9237-C55-2E

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Canterra Energy Ltd.

MIDDLE DEVONIAN GEOLOGICAL FIELD PARTY LOWER MACKENZIE VALLEY DRAINAGE NORTHWEST TERRITORIES

PROJECT ACTION SHEET

RESOURCE EVALUATION BRANCH

PROJECT NUMBER: 9237-C55-2E

COMPANY: CANTERRA ENERGY LTD.

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AREA NORTHWEST TERRITORIES LOWER MACKENZIE VALLEY

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REPORTS

OPERATIONS REPORT: NUMBER 1

-MIDDLE DEVONIAN GEOLOGICAL FIELD PARTY LOWER MACKENZIE VALLEY DRAINAGE N.W.T.

INTERPRETATION REPORT: NUMBER 0

MAPS
SHOTPOINT MAPS NUMBER 0

INTERPRETATION MIDDLE DEVONIAN HUME FORMATION NUMBER 10

LOCALITY: FRANCIS CREEK
MT.MORROW
MT.ST.CHARLES
BELL CREEK
CARNWATH RIVER
DODO CANYON
LITTLE BEAR RIVER
HARE INDIAN R.TRIBUTARY
POWELL CREEK
HUME RIVER TRIBUTARY(TYPE SECTION)

OTHER NUMBER 0

SECTIONS NUMBER 0

MIDDLE DEVONIAN GEOLOGICAL FIELD PARTY
LOWER MACKENZIE VALLEY DRAINAGE
NORTHWEST TERRITORIES

COGLA PROGRAM NO.
9237-C55-2E

Submitted by:
R.L. McKellar
Northern District Exploration
Canterra Energy Ltd.
February, 1987

EXECUTIVE SUMMARY

A geological field party was conducted in the lower MacKenzie Valley drainage in the vicinity of Norman Wells and Fort Good Hope, N.W.T. Outcrops of the middle Devonian Ramparts (Kee Scarp) were visited and those of the Hume Formation were studied in detail. A facies model of outcrop data was constructed, based on interpretations of the depositional environments associated with various rock lithologies. By incorporation of subsurface mapping an overall depositional model for the Hume is described. Additional field work to refine aspects of the model should be concentrated on the Franklin Mountains and west of Hume River.

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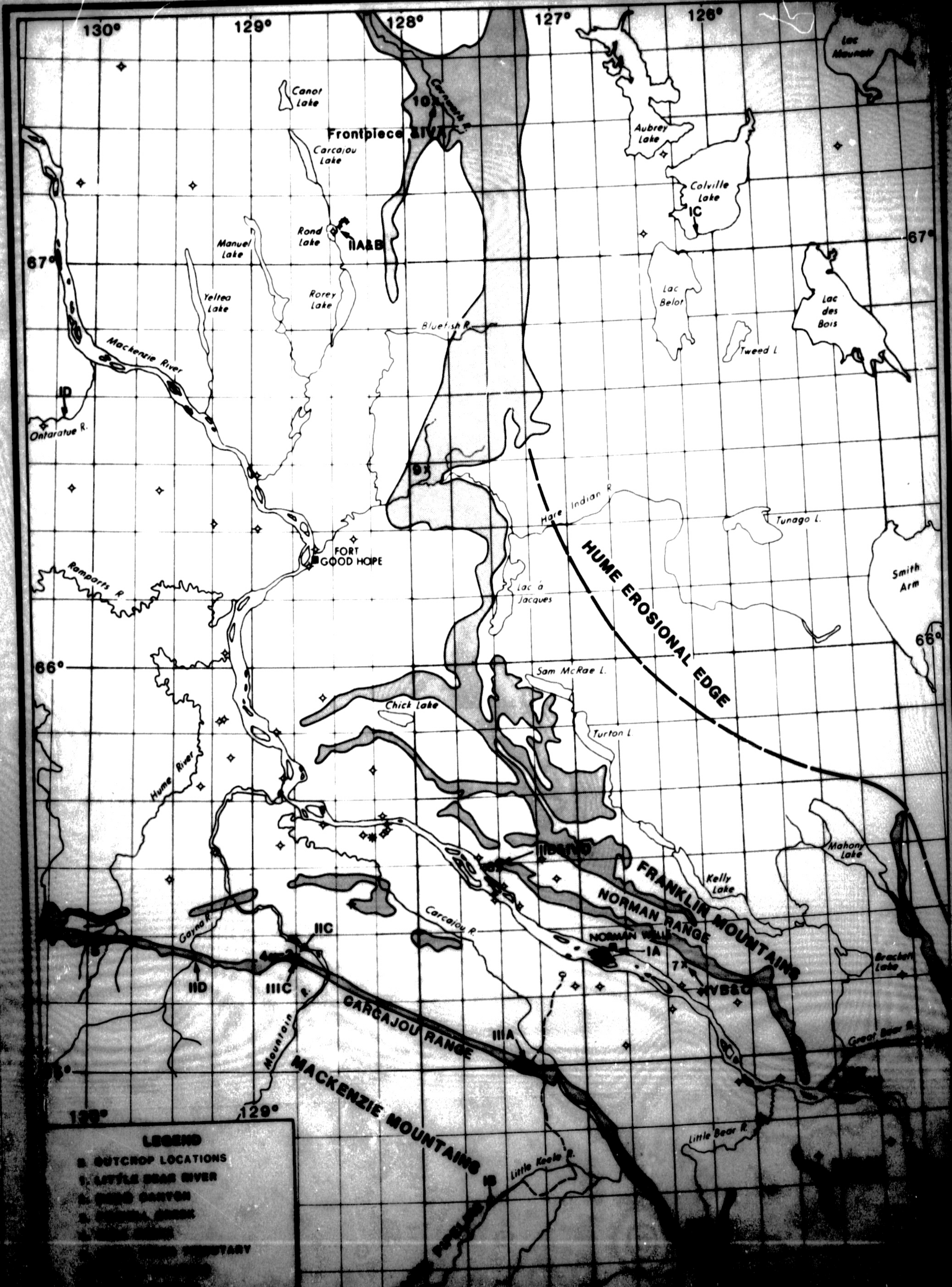

130°
129°
128°
127°
126°
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66°
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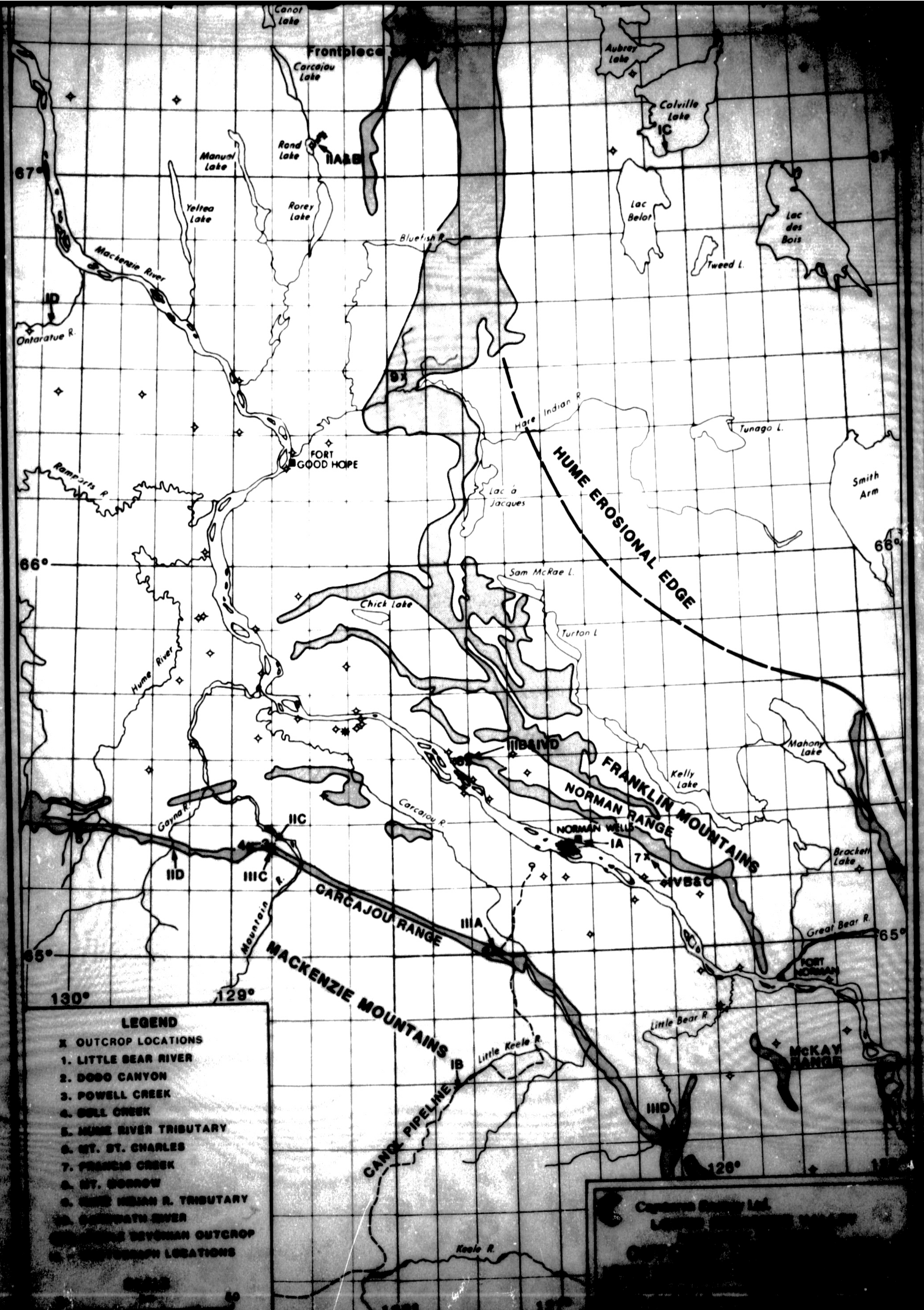
Canot Lake
Frontpiece & IV
Carcajou Lake
Aubrey Lake
Colville Lake
IC
Rond Lake
IIA&B
Manuel Lake
Yeltea Lake
Rorey Lake
Lac Belot
Lac des Bois
Tweed L.
Bluefish R.
Mackenzie River
ID
Ontaratue R.
Hare Indian R.
Tunago L.
FORT GOOD HOPE
Ramparts R.
Lac à Jacques
Smith Arm
HUME EROSIONAL EDGE
Sam McRae L.
Chick Lake
Turton L.
Hume River
Mahony Lake
Kelly Lake
FRANKLIN MOUNTAINS
NORMAN RANGE
Carcajou R.
Gayna R.
IIC
IID
IIIC
NORMAN WELLS
IA
VB&C
Brackett Lake
Great Bear R.
Mountain R.
CARCAJOU RANGE
IIIA
MACKENZIE MOUNTAINS
Little Bear R.
Little Keele R.
LEGEND
OUTCROP LOCATIONS



Frontpiece
Canot Lake
Carcajou Lake
Aubrey Lake
Colville Lake
IC
Rand Lake
IIA&B
Manuel Lake
Yeltea Lake
Rorey Lake
Lac Belot
Lac des Bois
Tweed L.
67°
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9
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Ramparts R.
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Smith Arm
HUME EROSIONAL EDGE
66°
Sam McRae L.
Chick Lake
Turton L
Hume River
IIIB&IVD
FRANKLIN MOUNTAINS
NORMAN RANGE
Kelly Lake
Mahony Lake
Gayna R.
IIC
Carcajou R.
NORMAN WELLS
IA
7
IVB&C
Brackett Lake
IID
IIIC
Mountain R.
CARCAJOU RANGE
IIIA
Great Bear R.
65°
MACKENZIE MOUNTAINS
FORT NORMAN
130°
129°
Little Bear R.
MCKAY RANGE
IB
Little Keele R.
CANOL PIPELINE
IIID
126°
Keele R.
LEGEND
OUTCROP LOCATIONS
1. LITTLE BEAR RIVER
2. DODO CANYON
3. POWELL CREEK

INTRODUCTION

A geological field party was conducted in the lower MacKenzie Valley drainage from August 19 through September 6, 1986. The main objective was to study the Middle Devonian Ramparts (Kee Scarp) and Hume Formations (figure 1) both of which have potential for reefal development. Canterra's efforts in the N.W.T. became focused on the area as a result of the Ft. Good Hope landsale in February, 1986 where Chevron is currently negotiating an agreement with the Fort Good Hope Indian Band. Initial efforts concentrated on studying the Ramparts Formation which historically had been the primary objective in the landsale area. However, as our understanding of the area matured interest shifted to the Hume Formation, a Keg River equivalent, which in at least one case (Manitou L-61) acts as a platform for pinnacle reef development.

This report is not intended as a comprehensive review of the geology of the area. For a more in depth discussion see Pugh 1983, Williams 1986, 1985, Aitken et al 1982, AGAT 1977.

LOGISTICS

The field party consisted of R.L. McKellar and F. Monnier. Initially J.W. Zaturecky accompanied the field crew on a two-day fixed wing reconnaissance of prospective outcrop locations. Consultant I. Muir conducted a 3 day tour of Ramparts outcrops in the Powell Creek area which he had studied for his doctoral thesis.

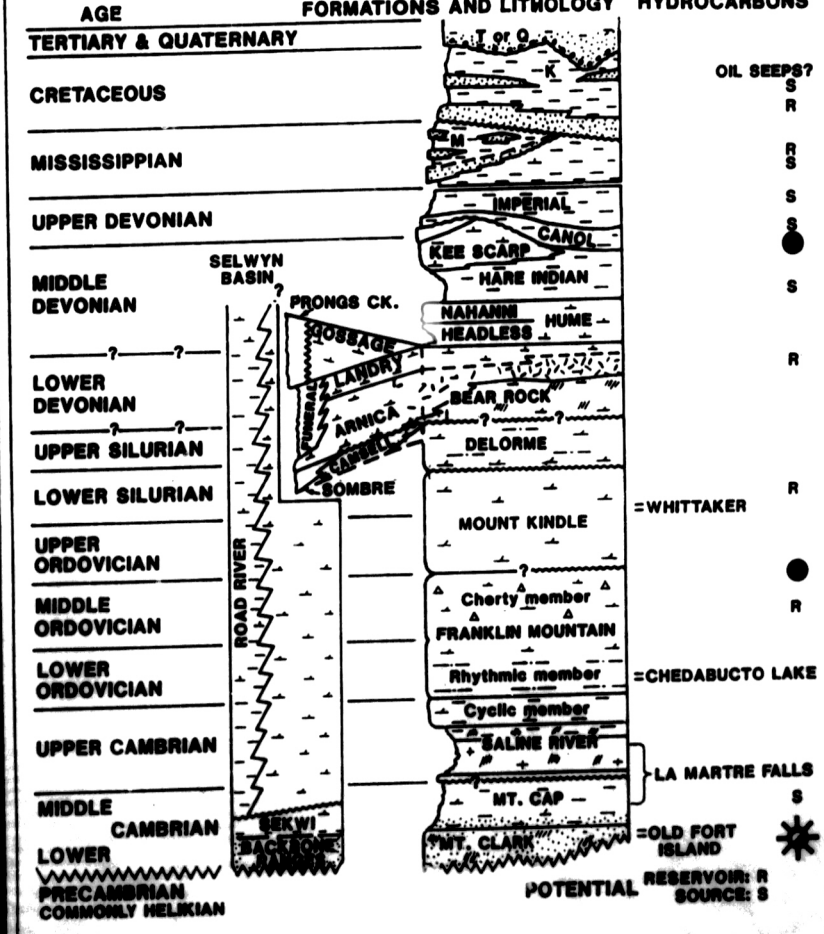
The field party was accommodated at the MacKenzie Valley Hotel in Norman Wells and the Ramparts Hotel in Ft. Good Hope. Colville Lake Lodge run by Bern and Margret Brown was also visited on refuelling stops. Transportation to Norman Wells was by PWA scheduled flight. Fixed wing reconnaissance was by Page Flights of Norman wells, Tom Leaman pilot. Okanagan Helicopters of Norman Wells with base manager Lois Hill handled all the outcrop work.

There was one day of down time due to equipment repair on the helicopter and none due to weather. The field party suffered 3 days of rain and snow flurries with temperatures around 1° C in the first week of work. Temperatures recovered to the 20° C mark by the last week of field work. Ten sections were measured with 109 samples being collected for lithological, geochemical and paleontological purposes. Paleontological specimens now reside at the Institute of Sedimentary and Petroleum Geology.

Figure 1

GENERALIZED STRATIGRAPHY
NORTHERN MACKENZIE PLATFORM

Canterra



ACKNOWLEDGEMENTS

I benefitted from discussions with Dr. G.K. Williams of the Institute Sedimentary and Petroleum Geology who has extensive experience working in the N.W.T. over the past 25 years. Drs. A.W. Norris and A.E.H. Pedder of the Institute identified paleontological specimens collected in the field. Dr. W.K. Braun of the University of Saskatchewan shared his knowledge of the area and identified micropaleo samples. J.W. Zaturecky and J.R. Lawrence critically read the manuscript. I would also like to recognize management in both Frontier and Northern districts for their support in carrying out this field project.

STRATIGRAPHY

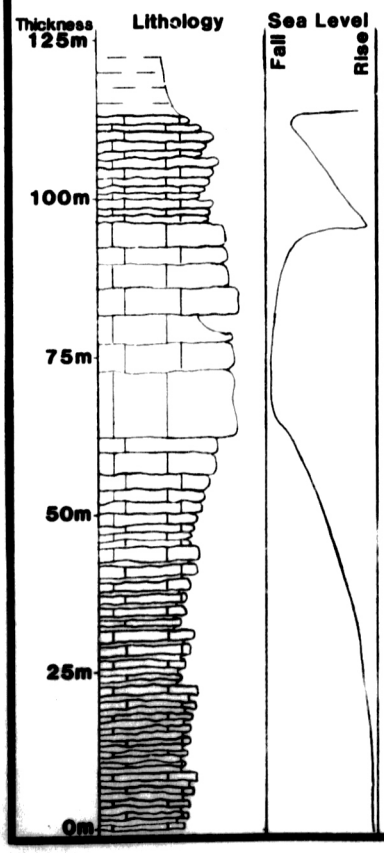
Introduction

It should be mentioned initially that considerable reconnaissance work has been carried out in the area primarily during the sixties by both industry and government. In examining this work, one finds that it was done before studies on recent carbonate depositional environments became available to the field geologist. Despite the generally high quality of the field mapping, notably by Plauchut and Duffaud (1968), this earlier work lacks an interpretation of the rock lithologies in terms of their depositional environments. It follows then that by re-examining some of these sections and by providing an interpretation of their depositional environments a greater understanding of a particular formation can be gained. These interpretations can be a powerful tool in determining where to look for hydrocarbons.

Ramparts (Kee Scarp) Formation

The Kee Scarp is the producing member of the Ramparts Formation at the Norman Wells oil field (Muir, 1987). As such it has been the most intensively studied formation in what is still a rank wildcat area. Hariman (1986) summarizes the play concepts developed for this formation. Discussions with I. Muir are incorporated in that summary. Iain's tour of his thesis area confirmed our prior play concepts. Although geochemical and spot lithology samples were taken during the tour no detailed measuring was done. Refer to Muir (1987,1985,1984) for further elaboration on his study area.

HUME FORMATION COMPOSITE



Lithology Description	Depositional Environment
BLACK BITUMINOUS SHALES WEATHERING OCHRE.	RESTRICTED MARINE
GREY LIME MUDSTONES WITH L. CASTANEA FAUNA.	TRANSITIONAL
THINLY BEDDED DARK GREY, LIME MUDSTONES TO WACKESTONES, INTERCALATED SHALES, ALLOCHTHONOUS MATERIAL, MOSTLY COVERED.	OPEN MARINE
DARK GREY CORAL/STROMATOPOROID FLOATSTONE AND RUDSTONE WITH A BIOCLASTIC WACKESTONE MATRIX, FAUNA, ABUNDANT AND DIVERSE, BIOHERMAL DEVELOPMENT.	BIOSTROMAL
LIGHT TAN LIME MUDSTONES TO WACKESTONES, FENESTRAL POROSITY OCCLUDED BY SPAR CALCITE CEMENT, HIGHLY BURROWED, TIDAL CHANNELS, MASSIVELY BEDDED, PAUCITY OF FAUNA.	INTERTIDAL
DARK GREY CORAL/STROMATOPOROID FLOATSTONE AND RUDSTONE WITH A BIOCLASTIC WACKESTONE MATRIX, FAUNA ABUNDANT AND DIVERSE.	BIOSTROMAL
THINLY BEDDED DARK GREY LIME MUDSTONE TO WACKESTONE INTERCALATED WITH CALCAREOUS SHALES. — LIMESTONE BEDS COMMONLY CONTAIN CRINOID AND BRACHIOPOD RUDSTONES INTERPRETED AS ALLOCHTHONOUS MATERIAL IN THE FORM OF TURBIDITES, DEBRIS FLOWS AND STORM DEPOSITS. — THIS SECTION IS MADE UP OF A SERIES OF CYCLES 3 TO 5 METRES THICK, FAUNAL ABUNDANCE AND BEDDING THICKNESS INCREASE UPWARD WITHIN EACH CYCLE AND THROUGHOUT THE SECTION.	OPEN MARINE

Figure 2

Hume Formation

Introduction

Detailed measurements of 10 sections were made with sampling for lithology, geochemistry and paleontology. The results are recorded on logs (Appendix III) and only a summary will be given here.

Basal Contact

The Hume can be generally divided into a shale dominated lower recessive unit and a carbonate dominated upper massive unit (Figure 2). The Landry to Hume boundary is abrupt but gradational. A very rapid drowning occurs at the top of the Landry and onset of the Hume is marked by a regressive phase. In outcrop (Plate IIID) this is manifested as centimetre thick beds of lime wackestone in dark grey calcareous shales.

Lower Hume

The lower Hume is characterized by thinly bedded dark grey lime mudstone to wackestone intercalated with calcareous shales. In the Hume all shales are somewhat calcareous and all limestones somewhat argillaceous. These intercalated units are combined in a series of third order shoaling upward cycles ranging from 1 to 5 m thick (Plate IIIC). The limestone beds varying from 1 to 50 cm in thickness are often nodular in appearance and commonly contain crinoid and brachiopod rudstones. The faunal abundance and bedding thickness increase upward within each cycle and throughout the section. The crinoid and brachiopod assemblages are here interpreted as allochthonous material transported downslope in the form of turbidites and debris flows. Near the top of the lower recessive unit the cycles apparently were shallow enough and stable enough that a Crinoid and Brachiopod Assemblage developed in place, quickly followed by a Coral Assemblage and finally a mixed Coral/Stromatoporoid Assemblage (Figure 3). The term biostromal is here used to designate the interval where corals and stromatoporoids are abundant and diverse usually occuring as a floatstone or rudstone (Plate IVA). The unit is observed to be laterally correlatable (Figure 4).

Upper Hume

The biostromal unit also marks the transition between the lower and upper units within the Hume. In the western portion of the field area (Figure 4), the biostromal unit occupies most of the upper massive unit while in the eastern portion, a thinner biostromal unit is superceded by a light tan,

HUME CARBONATE SHELF ENVIRONMENT

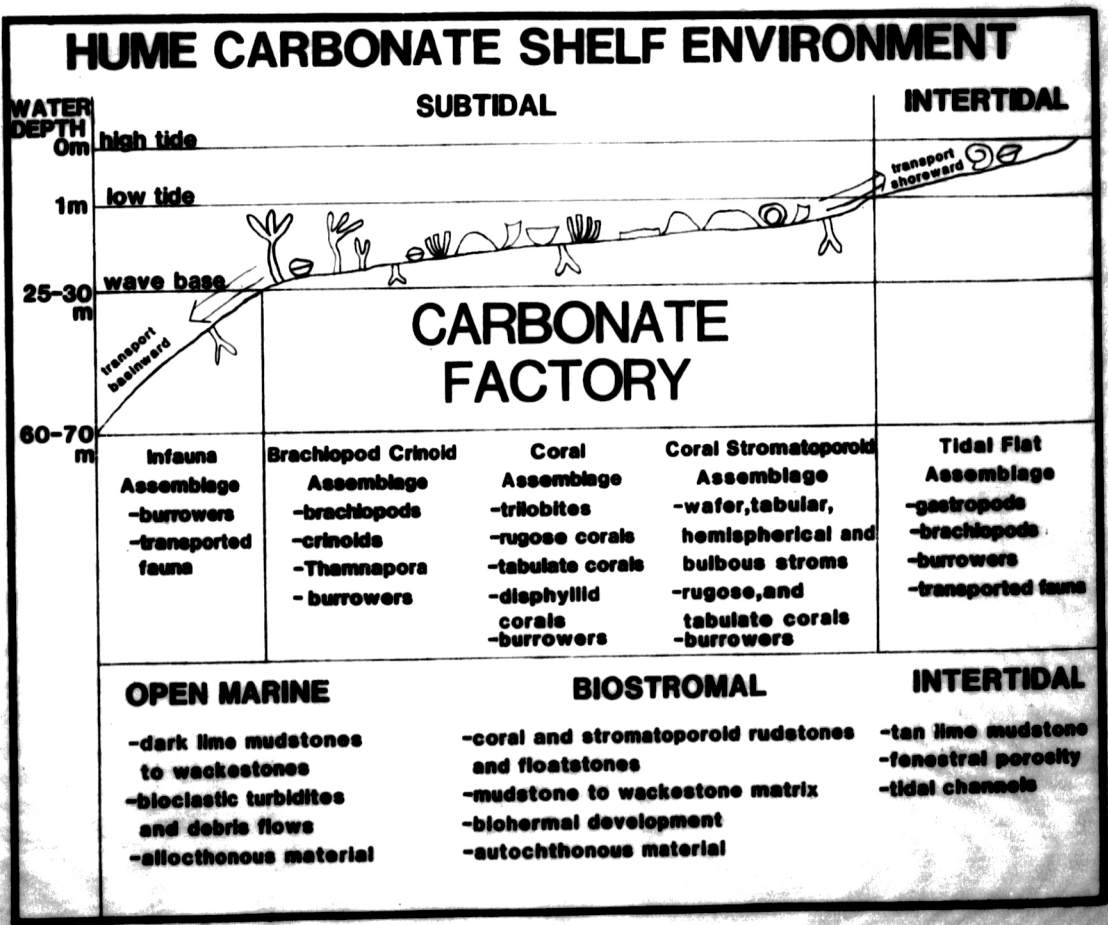
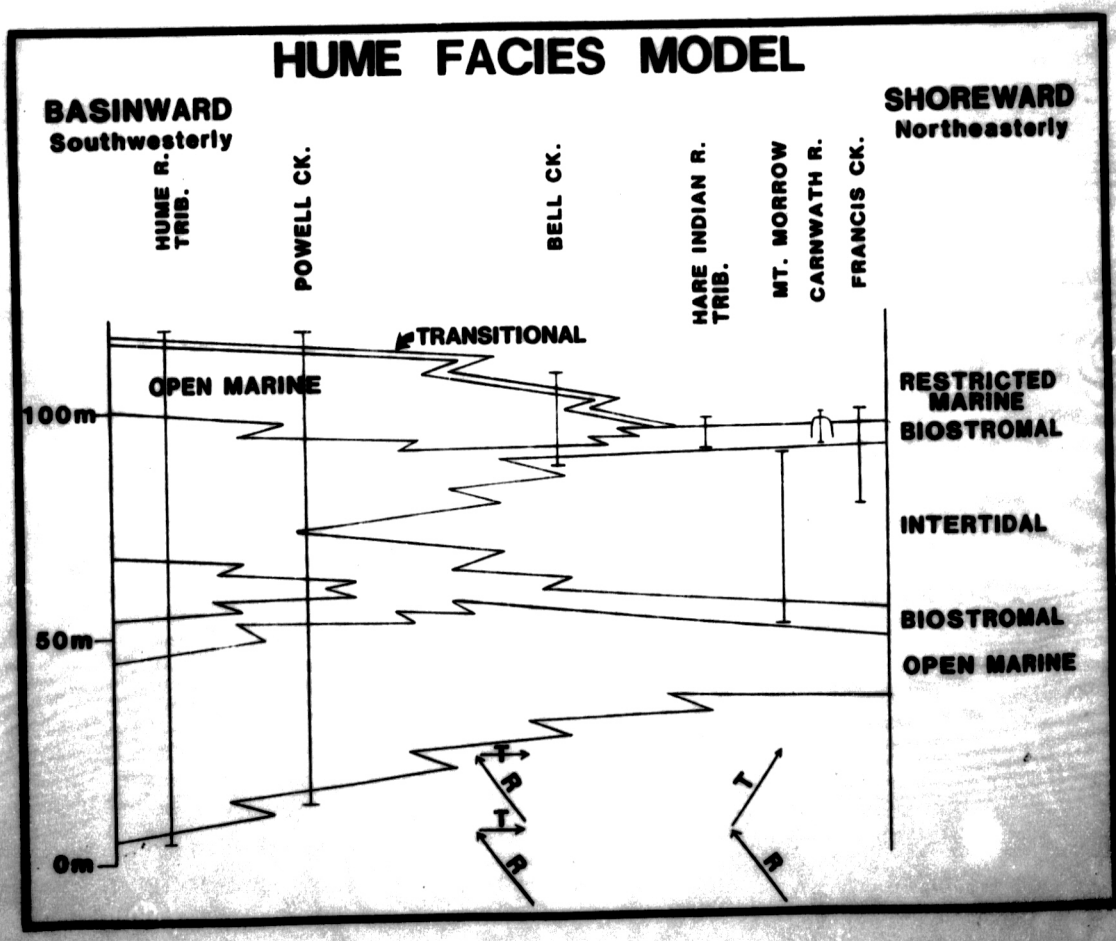


Figure 3


HUME FACIES MODEL
BASINWARD
Southwesterly
SHOREWARD
Northeasterly
HUME R. TRIB.
POWELL CK.
BELL CK.
HARE INDIAN R. TRIB.
MT. MORROW
CARNWATH R.
FRANCIS CK.
TRANSITIONAL
OPEN MARINE
RESTRICTED MARINE
BIOSTROMAL
INTERTIDAL
BIOSTROMAL
OPEN MARINE
100m
50m
0m
T
R
T
R
T
R

massively bedded and highly burrowed lime mudstone. This unit contains cryptalgal laminites (Plate IVD) and tidal channels (Plate IVC). Fenestral and stromatactis porosity was initially high but has since been occluded by spar calcite cement (Plate IVB). This unit is interpreted as intertidal in origin. This marks the apex of the regression within the Hume and everywhere a marine transgression continues until the end of Hume time.

Above the intertidal unit an upper biostromal unit appears as sea level drops into subtidal range. At the Hare Indian River tributary outcrop the biostromal unit continues until it is abruptly terminated by the Bluefish facies. At Carnwath River the uppermost biostromal facies develops bioherms which presumably project into the overlying but now eroded Bluefish. An inspection of the facies between bioherms indicates an increasing shale content as one moves up section and a decrease in the numbers and diversity of fauna within the limestone beds (see Carnwath River section Appendix III). A readily apparent interpretation is that increasingly muddy conditions forced the fauna into biohermal development in order to elevate themselves above the turbid waters on the sea floor. Relief on the bioherms was probably 1 to 2 m at any given time as measured from the uppermost limestone bed to the top of the exposed bioherms.

In a portion of the Hume platform a rapid drowning occurs terminating biostromal growth. This succession, mainly covered in outcrop, is made of intercalated shales and lime wackestones interpreted to be open marine turbidites. Basin fill at this time is superbly displayed in the Dodo Canyon section (Plate IIIA) where clinoforms can be seen prograding in a basinward (westerly) direction. Wherever this "drown" unit occurs a thin transitional unit marks the top of the Hume. This unit contains the distinctive L. castanea beds. Speculatively, this fauna represents increasingly reduced oxygen conditions in the basin, a prelude to the highly restricted Bluefish facies of the Hare Indian Formation. At Dodo Canyon these two facies are intercalated (Plate IIIA) illustrating the transitional relationship. The Bluefish contains a distinctive Tentaculiti and Styliolinid fauna at its base and the black shales are identified as having good source rock potential.

FACIES MODEL

All lithofacies types and their depositional environments fit into a simple carbonate shelf environment (Figure 3). This carbonate shelf starts in the intertidal zone, moves through a broad shallow subtidal region and then into a deeper water region below storm wave base. The postulated depth of the basin comes from a Powell Creek measurement from the base of the Hume to the intertidal unit. Using the outcrop control and incorporating the transgressions and regressions that affected this carbonate shelf a facies

model for the Hume can be created (Figure 4). It should be noted that the outcrop sections are not set in sequential order but are placed as they best relate to the overall model. The key to this model are the observations that the intertidal unit is associated with the Franklin Mountains and that the biostromal and open marine units envelop the intertidal zone.

PETROLEUM POTENTIAL

The Kee Scarp (Ramparts) hydrocarbon potential is considered good. At least one other buildup besides Norman Wells has been drilled at Hoosier and more may exist in the area. Muir (Figure 5) illustrates the similarities between the Powell Creek outcrop and that at Norman Wells. Buildups in between these two locations should have a similar configuration and could possess the same hydrocarbon trapping characteristics as Norman Wells.

The Hume's hydrocarbon reservoir potential historically has been considered poor. The lower Hume is shaley while the upper Hume is tight. Outcrop observations indicate initial porosity was high in the intertidal unit but has since been filled with spar calcite cement. The rudstone facies of the biostromal unit is recessive in outcrop and poorly cemented (Plate IIIB). This may have been an artifact of outcrop weathering or may genuinely reflect porosity development within the matrix. This situation may exist within any pinnacle reefs developed on the Hume platform. The only example drilled so far (Manitou L-61) is shaved off by the pre-Cretaceous unconformity and is therefore anomalous in many ways. Porosities presumably have been enhanced by surface ground water leaching.

The lateral seals on any reefs found would be the Hare Indian shale underneath the Ramparts platform and, outside these boundaries, the Canol and Imperial shales could act as lateral and top seals. The latter two acts as the sealing rocks at Norman Wells.

CONCLUSIONS

- Detailed measurements of outcrop sections have allowed us to make an interpretation of the depositional environments of the Hume.
- Understanding the environments has lead to the creation of facies models for the Hume.
- Petroleum prospects look good for the Kee Scarp Formation and any pinnacle reefs growing from the Hume may contain hydrocarbons as well.

R.L. McKellar

Canterra Energy Ltd.
R.L. McKellar, Senior Geologist
April 7, 1987

MIDDLE - UPPER DEVONIAN STRATIGRAPHY
OF THE NORMAN WELLS SUBSURFACE
AND MACKENZIE MOUNTAIN OUTCROP

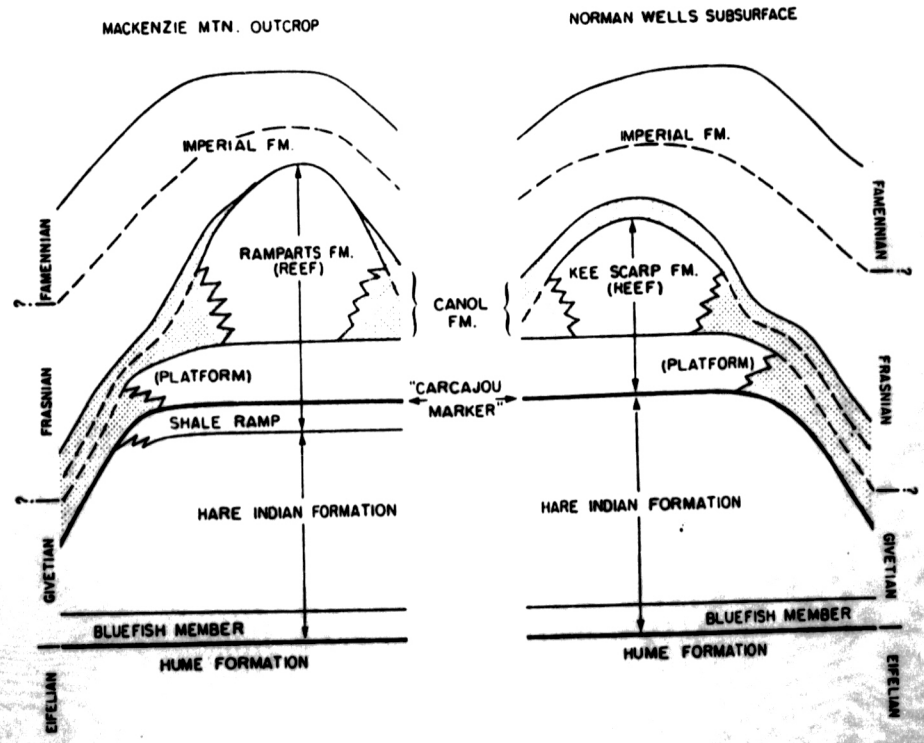


Figure 5
Muir et al, 1984

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PLATE I

A. Norman Wells looking west southwest towards the Carcajou Range of the MacKenzie Mountains. Production berms in the river and on Goose and Bear Islands produce oil from the Kee Scarp reef for transmission via pipeline to Rainbow Zama.

B. Abandoned vehicles from the Canol project found at Pumpstation II on Little Keele River.

C. Colville Lake Village - view from the second floor of Bern Will Brown's museum. Tweed Lake C-12 was drilled within sight of the village.

D. Gas seep in 1 m of water on the Ontaratue River. Gas was reported from this same spot 25 years ago by J.C. Sproule.

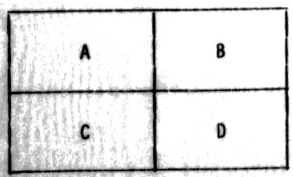


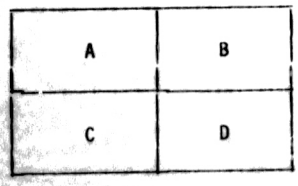
PLATE II

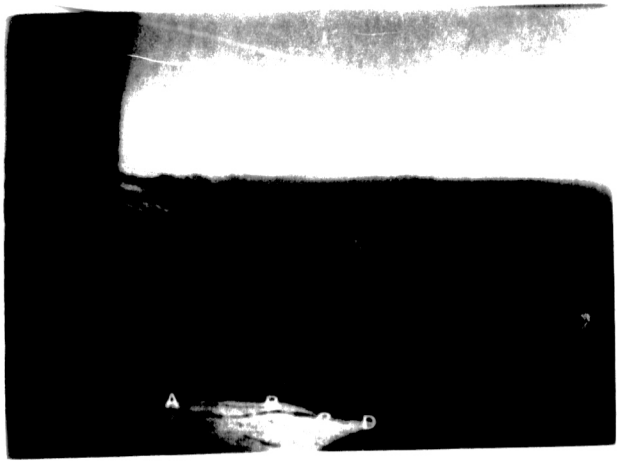
A. Looking west towards Rond Lake from the eastern ridge. Oil seep occurs over a 100 m^2 area just below the helicopter.

B. Sampling Rond Lake oil seep, 5 cm of heavy crude is floating on pond water.

C. Spectacular exposure of Ramparts (Kee Scarp) reef immediately beyond West Powell Creek. On Powell Creek steeply dipping Hume Formation occurs at (A), overlain by recessive Hare Indian Formation (B), Ramparts platform (C) and Canol Formation (D). Treed area is recessive Imperial Formation. The reef extends for a distance of 15 km in photo. Linear ridge of the Imperial anticline can be seen on the right.

D. Hume Formation exposed on the Gayna River. Dark grey lime mudstones of the Landry Formation are exposed at (A). The recessive shale dominated lower Hume (B) is capped by the cliff-forming upper Hume (C) and finally the overlying black recessive shales of the Bluefish Member of the Hare Indian Formation can be seen at D).




A
D


D
C
B
A

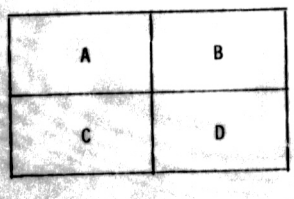
PLATE III

A. Upper Hume exposed on Dodo Canyon. The lower recessive unit is just exposed above creek bottom (A). The lower biostromal and intertidal units are seen in the middle massive section (B). The upper open marine section (C) is here more carbonate rich than in the more northerly sections and illustrates the clinoform pattern of basin infill. Here an additional biostromal unit (D) and finally the transitional unit and the black shale of the Bluefish source rock (E) caps the sequence.

B. Hume exposed on a breached anticline at the top of Mt. Morrow. The lower biostromal unit (A) is made up of poorly cemented corals and stromatoporoids which have differentially weathered compared to the upper massively bedded intertidal unit (B).

C. Hume exposed along the east side of main Powell Creek. This illustrates the carbonate shoaling-upward cycles which predominate throughout the Hume. The lower portion of the cycle starts out as thin-bedded and shale dominated. Faunal abundance and bedding thickness increase towards the top of each cycle.

D. Lowermost Hume exposed along the southeast side of Little Bear River. There is a gradational contact between the dark-colored lime mudstone of the Landry Formation (A) and the Hume Formation (B) which is marked by the appearance of turbidites seen as light colored centimetre thick lime wackestones to rudstones starting above the red and white marker (1.5 m Jacob's staff for scale).



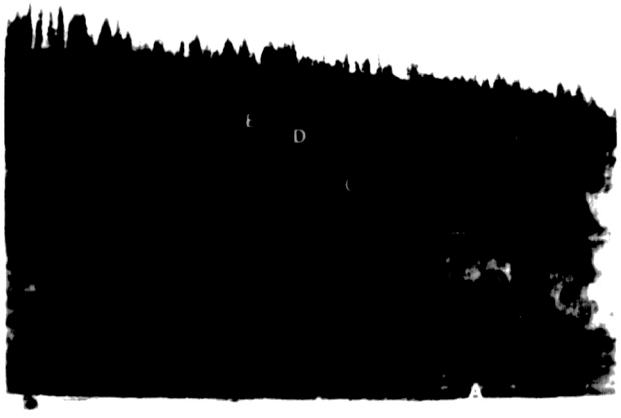

E
D
C

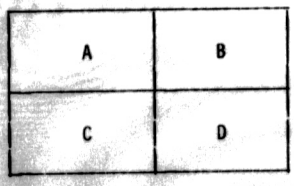
PLATE IV

A. Coral and stromatoporoid rudstone from Bioherm B at the top of the Hume located on the Carnwath River. The section in this photo is dominated by large solitary and disphyllid corals. However bulbous and tabular stromatoporoids populate the bioherms as well.

B. Intertidal lime mudstones at Francis Creek. Gastropod shells and fenestral/stromatactis? porosity is infilled by spar calcite cement. Red bar is 10 cm.

C. At Francis Creek a tidal channel cuts through the section with its base defined by the orange tape and the red and white scale bar. Photo B was taken from the lower left portion of this picture.

D. Intertidal unit from the Mt. Morrow section. The tan colored lime mudstones are interpreted to be derived from cryptalgal stromatolites represented by the faint parallel laminations in the photo. Red bar is 8 cm.



APPENDIX I

CANTERRA GEOLOGICAL FIELD PARTY
SAMPLE LIST
August 19 to September 6, 1986

Date	Outcrop Locality	Sample #	Sample Type: Lith	Geochem	Paleo	Sample Preparation	Comments
08/21	Gossage R.	G.R.#1	x			S.&T.S.	
		G.R.#2			x		In Hare Indian
		G.R.#3			x		Lower 3 m of S.S.
08/21	Ontaratue R.	O.R.#1		x			
08/22	Hare Indian R. Trib.	*H.I.R.#1A	x			S.	
		*H.I.R.#1B			x		Grab sample at recessive ledge.
		H.I.R.#2		x	x		Grab sample above shale
		*H.I.R.					2 bags & sack macro
08/24	Carnwath R. Bioherm A	C.R.B.A.#1	x			S.	
		C.R.B.A.#2	x			S.	
		C.R.B.A.#3	x				As Below
		C.R.B.A.#4	x				As Below
		*C.R.B.A.#5	x			S.	
		*C.R.B.A.#6	x		x	S.	Much Paleo
		C.R.B.A.#7	x			S.	
		*C.R.B.A.			x		2 bags macropaleo
	Carnwath R. Bioherm B	C.R.B.B.#1	x			S.	
		C.R.B.B.#2	x			S.	
		C.R.B.B.#3	x				
		C.R.B.B.#4	x			S.	
		C.R.B.B.#5	x				
		C.R.B.B.#6	x			S.	Encrusting-tabstrom
		C.R.B.B.#7	x				Orange patina
		C.R.B.B.#8	x				
		C.R.B.B.#9	x			S.	
		*C.R.B.B.			x		4 bags macropaleo
08/24	Carnwath R.C.	C.R.C.		x			Sample of coaly sand
	Carnwath R.D.	C.R.D.#1	x				
		C.R.D.#2	x			S.	
		C.R.D.			x		Micropaleo
08/29	Francis Ck.	F.C.#1	x			S.&T.S.	
		F.C.#2	x			S.	
		F.C.#3	x				
		*F.C.#4			x		Macropaleo
		F.C.#5	x			S.	
		F.C.#6	x		x	S.	
		F.C.#7		x			
08/30	Hume R. Trib.	H.R.#1		x			Missing
		H.R.#2	x				
		*H.R.#3	x			S.	
		*H.R.#4	x		x	S.	

Date	Outcrop Locality	Sample #	Sample Type: Lith	Geochem	Paleo	Sample Preparation	Comments
	Hume R. Trib.	H.R. #4	x		x	S.	
		H.R. #5	x			S.	
		H.R. #6		x			
		H.R. #7	x			S.	
		H.R. #8	x			S.&T.S.	
		H.R. #9	x			S.	Trilobite pygidium
		H.R.#10	x			S.&T.S.	
		H.R.#11	x			S.	
		H.R.#12	x			S.	
		H.R.#13	x		x		
		H.R.#14	x			S.	
		H.R.#15		x			
		*H.R.#16			x		Macropaleo
08/31	Powell Ck. (West)	P.C. #1	x			S.	Light gy mudstone
		P.C. #2		x			
		P.C. #3	x			S.	Probably a.a. faulted
		P.C. #4	x				
		P.C. #5	x			S.	Biostromal unit matrix
		P.C. #6	x			S.	Orange patina
	Powell Ck. (East)	P.C. #7	x			S.	Corals & sand
		P.C. #8	x			S.	
		P.C. #9	x			S.	Two #9's
		*P.C.#10			x		Coral floatstone
09/01	Dodo Canyon	D.C. #1	x			S.	
		D.C. #2	x				
		D.C. #3	x			S.	
		D.C. #4	x	x			Pic of wall 50% stroms
		D.C. #5	x			S.	I.T.
		D.C. #6	x			S.	
		D.C. #7		x			)
		D.C. #8		x			) Unit sample above
		D.C. #9		x			) biostromal unit
		D.C.#10		x			)
		D.C.#11		x			
		D.C.#12	x			S.	
09/02	Little Bear R.	L.B.R. #1			x		Perhaps B.R.
		L.B.R. #2		x			
		L.B.R. #3	x			S.	Shell hash *orient
		L.B.R. #4		x			
		L.B.R. #5	x			S.&T.S.	Shell hash *orient
		L.B.R. #6	x				
		L.B.R. #7	x			S.&T.S.	Have poloroid
		L.B.R. #8	x				
		L.B.R. #9	x			S.	
		L.B.R.#10	x				
		L.B.R.#11		x			1st strom at sequance
		L.B.R.#12	x			S.	

Date	Outcrop Locality	Sample #	Sample Type: Lith	Geochem	Paleo	Sample Preparation	Comments
09/03	Mt. St. Charles	M.S.C. #1			x	S.	Sample is coral
		M.S.C. #2	x			S.&T.S.	Calcareous s.s.
		*M.S.C. #3	x		x	S.	
09/03	Mt. Morrow	M.M. #1	x			T.S.	Unmeasured sample
		M.M. #2		x			Unmeasured intertidal
		M.M. #3	x				
		M.M. #4	x			S.	Matrix sample in biostromal unit
		M.M. #5	x			S.	
09/04	Hare Indian R. Trib.	H.I.R.(2)#1	x			S.	Sample of matrix
		H.I.R.(2)#2			x		Shale micropaleo
		H.I.R.(2)#3	x				Coral filled with oil
		H.I.R.(2)#4		x			Coral frags
		H.I.R.(2)#5		x			Bluefish sample
		H.I.R.(2)#6	x			S.	
09/05	Bell Ck.	B.C. #1	x			S.&T.S.	Biostromal
		B.C. #2	x				I.T.
		*B.C. #3	x		x	S.	Biostromal Matrix
		*B.C. #4		x	x		Coral debris fauna
		*B.C. #5	x		x		Fossil hash from turbdite
		B.C. #6		x			Fred took for geochem
		B.C. #7		x			
		B.C. #8	x			S.	

GRAND TOTAL 109 samples

S. = slabbed and polished
T.S. = thin section

* Samples have been sent to Drs. A.W. Norris and A.E.H. Pedder of the I.S.P.G. for identification and will henceforth reside at the Institute under their identification (see Appendix II).

APPENDIX II

PALEONTOLOGICAL IDENTIFICATIONS

File B16AWN87

Report No. 6-AWN-1987

[redacted]

Report on sixteen lots of Devonian fossils from eight localities in the lower Mackenzie Valley area, District of Mackenzie; collected by R. L. Mckellar and F. Monnier, 1986, geologists of Canterra Energy Ltd., 505-5th Avenue S. W., Calgary T2P 2K7.

The relevant parts of any manuscript prepared for publication that paraphrase or quote from this report should be referred to the Paleontology Subdivision, Calgary, for possible revision.

TRIBUTARY OF HARE INDIAN RIVER

Field No. & Stratigraphy
86HIR-1A; Hume Fm., 27 m below top of fm.
Locality, Fauna & Age
Tributary of Hare Indian River at 66°29 N, 127°54 W (NTS 92L/5).
cup and colonial corals - to A. E. H. Pedder
Variatrypa (Variatrypa) arctica (Warren, 1944)
Spinatrypa (Isospinatrypa) borealis (Warren, 1944)
Carinatrypa pauciplicata Copper, 1978
cf. **Philoxene** sp.
cf. **Spirorbis** sp.
Age: **V. (V.) arctica** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146956.

Field No. & Stratigraphy
86HIR-1B; Hume Fm., 27 m below top of fm.; grab sample at recessive ledge.
Locality, Fauna & Age
Locality as above.
cup and colonial corals - to A. E. H. Pedder
Variatrypa (Variatrypa) arctica (Warren, 1944)
Age: **V. (V.) arctica** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146957.

Field No. & Stratigraphy
86HIR; Hume Fm., 27 m below top of fm.; grab sample above shale.
Locality, Fauna & Age
Locality as above.
colonial corals - to A. E. H. Pedder
Age: not determined.
GSC Locality No. C-146958.

CARNWATH RIVER

Field No. & Stratigraphy
86CRBA-5; Hume Fm., 3 m below top of bioherm A.
Locality, Fauna & Age
Carnwath River at 67°23'N, 127°43'W (NTS 92M/5).
Spinatrypa (Spinatrypa) andersonensis (Warren, 1944)

Age: **C. dysmorphostrota** Zone of Pedder (1975), late Eifelian, early Middle Devonian.

GSC Locality No. C-146959.

Field No. & Stratigraphy
86CRBA-6; Hume Fm., top of bioherm A.
Locality, Fauna & Age
Locality as above.
colonial corals - to A. E. H. Pedder
Spinatrypa (Spinatrypa) andersonensis (Warren, 1944)
undet. gastropod
echinoderm ossicle with single axial canal
Age: **C. dysmorphostrota** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146960.

Field No. & Stratigraphy
86CRBA; Hume Fm., float from base of bioherm A.
Locality, Fauna & Age
Locality as above.
corals - to A. E. H. Pedder
Variatrypa (Variatrypa) arctica (Warren, 1944)
Spinatrypa (Isospinatrypa) borealis (Warren, 1944)
Emanuella sp.
Dechenella (Dechenella) sp. cf. **D. (D.) spaekkassensis** (Tolmachoff, 1926)
Age: **C. dysmorphostrota** or **V. (V.) arctica** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146961.

Field No. & Stratigraphy
86CRBB; Hume Fm., float from base of bioherm B.
Locality, Fauna & Age
Locality almost same as above; 450 m downstream (north) of bioherm A.
corals - to A. E. H. Pedder
Gypidula n. sp., a new costate form - to Index Collection
Spinatrypa (Isospinatrypa) borealis lata (Warren, 1944)
Carinatrypa dysmorphostrota (Crickmay, 1960)
Emanuella sp.
Tentaculites sp.
undet. planispiral gastropod with radial ornament - to Index Collection
circular echinoderm ossicle with single axial canal
five-sided echinoderm ossicle with single axial canal
Age: **C. dysmorphostrota** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146962.

FRANCIS CREEK

Field No. & Stratigraphy
86FC-4; Hume Fm., 2 m below top of fm.
Locality, Fauna & Age
Francis Creek at 65°14'N, 126°22'W (NTS 96E/1).
coral fragments - to A. E. H. Pedder

cf. **Dechenella (Dechenella) spaekkassensis**
(Tolmachoff, 1926), of Ormiston, 1967
echinoderm ossicle with single axial canal
Age: Eifelian, early Middle Devonian.
GSC Locality No. C-146963.

TRIBUTARY OF HUME RIVER

Field No. & Stratigraphy
86HR-3; Hume Fm., 2 m a.b. of fm.
Locality, Fauna & Age
Tributary of Hume River at 65°20'N, 129°57'W (NTS 106H/5)
Eoschuchertella adoceta (Crickmay, 1960)
undet. trilobite cephalon fragment
Age: **E. adoceta** Zone of Crickmay (1960), early Eifelian, early Middle Devonian.
GSC Locality No. C-146964.

Field No. & Stratigraphy
86HR-4; Hume Fm., 10.5 m a.b.
Locality, Fauna & Age
Locality as above.
Eoschuchertella adoceta (Crickmay, 1960)
Tentaculites sp.
circular echinoderm ossicle with single axial canal
five-sided echinoderm ossicle with single axial canal
Age: **E. adoceta** Zone, early Eifelian, early Middle Devonian.
GSC Locality No. C-146965.

Field No. & Stratigraphy
86HR-16; Hume Fm., 0.5 m from top (lithology and fossils suggest basal Hare Indian Fm.).
Locality, Fauna & Age
Locality as above.
Leiorhynchus castanea (Meek, 1868)
Spinatrypa (Isospinatrypa) borealis (Warren, 1944)
Age: **L. castanea** Zone (Warren and Stelck, 1950), probably within conodont **ensensis** Zone which straddles the Eifelian/Givetian boundary.
GSC Locality No. C-146966.

POWELL CREEK (EAST)

Field No. & Stratigraphy
86PC-10; Hume Fm., float from base of fm.
Locality, Fauna & Age
Powell Creek (east section) at 65°16'N, 128°46'W (NTS 106H/7).
colonial coral - to A. E. H. Pedder
echinoderm ossicle with single axial canal
undet. trilobite tail fragment
Age: not determined.
GSC Locality No. C-146967.

MOUNT ST. CHARLES

Field No. & Stratigraphy
86MSC-3; Hume Fm., 0.5 m from top of fm.
Locality, Fauna & Age
Mount St. Charles at 65°10'N, 124°49'W (NTS 96F/2).
undet. stromatoporoid
colonial coral - to A. E. H. Pedder
cf. **Dechenella (Dechenella) maclareni** Ormiston, 1967
Age: Eifelian, early Middle Devonian.
GSC Locality No. C-146968.

BELL CREEK

Field No. & Stratigraphy
86BC-3; Hume Fm., 16 m below top of fm.; biostromal matrix.
Locality, Fauna & Age
Bell Creek at 65°17'N, 128°53'W (NTS 106N/7).
colonial coral - to A. E. H. Pedder
Age: not determined.
GSC Locality No. C-146969.

Field No. & Stratigraphy
86BC-4; Hume Fm., 9.5 m below top of fm.; coral debris fauna.
Locality, Fauna & Age
locality as above.
corals - to A. E. H. Pedder
Carinatrypa pauciplicata Copper, 1978
Age: **C. dysmorphostrota** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146970.

Field No. & Stratigraphy
86BC-5; Hume Fm., 9 m below top of fm.; fossil hash from turbidite.
Locality, Fauna & Age
locality as above.
Spinatrypa (Spinatrypa) andersonensis (Warren, 1944)
cf. **Nucleospira** sp.
Tentaculites sp.
cf. **Fuscinipyge yolkini** Ormiston, 1972
Spirorbis sp.
echinoderm ossicle with single axial canal
Age: **C. dysmorphostrota** Zone, late Eifelian, early Middle Devonian.
GSC Locality No. C-146971.

Comments

TRIBUTARY OF HARE INDIAN RIVER

Samples C-146956 and C-146957 contain **Variatrypa (Variatrypa) arctica** which in the Mackenzie Valley region overlaps the ranges of the **Carinatrypa dysmorphostrota** and **Leiorhynchus castanea** zones. V. (V.) **arctica** has a wide geographical distribution outside of the Mackenzie Valley region where it has been recorded from the lower Keg River and lower Methy formations of

northern Alberta, the lower Winnipegosis Formation of Saskatchewan, the Elm Point and lower Winnipegosis formations of Manitoba, the Murray Island Formation of the Moose River Basin of northern Ontario, and the lower Rogers City Formation of Michigan. In the latter areas, **V.** (**V.**) **arctica** is a much more useful form than **C. dysmorphostrota**, which is sporadically and sparsely represented, and where **L. castanea** is absent.

CARNWATH RIVER

The fossils of bioherms A and B of the Hume Formation (samples C-146959 to C-146963 inclusive) are representative of the **C. dysmorphostrota** Zone of Pedder (1975). This zone is broadly aligned with the conodont **kockelianus** Zone of late Eifelian, early Middle Devonian age, but its precise relationship to the conodont zonal scheme has not been established.

The distinctive brachiopod **V.** (**V.**) **arctica** and a trilobite suggestive of **Dechenella** (**D.**) **spaekkassensis** (Tolmachoff, 1926) of Ormiston (1967) are present in sample C-146961.

FRANCIS CREEK

The trilobite suggestive of **Dechenella** (**D.**) **spaekkassensis**, present in sample C-146963, appears to be a common element of the **C. dysmorphostrota** Zone.

TRIBUTARY OF HUME RIVER

Samples C-146964 and C-146965 contain the zonal designate, **Eoschuchertella adoceta** Crickmay (1960). The **adoceta** Zone is broadly aligned with the conodont **australis** Zone of early Eifelian, early Middle Devonian age (Norris, 1985).

Elements of both the **adoceta** and **dysmorphostrota** zones have been collected recently from Melville Island of the western Arctic Archipelago in beds with numerous pelecypods.

Leiorhynchus castanea (Meek, 1868), in sample C-146966, occurs typically in a thin stratigraphical interval in the uppermost Hume and lower Hare Indian formations in the lower Mackenzie Valley region. Its occurrence here in a matrix of dark bituminous limestone is more suggestive of basal Hare Indian rather than uppermost Hume Formation. Many workers including Warren and Stelck (1950), Bassett (1961), Tassonyi (1969) and Caldwell (1971) placed the **castanea**-bearing beds in the basal Hare Indian Formation. In this area, the zone is broadly equivalent to the conodont **ensensis** Zone which straddles the Eifelian/Givetian boundary of the Middle Devonian, although a precise biological marker for the base of the Givetian is still not decided.

Forms suggestive of **L. castanea** have been found in the Nahanni River region, northeastern British Columbia, Great Slave Lake area, Nevada, and a single specimen has been noted in an early collection from Melville Island. The form occurring in the Bituminous limestone member of the Pine Point Formation on the south side of Great Slave Lake is currently being studied and appears to be slightly younger (Lower and Middle **varcus** subzones) than the typical **castanea** of the lower Mackenzie Valley region.

POWELL CREEK (EAST)

No diagnostic fossils in sample C-146967, and age not determined.

MOUNT ST. CHARLES

The form suggestive of **Dechenella (D.) maclareni** Ormiston (1967), present in sample C-146968, is known in the northern Yukon Territory in beds broadly equivalent to the Hume Formation. It occurs typically in the Blue Fiord Formation of the Arctic Archipelago.

BELL CREEK

The presence of **Carinatrypa pauciplicata** Copper (1978) in sample C-146970, and **Spinatrypa (S.) andersonensis** (Warren, 1944) and cf. **Nucleospira** sp. in sample C-146971, suggest assignment to the **C. dysaorphostrota** Zone of late Eifelian, early Middle Devonian age.

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A. W. Norris

Paleontology Subdivision,
Institute of Sedimentary and Petroleum Geology,
Calgary, February 3, 1987.

Copies to: R. L. McKellar
A. E. H. Pedder

Report No. RLM-128-AEHP-87

Report on 12 lots of Middle Devonian fossils submitted by R.L. McKellar, Canterra Energy Ltd., from the District of Mackenzie, NTS 96E, 96F, 96L, 96M and 106H.

The relevant parts of any manuscript prepared for publication that paraphrase or quote from this report should be referred to the Paleontology Subdivision, Calgary, for possible revision.

Field No. 86 H1R 1A GSC Loc. C-146956

Stratigraphy: Hume Formation, 27 m below top of formation.

Locality: District of Mackenzie, tributary of Hare Indian River; 66°29'N, 127°54'W; NTS 96L.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Favosites** sp.
Thamnopora sp.
Alveolites sp.
Digonophyllum sp. nov.
Lekanophyllum mediale McLean
Sociophyllum glomerulatum (Crickmay)
Radiastraea norrisi Pedder
Hederella sp.
Variatrypa (V.) arctica (Warren)
Spinatrypa (Isospinatrypa) borealis (Warren)
Carinatrypa dysmorphostrota (Crickmay)
Serpulospira ? sp.
Spirorbis sp.

Remarks: This is a typical **dysmorphostrota** Zone assemblage.

Field No. 86 H1R 1B GSC Loc. C-146957

Stratigraphy: Hume Formation, 27 m below top of formation.

Locality: District of Mackenzie, tributary of Hare Indian River; 66°29'N, 127°54'W; NTS 96L.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Favosites** sp.
Alveolites sp.
Microplasma caespitosum (Schluter) small form
Lekanophyllum andersonense McLean

Aphroidophyllum sp. nov.
Variatrypa (V.) arctica (Warren)

Remarks: The new species of **Aphroidophyllum** is well known to the writer and is diagnostic of the **dysmorphostrota** Zone.

Field No. 86 H1R GSC Loc. C-146958

Stratigraphy: Hume Formation, 27 m below top of formation.

Locality: District of Mackenzie, tributary of Hare Indian River; 66°29'N, 127°54'W; NTS 96L.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Favosites** sp.
Alveolites sp.
Mastopora sp.
digitate tabulate corals, not studied
Digonophyllum rectum (Meek)
Aphroidophyllum howelli Lenz
Taimyrophyllum stirps (Crickmay)
Tawuphyllum sp. nov.
Radiastraea sp. nov.

Remarks: **Aphroidophyllum howelli** and **Taimyrophyllum stirps** are diagnostic of the **dysmorphostrota** Zone.

Field No. 86 CRBA 5 GSC Loc. C-146959

Stratigraphy: Hume Formation, Bioherm "A", 3 m below top.

Locality: District of Mackenzie, Carnath River, 67°23'N, 127°43'W; NTS 96M.

Age: Middle Devonian, late Eifelian, **adoceta** or **dysmorphostrota** Zone.

Fauna: **Thamnopora** sp.
Alveolites sp.
Spinatrypa (S.) andersonensis (Warren)

Remarks: The two tabulate corals are far less diagnostic than **Spinatrypa (S.) andersonensis**, which is characteristic of the **dysmorphostrota** Zone, but also occurs rarely in the underlying **adoceta** Zone.

Field No. 86 CRBA 6 GSC Loc. C-146960

Stratigraphy: Hume Formation, Bioherm "A", top of bioherm.

Locality: District of Mackenzie, Carnath River, 67°23'N, 127°43'W; NTS 96M.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Thamnopora** sp.
Digonophyllum sp. fragmentary and immature specimen
Radiastraea norrisi Pedder
Spinatrypa (S.) andersonensis (Warren) identified by A.W. Norris
gastropods, indet.

Remarks: Corals such as **Radiastraea norrisi** were confused with **R. verrilli** for many years. **R. verilli**, in the strictest sense, may be confined to the **adoceta** Zone, whereas **R. norrisi** is confined to the **dysmorphostrota** Zone.

Field No. 86 CRBA GSC Loc. C-146961

Stratigraphy: Hume Formation, loose from base of Bioherm "A".

Locality: District of Mackenzie, Carnath River, 67°23'N, 127°43'W; NTS 96M.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Favosites** sp.
Thamnopora sp.
Alveolites sp.
Syringopora sp.
Lekanophyllum andersonense McLean
L. mediale McLean
new cystiphyllid coral; study pending
Disphyllum? sp. solitary corallites only
Radiastraea norrisi Pedder
R. tapetiformis (Crickmay) small fragment
stropheodontid brachiopod
Spinatrypa (Isospinatrypa) borealis (Warren)
Emanuella sp.
Tentaculites sp.
trilobite pygidium

Remarks: This is another typical **dysmorphostrota** Zone assemblage, although the new cystiphyllid coral has not been seen before. It may represent a new genus.

Field No. 86 CRBB GSC Loc. C-146962

Stratigraphy: Hume Formation, loose from base of Bioherm "B".

Locality: District of Mackenzie, Carnath River, approximately 450 m north, that is downstream, from Bioherm "A"; 67°23'N, 127°43'W; NTS 96M.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Favosites** sp.
Thamnopora sp.
Alveolites sp.
Lekanophyllum sp. small, presumed immature specimen
Aphroidophyllum meeki Pedder
A. sp. nov.
Taimyrophyllum stirps (Crickmay)
Redstonea sperabilis (Crickmay)
Spinophyllum sp. nov.
Radiastraea tapetiformis (Crickmay)
stropheodontid brachiopod
Gypidula sp. nov. identified by A.W. Norris
Variatrypa (**V.**) **arctica** (Warren)
Spinatrypa (Isospinatrypa) borealis (Warren)
Emanuella sp.
Cyrtina sp.
gastropod, not studied, see Pal. Rept. 6-AWN-1987
Tentaculites sp.
Spirorbis sp.

Remarks: This is another typical **dysmorphostrota** Zone assemblage. The new species of **Aphroidophyllum** is conspecific with the species in C-149657 (field no. 86 H1R 1B).

Field No. 86 FC 4 GSC Loc. C-146963

Stratigraphy: Hume Formation, 2 m below top of formation.

Locality: District of Mackenzie, Francis Creek; 65°14'N, 126°22'W; NTS 96E.

Age: not determined.

Fauna: stromatoporoid, not studied.
Alveolites? sp.
trilobite pygidium, see Pal. Rept. 6-AWN-1987

Field No. 86 PC 10 GSC Loc. C-146967

Stratigraphy: Hume Formation, loose from base of formation.

Locality: District of Mackenzie, Powell Creek (east section); 65°16'N, 128°46'W; NTS 106H.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **Utaratuia laevigata** Crickmay very poor preservation

Remarks: Although this talus specimen was collected at the base of the Hume Formation, all known **in situ** examples of **U. laevigata** are from the **dysmorphostrota** Zone, which is above the basal Hume megafossil zone of **Eoschuchertella adoceta**.

Field No. 86 MSC 3 GSC Loc. C-146968

Stratigraphy: Hume Formation, 0.5 m below top of formation.

Locality: District of Mackenzie, Mount St. Charles; 65°10'N, 124°49'W; NTS 96F.

Age: Middle Devonian, Eifelian, see Pal. Rept. 6-AWN-1987

Fauna: stromatoporoid, not studied.
Alveolites sp.
trilobite pygidium, see Pal. Rept. 6-AWN-1987

Field No. 86 BC 3 GSC Loc. C-146969

Stratigraphy: Hume Formation, 16 m below top of formation.

Locality: District of Mackenzie, Bell Creek; 65°17'N, 128°53'W; NTS 106H.

Age: not determined.

Remarks: The rugose coral present in this sample is too fragmentary and too poorly preserved for identification.

Field No. 86 BC 4 GSC Loc. C-146970

Stratigraphy: Hume Formation, 9.5 m below top of formation.

Locality: District of Mackenzie, Bell Creek; 65°17'N, 128°53'W; NTS 106H.

Age: Middle Devonian, late Eifelian, **dysmorphostrota** Zone.

Fauna: **"Disphyllum"** sp. nov.
Carinatrypa pauciplicata Copper, identified by A.W. Norris.

Remarks: The unnamed species of rugose coral is well known to the writer from the **dysmorphostrota** Zone of the Hume Formation. It resembles species of **Disphyllum** but has a peculiar disseptimentarium, that is sufficiently different to remove it from that genus.

Alan Pedder.

A.E.H. Pedder

Paleontology Subdivision
Institute of Sedimentary
and Petroleum Geology
Calgary, Alberta
March 24, 1987

APPENDIX III

MEASURED SECTION LOGS

9237-C55-2E

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

(type section)
LOCALITY: HUME RIVER TRIBUTARY LATITUDE: 65° 20'N. LONGITUDE: 129° 57' W.

MILITARY GRID REFERENCE: 554463 GRID AREA: 106 H/5

REMARKS: This type section can be located by the distinctive "S" curve of the Hume River tributary as it passes through the resistant upper Hume cliffs

MEASURED BY: R.L. McKellar and F. Monnier DATE: August 30, 1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

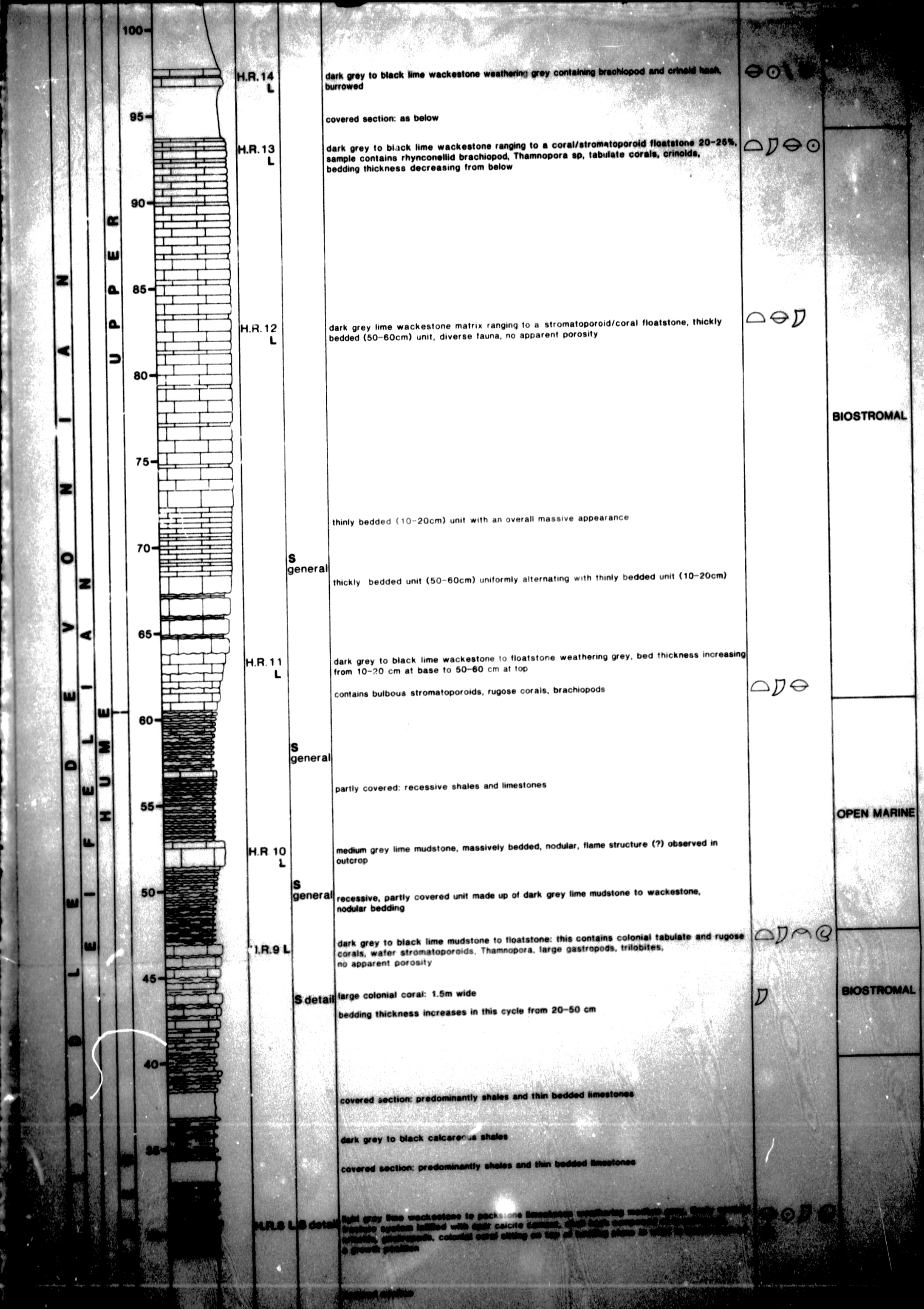
PHOTO RECORD

- P POLAROID
- S SLIDE
- T TEXT

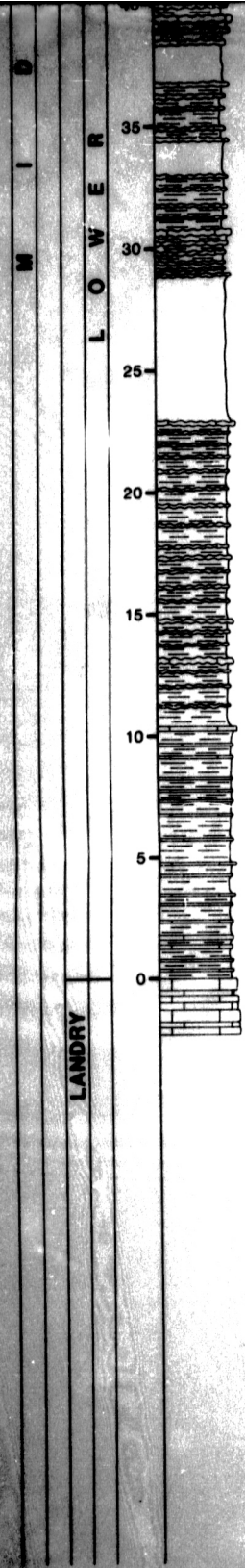
SAMPLE TYPE

- G GEOCHEMISTRY
- P PALEONTOLOGY
- L LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								5. HUME RIVER		
	GIVETIAN	HUME						upper portions weathering yellow and ochre		RESTRICTED MARINE
						H.R.17 G		black bituminous shale, thinly laminated, platy, containing Stylolinids and Tentaculites		
				110		H.R.15 P,G (TOC: 2.04%) (TOC: 3.43%)	P detail S detail	black calcareous shale composed over 90% of L. castanea fauna intercalated with grey lime mudstone beds with a nodular appearance		TRANSITIONAL
				105				covered section: lithology as below, becoming more thinly bedded		
				100		H.R.14 L		dark grey to black lime wackestone weathering grey containing brachiopod and crinoid fossil, burrowed		
								covered section: as below		



D E V O N I A N
M I D D L E
E I F E L I A N
H U M E
U P P E R
100
95
90
85
80
75
70
65
60
55
50
45
40
35
H.R.14 L
dark grey to black lime wackestone weathering grey containing brachiopod and crinoid hash, burrowed
covered section: as below
H.R.13 L
dark grey to black lime wackestone ranging to a coral/stromatoporoid floatstone 20-25%, sample contains rhynconellid brachiopod, Thamnopora sp, tabulate corals, crinoids, bedding thickness decreasing from below
H.R.12 L
dark grey lime wackestone matrix ranging to a stromatoporoid/coral floatstone, thickly bedded (50-60cm) unit, diverse fauna, no apparent porosity
thinly bedded (10-20cm) unit with an overall massive appearance
S general
thickly bedded unit (50-60cm) uniformly alternating with thinly bedded unit (10-20cm)
H.R.11 L
dark grey to black lime wackestone to floatstone weathering grey, bed thickness increasing from 10-20 cm at base to 50-60 cm at top
contains bulbous stromatoporoids, rugose corals, brachiopods
S general
partly covered: recessive shales and limestones
H.R.10 L
medium grey lime mudstone, massively bedded, nodular, flame structure (?) observed in outcrop
S general
recessive, partly covered unit made up of dark grey lime mudstone to wackestone, nodular bedding
H.R.9 L
dark grey to black lime mudstone to floatstone: this contains colonial tabulate and rugose corals, wafer stromatoporoids, Thamnopora, large gastropods, trilobites, no apparent porosity
S detail
large colonial coral: 1.5m wide
bedding thickness increases in this cycle from 20-50 cm
covered section: predominantly shales and thin bedded limestones
dark grey to black calcareous shales
covered section: predominantly shales and thin bedded limestones
H.R.8 L,S detail
light grey lime wackestone to packstone
calcite
colonial coral sitting on top of
BIOSTROMAL
OPEN MARINE
BIOSTROMAL



covered section: predominantly shales and thin bedded limestones

dark grey to black calcareous shales

covered section: predominantly shales and thin bedded limestones

H.R.8 L — S detail — light grey lime wackestone to packstone limestones weathering medium grey, finely vertical fracture system infilled with spar calcite cement, shell hash composed of brachiopods, crinoids, gastropods, colonial coral sitting on top of bedding plane in what is interpreted as a growth position

covered section

H.R.7 L — dark grey lime mudstone weathering medium grey, beds nodular contact with shale abrupt rugose corals, tabulate corals, tabular stromatoporoids in lime wackestone matrix, no apparent porosity

H.R.6 G (TOC: 0.47%) — dark grey to black calcareous shale, 5-6 cm nodular beds

S general

H.R.5 L — dark grey to black lime wackestone weathering dark grey

S detail — high extended hemispherical stromatoporoid, colonial coral, Thamnopora in a lime mud matrix

bed thickness increasing to 3-4 cm

limestone beds become nodular, however the contact between shale and limestone is still abrupt

H.R.4 L — dark grey lime wackestone to packstone, thinly bedded 1-2 cm occasionally grading to 15-20 cm thick: these wackestone/packstones exhibit a grading similar to components of the Bouma sequence and are interpreted as turbidites

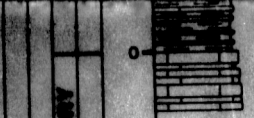
S general

H.R.3 L — dark grey to black calcareous shales, thinly bedded 1-2 cm alternate with dark grey lime

H.R.2 L — wackestone to packstone thinly bedded 1-2 cm with occasional thicker bedded wackestones 15-20 cm thick: wackestones predominantly composed of brachiopod and crinoid hash: some foraminifera and ostracods in a mudstone matrix

H.R.1 G (TOC: 0.73%) — dark grey lime mudstone weathering grey

OPEN MARINE



H.R.3 L
H.R.2 L

0

H.R.1 Q
(TOC:
0.75%)

dark grey to black calcareous shales, thinly bedded 1–2 cm alternate with dark grey lime wackestone to packstone thinly bedded 1–2 cm with occasional thicker bedded wackestones 15–20 cm thick; wackestones predominantly composed of fragments and whole tests of foraminifera and ostracods in a mudstone matrix

dark grey lime mudstone weathering grey

9287-C55-26

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: POWELL CREEK LATITUDE: 65°16'N. LONGITUDE: 128°46'W.

MILITARY GRID REFERENCE: 105388 (west side) 107385 (east side) GRID AREA: 106 H/7

REMARKS: This section was measured on the west side and east side of the creek where the outcrop meets the creek bottom.

MEASURED BY: R.L. McKellar and F. Monnier DATE: August 31, 1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

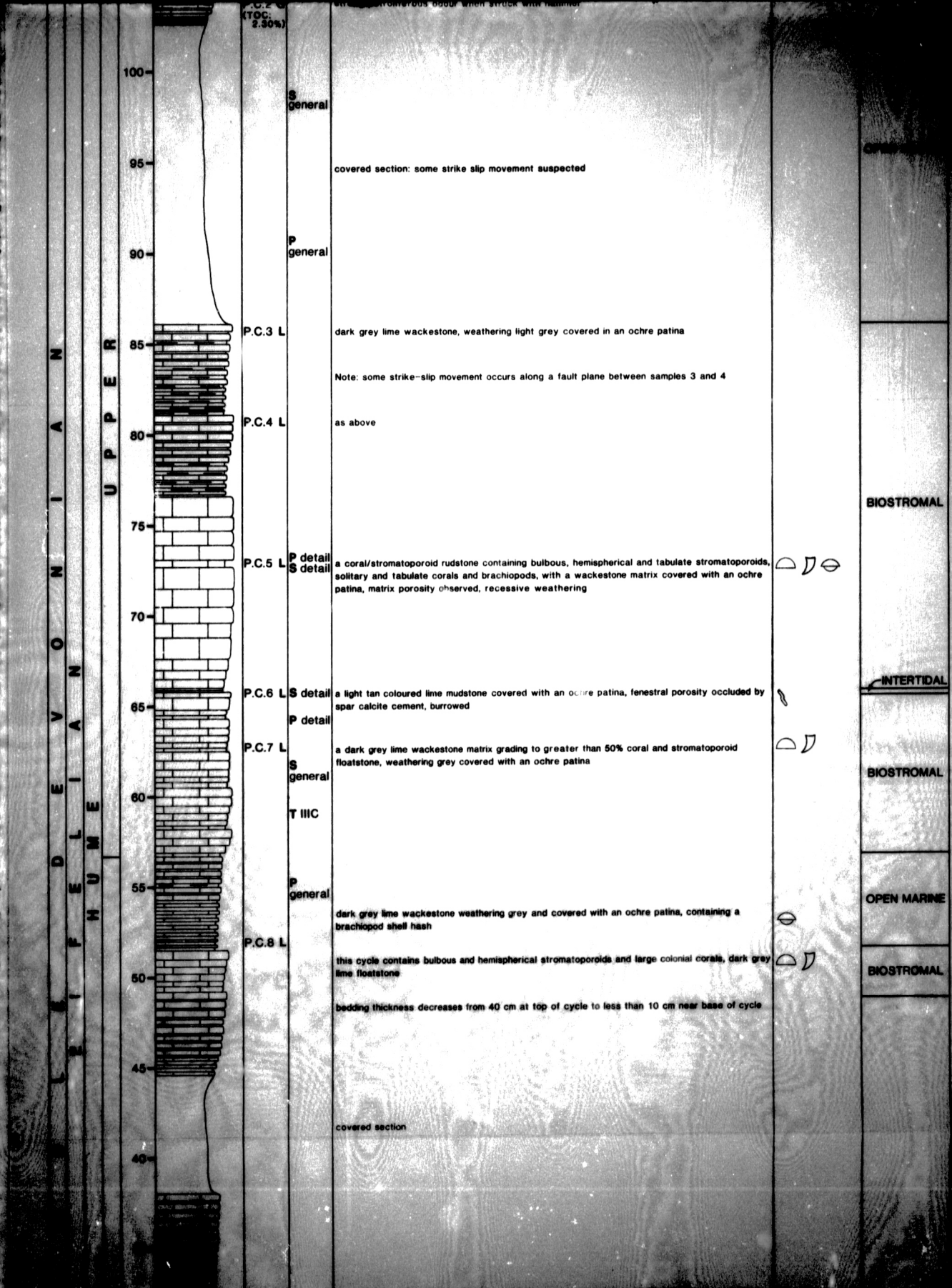
PHOTO RECORD

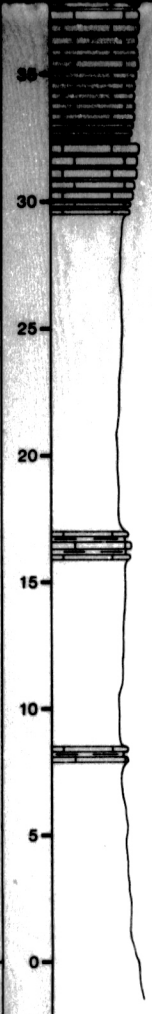
- P POLAROID
- S SLIDE
- T TEXT

SAMPLE TYPE

- G GEOCHEMISTRY
- P PALEONTOLOGY
- L LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
					3. POWELL CREEK					
DEVONIAN	GIVETIAN	HUME	BLUEFISH	110				covered section		RESTRICTED MARINE
								black bituminous shale, platy, fissile, basal portion filled with Stylolinids and Tentaculites	A	TRANSITIONAL
				105		P.C.1 L P.C.2 G (TOC-2.36%)	P detail S detail	L. castanea fauna found above sample I dark grey lime mudstone, weathering light grey to white, burrowed, no apparent porosity, strong petroliferous odour when struck with hammer		
				100			S general			
								covered section: some strike slip movement suspected		


DEVONIAN
LEIDELIAN
UPPER
LEFEVRE HUMME
(TOC; 2.30%)
100
95
90
85
80
75
70
65
60
55
50
45
40
S general
P general
P.C.3 L
P.C.4 L
P detail
S detail
P.C.5 L
P.C.6 L
S detail
P detail
P.C.7 L
S general
T IIIC
P general
P.C.8 L
strong petroliferous odour when struck with hammer
covered section: some strike slip movement suspected
dark grey lime wackestone, weathering light grey covered in an ochre patina
Note: some strike-slip movement occurs along a fault plane between samples 3 and 4
as above
a coral/stromatoporoid rudstone containing bulbous, hemispherical and tabulate stromatoporoids, solitary and tabulate corals and brachiopods, with a wackestone matrix covered with an ochre patina, matrix porosity observed, recessive weathering
a light tan coloured lime mudstone covered with an ochre patina, fenestral porosity occluded by spar calcite cement, burrowed
a dark grey lime wackestone matrix grading to greater than 50% coral and stromatoporoid floatstone, weathering grey covered with an ochre patina
dark grey lime wackestone weathering grey and covered with an ochre patina, containing a brachiopod shell hash
this cycle contains bulbous and hemispherical stromatoporoids and large colonial corals, dark grey lime floatstone
bedding thickness decreases from 40 cm at top of cycle to less than 10 cm near base of cycle
covered section
BIOSTROMAL
INTERTIDAL
BIOSTROMAL
OPEN MARINE
BIOSTROMAL



P.C.9 L

dark grey lime wackestone ranging in places to a coral floatstone weathering light grey covered with an ochre patina, containing a brachiopod shell hash, bedding thickness varies from less than 10 cm at the base of a cycle to 40 cm at the top with thin 1–2 cm beds of calcareous shale between limestone beds, no apparent porosity

covered section

a dark grey lime wackestone weathering light grey covered with an ochre patina, containing a brachiopod shell hash

covered section

a dark grey lime wackestone weathering light grey covered with an ochre patina, containing a brachiopod shell hash, no apparent porosity, thinly bedded

covered section: thinly laminated shales and limestones

M I
LOWER
LANDRY

OPEN

9237-c55-2E

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: FRANCIS CREEK LATITUDE: 65° 14'N. LONGITUDE: 126° 22'W.

MILITARY GRID REFERENCE: 224379 (start) 219378 (finish) GRID AREA: 96E/1

REMARKS: This section starts at the base of a 6 cm waterfall which cuts through the resistant upper Hume within the narrow confines of a canyon created by the upper Hume, Hare Indian and Canol sequence.

MEASURED BY: R.L. McKellar and F. Monnier DATE: August 29, 1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- P POLAROID
- S SLIDE
- T TEXT

SAMPLE TYPE

- G GEOCHEMISTRY
- P PALEONTOLOGY
- L LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								7. FRANCIS CREEK		
				25			S general	black bitumenous shale weathering yellow and ochre		
				30		TOC:3.15% F.C.7 G	S detail	black thinly laminated, platy shale containing Styliolinids and Tentaculites		
						F.C.6 L F.C.8 G		medium grey lime mudstone weathering light grey, burrowed with L. castanea fauna intercalated with 10 cm thick black calcareous shale beds		
						F.C.4 L		dark grey lime floatstone to rudstone with a wackestone matrix weathering grey, thinly bedded, contains bulbous stromatoporoids, tabulate corals, trilobites, no apparent porosity		
							P general			
							S detail			

ECHINODERMS

7. FRANCIS CREEK

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION
MIDDLE DEVONIAN	EIFELIAN	HUME	UPPER	25			S general	black bitumenous shale weathering yellow and ochre
	GIVETIAN	HARE INDIAN	BLUEFISH	20		TOC:3.13% F.C.7 G	S detail	black thinly laminated, platy shale containing Styliolinids and Tentaculites
			GREY SHALE			F.C.5 L F.C.6 G		medium grey lime mudstone weathering light grey, burrowed with L. castanea fauna intercalated with 10 cm thick black calcareous shale beds
						F.C.4 L		dark grey lime floatstone to rudstone with a wackestone matrix weathering grey, thickly bedded, contains bulbous stromatoporoids, tabulate corals, trilobites, no apparent porosity
				15			P general	
							S general	
				10		F.C.3 L		light tan coloured lime mudstone to wackestone weathering light grey, fenestral porosity occluded by spar calcite cement, massively bedded, contains brachiopods, Thamnopora, robust cylindrical stromatoporoids, no apparent porosity
							T IVC	
							P detail	tidal channels observed in outcrop, 1 to 2 m deep, 3 to 5m wide
				5		F.C.2 L	T IVB	dark grey lime mudstone to wackestone weathering grey, burrowed, some spar calcite cement, no apparent porosity
						F.C.1 L	P general	light tan coloured lime mudstone to floatstone, fenestral porosity occluded by spar calcite cement, fossil molds also replaced by spar calcite cement, stylotized, massively bedded, contains fragments of brachiopods and solitary corals
				0				covered section

RESTRICTED MARINE

TRANSITIONAL

BIOSTROMAL

INTERTIDAL

9237-C55-26

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: MT. MORROW LATITUDE: 69° 29'N. LONGITUDE: 127° 29'W.

MILITARY GRID REFERENCE: 695645 GRID AREA: 96E/6

REMARKS: This section was measured on the southern end of the northeast arm of the breached anticline that is Mt. Morrow. A break in the cliff face allowed us to land the helicopter on the top of the mountain and walk down to the base of the cliff to measure the section.

MEASURED BY: R.L. McKellar and F. Monnier DATE: September 3, 1986

PLOTTED BY: R.L. McKellar DATE: October 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- [P] POLAROID
- [S] SLIDE
- [T] TEXT

SAMPLE TYPE

- [G] GEOCHEMISTRY
- [P] PALEONTOLOGY
- [L] LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								8. MT. MORROW		
				40			P general	light tan coloured lime mudstone weathering light grey, fenestral porosity occluded by spar calcite cement, massively bedded, occasional coral, shell and gastropod fragments in mud matrix, no apparent porosity		
				35						
							P general			

ECHINODERMS

8. MT. MORROW

EPOCH	STAGE	FORMATION	MEMBER	METRES	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION		
MIDDLE DEVONIAN	ELIAN	HUME	UPPER	40			P general	light tan coloured lime mudstone weathering light grey, fenestral porosity occluded by spar calcite cement, massively bedded, occasional coral, shell and gastropod fragments in mud matrix, no apparent porosity		
				35						
				30			P general			
				25				light tan coloured lime mudstone weathering light grey, fenestral porosity occluded by spar calcite cement, massively bedded, occasional coral, shell and gastropod fragments in mud matrix, no apparent porosity		INTERTIDAL
				20		M.M.1L	P general	light tan coloured lime mudstone to wackestone weathering light grey, massively bedded		
				15		M.M.2G				
				10				light tan coloured lime mudstone to wackestone, fenestral porosity occluded by spar calcite cement, occasional coral fragment, gastropods in mud matrix, massively bedded		BIOSTROMAL INTERTIDAL
				5			T IIIB	coral/stromatoporoid rudstone, light tan coloured, rubbly, poorly cemented less than 10% matrix		
						M.M.5L	T IVD	tan coloured lime mudstone, possible stromatolites in sample, fenestral porosity occluded by spar, burrowed coral/stromatoporoid rudstone, less than 10% packstone/wackestone matrix, light tan coloured, poorly cemented		
						M.M.4L	P detail	tabular, hemispherical, bulbous stromatoporoids with colonial and solitary corals, dark grey lime wackestone to packstone matrix in a coral/strom rudstone		BIOSTROMAL
				0		M.M.3L		light tan coloured lime mudstone, fenestral porosity occluded by spar calcite cement		INTERTIDAL
								covered section within core of anticline		

9237-C55-26

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: MT. ST CHARLES LATITUDE: 65°10'N. LONGITUDE: 124°49'W.

MILITARY GRID REFERENCE: 144285 GRID AREA: 96F/2

REMARKS: This section was measured on the second Hume ridge north of the prominent Pleistocene stream cut through Mt. St. Charles: the top of the outcrop is in probable fault contact with the Cretaceous Basin to the east while the base of the formation is recessive and covered.

MEASURED BY: R.L. McKellar and F. Monnier DATE: September 3, 1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- [P] POLAROID
- [S] SLIDE
- [T] TEXT

SAMPLE TYPE

- [G] GEOCHEMISTRY
- [P] PALEONTOLOGY
- [L] LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								6. MT. ST. CHARLES		
								top of Hume in fault contact with Mesozoic		
				5		L & P MSC.3		dark grey brown lime mudstone grading to floatstone in parts with crinoids, brachiopods, trilobites and corals		OPEN MARINE
						MSC.2LS detail		very fine grained spar calcite cemented quartz sandstone, bedding plane thickness 2-3 cm, burrowed extremely low amplitude ripples, wave length 3-4 m		
						MSC.1PS detail		dark grey brown lime mudstone grading to a floatstone in part dominated by crinoids and brachiopods		
				0				recessive covered section of 20 m to Bear Rock		

9237-C55-2E

CANTERRA ENERGY LIMITED
LOWER MACKENZIE VALLEY FIELD PARTY 1986
MIDDLE DEVONIAN HUME FORMATION

LOCALITY: BELL CREEK LATITUDE: 65° 17'N. LONGITUDE: 123° 53'W

MILITARY GRID REFERENCE: 051404 GRID AREA: 106H/7

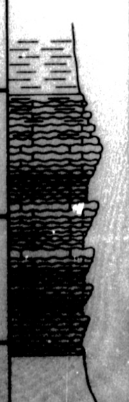
REMARKS: This section was measured where a small tributary plunges down a 3m waterfall through a narrow gorge in the resistant upper Hume and meets the main creek.

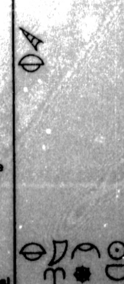
MEASURED BY: R.L. McKellar and F. Monnier DATE: September 5, 1986

PLOTTED BY: R.L. McKellar DATE: October 1986

LITHOLOGY	PALEONTOLOGY		PHOTO RECORD
MASSIVE LIMESTONE	STROMATOPOROIDS	OSTRACODS	P POLAROID
NODULAR LIMESTONE	CORALS	STYLIOLINIDS	S SLIDE
SHALE	BRACHIOPODS	GASTROPODS	T TEXT
SANDSTONE	CRINOIDS	BURROWS	**SAMPLE TYPE**
	TRILOBITES	BRYOZOANS	G GEOCHEMISTRY
	ECHINODERMS		P PALEONTOLOGY
			L LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONENTAL INTERPRETATION
								4. BELL CREEK		
[illegible]	GIVETIAN	HARE INDIAN	BLUEFISH					black bitumenous shale weathering yellow and ochre		RESTRICTED MARINE
				30		B.C.7 G TOC:3.74%		Bluefish marked by a 4 cm thick resistive bed containing Styliolinids and Tentaculites		TRANSITIONAL
						B.C.6 G TOC:2.44%		shale beds 20-30cm thick contain L. castanea fauna		
						B.C.8 L		dark grey lime mudstone weathering light grey, bed thickness 20-30 cm, bed contacts sharp but undulose with intercalated shales		OPEN MARINE
				25			P general; S general	each cycle is made up of beds of dark grey lime mudstone with bioclastic debris flows at the base of the cycle beds are 2-5cm ranging up to 10 cm thick at the top of the cycle, beds are nodular with sharp top and bottom contacts with intervening shales 2-4 cm thick, beds at the top of the cycle contain more numerous debris flows		
						B.C.5 P	P general	medium grey lime rudstone, weathering light grey, composed of brachiopods, crinoids, ostracods, trilobites, rugose corals and bryozoans, interpreted as a debris flow		
				20		B.C.4 P	P detail	black lime bafflestone composed of the disphyllid coral in a black shale, interpreted as a coral debris flow approximately 10 cm thick		
								covered section in creek		
				15		B.C.3 L		[illegible]		





SHALE
SANDSTONE
CRINOIDS
TRILOBITES
ECHINODERMS
BURROWS
BRYOZOANS
GEOCHEMISTRY
PALEONTOLOGY
LITHOLOGY

EPOCH | STAGE | FORMATION | MEMBER | METERAGE | LITHOLOGY AND TOPOGRAPHIC EXPRESSION | ROCK SAMPLE | PHOTO RECORD | LITHOLOGY DESCRIPTION | PALEONTOLOGY | ENVIRONMENT

4. BELL CREEK

MIDDLE DEVONIAN | EIFELIAN | GIVETIAN | HARE INDIAN | HUME | BLUEFISH | UPPER

30
25
20
15
10
5
0

B.C.7 G TOC:3.74%
B.C.6 G TOC:2.44%
B.C.8 L
P general
S general
P general
B.C.5 P
P detail
B.C.4 P
B.C.3 L
B.C.2 L
P general
3 detail
B.C.1 L

black bituminous shale weathering yellow and ochre
Bluefish marked by a 4 cm thick resistive bed containing Styliolinids and Tentaculites
shale beds 20-30cm thick contain L. castanea fauna
dark grey lime mudstone weathering light grey, bed thickness 20-30 cm, bed contacts sharp but undulose with intercalated shales
each cycle is made up of beds of dark grey lime mudstone with bioclastic debris flows at the base of the cycle, beds are 2-5cm ranging up to 10 cm thick at the top of the cycle, beds are nodular with sharp top and bottom contacts with intervening shales 2-4 cm thick, beds at the top of the cycle contain more numerous debris flows
medium grey lime rudstone, weathering light grey, composed of brachiopods, crinoids, ostracods, trilobites, rugose corals and bryozoans, interpreted as a debris flow
black lime bafflestone composed of the disphyllid coral in a black shale, interpreted as a coral debris flow approximately 10 cm thick
covered section in creek
dark grey lime rudstone with less than 10% wackestone matrix, rudstone made up of encrusting stromatoporoids and tabulate corals, petroliferous odour when struck, rudstone disappears under the creek
light tan coloured lime mudstone, well displayed fenestral porosity occluded by spar calcite cement, massively bedded, no apparent porosity
light tan coloured lime mudstone weathering light grey, fenestral porosity occluded by spar calcite cement, no fauna in unit
dark grey lime floatstone with a wackestone matrix weathering light grey, spar calcite replacement of fossil molds as well as spar calcite infilling of stress fracture system, leached porosity observed in hand specimen, stromatoporoid and coral specimens in outcrop, petroliferous odour when struck by hammer
covered section

RESTRICTED MARINE
TRANSITIONAL
OPEN MARINE
BIOSTROMAL
INTERTIDAL
BIOSTROMAL
INTERTIDAL
BIOSTROMAL

R. McKellar

9237-C55-26

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: DODO CANYON LATITUDE: 65°00'N. LONGITUDE: 127°20'W.

MILITARY GRID REFERENCE: Southside (start) 785101 (finish) Northside 781103 GRID AREA: 96E/3
782101

REMARKS: This section was measured on a prominent bend of Dodo Creek near the entrance to Dodo Canyon. The section was measured on both sides of the creek because faulting in the upper Hume causes a shortening within the section. Only the upper two thirds of the formation are exposed here, the lower portion being covered.

MEASURED BY: R.L. McKellar and F. Monnier DATE: September 1, 1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- [P] POLAROID
- [S] SLIDE
- [T] TEXT

SAMPLE TYPE

- [G] GEOCHEMISTRY
- [P] PALEONTOLOGY
- [L] LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
MIDDLE DEVONIAN	GIVETIAN	HUME	KOTAKAN					**2. DODO CANYON**		
			BLUEFISH			TOC:1.27% TOC:1.86% D.C. 11G D.C. 12L D.C.10G D.C.9 G D.C.8 G TOC:2.33% TOC:1.93%	S detail	black bitumenous shale containing Tentaculites and Styliolinids weathering ochre in places this unit contains dark grey lime mudstone beds ranging up to 25 cm thick alternating with 30 cm thick shale beds, the lower 10 cm of the bed being black while the upper portion is brownish - grey. The L. castanea fauna is present within the shales grey lime floatstone weathering light grey containing bulbous hemispherical stromatoporoids and corals with a wackestone matrix, massively bedded, no apparent porosity		RESTRICTED MARINE TRANSITIONAL BIOSTROMAL
				45 40			S general	intervening shale layers have become predominantly cherty, bedding thickness extremely uniform throughout this interval, bedding contacts between limestone beds and intercalated shales abrupt and planar		
						D.C.7 L		moved to west side of creek, as below, dark grey lime mudstone to wackestone, weathering light grey		

ECHINODERMS

EPOCH | STAGE | FORMATION | MEMBER | METRAGE | LITHOLOGY AND TOPOGRAPHIC EXPRESSION | ROCK SAMPLE | PHOTO RECORD | LITHOLOGY DESCRIPTION | PALEOENVIRONMENT

2. DODO CANYON

MIDDLE DEVONIAN — LOWER EIFELIAN — UPPER HUME — GIVETIAN — HARE INDIAN — BLUEFISH

TOC:1.27%
TOC:1.66%
D.C. 11G
D.C. 12L
D.C.10G
D.C.9 G
D.C.8 G
TOC:2.33%
TOC:1.93%
S detail

black bitumenous shale containing Tentaculites and Styliolinids weathering ochre in places

this unit contains dark grey lime mudstone beds ranging up to 25 cm thick alternating with 30 cm thick shale beds, the lower 10 cm of the bed being black while the upper portion is brownish - grey. The L. castanea fauna is present within the shales

grey lime floatstone weathering light grey containing bulbous hemispherical stromatoporoids and corals with a wackestone matrix, massively bedded, no apparent porosity

RESTRICTED MARINE

TRANSITIONAL

BIOSTROMAL

45

40

S general

intervening shale layers have become predominantly cherty, bedding thickness extremely uniform throughout this interval, bedding contacts between limestone beds and intercalated shales abrupt and planar

OPEN MARINE

35

D.C.7 L

moved to west side of creek, as below; dark grey lime mudstone to wackestone weathering light grey

30

D.C.6 L

S detail

dark grey lime mudstone to wackestone weathering light grey, bedding thickness 20-30 cm separated by discreet 1-2 cm thick beds of black shale becoming partly cherty, shale beds contain brachiopods

25

light tan coloured lime mudstone to wackestone weathering light grey, no apparent porosity, paucity of fauna, massively bedded

T IIIA

INTERTIDAL

20

15

D.C.5 L

light tan coloured lime mudstone to wackestone weathering light grey, fenestral porosity occluded by spar calcite cement, burrowed, tabulate coral fragments

D.C.4 L&G
TOC:0.66%
S detail

dark grey lime wackestone containing skeletal debris, bed thickness 50-60 cm intercalated shales 1-2 cm thick

bed containing greater than 50% bulbous hemispherical stromatoporoids and corals

BIOSTROMAL

10

D.C.3 L

S detail

dark grey to black lime wackestone containing skeletal debris weathering light grey with an orange patina, bed thickness 30-50 cm, beds have sharp but undulating boundaries, petroliferous smell when struck, first appearance of a wafer stromatoporoid, coral in outcrop

shale bed with burrows and brachiopods

large colonial coral

5

OPEN MARINE

D.C.2 L

P detail

dark grey lime wackestone weathering light grey, bedding nodular, bed thickness 10-20 cm separated by 2-4 cm thick black calcareous shale units: shale contains thick (1-2 cm) tubular horizontal burrows and brachiopod shells

0

D.C.1 L

base of Hume: covered

9237-C55-2E

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: CARNWATH RIVER LATITUDE: 67°23'N. LONGITUDE: 127°43'W

MILITARY GRID REFERENCE: 549742 (Bioherm A) GRID AREA: 96M/5

REMARKS: Bioherm A - the southernmost bioherm exposed on the Carnwath R. is located in the east cutbank of a prominent bend in the river. Bioherm B (544746) can be found approximately 450m downstream (north) and Location (Carnwath R.) D (544745) is located roughly 250m further downstream between two prominent bioherms on the east bank. Site (Carnwath R.) C (489803) is located in a prominent cutbank where the river runs against the valley escarpment exposing Lower Cretaceous sandstones.

MEASURED BY: R.L. McKellar and F. Monnier DATE: August 24, 1986

PLOTTED BY: R.L. McKellar DATE: October 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- [P] POLAROID
- [S] SLIDE
- [T] TEXT

SAMPLE TYPE

- [G] GEOCHEMISTRY
- [P] PALEONTOLOGY
- [L] LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								10. CARNWATH RIVER BIOHERM A		
						CRBA6 &7		grey lime coral/stromatoporoid rudstone with a packstone matrix, outcrop appears massive and rubbly with thin discontinuous shales, bioherm sits 2 m above surrounding lithology, outcrop covered in an ochre patina, matrix porosity		
				10		CRBA5	P general S general	beds adjacent to the bioherm are a dark grey lime floatstone with a wackestone matrix, faunal abundance is significantly reduced compared to the bioherm, bed thickness 5-10 cm with shales 2-4 cm thick, bed thickness increases to base of outcrop, limestone beds have have sharp but undulating contacts with intercalated shales		
						CRBA4	T IVA	as below		BIOHERMAL
						CRBA3	P detail	grey lime coral/stromatoporoid rudstone with a packstone matrix, shale beds are now only 2-3 cm thick and no longer continuous across the outcrop		
				5		CRBA2	S detail	grey lime coral/stromatoporoid rudstone with a packstone matrix, bedding thickness increased to 50 cm while shales have decreased to 10 cm		
				0		CRBA1		grey lime coral/stromatoporoid rudstone with a packstone matrix, bedding thickness 30 cm with intercalated medium grey calcareous shales 20 cm thick, shales contain brachiopod and coral fragments, outcrop covered in an ochre patina water line		

9237-C65-2E

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: HARE INDIAN R. TRIBUTARY LATITUDE: 66° 29'N. LONGITUDE: 127° 54'W.

MILITARY GRID REFERENCE: 492747 (start) 489757 (finish) GRID AREA: 96L/5

REMARKS: This section starts in an unnamed creek flowing into the Hare Indian R. and moves up through the escarpment overlooking the north side of the river valley. Several 3 to 5m waterfalls are traversed on the way up the creek and 3m of Bluefish cover the Hume before the top of the creek is reached.

MEASURED BY: R.L. McKellar and F. Monnier DATE: September 4, 1986

PLOTTED BY: R.L. McKellar DATE: October 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

PHOTO RECORD

- [P] POLAROID
- [S] SLIDE
- [T] TEXT

SAMPLE TYPE

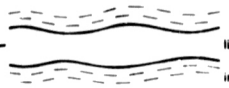
- [G] GEOCHEMISTRY
- [P] PALEONTOLOGY
- [L] LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
								9. HARE INDIAN RIVER		
M. DEVONIAN	EIFELIAN	HARE INDIAN	BLUEFISH	45		TOC:6.18% TOC:7.53% HR2 G HR(2)6 G HR(2)3 P HR(2)4 G	detail	black bitumenous shale, contact with Hume very sharp, lowest beds containing Styliolinids and Tentaculites dark grey lime rudstone made up of corals, stromatoporoids weathering grey covered in an ochre patina		RESTRICTED MARINE
				40			detail P general S	large tabulate coral of which the interior is filled with oil		
						HR(2)2 L S HR(2)1 L	general P detail	dark grey lime coral and stromatoporoid rudstone to floatstone with a wackestone to packstone matrix, spar calcite replacement of fossil molds, no apparent porosity, outcrop covered in an ochre patina, limestone beds at base of cycle are 5 cm thick ranging to 15 cm thick at top of cycle, intercalated shale beds are 5 cm thick, limestone bed contacts are sharp but undulose, matrix material represents about 50% of limestone rock volume		
				35				limestone bed with undulose boundaries intercalated shale		

MIDDLE DEVONIAN
HUME
UPPER

45
40
35
30
25
20
15
10
5
0

			black bituminous shale, contact with Hume very sharp, lowest beds containing Styliolinids and Tentaculites
	P	detail	dark grey lime rudstone made up of corals, stromatoporoids weathering grey covered in an ochre patina
	S	detail	large tabulate coral of which the interior is filled with oil
	P	general	
HIR(2)	S	general	dark grey lime coral and stromatoporoid rudstone to floatstone with a wackestone to packstone matrix, spar calcite replacement of fossil molds, no apparent porosity, outcrop covered in an ochre patina, limestone beds at base of cycle are 5 cm thick ranging to 15 cm thick at top of cycle, intercalated shale beds are 5 cm thick, limestone bed contacts are sharp but undulose, matrix material represents about 50% of limestone rock volume
HIR(2)	P	detail	



limestone bed with undulose boundaries

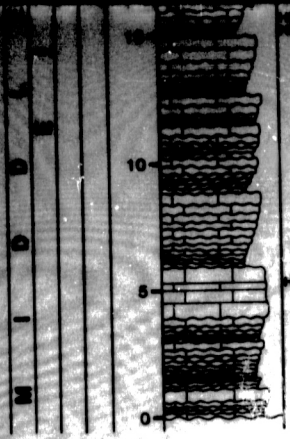
intercalated shale

BIOSTROMAL

limestone beds at base of cycle are 5 cm ranging up to 20-30 cm at top of cycle, intercalated with dark grey calcareous shale 2-3 cm thick, bedding contacts are sharp but undulose

	S	general	helicopter ledge
HIR1A	L	general	medium grey coral and stromatoporoid floatstone with a wackestone matrix containing fragments of brachiopods, Thamnopora, Styliolina sp, crinoids, trilobites, burrowed
HIR1B	P	detail	collected a large quantity of macrofossils from recessive ledge below waterfall
HIR	P	detail	
	P	general	
	S	general	
HIR(2)6			light grey to tan coloured lime wackestone, massively bedded, burrowed, containing fossil fragments of brachiopods, gastropods, Thamnopora fragments, outcrop covered in an ochre patina
	P	general	dark grey lime floatstone with a wackestone matrix
	S	general	
			light grey to tan coloured lime mudstone to wackestone bioclastic debris containing brachiopod, crinoid and Thamnopora fragments, no apparent porosity in outcrop

covered section



collected a large quantity of macrofossils from recessive ledge below waterfall

general

general

light grey to tan coloured lime wackestone, massively bedded, burrowed, containing fossil fragments of brachiopods, gastropods, Thamnopora fragments, outcrop covered in an ochre patina

general

dark grey lime floatstone with a wackestone matrix

general

light grey to tan coloured lime mudstone to wackestone bioclastic debris containing brachiopod, crinoid and Thamnopora fragments, no apparent porosity in outcrop

covered section

R. McKellar

9237-C55-2E

CANTERRA ENERGY LIMITED

LOWER MACKENZIE VALLEY FIELD PARTY 1986

MIDDLE DEVONIAN HUME FORMATION

LOCALITY: LITTLE BEAR RIVER LATITUDE: 64°28'N. LONGITUDE: 126°29'W.

MILITARY GRID REFERENCE: (start) 207517 (finish) 210520 GRID AREA: 96D/8

REMARKS: This section was measured on the southern exposure of the north fork of Little Bear River where the Hume outcrop meets the river channel.

MEASURED BY: R.L. McKellar and F. Monnier DATE: September 2,1986

PLOTTED BY: R.L. McKellar DATE: September 1986

LITHOLOGY

- MASSIVE LIMESTONE
- NODULAR LIMESTONE
- SHALE
- SANDSTONE

PALEONTOLOGY

- STROMATOPOROIDS
- CORALS
- BRACHIOPODS
- CRINOIDS
- TRILOBITES
- ECHINODERMS
- OSTRACODS
- STYLIOLINIDS
- GASTROPODS
- BURROWS
- BRYOZOANS

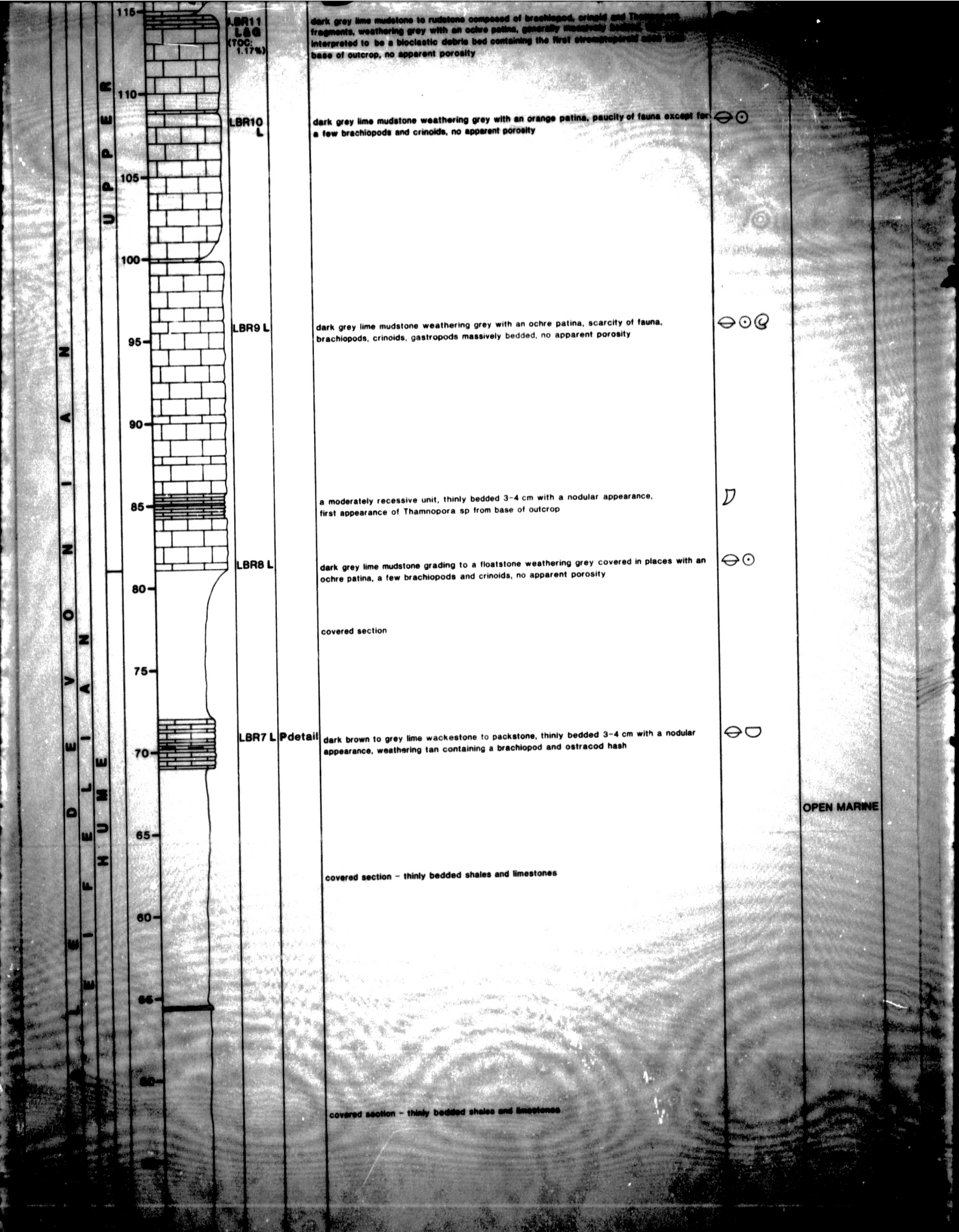
PHOTO RECORD

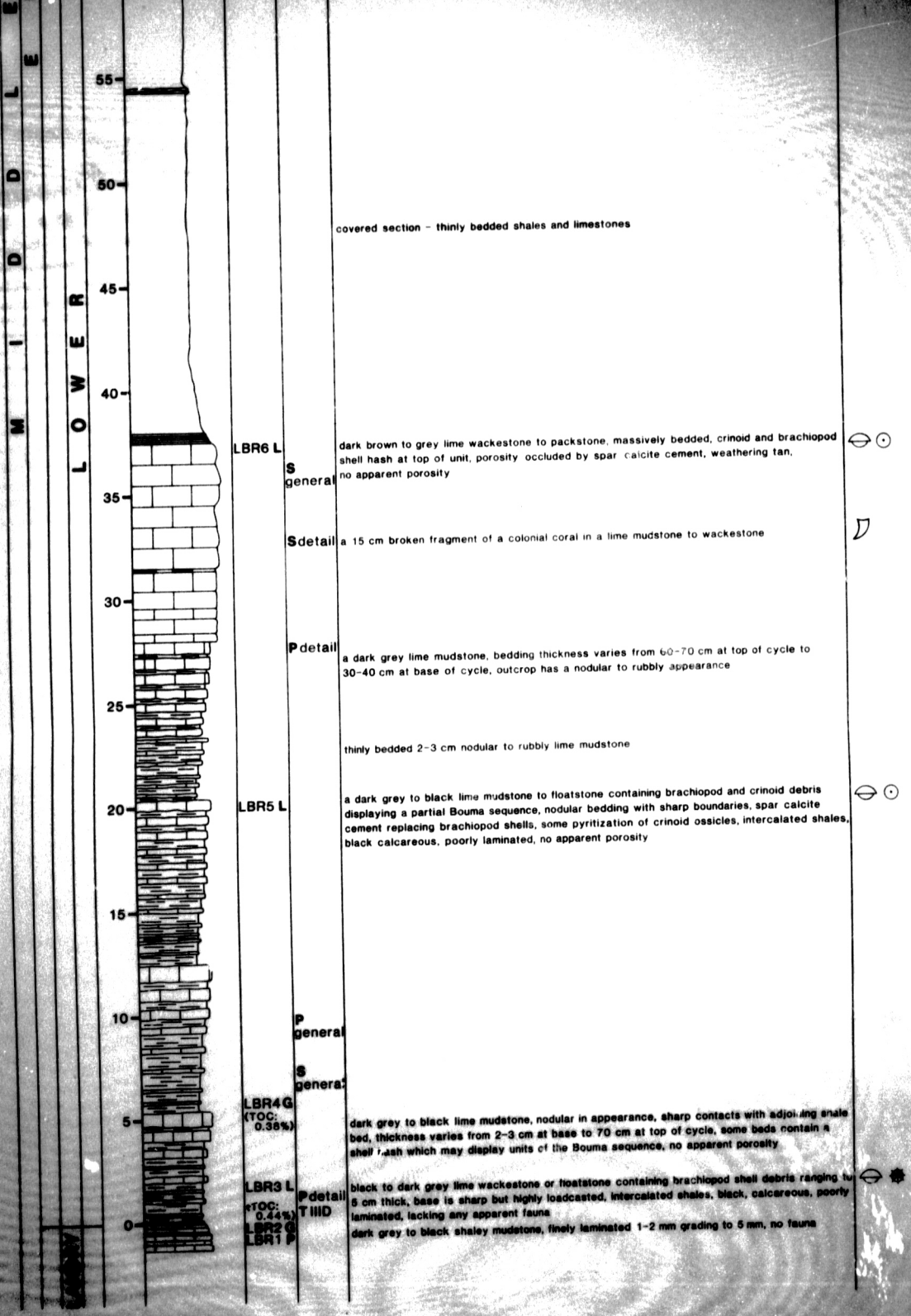
- P POLAROID
- S SLIDE
- T TEXT

SAMPLE TYPE

- G GEOCHEMISTRY
- P PALEONTOLOGY
- L LITHOLOGY

EPOCH	STAGE	FORMATION	MEMBER	METERAGE	LITHOLOGY AND TOPOGRAPHIC EXPRESSION	ROCK SAMPLE	PHOTO RECORD	LITHOLOGY DESCRIPTION	PALEONTOLOGY	PALEO-ENVIRONMENTAL INTERPRETATION
					1. LITTLE BEAR RIVER					
	GIVETIAN	HUME	BLUEFISH	135				black bituminous shale, fissile, basal beds containing Tentaculites and Styliolinids, weathering yellow and ochre		RESTRICTED MARINE
				130		LBR12 L	S detail P general	dark grey lime mudstone matrix ranging up to 10-20% coral/strom floatstone, weathering grey with an ochre patina, generally massively bedded with bedding planes 80-100 cm spacing, rocks have a strong petroliferous odour when struck by hammer, no apparent porosity		
				125						BIOSTROMAL
				120			P general			
								dark grey lime mudstone to wackestone composed of brachiopod, crinoid and trilobite fragments, weathering grey with an ochre patina, generally massively bedded with bedding planes 80-100 cm spacing, rocks have a strong petroliferous odour when struck by hammer, no apparent porosity		


DEVONIAN
LEIFELIEAN
HUME
UPPER
115
110
105
100
95
90
85
80
75
70
65
60
55
50
LBR11 L&G (TOC: 1.17%)
LBR10 L
LBR9 L
LBR8 L
LBR7 L
Pdetail
dark grey lime mudstone to rudstone composed of brachiopod, crinoid and Thamnopora fragments, weathering grey with an ochre patina, generally massively bedded, interpreted to be a bioclastic debris bed containing the first stromatoporoid at base of outcrop, no apparent porosity
dark grey lime mudstone weathering grey with an orange patina, paucity of fauna except for a few brachiopods and crinoids, no apparent porosity
dark grey lime mudstone weathering grey with an ochre patina, scarcity of fauna, brachiopods, crinoids, gastropods massively bedded, no apparent porosity
a moderately recessive unit, thinly bedded 3-4 cm with a nodular appearance, first appearance of Thamnopora sp from base of outcrop
dark grey lime mudstone grading to a floatstone weathering grey covered in places with an ochre patina, a few brachiopods and crinoids, no apparent porosity
covered section
dark brown to grey lime wackestone to packstone, thinly bedded 3-4 cm with a nodular appearance, weathering tan containing a brachiopod and ostracod hash
covered section - thinly bedded shales and limestones
covered section - thinly bedded shales and limestones
OPEN MARINE


MIDDLE
LOWER
55
50
45
40
35
30
25
20
15
10
5
0
LBR6 L
S general
Sdetail
Pdetail
LBR5 L
P general
S general
LBR4 G
(TOC: 0.38%)
LBR3 L
(TOC: 0.44%)
Pdetail
T IIID
LBR2 G
LBR1 P
covered section - thinly bedded shales and limestones
dark brown to grey lime wackestone to packstone, massively bedded, crinoid and brachiopod shell hash at top of unit, porosity occluded by spar calcite cement, weathering tan, no apparent porosity
a 15 cm broken fragment of a colonial coral in a lime mudstone to wackestone
a dark grey lime mudstone, bedding thickness varies from 60-70 cm at top of cycle to 30-40 cm at base of cycle, outcrop has a nodular to rubbly appearance
thinly bedded 2-3 cm nodular to rubbly lime mudstone
a dark grey to black lime mudstone to floatstone containing brachiopod and crinoid debris displaying a partial Bouma sequence, nodular bedding with sharp boundaries, spar calcite cement replacing brachiopod shells, some pyritization of crinoid ossicles, intercalated shales, black calcareous, poorly laminated, no apparent porosity
dark grey to black lime mudstone, nodular in appearance, sharp contacts with adjoining shale bed, thickness varies from 2-3 cm at base to 70 cm at top of cycle, some beds contain a shell hash which may display units of the Bouma sequence, no apparent porosity
black to dark grey lime wackestone or floatstone containing brachiopod shell debris ranging to 5 cm thick, base is sharp but highly loadcasted, intercalated shales, black, calcareous, poorly laminated, lacking any apparent fauna
dark grey to black shaley mudstone, finely laminated 1-2 mm grading to 5 mm, no fauna