is present in this clastic interval. Under this succession, at the bottom of the well is 15m of fine crystalline, cherty dolomite.

East Reindeer A-01

The sub-Mesozoic unconformity is at the 9260' (2822m) level. Below it is a 132m thick succession of fine to mainly coarse siliceous white sandstone in units of up to 3m thick, and containing a few intervas of dark-grey shale beds of similar thickness.

East Reindeer C-38

The sub-Mesozoic unconformity is at 4200' (1280m) depth. 1314m of stata were penetrated below the unconformity. This succession consists basically of 88m of dolomite, which overlies 1256m of interbedded shale-sandstone/siltstone similar to the rocks in P-60.

The dolomite is light grey or white coloured and contains some white chert and a few thin sandstone beds at the bottom of the interval. The clastic sequence contains a few thin dolomite and limestone beds, as well as conglomerates, but in larger quantities. An attempt was made to retrieve conodonts from carbonates in the interval between 6349'-6352' (1935m-1936m), but none were recovered (GSC Rep. 18-TTU -86).
The clastics are analogous to the succession in P-60 well, except that here a cherty dolomite overlies them, and although a thicker clastic section was penetrated, no underlying carbonates were found.

As discussed in Appendix 1, a Precambrian age is suggested for the clastic succession. The carbonate is problematic. Its description matches that of the light buff coloured Cherty Member of the Franklin Mountain Formation, but the missing section below it would mean a unique hiatus during part of the Franklin Mountain and Cambrian period. Considering the regional pattern, a Proterozoic age is more likely for this dolomite.

East Reindeer G-04

The pre-Mesozoic section, below 11784' (3592m) consists of 142m of light grey coloured dolomite with free quartz crystals and some grey shale. This type of dolomite is found in the Peel Formation, but its age may also be Proterozoic, being similar to the carbonate in C-38.

3. Parsons group.

Parsons P-53

Beneath the sub-Mesozoic unconformity at 10450' (3185m) depth, a 30 m thick dolomite overlies 220m of black and white chert with some thin interbedded dolomite and shale.

Parsons P-41

Below the sub-Mesozoic unconformity at 11620' (3542m) depth is a 13m thick succession of white and light grey coloured chert and a thin cherty dolomite. The samples in this interval are of questionable quality. Wireline logs are very close to or on first reading, and thus of little help to determine the lithology.

The lithology of this section indicates a Ronning Group or Road River Formation age.

Parsons L-37

Underlying the sub-Mesozoic unconformity at 12940' (3944m) depth is 21m of light grey and white coloured cherty dolomite and white chert. No wireline logs are available for this interval to assist in lithology determination.

Considering the lithology, this section may correlate with the Ronning Group or Road River Formation.

Parsons N-10

Below the sub-Mesozoic unconformity at 10095' (3077m) depth, is a 128m thick succession of light to dark grey dolomite with white and black interbedded chert and a thin, light grey sandstone near the top. Although there is some agillaceous material present, shale beds are absent.

This dolomite is tentatively assigned to the Ronning Group on the basis of lithology.

Parsons A-44

Below the sub-Mesozoic unconformity at 11320' (3450m) is a 85m thick succession of dark, silty dolomite and limestone and black shales. Some thin marlstone beds are present. The gamma ray response of this section is abnormally high.

These lithologies are comparable to the Road River Formation and a Lower Paleozoic age is assumed. The colour of the rocks and absence of fossils in the limestone appear to preclude correlation with the Tatsieta or Hume Formations.

Parsons L-43

Below the sub-Mesozoic unconformity at 10760' (3280m) depth, is a 25m thick succession consisting of chert with interbedded light buff coloured dolomite and some shale. Near the top of this succession is a brown sandstone containing some chert pebbles.

On the basis of lithology, this succession is most comparable to the

Lower Paleozoic Ronning Group or Road River Formation.

Parsons D-20

Below the sub-Mesozoic unconformity at the 13465' (4104m) level is a 26m thick succession of light grey pure dolomite, with a trace of quartz crystals.

On the basis of lithology, this succession is most comparable to the Ronning Group or possibly the Arnica Formation.

Parsons F-09

Below the sub-Mesozoic unconformity at 10870' (3313m) depth is a 45m thick succession of light grey to white coloured chert with some waxy green shale partings This upper succession overlies 70m of fine crystalline, brown, somewhat argillaceous and cherty dolomite with free quartz crystals. It, in turn, overlies a 120m thick section of cryptocrystalline limestone with some interbedded dark grey to green grey shale. Near the bottom of the limestone interval are a few thin dolomite beds. Pellets, oolites and bioclastic debris have been observed in the limestone beds.

The chert near the top of the succession suggests that these limestones most likely are Ronning Group. This also excludes the Tatsieta for correlation. Both the limestone and chert may be explained by facies change near a shaleout into the Road River Formation. Therefore, the section may correlate to either part of the Ronning Group or the Road River Formation.

Parsons O-27

The pre-Mesozoic section, below 11710' (3569m) depth, penetrated only a 1m thick chert bed of light-brown to brown colour.

Taking the lithologies and correlations of the surrounding wells into account, the chert bed probably correlates to the Ronning Group, or the Road River Formation.

Kamik D-48

Underlying the sub-Mesozoic unconformity, at 10540' (3216m) depth, is 20m of white to grey argillaceous dolomite with a thin bed of siltstone and marlstone.

Similar rocks have been described in the Arnica Formation, the Ronning Group, the Road River Formation, or Precambrian.

Eskimo J-07

The sub-Mesozoic unconformity sequence at 2715' (827m) depth is unique, and consists of 5m of brown sandstone overlying a 70m thick volcanic succession. The volcanics are described as as an amygdaloidal, aphanitic to porphyritic rock, or even an olivine basalt. Zeolite minerals indicate a later hydrothermal phase. These volcanics overlie 8m of brecciated and probably metamorphosed, pink to light grey dolomite.

The possible age ranges for volcanics have been discussed in Appendix 1. A tentative Precambrian age is suggested for this section also.

Appendix 3

Paleontological data

Samples from East Reindeer P-60 were taken between 4566'-4577' (1392m-1395m), 4578-4593' (1395m-1400m) and 5197'-5201' (1584m-1585m) depth (C-25315). No palynomorphs were recovered. Reprocessing of larger amounts of the remainder of the samples also failed to recover palynomorphs or organic material (ISPG report 3-JU-87).

Previously collected samples from East Reindeer C-38 have been reexamined. Samples overlying the carbonate are of Jurassic age; a sample from 5170' (1576m) contains no fossils (McNeil, 1987, pers. comm.).

Appendix 4

Geochemical analyses (Rock Eval)

Samples were taken from the cores of two wells for Rock-Eval analysis, in an attempt to obtain some maturity data.

East Reindeer P-60

Two samples, from 4574' and 4587' (1394m and 1398m) had an S2 yield too small for a reliable Tmax. A high production index indicates a high maturity, or contamination. If the samples are highly mature, their TOC values of 0.06 and 0.17, respectively, may be too low. The low S2 values suggest that there is no residual source potential left, which may indicate a high maturity. (L.R. Snowdon, pers. comm., 1987)

Kugaluk N-02

A sample from 890' (271m) with TOC of 0.82 and low hydrogen index suggests high maturity, while the low Tmax indicates contamination. (L.R. Snowdon, pers. comm., 1987)

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TABLE I: Numerical information on wells with pre-Mesozoic penetration

IMPERIAL

Pre-Mesozoic of Tuk Peninsula

Wells with Pre-Mesozoic penetrations I CORES IN PRE-MESOZOIC

NAME		R.R.	KB	TD	DEV	FM	UNCONF.	DELTA	UNC.SS	FROM	TO	REC.	FROM	TO	REC	FROM	TO	REC
RUSSELL	H23	1974	35	6010		DIM	3612	2398	-3577	5975	6010	8						
KANNERK	G42	1977	40	8138		C-PC	7832	306	-7792	--								
NUVORAK	O09	1970	36	3798		DIM	3424	374	-3388	3434	3494	58						
KAPIK	J39	1975	44	4812		DIM	4045	767	-4001	--								
LOUTH	K45	1975	28	7274			6950	324	-6922	--								
KANGUK	F42	1973	26	5070		DIM	4820	250	-4794	--								
KANGUK	I24	1971	37	5254		DIM	4563	691	-4526	4561	4607	46	5239	5254	15			
AMAROK	N44	1974	63	7652		DIM	3818	3834	-3755	7634	7652	18						
NATAGNAK	H50	1970	21	6402		PC	6330	72	-6309	6334	6337	2	6364	6402	38			
NATAGNAK	K23	1970	88	4977			4860	117	-4772	4954	4977	22						
NATAGNAK	K53	1973	66	5747			5550	197	-5484	--								
NATAGNAK	O59	1983	9.2	2120.0	**	PC	2100.0	20	-2090.8	2101.3	2101.9	0.6						
ATKINSON	A55	1974	30	7325		DGSG	6764	561	-6734	7305	7325	20						
ATKINSON	H25	1970	28	5941		PC	5916	25	-5888	5900	5930							
ATKINSON	M33	1970	42	6327		PC	6220	107	-6178	6274	6285	11	6313	6327	14			
ATKINSON	L17	1982	13.9	2480.0	**		2331.0	149	-2317.1	2337.01	2350.2	13.1	2411.5	2430.2	18.7			
KIMIK	D29	1972	61	8720			8470	250	-8409	8463	8482	14	8536	8558		8602	8624	22
AMAGUK	H16	1973	66	4126		DIM	3136	990	-3070	4112	4126	11						
MAGAK	A32	1971	115	5160		PC	4996	164	-4881	5004	5024	18	5142	5160	16			
KILIGVAK	I29	1973	57	6447		DIM	650	5797	-593	5911	5926	9						
MAYOGIAK	L39	1974	47	14589			14517	72	-14470	--								
MAYOGIAK	M16	1980	18.9	3093.0	**		2867.0	226	-2848.1	2887.3	2894.3	6.2						
MAYOGIAK	J17	1971	74	12094		DGSG	9372	2722	-9298	9366	12093	TABLE 3, MANY CORES						
PIKIOLIK	E54	1972	80	10230		DGSG	8985	1245	-8905	9048	9108	60						
PIKIOLIK	G21	1983	74.8	1429.6	**		1378.0	51.59	-1303.2	--								
PIKIOLIK	M26	1972	79	6510		RO?	5608	902	-5529	5633	5645	11.5						
AKKU	F14	1973	132	4996		PC	4477	519	-4345	--								
TUK	M09	1984	31.2	3030.0	**		2966.5	63.51	-2935.3	3008.0	3009.0	0.9						
TUKTU	O19	1971	100	7597		DGSG	7216	381	-7116	7350	7390	40	7582	7597	15			
ESKIMO	J07	1969	89	2971		PC	2714	257	-2625	2760	2770	7	2849	2892	43	2905	2971	66
WAGNARK	C23	1976	100	13947			13712	235	-13612	--								
NUNA	A10	1984	54.2	3250.5	**	RO?	3222.0	28.5	-3167.8	3243.0	3250.5	7.5						
IMNAK	J29	1975	60	11170			10840	330	-10780	--								
SIKU	A12	1976	212	10787		OCF	10612	175	-10400	--								
SIKU	C11	1976	207	10810		OCF	10550	260	-10343	--								
SIKU	E21	1977	212	11245		OCF	11135	110	-10923	--								
PARSONS	A44	1975	207	11600			11320	280	-11113	--								
PARSONS	D20	1976	231	13550		SK	13465	85	-13234	--								
PARSONS	F09	1972	207	11638		RO	10870	768	-10663	--								
PARSONS	L37	1977	153	13010	*	RO	12940	70	-12787	--								
PARSONS	L43	1976	190	10844		RO	10760	84	-10570	--								
PARSONS	N10	1973	222	10515		RO	10095	420	-9873	--								
PARSONS	O27	1974	138	11714	*	RO	11710	4	-11572	--								
PARSONS	P41	1977	234	11665	*	RO	11622	43	-11388	--								
PARSONS	P53	1974	168	11270			10450	820	-10282	--								
KAMIK	D48	1976	109	10614	*		10540	74	-10431	--								
E. REINDEER	A01	1971	625	9693		PC	9260	433	-8635	9532	9543	10						
E. REINDEER	C38	1970	235	8512		PC	4200	4312	-3965	4724	4746	22	5805	5828	22	6342	6365	18
E. REINDEER	G04	1971	171	12250		D	11784	466	-11613	--								
E. REINDEER	P60	1970	380	6300		DIM	3250	3050	-2870	4560	4593	33	5182	5201	16.5			
OGEOQEOQ	J06	1975	266	6034			5865	169	-5599	--								
INUVIK	D54	1969	138	5126			1050	4076	-912	2334	2360	23	5115	5126	5			
KUGALUK	N02	1969	708	8045		DIM	2671	5374	-1963	807	8045	CONTINUOUS CORE						
WOLVERINE	H34	1974	478	6698		DIM	2	6696	476	--								
*ILANNAK	A77	1981	12.8	2966	**	DIM	1267	1699	-1254.2	--								

TABLE II: Numerical information on wells with pre-Mesozoic penetration

METRIC

Pre-Mesozoic of Tuk Peninsula

Wells with Pre-Mesozoic penetrations I

NAME		R.R.	KB	TD	DEV	FM	UNCONF.	DELTA	UNC.SS	FROM	TO	REC.	FROM	TO	REC	FROM	TO	REC
										CORES IN PRE-MESOZOIC								
RUSSELL	H23	1974	10.7	1831.8		DIM	1100.9	730.9	-1090.3	1821.2	1831.8	2.4						
KANNERK	G42	1977	12.2	2480.5		C-PC	2387.2	93.3	-2375.0	--								
NUVORAK	O09	1970	11.0	1157.6		DIM	1043.6	114.0	-1032.7	1046.7	1065.0							
KAPIK	J39	1975	13.4	1466.7		DIM	1232.9	233.8	-1219.5	--								
LOUTH	K45	1975	8.5	2217.1		C-PC	2118.4	98.8	-2109.8	--								
KANGUK	F42	1973	7.9	1545.3		DIM	1469.1	76.2	-1461.2	--								
KANGUK	I24	1971	11.3	1601.4		DIM	1390.8	210.6	-1379.5	1390.2	1404.2	14.0	1596.8	1601.4	4.6			
AMAROK	N44	1974	19.2	2332.3		DIM	1163.7	1168.6	-1144.5	2326.8	2332.3	5.5						
NATAGNAK	H50	1970	6.4	1951.3		PC	1929.4	21.9	-1923.0	1930.6	1931.5	0.6	1939.7	1951.3	11.6			
NATAGNAK	K23	1970	26.8	1517.0		PC?	1481.3	35.7	-1454.5	1510.0	1517.0	6.7						
NATAGNAK	K53	1973	20.1	1751.7		PC	1691.6	60.0	-1671.5	--								
NATAGNAK	O59	1983	9.2	2120.0	**	PC	2100.0	20.0	-2090.8	2101.3	2101.9	0.6						
ATKINSON	A55	1974	9.1	2232.7		DGSG	2061.7	171.0	-2052.5	2226.6	2232.7	6.1						
ATKINSON	H25	1970	8.5	1810.8		PC	1803.2	7.6	-1794.7	1798.3	1807.5	0.0						
ATKINSON	M33	1970	12.8	1928.5		PC	1895.9	32.6	-1883.1	1912.3	1915.7	3.4	1924.2	1928.5	4.3			
ATKINSON	L17	1982	13.9	2480.0	**	RO	2331.0	149.0	-2317.1	2337.0	2350.2	13.1	2411.5	2430.2	18.7			
KIMIK	D29	1972	18.6	2657.9		RO	2581.7	76.2	-2563.1	2579.5	2585.3	4.3	2601.8	2608.5		2621.9	2628.6	6.7
AMAGUK	H16	1973	20.1	1257.6		DIM	955.9	301.8	-935.7	1253.3	1257.6	3.4						
MAGAK	A32	1971	35.1	1572.8		PC	1522.8	50.0	-1487.7	1525.2	1531.3	5.5	1567.3	1572.8	4.9			
KILIGVAK	I29	1973	17.4	1965.0		DIM	198.1	1766.9	-180.7	1801.7	1806.2	2.7						
MAYOGIAK	L39	1974	14.3	4446.7		RO	4424.8	21.9	-4410.5	--								
MAYOGIAK	M16	1980	18.9	3093.0	**	RO-DG	2867.0	226.0	-2848.1	2887.3	2894.3	6.2						
MAYOGIAK	J17	1971	22.6	3686.3		DGSG	2856.6	829.7	-2834.0	2854.8	3685.9	Many	ores,see TABLE					
PIKIOLIK	E54	1972	24.4	3118.1		DGSG	2738.6	379.5	-2714.2	2757.8	2776.1	18.3						
PIKIOLIK	G21	1983	74.8	1429.6	**	RO	1378.0	51.6	-1303.2	--								
PIKIOLIK	M26	1972	24.1	1984.2		RO?	1709.3	274.9	-1685.2	1716.9	1720.6	3.5						
AKKU	F14	1973	40.2	1522.8		PC	1364.6	158.2	-1324.4	--								
TUK	M09	1984	31.2	3030.0	**	RO	2966.5	63.5	-2935.3	3008.0	3009.0	0.9						
TUKTU	O19	1971	30.5	2315.6		DGSG	2199.4	116.1	-2169.0	2240.3	2252.5	12.2	2311.0	2315.6	4.6			
ESKIMO	J07	1969	27.1	905.6		PC	827.2	78.3	-800.1	841.2	844.3	2.1	868.4	881.5	13.1	885.4	905.6	20.1
WAGNARK	C23	1976	30.5	4251.0		RO	4179.4	71.6	-4148.9	--								
NUNA	A10	1984	54.2	3250.5	**	RO?	3222.0	28.5	-3167.8	3243.0	3250.5	7.5						
IMNAK	J29	1975	18.3	3404.6		RO	3304.0	100.6	-3285.7	--								
SIKU	A12	1976	64.6	3287.9		OCF	3234.5	53.3	-3169.9	--								
SIKU	C11	1976	63.1	3294.9		OCF	3215.6	79.2	-3152.5	--								
SIKU	E21	1977	64.6	3427.5		OCF	3393.9	33.5	-3329.3	--								
PARSONS	A44	1975	63.1	3535.7		?	3450.3	85.3	-3387.2	--								
PARSONS	D20	1976	70.4	4130.0		SK	4104.1	25.9	-4033.7	--								
PARSONS	F09	1972	63.1	3547.3		RO	3313.2	234.1	-3250.1	--								
PARSONS	L37	1977	46.6	3965.4	*	RO	3944.1	21.3	-3897.5	--								
PARSONS	L43	1976	57.9	3305.3		RO	3279.6	25.6	-3221.7	--								
PARSONS	N10	1973	67.7	3205.0		RO	3077.0	128.0	-3009.3	--								
PARSONS	O27	1974	42.1	3570.4	*	RO	3569.2	1.2	-3527.1	--								
PARSONS	P41	1977	71.3	3555.5	*	RO	3542.4	13.1	-3471.1	--								
PARSONS	P54	1974	51.2	3435.1		RO	3185.2	249.9	-3134.0	--								
KAMIK	D48	1976	33.2	3235.1	*	?	3212.6	22.6	-3179.4	--								
E. REINDEER	A01	1971	190.5	2954.4		PC	2822.4	132.0	-2631.9	2905.4	2908.7	3.0						
E. REINDEER	C38	1970	71.6	2594.5		PC	1280.2	1314.3	-1208.5	1439.9	1446.6	6.7	1769.4	1776.4	6.7	1933.0	1940.1	5.5
E. REINDEER	G04	1971	52.1	3733.8		D	3591.8	142.0	-3539.6	--								
E. REINDEER	P60	1970	115.8	1920.2		DIM	990.6	929.6	-874.8	1389.9	1399.9	10.1	1579.5	1585.3	5.0			
OGEOQEOQ	J06	1975	81.1	1839.2		PC	1787.7	51.5	-1706.6	--								
INUVIK	D54	1969	42.1	1562.4		C-PC	320.0	1242.4	-278.0	711.4	719.3	7.0						
KUGALUK	N02	1969	215.8	2452.1		DIM	814.1	1638.0	-598.3	246.0	2452.1							
WOLVERINE	H34	1974	145.7	2041.6		DIM	0.6	2040.9	145.1	--								
KILANNAK	A77	1981	12.8	2966.0	**	DIM	1102.5	1863.5	-1089.7									

TABLE III: Cores taken in Mayogiak J-17

Imp. Metric

CORES IN MAYOGIAK J-17

FROM	TO	REC.	FROM	TO	REC.
9366	9383	17	2854.8	2859.9	5.2
9394	9397	3	2863.3	2864.2	0.9
9407	9410	0.8	2867.3	2868.2	0.2
9426	9429	3	2873.0	2874.0	0.9
9450	9453	3	2880.4	2881.3	0.9
9462	9465	3	2884.0	2884.9	0.9
9481	9632	149	2889.8	2935.8	45.4
9634	9656	13	2936.4	2943.1	4.0
9659	9692	24	2944.1	2954.1	7.3
9692	9705	11	2954.1	2958.1	3.4
9787	9817	30	2983.1	2992.2	9.1
10321	10347	23	3145.8	3153.8	7.0
10596	10602	5.5	3229.7	3231.5	1.7
10940	10947	6	3334.5	3336.6	1.8
11238	11251	12	3425.3	3429.3	3.7
11499	11521	22	3504.9	3511.6	6.7
12070	12093	23	3678.9	3685.9	7.0

TABLE IV: Numerical information on wells with pre-Mesozoic penetration, lying to the southwest of Tuktoyaktuk Peninsula

METRIC				Pre-Mesozoic of Tuk Peninsula															
		OUTSIDE		Wells with Pre-Mesozoic penetrations					I	.		CORES IN PRE-MESOZOIC							
NAME		R.R.	KB	TD	DEV	FM	UNCONF.	DELTA	UNC.SS	FROM	TO	REC.	FROM	TO	REC	FROM	TO	REC	
TULLUGAK	K31	1977	9.8	2926.1		P???	1802.9	1123.2	-1793.1										
BEAVERHOUSE	H13	1971	74.7	3747.5		P	1176.5	2571.0	-1101.9	2085.1	2085.7	0.2	2515.2	2524.0	8.8	3177.8	3185.8	7.0	
AKLAVIK	A37	1970	10.1	2584.4		P	1758.7	825.7	-1748.6	2579.2	2584.4	5.2							
AKLAVIK	F17	1973	8.2	891.5		C?	771.1	120.4	-762.9	890.6	891.2	0.6							
AKLAVIK	F38	1973	12.2	2056.5		P	1626.7	429.8	-1614.5	--									
KILANNAK	A77	1981	12.7	2996.0	*	DIM	1260.0	1736.0	-1247.3	--									
KUGPIK	L24	1975	12.2	2817.0		P	2731.0	86.0	-2718.8	2257.0	2267.7	10.1	2494.8	2505.8	10.1				
KUGPIK	O13	1973	10.4	3689.0		P?	3240.0	449.0	-3229.7	3095.2	3102.3	6.7	3651.5	3654.6	2.4				
NAPOIAK	F31	1974	13.1	1528.6		P	1264.3	264.3	-1251.2	1514.9	1525.5	10.7							
NAPARTOK	M01	1969	15.8	1960.0	*	P?	1683.0	277.0	-1667.2										
ULU	A35	1976	11.3	3919.7		P?	2772.5	1147.3	-2761.2	2939.2	2947.4	8.8							
UNAK	B11	1974	9.2	2120.0	**	P???	2100.0	20.0	-2090.8	2101.3	2101.9	0.6							
IMPERIAL																			
TULLUGAK	K31	1977	32	9600		P???	5915	3685	-5883	--									
BEAVERHOUSE	H13	1971	245	12295		P	3860	8435	-3615	6841	6843	0.5	8252	8281	29	10426	10452	23	
AKLAVIK ·	A37	1970	33	8479		P	5770	2709	-5737	8462	8479	17							
AKLAVIK	F17	1973	27	2925		C?	2530	395	-2503	2922	2924	2							
AKLAVIK	F38	1973	40	6747		P	5337	1410	-5297	--									
KILANNAK	A77	1981	12.7	2996	*	DIM	1267	1729	-1254.3	--									
KUGPIK	L24	1975	40	9242		P	8960	282	-8920	7405	7440	33	8185	8221	33.3				
KUGPIK	O13	1973	34	12103		P?	10630	1473	-10596	10155	10178	22	11980	11990	8				VERY PELLETAL
NAPOIAK	F31	1974	43	5015		P	4148	867	-4105	4970	5005	35							
NAPARTOK	M01	1969	15.8	1960	*	P?	1683	277	-1667.2	--									CHERTY DOL! TOP SHALE ONLY
ULU	A35	1976	37	12860		P?	9096	3764	-9059	9643	9670	29							IF P 8210, BUT V GLAUC SANDY (
UNAK	B11	1974	33	10975		P???	8180	2795	-8147	9495	9525	30							A.A. SHELL FROM 9100 BURNED P

Legend for tables I, II, III and IV

R.R.	: Rig release date
KB	: Kellybushing depth
TD	: Total depth
DEV	: Deviated hole
FM	: Probable formation underlying sub-Mesozoic unconformity
UNCONF	: Depth of sub-Mesozoic unconformity
DELTA	: Thickness of pre-Mesozoic section penetrated
UNC.SS	: Depth of sub-Mesozoic unconformity below sea level
REC	: Amount of core recovered
*	: Deviated hole
**	: Well with all data in metric

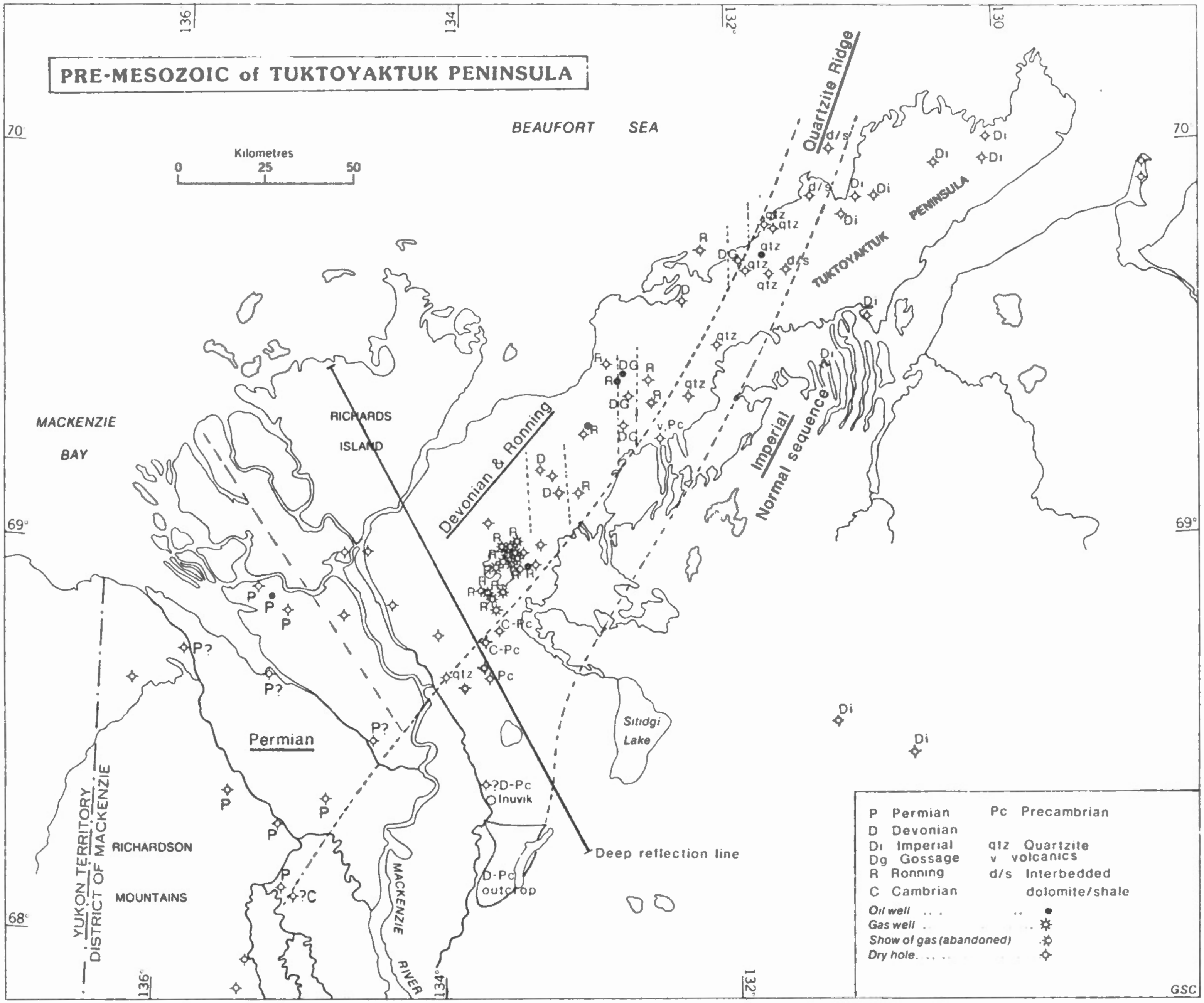


FIGURE 1: Areal distribution pattern of lithology groups underlying the sub-Mesozoic unconformity

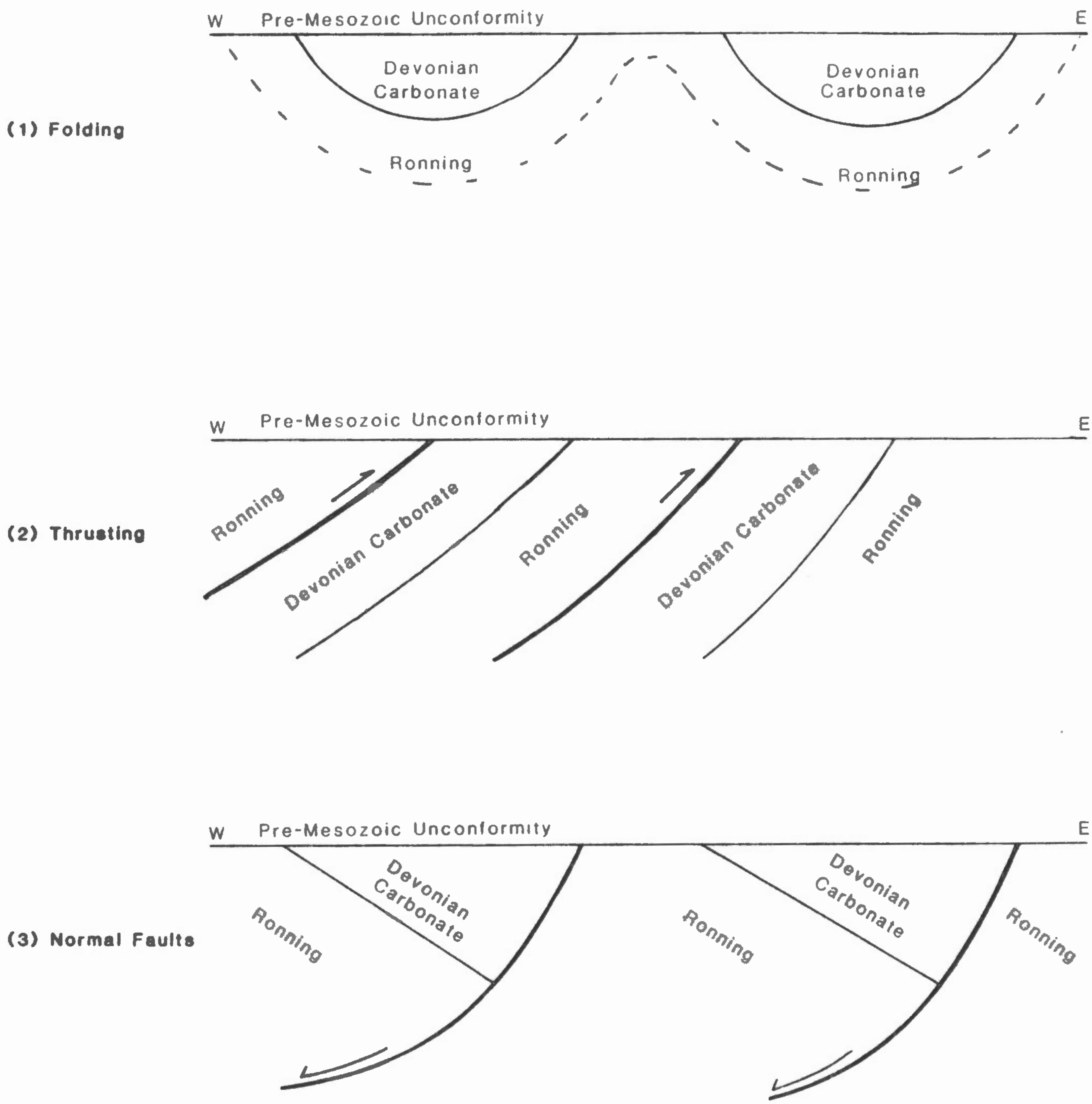
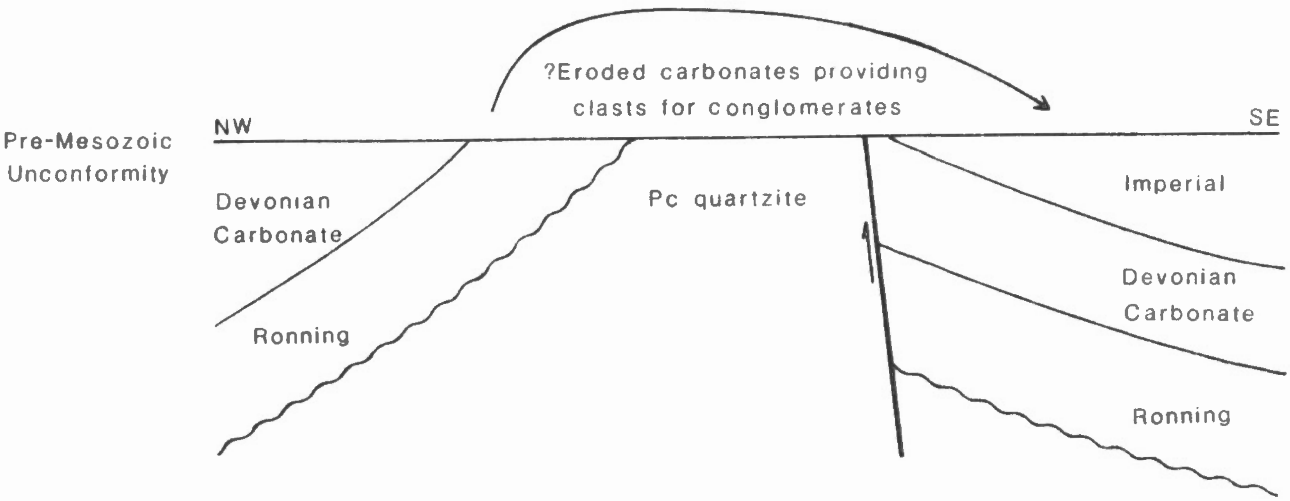
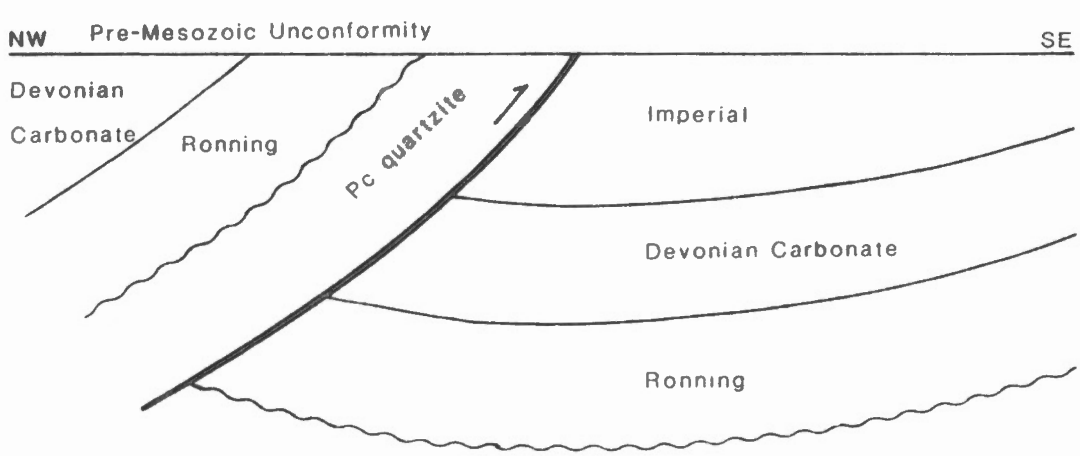


FIGURE 4: POSSIBLE CROSS-SECTIONS FOR GEOLOGICAL PATTERNS NORTH OF THE QUARTZITE RIDGE



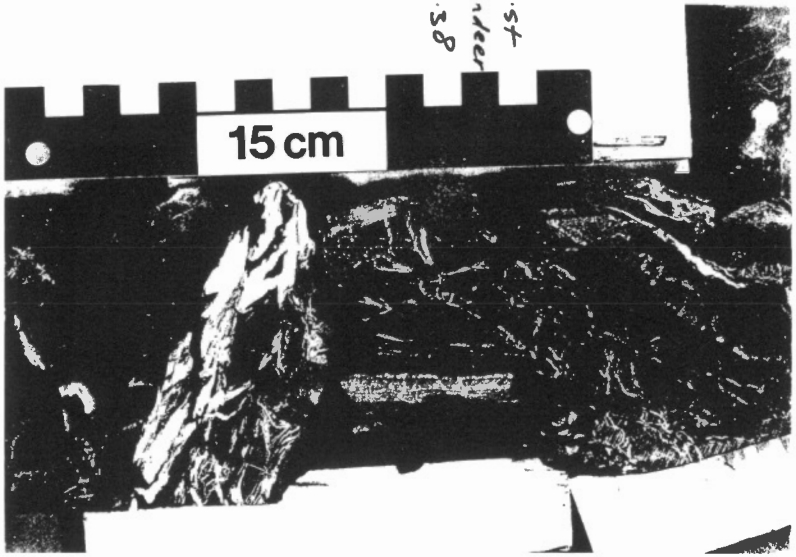
(1) Normal or Transcurrent Faulting, possibly contemporaneous with Devonian Sedimentation



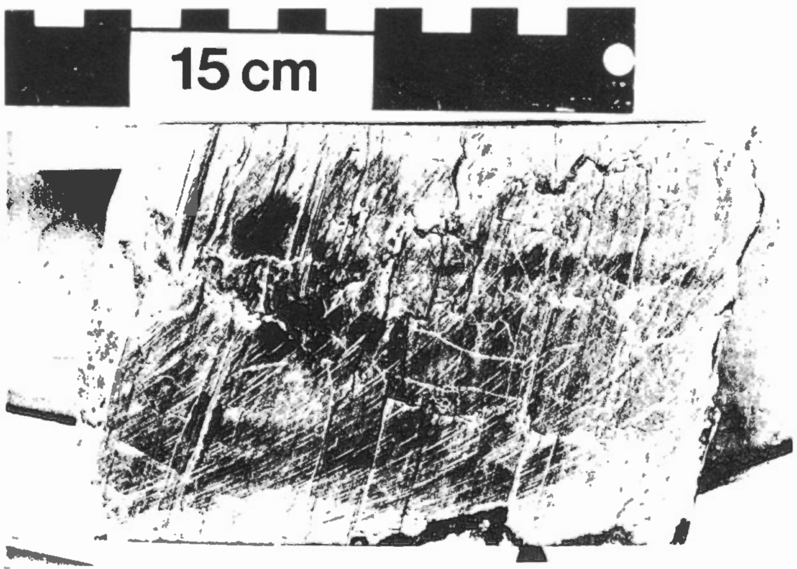
(2) Thrusting

FIGURE 5: SOME POSSIBLE CROSS-SECTIONS FOR GEOLOGICAL PATTERNS AROUND THE QUARTIZITE RIDGE

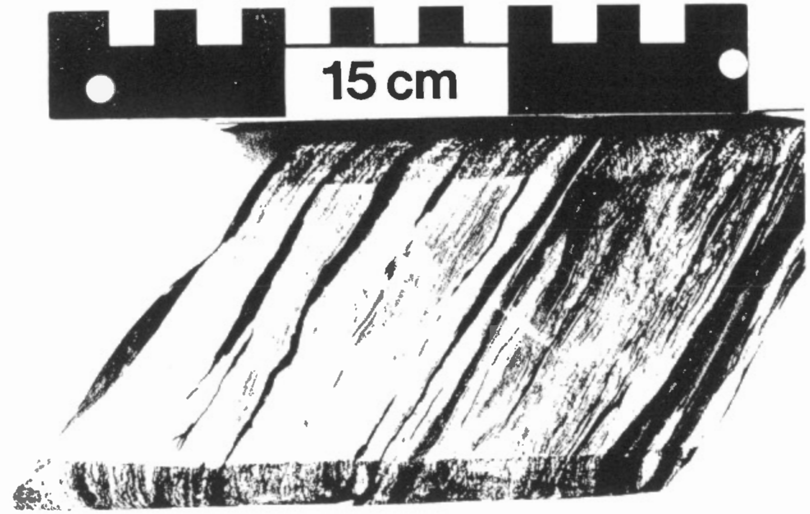
PLATE I: Core photographs East Reindeer C-38 and A-01 (scale: 1white block - 1cm)



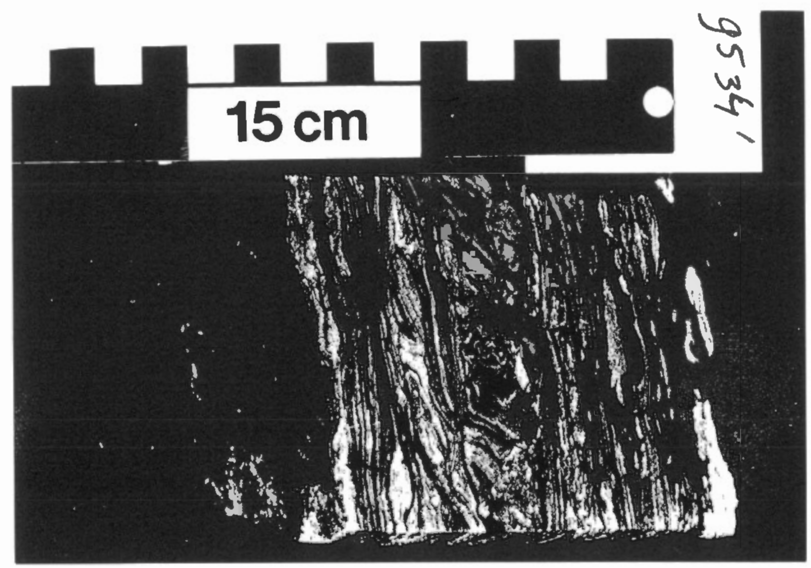
a. C-38, 5824' depth: Deformed and recemented shales and siltstones (2740-28)



b. C-38, 6351' depth: Fractured and recemented limestone (2740-37)



c. A-01, 9533' depth: Deformation of interbedded siltsones and shales (2740-46)



d. A-01, 9534' depth: Enterolithic appearance resulting from soft sediment deformation (2740-71)