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FACIES AND RESERVOIR ANALYSIS,

KEE SCARP FORMATION,

NORMAN WELLS AREA,

NORTHWEST TERRITORIES

Prepared for the Geological Survey of Canada,

by

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INTRODUCTION

The purpose of this study was to describe and delineate the lithofacies of the Kee Scarp reef complex to formulate a better understanding of the oil reservoir which could assist in predicting the presence of other reef complexes in adjacent areas.

The interpretations formulated in this study were made from the examination of 1485 metres (4873 feet) of core taken from 17 wells in, and adjacent to, the Norman Wells oil field. The cores were examined with a binocular microscope and photographs were taken of pertinent faunal and sedimentary features.

Since its discovery in 1920 by a subsidiary of Imperial Oil Limited and the subsequent commencement of production, the Norman Wells oil field and immediate area has been investigated extensively by geologists including Boggs, 1944; Stelck and Gibson, 1944; Hume 1958; Bassett, 1961; Statham, 1969; Braun, 1966; 1978; Williams, 1979; Kempthorne and Irish, 1980; Aitken, Cook and Yorath, 1982; and Muir and Dixon, 1984. The reader is referred to these authors for regional implications, age dating and other pertinent features.

Stratigraphic terminology used in this study follows that of Bassett, 1961, and also Braun, 1966 and Statham, 1969 (see Figure 1).

The Norman Wells field is located on the MacKenzie River at Latitude 65°16'N and Longitude 126°55'W. The pool outline and cored wells examined are shown on the accompanying map.

Since the area has always been remote development progressed rather sporadically, and when the field was first discovered the only market was minor local Territorial needs. However, with the increase in oil prices, especially in the 1970's, it has become feasible for a pipeline to be built to supply markets in southern and eastern Canada. Consequently, the operator began a major development programme in 1979 (Kempthorne and Irish, 1980). Delineation wells have been drilled, most of which have been extensively cored; some of the wells

i.e. Esso MacKenzie River #1 and Bear Island #22 (see cross section 2) were cored through the entire Kee Scarp section as well as the overlying Canol Formation and the underlying Hare Indian Formation.

MAPPING AND PALAEO-INTERPRETATION

Gamma density and gamma sonic mechanical logs were used to assist in correlation of the lithological units, and porosity values from core analyses was plotted on the cross sections. Datum on the cross sections was taken at the top of the Hare Indian Formation and where a well was drilled directionally the same datum was used but the log was tilted to maintain the true vertical thickness; due to scale effects this resulted in exaggerated deviation of the log on the cross section.

The reef complex trends NE - SW and structural dip is approximately 4° to the southwest. Consequently, the oil is trapped against the easterly updip margin of the complex. The oil column is an average of 274 metres (900 feet) in total thickness; with an effective reservoir section of 110 metres (360 feet).

Plotting the palaeolatitude as it was during Devonian time (after Habicht, 1979) on the isopach-facies map indicates that the Kee Scarp reef complex grew at approximately 25° north latitude. This places the reef within the palaeotropical zone. Therefore, Devonian trade winds and associated current and surf direction would have been from the northeast which would have provided nutrients for active reef growth on the present-day northeast side of the complex. It is noteworthy that the best porosity and permeability also are present on the northeast side of the Kee Scarp complex, as is likewise the case for the Swan Hills reef complexes in north-central Alberta.

FACIES AND STRATIGRAPHY

The Kee Scarp reef complex consists of three reefal stages, or cycles of reef growth. The lowermost stage is designated as Unit I which acted as a platform upon which two successive stages; Units II and III were built.

UNIT I

Unit I contains dendroid stromatoporoids, rarely tabular stromatoporoids, and commonly dendroid forms of the corals *Thamnopora*, *Coenites*, and *Alveolites*. True facies separation is not obvious in Unit I but a somewhat more porous matrix is evident toward defined off-reef positions such as the northern side. In general it appears that Unit I began to develop on a gradually shallowing seafloor at the close of Hare Indian time; as sunlight was able to penetrate to the shallow sea bottom corals and tabular stromatoporoid polyps began to grow, firstly on the argillaceous muds, and later on the carbonate muds and calcarenites of the developing reefal bank. Unit I is relatively thick (40 to 50 metres) compared to less than the 10 metre thick "coral zone" (or Division I) of the Swan Hills Formation of north central Alberta. Both Division I and Unit I appear to have been deposited in a very similar environment.

Porosity in the lower 30 metres of Unit I generally is less than 4% and the permeability is less than 0.5 millidarcies; consequently, the lowermost 30 metres of Unit I is relatively nonporous. However, the uppermost 10 metres of Unit I averages 8% porosity with permeabilities from 1 to 5 millidarcies which, undoubtedly, contributes to the reservoir. The increase in porosity in the upper part of Unit I may be due to an increase in the quantity of dendroid stromatoporoids as well as an increase in the amount of fine-grained fossil debris in the matrix. An exception to the generally low porosity in Unit I is

apparent in the Goose Island #19 well (see cross section 2). This well was drilled directionally west to northwest and probably bottomed in the fore-reef of Unit I. Here the upper part of Unit I has 12 - 14% porosity and permeabilities up to 4 millidarcies.

UNIT II

Unit II is approximately 50 metres thick and grew upon the platform formed by Unit I. Unit II grew in a definable reefal pattern and fore-reef, reef, and lagoonal facies are distinguishable (see cross sections). A relatively efficient reef wall composed of subspherical and dendroid stromatoporoids allowed *Amphipora* thickets to flourish in the lagoon. Maximum wind and current direction was obviously from the northeast, since it is here that the reef and fore-reef facies are most strongly developed (see isopach-facies map).

Generally, porosity in Unit II is better than that of Unit I with again the best porosity at the north and northeast margin of the Kee Scarp complex. In the D-39X and G-24X wells, which are both in a reef or fore-reef position, Unit II porosity averages 8 to 12% with permeabilities of 4 to 6 millidarcies (see cross sections 1 and 3). In contrast, on cross section 3, however, the lagoonal Bear Island #21 well has porosity to a maximum of only 5% with permeabilities less than 1 millidarcy.

UNIT III

Unit III averages 60 metres in thickness and is very similar in faunal content and general configuration to Unit II, and likely was deposited under very similar environmental conditions and water depths. However, porosity ranges somewhat higher - up to 20% - with permeabilities

to 10 millidarcies. Unit III was the final stage of reef growth and probably was terminated by rapidly deepening seas.

Units I, II and III are roughly equivalent to the K1, K2 and K3 zones of Kempthorne and Irish (1980). Their K4 zone was taken as the upper part of Unit III and appears to be the final stage of reef shoaling in this unit.

In the Kee Scarp reef complex as a whole porosity appears to have developed somewhat differently than at Swan Hills. For example, much of the Norman Wells matrix porosity is very fine or "chalky" and can range as high as 20%, but permeabilities are a relatively low 5 or 6 millidarcies. If the matrix porosity is 6% or less the permeability commonly is less than 1 millidarcy. This is much different than at Swan Hills where effective reservoir rock has a lower limit of 3% porosity and a permeability of 1 millidarcy.

Sparry calcite infill is a greater limiting factor in intra-skeletal and interparticle porosity at Norman Wells than at Swan Hills. This may be the result of a greater amount of post lithification percolating waters at Norman Wells.

In the Kee Scarp reef complex porosity in general appears to have developed best in the matrix rather than in the fossils themselves, except where wave action in the reef and fore-reef was the greatest. Here the rigid subspherical stromatoporoids are highly fragmented, are porous, and underwent much abrasion to form coarse-grained matrix calcarenites. Much of the original porosity was altered by chalkification (see core descriptions in Appendix A) that may have occurred shortly after or even during lithification by algal action.

FRACTURING

Both vertical and horizontal fractures are significant in enhancing the Kee Scarp reservoir. Horizontal fractures are common and, undoubtedly, contribute to lateral permeability. The fractures have a dominant northeasterly orientation (Kempthorne and Irish, 1980) and studies of them have been incorporated into a reservoir enhancement recovery programme by Esso. Aquilera (1978) has shown that fracture systems have significant effects on relatively tight reservoir rocks where the fractures provide avenues of nearly infinite permeability. The Kee Scarp reef complex is a classic example of a reservoir with high matrix porosity and, therefore, a high oil storage capacity, all of which are combined with low permeability. Consequently, a fracture system would enhance recovery a very significant amount. Furthermore, since the field is relatively shallow, has no gas cap, has low reservoir pressure, and no water drive, makes enhanced waterflood recovery a necessity. It appears that without the fracture system waterflooding would be largely ineffective.

RESERVOIR COMPARISON TO JUDY CREEK

Reservoir parameters of both the Norman Wells field and the Judy Creek field in the Swan Hills area of north central Alberta are listed in Table 1. Most of the reservoir features compare relatively well, with the exception of permeability which averages 45 millidarcies at Judy Creek but averages only 4 millidarcies at Norman Wells. This also is reflected by the fact that 10 times as much oil has already been produced from the Judy Creek field. The low permeability at Norman Wells

emphasizes the importance of the fracture system as to enhancing the permeability and would directly affect the ultimate recovery. Judy Creek does not have a significant fracture system; this may be due to the fact of its greater depth of burial. Kempthorne and Irish (1980) suggest that limestones at shallow depths have a low ductility and respond to stress in a more brittle manner than limestones at depth (i.e. Judy Creek).

TABLE I

COMPARATIVE RESERVOIR PARAMETERS

	<u>JUDY CREEK</u>	<u>NORMAN WELLS</u>
Depositional setting	Reef-inner shelf	Reef-outer shelf
Age	Middle Devonian	Middle Devonian
Formation	Swan Hills	Kee Scarp
Rock type	Limestone	Limestone
Number of wells	220	60 -- 250
Area of reef	120 km ²	140 km ²
Area of pool	116 km ²	16 km ²
Platform thickness	50 metres	50 metres
Reef buildup	80 metres	110 metres
Trap-fill	75%	10%
Aquifer	Small	Ineffective
Average depth	2640 metres	400 metres
Oil gravity	41° A.P.I.	39° A.P.I.
Maximum pay (gross)	65 metres	110 metres
Average porosity	9%	10%
Average matrix permeability	45 md (k90)	4 md (k90)
Connate water saturation	16%	10%
Original oil-in-place	132x10 ⁶ m ³	100x10 ⁶ m ³
Depletion-natural	Solution gas	Solution gas
Depletion-enhanced	Waterflood	Waterflood
Approximate recovery factor	45%	40%
Production to date	39x10 ⁶ m ³	4x10 ⁶ m ³

from Jardine and Wishart, (1982)

FACIES AND DEPOSITIONAL COMPARISON OF SWAN HILLS TO NORMAN WELLS

In comparing the faunal and depositional features of the Kee Scarp reef complexes to those of the Swan Hills area of Alberta there are distinct similarities, but also significant differences. For example, there are more algal coatings and algal mats in the Kee Scarp complexes. This preponderance of algal material may have had a bearing on the subsequent "chalkification" of the Kee Scarp carbonates. The Divisional, or unit, breaks between reef cycles is much more pronounced at Swan Hills than at Norman Wells, and even microstylolitization is less common at Norman Wells. This suggests that deposition was more continuous at Norman Wells with less variation of environments. Whereas, at Swan Hills the breaks between reef cycles was quite abrupt, and the lateral variation occurred as a result of sharp rises and falls in sea level, possibly due to tectonic movements of the Peace River Arch.

The porosity in the two areas also differs in that open stromatoporoid galleries and other intrafossil porosity is much more common at Swan Hills; this may be the result of less algal growth and less chalkification or secondary calcitization at Swan Hills.

Although no faunal age dating or detailed well log correlation was done in this study there is a strong inference that Units I, II and III of the Kee Scarp Formation, even though they are considerably thicker, may be equivalent to Divisions I, II and III of the Swan Hills Formation (see Figure 1). Division I is very similar faunally and lithologically to Unit I and together with Units II and III could equate to the Swan Hills "platform" which consists of Divisions I, II and III. The major difference is the fact that the Kee Scarp Units are nearly four times as thick. This, however, could have resulted from the fact that the Kee Scarp reefs grew on a more stable base and were not subjected to "Peace River

STATHAM, 1969; NORMAN WELLS

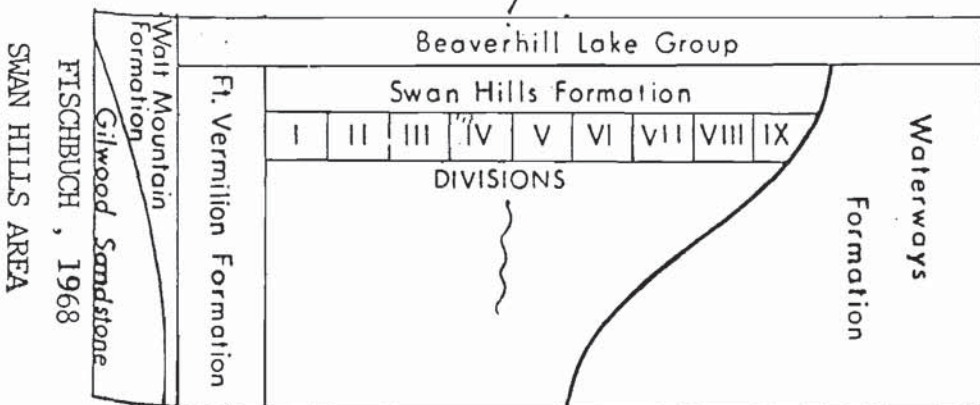
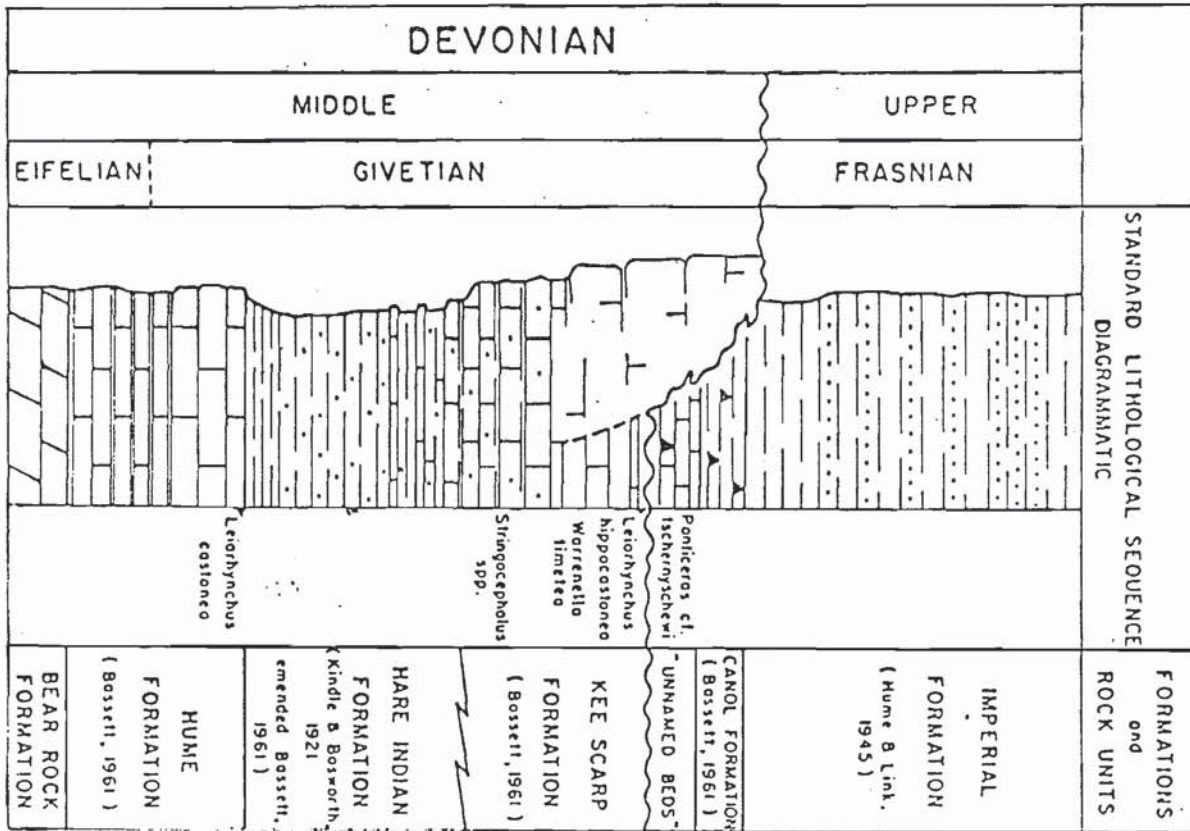


FIGURE 1

Arch - type" of tectonic movement.

PROSPECTS FOR OTHER NORMAN WELLS OIL FIELDS

A regional analysis outlining further Kee Scarp reservoirs is not part of this study. However, Williams (1979) has mapped the regional distribution of the Kee Scarp Formation as extending roughly along both sides of the Mackenzie River, in a belt about 120 kilometres wide, a distance of 200 kilometres northwesterly of Norman Wells and about 100 kilometres southeasterly of the field. Over much of this area the Kee Scarp Formation reef complexes are exposed in outcrop along the river and in the adjacent Franklin Mountains, Kee Scarp, Hoosier Ridge, Carcajou Ridge, Powell Creek and Beavertail Ridge; these reefs in many cases are breached Norman Wells type of complexes. Boreholes have been drilled adjacent to many of these outcrops in attempts to find the reefs in conditions suitable for oil entrapment, but to date no other commercial hydrocarbons have been found.

All of the reef complexes in the general area, including Norman Wells, rest on Laramide, upthrust fault plates; this complicates the search for reefal traps of the Norman Wells type. However, modern seismic techniques and processing may be of assistance in resolving this problem.

The area is still considered to have good prospects for hydrocarbons in Kee Scarp reservoirs similar to Norman Wells above the major upthrust faults in areas to the northwest, between Norman Wells and Powell Creek, and the areas southeast and west of Norman Wells, since all these areas have allochthonous sequences. Attempts were made to drill through the thrust faults into the autochthonous beds, but as the Cambrian Saline River halite is the

glide plane for absorption of the compression, no Devonian is present below the halite and, therefore, no Kee Scarp reefs can be expected below the present sequence.

FURTHER STUDIES

Although several studies have been made of the Norman Wells area and the Kee Scarp reef reservoir, there are still many questions to be answered and much further work that could be done to assist in the exploration for other similar productive reefs in the area.

Among these are:

1. Study of the thrust fault systems, using both geological and geophysical data to locate the Kee Scarp reefs in favourable conditions for oil entrapment.
2. Light-gravity oil occurs in the Kee Scarp Formation at Norman Wells at a depth of 300 - 400 metres, but this depth is too shallow for normal maturation and generation of light oils; therefore, geochemical studies should be carried out to determine:
 - *(a) If the oil has migrated into the reservoir, and if so, from where.
 - *(b) Source rock to oil matching analyses of the Canol and "Unnamed beds", basal Kee Scarp (Unit I) and Hare Indian Formation, to determine the most likely source rock.
 - *(c) Vitrinite reflectance studies to determine the maturation level of the above formations in the Norman Wells field and area, and the paleoburial depths of these rocks.
3. In the Norman Wells field itself, with the abundance

of cored reservoir rock, further field studies could be done, such as:

- (a) Detailed petrology and studies of the diagenetic fabric and its relationship to porosity and permeability in conjunction with mercury injection and capillary pressure measurements of the pore and pore throat sizes could be done to determine the effects of diagenesis on reservoir permeability and porosity.
- (b) Further measurements of the effects of fractures on reservoir permeability and associated enhancement of matrix permeability.

4. Analysis of the clay content of the reef complex in order to determine the effect of clays on the porosity and permeability of the various lithofacies, and also on the vertical porosity variation in Units I, II and III.

5. The stratigraphic position and lithology of the Canol Formation suggests a possible correlation with the Duvernay and Majeau Lake Formations of northern and central Alberta; faunal studies, perhaps using microfossils may help in age dating and resolving this possibility.

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A P P E N D I X

IMPERIAL NORMAN WELLS # 37-X N-37 65°16' 57'N
126°51' 50'W, K.B. 162 ft., T.D. 1439 ft.

- 1032-1085 Calcirudite, light brown, of abraded subspherical stromatoporoids to 3 inches diameter 20%, dendroid stromatoporoids 5%, most fossils have algal coating and rarely bituminous staining along outer rims, and matrix of fine-grained fossil debris, pellets and micrite, matrix is much softer than fossils, commonly chalky; very poor fossil porosity, fair intergranular and chalky porosity in matrix.
Fore-reef to reef
- 1085-1127 Calcarenite, light brown, of pellets, coalescent pellets and fine-grained fossil debris, evenly sorted, massive fair intergranular and chalky porosity.
Fore-reef calcarenite facies
- 1127-1147 Calcirudite, light brown, of highly abraded and algal coated dendroid stromatoporoids to 30%, subspherical stromatoporoid fragments 5%-; matrix of pellets and fine-grained fossil debris, very chalkified, trace medium-shelled brachiopods; fossil tight, fine intergranular and chalky porosity.
Fore-reef dendroid stromatoporoid facies
- 1147-1167 Calcarenite, light brown, of pellets, coalescent pellets and fine-grained fossil debris, evenly sorted, chalkified, relatively massive; coated dendroid stromatoporoid fragments and small bulbous stromatoporoids totalling 5%-; fair intergranular and chalky porosity.
Fore-reef calcarenite facies
- 1167-1212 Calcirudite, light brown, of abraded algal-coated dendroid stromatoporoids with skeletons and rims slightly chalkified, remaining galleries filled with sparry calcite 30%, subspherical? stromatoporoids with algal coatings 5%-; matrix of pellets and fine-grained fossil debris very chalkified; poor fossil porosity, fair intergranular and

- 1167-1212
(cont'd) chalky porosity at 1185.
Fossil galleries are filled with white and clear spar.
Matrix porosity (original) has been severely altered or "chalkified", moderate intergranular porosity, but probably poor perm.
Fore-dendroid (classic)
- 1212-1310 Calcirudite, light brown, of abraded and algal coated dendroid stromatoporoids to 25%, subspherical stromatoporoid fragments and irregular encrusting stromatoporoids 10%; matrix of pellets and fine-grained fossil debris very chalkified, but rare irregular zones of denser sparry calcite-filled cavings and beds, small crinoid ossicles and thick-shelled large pelecypods (*Megalodon?*), large thick-shelled gastropods and thamnoporid corals at 1297-1302. Fossils tight, matrix with fair chalky and intergranular porosity.
Fore-dendroid
- 1310-1322 Calcirudite, brown to slightly chalky brown, of dendroid stromatoporoids 40%, in tightly packed beds, very abraded with bitumen in outer pseudozoidal tubes, *Amphipora* trace, crinoids common, *Thamnoporid* corals rare; matrix of fine-grained fossil debris, rare pellets and black bituminous content; trace matrix porosity, poor pinpoint porosity very slightly dolomitized, unrelated to fossils. Fossils tight.
- 1322-1357 Calcirudite, light brown, of abraded and algal-coated dendroid stromatoporoids 40% tightly packed in places, subspherical stromatoporoid fragments 5%; matrix of fine-grained fossil debris; rarely pellets with interstitial sparry calcite; uppermost 15 feet of interval has abundant primary shelter porosity filled with white calcite; whole interval relatively tight and competent.

1357-1439

Calcirudite, brown, of dendroid stromatoporoids abraded but not coated 30%, tabular stromatoporoids and dendroid alveolitid corals 5%-; matrix of micrite and rare very fine-grained pellets, generally interval tight with very slight trace intergranular porosity in places.

Fracturing -- Horizontal fractures every 2 to 3 metres.

IMPERIAL GOOSE ISLAND # 21 E-57 65°16' 28.75'N
126°55 49.69'W, K.B. 156 ft., T.D. 1664 ft.

- 1514-1570 Calcirudite, brown - light brown, of dendroid stromatoporoids abraded and slightly coated 40% and tightly packed at top of interval, grades to 25-30% and floating at base of interval; thin irregular tabular and subspherical stromatoporoids 5%-, rare horizontal and Thamnoporid corals, ostracode trace; intermittent matrix porosity - approximately 6 inches alternating beds of fair - poor intergranular porosity to trace porosity depending on the amount of alteration and/or amount of micrite present, rare interfossil vugs, overall porosity fair-poor-trace. Back-reef dendroid stromatoporoid to dendroid stromatoporoid facies.
- 1570-1664 Calcirudite, brown - light brown, of abraded and slightly coated subspherical stromatoporoid fragments to 3 inches diameter grading to very irregular encrusting stromatoporoids to 4 inches thick 40%; dendroid stromatoporoids 5%-, slightly more abundant to base of interval, small crinoid ossicles rare in top 10 feet of interval; matrix of fine-grained fossil debris; fair slightly chalky intermittent 6 inch alternating beds of matrix porosity, fossils have trace porosity to completely tight.
Fracturing -- Horizontal fractures 2 to 3 per metre.
Reef

ESSO NORMAN WELLS # P-15X H-67 65°16' 16.71'N
126°56' 23.38'W, K.B. 51.2M., T.D. 661M.

- 504.8-518 Calcirudite, brown - light brown, of abraded and slightly coated dendroid stromatoporoids from 1/4 inch diameter (top of interval) to 1 inch diameter and irregular shaped (base of interval) 40% of rock, irregular tabular grading to encrusted stromatoporoids 10%, subspherical stromatoporoid fragments to 3 inches diameter 5%, matrix of fine-grained fossil debris and pellets, matrix poor-fair porosity, fossils tight, oil staining at alternate 6 inch intervals with stained areas only in matrix, little to no sparry calcite in stained areas -- only chalkified matrix or 'microcalcification'. In unstained areas there are irregular blebs of sparry calcite and on 30-40% chalkification therefore, tightness?
Fore-reef dendroid stromatoporoid facies
- 518-550 Calcirudite, brown - light brown, of large subspherical stromatoporoids 20% (rare irregular tabular and encrusted stromatoporoids) to 6 inches diameter but are abraded and even rounded slightly coated, abundant dendroid stromatoporoids 5% to 10% from 537 to 550; matrix of fine-grained fossil debris and pellets, relatively no sparry calcite, therefore, near complete chalkification of matrix; fair matrix porosity, poor-trace fossil porosity, staining is present in alternating 6 inch beds and appears unrelated to fossil or matrix; basal 3 metres of interval very rubbly looks like core jamming off but may be fracturing.
Reef
- 550-554 Calcirudite, brown, of dendroid stromatoporoids slightly abraded, highly packed 65% surrounded by microstylolites, matrix of fine-grained fossil debris, tight.
Packed dendroid stromatoporoid facies - tight

ESSO NORMAN WELLS # P-15X H-67 65°16' 16.71'N
126°56' 23.38'W, K.B. 51.2M., T.D. 661M.

554-561 Calcirudite, light brown, of tabular stromatoporoids 20%, irregular interbedded with graded beds ranging from clotted micrite (algal mats) to coalescent pellets to pellets to fine-grained fossil debris; dendroid stromatoporoids 10% floating and scattered throughout interval, fossils slightly coated, generally matrix consists of micrite, vague pellets, pellets and fine-grained fossil debris; disarticulated thick-shelled brachiopods common, tight. Platform shoal - tight.

561-607 Calcirudite, light brown, of dendroid stromatoporoids 30%, irregular subspherical and tabular stromatoporoid fragments 25%, rare large pisolites with several fossil fragments and debris as nucleii, matrix of fine-grained fossil debris, pellets and coalescent pellets, fossil tight, matrix poor - trace porosity, large (2 inches diameter) very thick-shelled gastropods at 576 M. with original shelter porosity from 566-570 M., crinoids, rubbly (fracturing?) and one distinct vertical fracture at 570 M. at least 2 feet long, 588 to 607 have less stained portions, rock mainly tight with both matrix and fossil galleries filled with sparry calcite - nearly completely tight, but still is relatively high energy reef. Also, rare Thamnoporid and horn corals. Horizontal fractures 2 - 3 per metre.
Reef.

ESSO NORMAN WELLS # G-24X C-48 65°17' 08.04'N
126°53' 34.42'W

- 475-483 No recorded recovery.
- 483-504 Calcirudite, light brown, of dendroid stromatoporoids rarely abraded and algal coated not packed 25%, irregular tabular and encrusting stromatoporoids rarely dipping to 15°; matrix of fine-grained fossil debris, pellets and rarely micrite, only minor chalkification; fossil tight to trace gallery porosity, matrix poor intergranular porosity.
Fore-reef dendroid stromatoporoid facies.
- 504-525 Calcirudite, light brown, of dendroid stromatoporoids ranging from abraded and coated to irregular and large not packed 20%, irregular tabular and encrusting stromatoporoids 10% - dipping at 15°; matrix of micrite, coalescent pellets and rarely fine-grained fossil debris, large thick-shelled gastropod trace, fossil tight, matrix tight, no chalkification - one open fracture 508-511.
Fore-reef dendroid stromatoporoid facies.
- 525-550 Calcirudite, light brown - brown, of dendroid stromatoporoids 20%, tabular and irregular encrusting stromatoporoids 20%, large irregular subspherical stromatoporoid fragments 10%, matrix of fine-grained fossil debris, pellets and rarely micrite, poor chalkification of matrix, trace fossil porosity, fair - poor matrix porosity - hard to tell if beds dip since stromatoporoids are too irregular.
- 550-566 Calcirudite, light brown, of large subspherical stromatoporoids 40%, dendroid stromatoporoids 5%, tabular stromatoporoids 10%; matrix of fine-grained fossil debris, pellets and micrite and sparry calcite, fossil tight, poor matrix porosity, trace chalkification.
Reef

ESSO NORMAN WELLS # G-24X C-48 65°17' 08.04'N
126°53' 34.42'W

- 566-593 Calcirudite, light brown, of tabular stromatoporoids grading from 1/2 inch thick and separated by sediment to 2 inches thick and stacked at base of interval 5%, dendroid stromatoporoids 5%, rare-trace fossil porosity; trace - poor matrix porosity, trace chalkification.
Back-reef
- 593-595 Calcarenite, light brown, very coarse-grained of rounded clusters of micrite and fossil debris, matrix of sparry calcite and matrix relatively tight.
Calcarenite facies.
- 595-596 Calcirudite, dark brown, of very abraded subspherical stromatoporoid fragments 20%, crinoid ossicles very abundant, matrix of coarse-grained fossil debris and black bituminous material, vague large boudins to 6 inches diameter.
Horizontal fractures 2 to 3 per metre.
Open-marine incursion.

ESSO NORMAN WELLS # K-48X J-36 65°15' 37.06'N
126°51' 10.24'W

- 530.6-542 Calcilutite/calcirudite, light brown, of Amphipora 5% coated but not highly abraded, oncolites/pisolites 5%, dendroid stromatoporoids 5% in matrix of micrite and coalescent pellets, fossils and matrix relatively tight with rare irregular zones of slight "chalkification" following no particular pattern, low-amplitude stylolites with bituminous material on seams rare.
Light lagoon.
- 542-552 Calcirudite, light brown, of dendroid stromatoporoids slightly abraded not coated and highly packed 65%, matrix of fine-grained fossil debris and pellets with slightly bituminous material, consistent "chalkification", poor to trace fossil porosity, matrix poor - fair porosity.
Back-reef dendroid stromatoporoid facies.
- 552-555 Calcilutite/calcarenite, light brown - buff, of coalescent pellets, coated grains, pisolites and fine-grained fossil debris, sparry calcite matrix, tight to trace intergranular porosity.
Light high energy lagoon.
- 555-562 Calcirudite, brown, of large irregular bulbous stromatoporoids to 4 inches diameter 25%, unabraded Amphipora 5%, dendroid stromatoporoids 5%, matrix of micrite and coalescent pellets, fossils tight with sparry calcite in galleries, matrix tight except for rare chalkification along micro-stylolites.
Dark lagoon.
- 562-566 Calcilutite, buff, laminated with low-amplitude stylolites, common, tight.
Light lagoon.

ESSO NORMAN WELLS # K-48X J-36 65°15' 37.06'N
126°51' 10.24'W

- 566-587 Calcirudite, brown, of large irregular bulbous stromatoporoids to 4 inches diameter 30%, unabraded Amphipora 5%, dendroid stromatoporoids 10%, fossil tight with sparry calcite in galleries, matrix tight except for rare chalkification along microstylolites. Fair matrix porosity in certain intervals i.e. 572-576 and 581-587.
Dark lagoon.
- 587-597 Calcirudite, light brown - dark brown, of dendroid stromatoporoids very abraded and packed 70%, matrix of fine-grained fossil debris and in places black bituminous material, rare sparry calcite in intrafossil areas; tight in uppermost 5 metres of interval. From 592-597 fossils are more sparse; matrix more common and has chalky porosity.
Dark lagoon with dendroid stromatoporoid facies.
- 597-600 Calcarenite, light brown, of fine-grained fossil debris and rarely pellets, crinoid ossicles and crinoid fragments to 70% of rock; matrix of sparry calcite and rarely micrite, tight.
Shallow on the shoal.
- 600-616 Calcirudite, light brown, of abraded and packed to unabraded and floating dendroid stromatoporoids 60%, Thamnoporid corals scattered throughout 5%, matrix ranges from buff micrite (600-605) with greenish cast to calcarenite (605-616) of pellets and fine-grained fossil debris, slight chalky porosity in coarser grained matrix in some places.
Fossils tight.
Fractures 2 to 3 per metre and are unrelated to facies.
Coral zone.

ESSO NORMAN WELLS # D-39X 0-37 65°16' 54.8'N
126°51' 06.20'W

- 360-366 Calcarenite, brown, composed of pellets, fine-grained fossil fragments and coalescent pellets, abraded, bored and algal coated subspherical stromatoporoid fragments to 1½ inches diameter 5%-, matrix partly to completely chalkified, fair intergranular porosity.
Fore-reef calcarenite facies.
- 366-378 Calcirudite, brown, composed of abraded subspherical stromatoporoids 20%, abraded dendroid stromatoporoids 20%, matrix of coarse-grained fossil debris and pellets, fair pinpoint vug porosity, fair - poor chalky matrix porosity, matrix becomes more micritic and less porous to base of interval.
Reef.
- 378-381 Calcirudite, light brown, composed of abraded dendroid stromatoporoids 40% in matrix of pellets, coalescent pellets, fine-grained fossil debris and micrite, fossil tight and matrix tight intergranular porosity.
Back-reef dendroid stromatoporoid facies.
- 381-396 No Core.
- 396-403 Calcirudite, light brown, composed of abraded dendroid stromatoporoids 70% grading to 30% at base of interval, matrix of fine-grained fossil debris micrite pellets and coalescent pellets with sparry calcite in some voids, tight at top grading to poor intergranular matrix porosity at base of interval, slightly chalky porosity.
Fore-reef dendroid stromatoporoid facies.
- 403-451 Calcirudite, light brown, composed of abraded subspherical stromatoporoids to 4 inches diameter 25%, dendroid stromatoporoids in places with thin algal coatings 20%, Amphipora rare; matrix of pellets, fine-grained fossil debris and

ESSO NORMAN WELLS # D-39X 0-37 65°16' 54.8'N
126°51' 06.20'W

403-451
(cont'd)

rarely micrite; fair chalky matrix porosity, fossils have trace porosity to tight. Dendroid stromatoporoids more abraded and more tightly packed to base of interval with crinoid ossicles common in coarse-grained matrix that has some sparry calcite.

Reef to slightly back-reef facies.

451-484.8

Calcirudite, brown, composed of irregular dendroid stromatoporoids slightly abraded 40%, flat tabular stromatoporoids 10%, Thamnoporid and Alveolitid corals common to abundant in places, thick-shelled brachiopods rare floating in matrix of fine-grained fossil debris, pellets, micrite, thin slightly bituminous partings, poor matrix porosity slightly chalky, fossil tight. Vertical fractures at 401, 405, 408, 412, and 417. Horizontal fractures 2 - 3 per metre and somewhat rubbly especially at 424, 432, 433, and 445.

Coral zone.

IMPERIAL GOOSE ISLAND # 19 E-67 65°16' 19.85'N
126°57' 46.48'W

- 2135-2152 Calcirudite, brown, composed of abraded dendroid stromatoporoids commonly with algal coating 15%, small (1 inch diameter) subspherical stromatoporoid fragments 10%, dendroid Thamnoporid corals common, Amphipora trace, matrix composed of fine - coarse-grained fossil debris partly "chalkified" trace dolomitization, good intergranular matrix porosity, fair - poor intrafossil porosity.
Fore-reef.
- 2152-2180 No Core.
- 2180-2209 Calcirudite, brown, composed of abraded dendroid stromatoporoids 25%, small subspherical stromatoporoid fragments to 1 inch diameter 10%, dendroid Thamnoporid corals rare, Amphipora trace, matrix of fine - coarse-grained fossil debris partly "chalkified", trace dolomitization, good intergranular matrix porosity, fair - poor intrafossil porosity.
Fore-reef.
- 2209-2229 No Core.
- 2229-2254 Calcarenite, brown, composed of fine-grained fossil debris and pellets, rare abraded dendroid stromatoporoid fragments slightly coated, crinoid ossicles and thick-shelled brachiopods rare to common, sparry calcite rare in matrix and inner fossil galleries, slight dolomitization, fair "chalky" intergranular porosity.
- 2254-2278 No Core.
- 2278-2289 Calcarenite, brown, composed of fine-grained fossil debris and pellets, rare abraded dendroid stromatoporoid fragments, slightly coated, crinoid ossicles and thick-shelled brachiopods rare - common, sparry calcite rare in matrix and common in fossil galleries, slight dolomitization, fair

IMPERIAL GOOSE ISLAND # 19 E-67 65°16' 19.85'N
126°57' 46.48'W

- 2278-2289 "chalky" intergranular porosity.
(cont'd) Fore-reef.
- 2289-2292 No Core.
- 2292-2311 Calcarenite, brown, composed of fine-grained fossil debris and pellets, abraded dendroid and tabular stromatoporoids to 15%, slightly coated, crinoid ossicles and thick-shelled brachiopods rare - common, sparry calcite rare in matrix and common in fossil galleries, fair "chalky" intergranular porosity.
Fore-reef.
- 2311-2320 No Core.
- 2320-2335 Calcarenite, brown, (as above).
Fore-reef.
- 2335-2586 No Core.
- 2586-2609 Calcarenite, brown, composed of pellets and fine-grained fossil debris, well sorted grains, relatively massive, rare very abraded dendroid stromatoporoid fragments slightly algal coated, crinoid ossicles and fragments common, fair - poor intergranular "chalky" matrix porosity.
Fore-reef.
- 2609-2613 No Core.
- 2613-2647 Calcarenite, brown, composed of pellets and fine-grained fossil debris, well sorted grains relatively massive, rare very abraded dendroid stromatoporoid fragments slightly algal coated, crinoid ossicles and fragments common, fair to poor intergranular "chalky" matrix porosity.
Fore-reef.
- 2647-2663 No Core.
- 2663-2699 Calcarenite, brown - dark brown, composed of pellets, micrite and fine-grained fossil debris, crinoid ossicles

IMPERIAL GOOSE ISLAND # 19 E-67 65°16' 19.85'N
126°57' 46.48'W

2663-2699

and calyxes common, trace intergranular porosity.

(cont'd)

Fore-reef shoal.

Core fragments are no longer than 3 to 4 inches - probably
a lot of fracturing along with physical core breakage.

ESSO MACKENZIE RIVER # 1 C-47 65°16' 12.3'N
126°53' 35.0'W

- 434.75-448 Shale, black bituminous fissile broken into poker chips
1/4 to 1 inch thick (fractured? horizontally) conchoidal
fracture patterns rare slickensides...
Open-marine.
- 448-454 Shale, black bituminous competent with core broken into
6 - 8 inch lengths, rare fine interbeds to 1/8 inch thick
of pyrite and white noncalcite material, probably
horizontal fracturing? rare vertical fracturing.
Open-marine.
- 454-467 Calcarenite/calculutite, light brown - buff, composed of
pellets, coalescent pellets and trace fine-grained fossil
debris, nonabraded and coated, Amphipora common in irregular
beds to 2 inches thick 5%, very abraded and coated dendroid
and bulbous stromatoporoids 10%, fossils become sparse to
base of interval, poor intergranular porosity in irregular
portions of slightly coarser-grained matrix, porosity
continues to base of interval.
Light lagoon.
- 467-498 Calculutite, light brown - buff, grading to calcarenite in
places, laminated with low-amplitude stylolites common,
rare interspersed algal mats, abraded and coated dendroid
stromatoporoids and bulbous stromatoporoid fragments 5%-,
Amphipora 5%- unabraded rarely concentrated in beds to 3
inches thick, spotty trace to very poor intergranular
porosity - not really chalky. One open vertical fracture
at 494 M.
- 498-517 Calcirudite, brown - light brown, composed of abraded dendroid
stromatoporoids 30%, tabular stromatoporoids 5%, abraded and
coated bulbous stromatoporoids 5%, rare solitary corals, rare
Amphipora, rare thick-shelled brachiopods, matrix of fine-

ESSO MACKENZIE RIVER # 1 C-47 65°16' 12.3'N
126°53' 35.0'W

- 498-517
(cont'd) grained fossil debris, pellets and light brown - buff micrite; poor intergranular (slightly chalky) porosity, fossil tight.
Back-reef dendroid stromatoporoid facies.
- 517-542 Calcarenite, light brown, of fine-grained fossil debris, pellets and micrite with floating unabraded *Amphipora* 5%, abraded *Amphipora* in beds to 3 inches thick in anastomosing microstylolites, various sized abraded, coated and bored bulbous stromatoporoids 5%, rare coated dendroid stromatoporoids, rare irregular zones of slightly chalky porosity - possibly in places of coarser grained original rock?
Light lagoon.
- 542-560 Calcirudite, light brown, composed of bulbous stromatoporoids 10%, large dendroid stromatoporoids slightly abraded with no algal coating to 5%. (542-545) highly abraded and coated dendroid stromatoporoids to 30% (545-560), matrix of pellets, coalescent pellets, fine-grained fossil debris and micrite, trace chalky porosity.
Back-reef dendroid stromatoporoid facies.
- 560-596 Calcirudite, brown, composed of dendroid stromatoporoids large slightly abraded 40%, concentrated in beds to 4 inches thick, tabular stromatoporoids 5%, dendroid *Thamnoporid* corals rare to common, thick-shelled disarticulated brachiopods trace, matrix of fine-grained fossil debris, pellets and micrite, very poor matrix (slightly chalky) porosity.
Coral zone.

ESSO MACKENZIE RIVER # 2 H-57 65°16' 24.895'N
126°54' 34.318'W

450-490

Calcirudite, light brown - brown, composed of abraded tabular stromatoporoids 15%, abraded dendroid stromatoporoids 15%, bulbous stromatoporoids 5%, all very thickly (to 50%) algal coated, grading to pisolites, matrix of very fine-grained fossil debris, pellets and rarely micrite, good to fair intergranular to chalky matrix porosity, poor fossil porosity. Alternating beds of calcarenite with abundantly fossiliferous zones.

Fore-reef shoal.

490-503.5

Calcirudite, light brown - brown, composed of abraded and coated dendroid stromatoporoids 45% with up to 60% of fossil represented by algal coating, tabular stromatoporoids with 5% algal coating 5%-, rare dendroid Thamnoporid corals, fair - poor intergranular "chalky" matrix porosity, fossils relatively tight.

Fore-reef dendroid stromatoporoid facies.

ESSO MACKENZIE RIVER # 3 A-47 65°16' 08.275'N
126°53' 03.850'W

- 458.75-462 Calcilutite/calcarenite, light brown - brown, with stylolites in places very irregular bedding, unabraded Amphipora 5%, dendroid stromatoporoids 5%- all slightly coated, poor intergranular matrix porosity very slightly chalky.
Light lagoon.
- 462-470 Calcarenite, light brown, massive to slightly laminated rare beds with boudins relatively unfossilized, very fine-grained poor intergranular (matrix) porosity, very slightly chalky.
Calcarenite reef shoal.
- 470-507 Calcilutite/calcarenite, light brown - buff, composed of coalescent pellets and micrite laminated to slightly laminated, rare massive beds of calcarenite very fine-grained with fair intergranular porosity, rare low-amplitude stylolites, algal coated clasts common; Amphipora 5%- on microstylolites at boundaries of irregular beds.
Light lagoon.
- 507-511.25 Calcirudite, light brown, composed of dendroid stromatoporoids to 45%, abraded and slightly coated matrix of fine-grained fossil debris, pellets and micrite, poor intergranular matrix porosity - slightly chalky, fossils tight.
Back-reef dendroid stromatoporoid facies.

IMPERIAL CANOL BEAR ISLAND #4 B-36 65°15' 06"N
126°51' 08"W

- X 1785-2044 Shale, black slightly bituminous, very' fissile with poker chips no thicker than 1/4 inch. ' Becomes slightly more bituminous and more competent to base of interval.
- 2162-2193 (Recovered 10 feet) rubbly with core catcher grooves on outside - only two pieces slabbed. Calcirudite, brown - dark brown, composed of dendroid corals - *Thamnopora* and *Alveolites* 15%, highly abraded and dendroid stromatoporoids 5%, all fossils slightly coated, matrix of fine-grained fossil debris, micrite and coalescent pellets with black bituminous material in places, tight.
Coral zone.
- 2305-2315 (Recovered 6 feet)
Shale, grey - green, blocky and fissile, calcareous to limy.

ESSO BEAR ISLAND #21 E-46 65°15' 26.926'N
126°54' 8.996'W

- 566-610 Calcilutite/calcarenite, light brown - buff, composed of coalescent pellets and micrite grading to calcarenite, highly coated dendroid stromatoporoids and Amphipora 5%-, gastropod and brachiopod fragments with algal coatings and internal sedimentation rare, laminate with micrite and augen with rare Amphipora in beds separated by low-amplitude stylolites -- calcarenite with floating dendroid stromatoporoids, gastropods and brachiopods -- but clasts with thick algal coatings and partly replaced by very fine-grained calcarenite type of chalkiness, therefore, get blotchy, poor intergranular chalky porosity.
Light lagoon.
- 610-621 Calcirudite, light brown, composed of slight to severely abraded dendroid stromatoporoids 40%, abraded bulbous stromatoporoids 5%, tabular stromatoporoids 5%, matrix of fine-grained fossil debris, rarely pellets and micrite, poor intergranular matrix porosity slightly chalkified.
Back-reef dendroid stromatoporoid facies.
- 621-655 Calcilutite/calcarenite, light brown, laminated in places grading to massive with floating large bulbous stromatoporoids 10%, Amphipora 5%, dendroid stromatoporoids 5% rare algal coating, trace thick-shelled gastropods and dendroid corals, rare irregular zones of very fine-grained porosity with trace chalkification, rare green shale breaks.
Light lagoon.
- 655-710 Calcirudite, light brown - brown, composed of dendroid stromatoporoids abraded and packed (top of interval) to 70%, floating and less abraded (base of interval) 30% of rock, dendroid unabraded both solitary and colonial (Thamnopora and Alveolites) 5% in general but from

ESSO BEAR ISLAND #21 E-46 65°15' 26.926'N
126°54' 8.996'W

655-710
(cont'd)

674-700 to 20% or rock, rare large bulbous stromatoporoids to 4 inches diameter, tabular stromatoporoids 5%, matrix of fine-grained fossil debris, coalescent pellets and micrite, rare bituminous material surrounding dendroid stromatoporoids in matrix, poor intermittent intergranular matrix (chalky) porosity. From 695-710 Alveolites and Thamnopora become dominant and constitute 3% of rock, also matrix becomes darker and more bituminous.

710-716

Calcirudite, dark brown, very argillaceous to shale with dendroid corals to 35% composed of Alveolites and abraded Thamnopora, thick- and thin-shelled disarticulated and articulated brachiopods abundant, trace large crinoid ossicles. Coral zone.

ESSO BEAR ISLAND #22 K-36 65°15' 35.22'N
126°51' 59.0'W

- 513-513.8 Shale, black bituminous blocky to fissile, pyritic trace to pyrite blebs near lower interval noncalcareous. Open-marine.
- 513.8-532 Calcarenite/calclutite, light brown - buff, composed of micrite, coalescent pellets and fine-grained fossil debris, thickly algal coated Amphipora, dendroid and subspherical(?) stromatoporoid fragments total 5%-, rare irregular patches of poor intergranular porosity trace chalkification.
Light lagoon.
- 532-544 Calcarenite, light brown - buff, composed of very fine-grained pellets and coalescent pellets, coated clasts common to abundant in upper part of interval, dendroid stromatoporoids very abraded 5%-, remainder of interval relatively massive calcarenite, very fine poor intergranular porosity - very rubbly not chalky.
Lagoon.
- 544-569 Calcirudite, light brown, composed of very abraded dendroid stromatoporoids floating to tightly packed 30-40%, trace abraded Amphipora, thin tabular stromatoporoids and gastropods, rare zones of sparry calcite filled augen, trace intergranular (matrix) porosity, fossil tight but where dendroid stromatoporoid are very abundant and floating have fair matrix porosity (554-561).
Back-reef dendroid stromatoporoid facies.
- 569-600 Calclutite/calcirudite, brown, composed of alternating beds of calcirudite of abraded dendroid stromatoporoids 20%, large bulbous stromatoporoids 10%, matrix of fine-grained fossil debris and micrite with anastomosing microstylolites; and beds of micrite, light brown, composed of coalescent

ESSO BEAR ISLAND #22 K-36 65°15' 35.22'N
126°51' 59.0'W

- 569-600 pellets and fine-grained fossil debris with floating
(cont'd) unabraded *Amphipora* to 5%, sparry calcite filled augen
common, relatively tight, very slightly more bituminous
(argillaceous?) to base of interval.
- 600-620 Calcirudite, brown, composed of dendroid stromatoporoids
10-40% packed in beds to 4 inches thick with microstylolites
common, intervening beds of micrite have rarer floating
stromatoporoids and rare crinoids, solitary corals rare,
Thamnoporid corals present in some beds, patchy very poor
matrix porosity very slightly chalky.
Back-reef dendroid stromatoporoid facies.

ESSO MACKENZIE RIVER #4 E-27 65°16' 19.24'N
126°50' 23.22'W

- 398-405 Shale, black bituminous blocky to fissile with rare thin beds of light siltstone very pyritic; pyrite blebs common throughout.
- 405-408 Calcirudite, light brown, composed of abraded dendroid stromatoporoids 20%, subspherical stromatoporoid fragments 5%, rare thick-shelled brachiopods and crinoids, fair intergranular matrix porosity, poor fossil porosity. Fore-reef dendroid stromatoporoid facies.
- 408-421 Calcilutite/calcarenite, light brown - buff, composed of coalescent pellets and micrite, very abraded dendroid stromatoporoids 10%, abraded subspherical stromatoporoids 5%-, Amphipora 5%, rare 6 inch zones with sparry calcite filled augen, trace intergranular matrix porosity, rare high-amplitude stylolites.
Back-reef dendroid stromatoporoid facies to lagoon.
- 421-431 Calcirudite, light brown, composed of dendroid stromatoporoids abraded and outlined by microstylolites 60-75%, matrix of fine-grained fossil debris and pellets, very poor intergranular matrix porosity, fossil tight.
Back-reef dendroid stromatoporoid facies.
- 431-462 Calcilutite/calcarenite, light brown - buff, composed of coalescent pellets and micrite, abraded dendroid stromatoporoids 10%, abraded subspherical stromatoporoids 5%-, Amphipora 5%, trace intergranular matrix porosity, rare stylolites.
Back-reef shoal to lagoon.
- 462-468 Calcirudite, light brown, composed of abraded and coated bulbous stromatoporoids 10%, abundant and coated dendroid stromatoporoids 20%, Amphipora 5% in matrix of fine-grained fossil debris and pellets and micrite, fair matrix porosity,

ESSO MACKENZIE RIVER #4 65°16' 19.24'N
126°50' 23.22'W

- 462-468 trace fossil porosity slightly chalky.
(cont'd) Back-reef dendroid stromatoporoid facies.
- 468-477 Calcarenite, light brown, composed of crinoids 40%, rare solitary corals and thick-shelled brachiopods, matrix of pellets and sparry calcite, trace intergranular porosity with 5 metres median zone of calcirudite of very abraded dendroid stromatoporoids to 60%, crinoids abundant, tabular stromatoporoids trace, very poor intergranular matrix porosity, fossil tight.
Crinoid shoal.
- 477-490 Calcirudite, light brown, composed of dendroid stromatoporoids 35%, dendroid Alveolites and Thamnopora 5%, crinoid ossicles rare, matrix of micrite and fine-grained fossil debris, trace matrix porosity, fossil tight.
Coral zone.

IMPERIAL SEEPAGE LAKE #1A 65°17' 40'N
126°50' 24'W

Cored 26 feet, recovered 18 feet.

- 985-988 Shale, black, slightly bituminous fissile.
- 988-9002 Shale, grey-green, blocky to slightly fissile, calcareous to very limy.
- 9002-9011 (represented by 3 feet of core) small pieces to 1/2 inch thick of calcilutite, light brown - buff, with irregular augen filled with sparry calcite and rarely black bituminous material, possibly are casts of gastropods and brachiopods; rare coalescent pellets with sparry calcite matrix, tight.

IMPERIAL CANOL MAC #2 65°14' 51'N
127°00' 22'W

- Cored 15 feet, recovered 10 feet.
- 2449-2453 Shale, black, bituminous fissile with very thin stringers of silt, light grey.
Black bituminous shale.
- 2453-2464 Calcarenite, light brown - buff, composed of well sorted pellets with floating Amphipora 5%, matrix of sparry calcite and rarely micrite, slight trace of intergranular porosity but mainly filled with sparry calcite.
Light lagoon.
Cored 15 feet, recovered 6 feet.
- 2650-2665 Calcarenite, light brown - buff, composed of well-sorted pellets floating abraded and coated dendroid stromatoporoids 5%, slightly to unabraded floating Amphipora 5%, matrix of sparry calcite and rarely micrite, tight.
Light lagoon.
Cored 19 feet, recovered 6 feet.
- 2803-2822 Calcirudite, light brown, composed of dendroid stromatoporoids slightly abraded to 40%, dendroid corals 5%, matrix of fine-grained fossil debris, pellets and black bituminous material, poor intergranular matrix porosity, fossil tight.
Coral zone.
- 2940-2958 Shale, grey-black, fissile to blocky, calcareous to very limy, crinoid ossicles common.
Open-marine limy shale.

IMPERIAL CANOL MAC #1 B-76 65°15' 30'N
126°59' 00'W

- 2075-2092 Shale, black, bituminous fissile with thin stringers of siltstone, light grey.
Black shale.
- 2092-2212 Calcarenite, light brown - buff, composed of well sorted pellets, rare very abraded dendroid stromatoporoids and Amphipora total 5%-, matrix of sparry calcite and very slight trace intergranular porosity (not chalky).
Light lagoon.
- 2262-2292 (recovered 12 feet) Calcirudite, light brown, composed of dendroid stromatoporoids 30%, dendroid Thamnopora corals 5% and rare solitary corals; matrix of fine-grained fossil debris, pellets and trace of bituminous material along fine partings.
Back-reef dendroid stromatoporoid minor coral calcirudite.
- 2370-2386 (recovered 10 feet) Calcarenite, light brown - buff, composed of well sorted pellets, rare floating very abraded and coated Amphipora and dendroid stromatoporoids, matrix of sparry calcite, tight.
Light lagoon.
- 2486-2495 Calcarenite, light brown - buff, composed of well sorted pellets, rare floating abraded Thamnopora and dendroid stromatoporoids, matrix of micrite and sparry calcite, tight.
- 2495-2504 Calcirudite, brown, composed of dendroid stromatoporoids 15%, dendroid Alveolitid corals 20%, matrix of fine-grained fossil debris and micrite with black bituminous partings, tight.
Coral zone.
- 2553-2582 Calcirudite, brown, composed of dendroid stromatoporoids 15%, dendroid Alveolitid corals 15%, matrix of fine-grained fossil debris and micrite with black bituminous partings, tight.

IMPERIAL CANOL MAC #1 B-76 65°15' 30'N
126°59' 00'W

2553-2582

(cont'd)

Coral zone.

2582-2591

Calcirudite, dark brown, composed of dendroid Alveolitid corals 30%, dendroid stromatoporoids 10%, matrix of fine-grained fossil debris and black bituminous limy shale.

Dark coral calcirudite.

2591-2601

Shale, grey-green, fissile calcareous.