Operation Identifier No. 9237-C131-001E

Report on Geologic Field Operation
August 3-13, 1999
Fort Simpson, Northwest Territories

Canyon, Nahanni and Tundra Ranges, Northwest Territories

1999

Confidential

Canadian Forest Oil Ltd.

Report by James R. Taylor, P. Geol.

March 15, 2000

Report submitted as hard copy and on IBM compatible floppy as a fixed format ASCII coded file.

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List of Enclosures. These are found in the map pocket in the back of the report

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Introduction

A Canadian Forest Oil Ltd. Geological Field Party was based at Fort Simpson, NWT during the period August 3-13, 1999. James R. (Jim) Taylor, P. Geol., the author, headed the party. Geologist Todd Burlingame, Kee Scarp Consulting Ltd., Yellowknife and Andrew Koostachin, the Northern Liaison Consultant for Canadian Forest based at Fort Liard, assisted him. Consultant geologist Ron McKellar of Pike Resources Ltd., Calgary joined the field party for one day. A 50% partner in the field party was Anschutz Exploration Corporation of Denver, Colorado.

The geological crew was lodged at the Morada Hotel, Fort Simpson. Great Slave Helicopters from their base at Fort Simpson provided helicopter services. Bruce Hilton was the pilot of helicopter C-GHPO. M. Colin and S. Crystalle served as helicopter engineers. A fixed wing, two engine Cheyenne aircraft C-GXTC chartered from Arctic Sunwest (171817 Canada Inc.) of Yellowknife was used on August 4, 1999 to over fly the area to identify outcrops for later visits by helicopter. J. Guillaume was the pilot.

Locality Map

The map, Enclosure 1 in the pocket at the back of this report, shows the outcrop localities visited. These locations are numbered from 1 to 7. Sample numbers are keyed to these location numbers. Lengthy stratigraphic sections (Stations 1 and 2) were located on 1:250,000 topographic maps. Other locations have Geographic Positioning System (GPS) coordinates from hand-held instruments. Station and section locations with numbers and coordinates are listed below.

Dusky Section:	(1)	Approximately 63-15N; 125-20N
Red Rock Pass Section:	(2)	Approximately 61-39N; 123-21W
Tundra:	(3)	GPS reading 61-41-49N; 124-45-02W
North Prairie:	(4) (5)	GPS reading 61-44-37N; 124-52-11W
Mine Airport:	(6)	GPS reading 61-33.655N; 124-48.955W
Tetcela:	(7)	GPS reading 61-37-47N; 123-54-15W

Statistical summary

Mobilization date:
Tuesday August 3, 1999
Demobilization date:
Friday August 13, 1999
Significant dates:
Fixed -wing over flight Wednesday August 4, 1999
3.3 hours flight time
Helicopter operations August 5-11, 1999 7 days
22.4 hours of helicopter time were billed
Poor weather days August 8-9, 1999
Close operation, pack and ship samples and gear Thursday August 12, 1999

Technical and non-technical personnel

3 Canadian citizens and 1 Canadian First Nations member.

Productivity data:

Total section surveyed:
3160 feet (962.3m) true vertical measurement including some covered intervals.
Lost time:
2 days due to low cloud ceiling
Daily Production:
Average for five good days of measuring = 632 feet (192.6m) true vertical measurement
Weather conditions:
Excellent, sunny and clear on 6 out of 8 days. Low cloud ceilings prevented helicopter landings at sampling stations on two days.
Factors causing significant down time:
Poor weather conditions.
There was no downtime because of aircraft maintenance, accidents or other problems.

Description of the Field procedures

A preliminary over flight on August 4, 1999 preceded the on-the-ground geological work. The fixed-wing aircraft departed and returned to Fort Simpson. The flight was of 3.3 hours duration. The flight ranged as far west as Prairie Creek and north into the Canyon Ranges west of Wrigley. The over flight allowed the team to scout, from the air, geological localities that would be visited on foot later in the operation using helicopter support.

All ground localities are in very remote areas and were reached by helicopter based at the Great Slave Helicopters facility at Fort Simpson. Fuel caches were located at the Wrigley and Prairie Creek airports. An additional back-up fuel cache at Nahanni Butte airport. No fuel was cashed at any remote sites.

Stratigraphic sections were measured using a sturdy metallic tape. A correction based on bed dip was applied to give true vertical measurement. Because all of the existing outcrop and topographic data was measured in feet (0.3048m) this unit of measure was retained for the present work. Measurements in feet are from the top (youngest) to the bottom (oldest) of sections. Sections were measured from the top down because the top held the most interest for gas exploration and the fear that weather conditions may prevent the completion of the work.

Correlation of buff colored, gray weathering dolomite section is difficult in this area because similar rocks occur in the Devonian and Ordovician as well as the Silurian. Dolomitization has destroyed the fine structure of macrofossils so these may be unreliable age indicators.

Sections were described in a field notebook and the information was transferred on to pre-prepared standard strip log forms. Drafted copies of the strip logs are Enclosures 2 and 3. A graphical lithologic description is included along with columns for indicating porosity and other field observations.

Rock samples were collected at all stations visited. Samples were assembled in gunnysacks and shipped to Calgary via Northland Transport out of Fort Simpson via Edmonton. The samples were inspected at warehouse facilities in Calgary and selected samples were dispatched to contract laboratories for various measurements and analyses.

A number of dolomite samples were selected for laboratory measurement of porosity, permeability and grain density. The same samples were used for thin section petrography and photomicroscopy (Table 1). Porosity, permeability and, grain density determinations and thin section work was done by AGAT Laboratories in Calgary. Their reports appear in Appendices 1 and 2.

Shales and darker colored carbonate rocks were sampled for total organic carbon (TOC) and maximum burial temperature (TMAX) analyses. Samples were collected in lined bags and labeled for identification. Laboratory work on these samples (Table 2) was done by Humble Geochemistry of Humble, Texas. Their report appears as Appendix 3.

Macrofossils were also sampled for examination. These were all silicified or dolomitized so that little in the way of detailed identification was possible. Bulk rock samples for conodont dating were collected at ten foot intervals in the carbonate Sections 1 and 2 where age dates were suspect. Conodont extraction and identification work on thirty representative samples (Table 3) was done by the Centre for Earth and Ocean Research at the University of Victoria. Their conodont report is Appendix 4.

Close-up and aerial views of localities were photographed. A number of captioned photographs appear in Appendix 5.

Summary operational objectives and ties to regional geology

The objectives of the limited field operation was to check outcrops previously described in geological studies from the 1960s, held in the Canadian Forest Oil Ltd. geological files. A 25-year moratorium on oil and gas exploration in the area lapsed in the late 1990s.

Two studies, Brady and Wissner (1960), Brady (1961) and Link Downing Cooke (1961) were originally prepared for Union Oil of California. Union Oil of California was subsequently re-named Unocal Canada Limited. All of Unocal Canada Limited's northern Canadian oil and gas properties and their extensive library of geologic reports and files on the Northwest Territories were acquired by Canadian Forest Oil Ltd. on June 12, 1998.

The author spent part of early 1999 scouring the Unocal studies and files looking for descriptions of structural and stratigraphic anomalies which could lead to extensions of known plays and to the development of new untried exploration concepts and plays. The reports by Brady and Wissner (1960) and by Link Downing Cooke (1961) and the author's knowledge of the regional geology led to the proposal to revisit specific outcrops in the Canyon, Tundra and Nahanni Ranges.

The *Dusky* section, number 21 of Link Downing Cooke (1961), needed to be re-sampled in the Mount Kindle Formation because the original samples collected at this locality were destroyed several years ago by Unocal. The *Red Rock Pass* Mount Kindle Formation section S-4 of Brady and Wissner (1960) needed more detailed lithology and porosity descriptions and sampling. *The Tetcela - Prairie Creek* Horn River, Funeral and Road River Shale sections needed to be sampled for geochemical testing.

Because of limited time and budgets, it was proposed to supplement and spot-check the high-quality previous work rather than to re-measure entire sections and re-map entire regions

Geologic base and interpretive map

A geologic base map that shows the locations of localities visited is an Enclosure 1. Sections 1 and 2 (Enclosures 2 and 3) were measured in the Mount Kindle Formation. The limits of the Mount Kindle Formation are sketched on the map. The off bank pre-Devonian Root Basin is identified as is the Tathlina Arch, a pre-Devonian high. A sketch of a possible basin to carbonate bank correlation is shown in Enclosure 2.

Stratigraphic correlations

The Silurian Mount Kindle Formation section is very poorly exposed in the region and biostratigraphic correlations have not been established. A conodont study (Appendix 4) gave limited results. Section 1 yielded only a single conodont age of Devonian – Silurian. The basal part of Section 2 is interpreted to be Lower Silurian age from conodont identifications.

Descriptions of measured sections and sampling points

Strip logs with descriptions and graphic representations of the measured sections are Enclosures 2 and 3.

Sample descriptions

Samples chosen for various types of laboratory analyses are tabulated in Tables 1 through 3.

Results of micro-paleontology as it relates to biostratigraphic correlations

A complete report by the Centre for Earth and Ocean Research, University of Victoria, is Appendix 4.

Results of geochemical analysis and other analysis

Geochemical analysis on selected samples was done by Humble Geochemical Services. Their report is Appendix 3

Photographs

A number of caption photographs are in Appendix 5

Table 1. 10 Porosity, permeability, grain density and thin section samples.

Serial #	Station	Sample # Interval or footage	Location	Age	Formation	Description
1A	F99-T-1	30'	Dusky	Silurian	Mt. Kindle	Buff dolomite
2A	F99-R-1	230'	Dusky	Silurian	Mt. Kindle	Buff dolomite
3A	F99-T-1	1112'	Dusky	Silurian	Mt. Kindle	Buff dolomite
4A	F99-P-1	1258'	Dusky	Silurian	Mt. Kindle	Buff dolomite
5A	F99-P-1	1340'	Dusky	Silurian	Mt. Kindle	Buff dolomite
6A	F99-B-1	1695'	Dusky	Silurian	Mt. Kindle	Buff dolomite
7A	F99-P-1	1725'	Dusky	Silurian	Mt. Kindle	Buff dolomite
8A	F99-B-1	1870'	Dusky	Silurian	Mt. Kindle	Buff dolomite
9A	F99-A-1	1890'	Dusky	Silurian	Mt. Kindle	Buff dolomite
10A	F99-F-1	2080'	Dusky	Silurian	Mt. Kindle	Buff dolomite

Table 2. 19 Geochemistry samples.

Serial #	Station	Sample # Interval or footage	Location	Age	Formation	Description	Comments
1	F99-S-1	193'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
2	F99-S-1	410'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
3	F99-S-1	2390-2400'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
4	F99-S-1	2400-2410'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
5	F99-S-1	2410-2420'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
6	F99-S-1	2420-2430'	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
7	F99-S-1	2430-2440	Dusky	Silurian	Mt. Kindle	Dark dolomite	Fossilliferous
8	F99-S-1	2445'	Dusky	Silurian	Mt. Kindle	Black argillaceous dolomite	
9	F99-S-3	0-10'	Tundra	Devonian	Funeral	Black shale, brown weathering	
10	F99-S-3	10-20'	Tundra	Devonian	Funeral	Black shale, brown weathering	
11	F99-S-3	20-30'	Tundra	Devonian	Funeral	Black shale, brown weathering	
12	F99-S-4	0-10'	North Prairie	Silurian	Road River	Black shale, tan weathering	
13	F99-S-4	10-20'	North Prairie	Silurian	Road River	Black shale, tan weathering	
14	F99-S-5	0-10'	North Prairie	Silurian	Road River	Black shale, tan weathering	
15	F99-S-5	10-20'	North Prairie	Silurian	Road River	Black shale, tan weathering	
16	F99-S-5	20-30'	North Prairie	Silurian	Road River	Black shale, tan weathering	
17	F99-S-6	# 1	Mine Airport	Silurian	Road River	Black shale, fresh road cut	
18	F99-S-7	0-10'	Tetcela	Devonian	Horn River	Black shale, brown weathering	
19	F99-S-7	10-20'	Tetcela	Devonian	Horn River	Black shale, brown weathering	

Table 3 Conodont samples

Serial #	Station	Sample # interval or footage	Location	Age Tentative	Formation	Lithology
1	F99-C-1	0-10	Dusky	[redacted]	Mt. Kindle	Dolomite
2	F99-C-1	100-110	Dusky	[redacted]	Mt. Kindle	Dolomite
3	F99-C-1	200-210	Dusky	[redacted]	Mt. Kindle	Dolomite
4	F99-C-1	420-430	Dusky	[redacted]	Mt. Kindle	Dolomite
5	F99-C-1	920-930	Dusky	[redacted]	Mt. Kindle	Dolomite
6	F99-C-1	990-1000	Dusky	[redacted]	Mt. Kindle	Dolomite
7	F99-C-1	1110-1120	Dusky	[redacted]	Mt. Kindle	Dolomite
8	F99-C-1	1210-1220	Dusky	[redacted]	Mt. Kindle	Dolomite
9	F99-C-1	1310-1320	Dusky	[redacted]	Mt. Kindle	Dolomite
10	F99-C-1	1410-1420	Dusky	[redacted]	Mt. Kindle	Dolomite
11	F99-C-1	1510-1520	Dusky	[redacted]	Mt. Kindle	Dolomite
12	F99-C-1	1610-1660	Dusky	[redacted]	Mt. Kindle	Dolomite
13	F99-C-1	1710-1720	Dusky	[redacted]	Mt. Kindle	Dolomite
14	F99-C-1	1810-1820	Dusky	[redacted]	Mt. Kindle	Dolomite
15	F99-C-1	1910-1920	Dusky	[redacted]	Mt. Kindle	Dolomite
16	F99-C-1	2010-2020	Dusky	[redacted]	Mt. Kindle	Dolomite
17	F99-C-1	2110-2120	Dusky	[redacted]	Mt. Kindle	Dolomite
18	F99-C-1	2210-2220	Dusky	[redacted]	Mt. Kindle	Dolomite
19	F99-C-1	2310-2320	Dusky	[redacted]	Mt. Kindle	Dolomite
20	F99-C-1	2400-2410	Dusky	[redacted]	Mt. Kindle	Dolomite
21	F99-C-1	2460-2470	Dusky	[redacted]	Mt. Kindle	Dolomite
22	F99-C-2	10~20	Red Rock	[redacted]	Mt. Kindle	Dolomite
23	F99-C-2	110-120	Red Rock	[redacted]	Mt. Kindle	Dolomite
24	F99-C-2	180-200	Red Rock	[redacted]	Mt. Kindle	Dolomite
25	F99-C-2	310-320	Red Rock	[redacted]	Mt. Kindle	Dolomite
26	F99-C-2	360-370	Red Rock	[redacted]	Mt. Kindle	Dolomite
27	F99-C-2	410-420	Red Rock	[redacted]	Mt. Kindle	Dolomite
28	F99-C-2	460-470	Red Rock	[redacted]	Mt. Kindle	Dolomite
29	F99-C-2	510-520	Red Rock	[redacted]	Mt. Kindle	Dolomite
30	F99-C-2	570-580	Red Rock	[redacted]	Mt. Kindle	Dolomite

Appendices

APPENDIX 1

Porosity, permeability and grain density determination

AGAT® Laboratories

SIDEWALL ANALYSIS REPORT

FIELD SAMPLES

DUSKY

Prepared for:

CANADIAN FOREST OIL LTD.

RC8365

September, 1999

"In Pursuit of Excellence"

- **AIHA Accredited**
- **CAEAL Accredited**
- **Registered with APEGGA**

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CORE ANALYSIS DATA

FIELD SAMPLES
DUSKY

COMPANY	: CANADIAN FOREST OIL LTD
WELL NAME	: FIELD SAMPLES
LOCATION	: DUSKY
FORMATION	: MT. KINDLE
DRILLING FLUID	: WATER BASE MUD

PAGE	: 1
DATE	: 09-20-1999
W/O No	: RC8365

CORE ANALYSIS - SIDEWALL REPORT

Sample	Interval (ft) Top	Base	Rep Thick (ft)	Sample Length (ft)	Kmax (mD)	Gas Permeability K90 (mD)	Kv (mD)	Capacity Kmax mD ft	Porosity	Capacity Ø ft	Density (Kg/m³) Bulk	Grain	Residual Saturation Oil	Water	Remarks
SP001	30.00	-	-	-	0.11	-	-	-	0.043	-	2730	2850	-	-	dol vf-fxln ppvugs
SP002	230.00	-	-	-	0.38	-	-	-	0.081	-	2620	2850	-	-	dol vf-mxln ppvugs
SP003	1112.00	-	-	-	0.71	-	-	-	0.077	-	2630	2850	-	-	dol vf-cxln ppvugs
SP004	1258.00	-	-	-	0.22	-	-	-	0.041	-	2740	2860	-	-	dol vf-cxln ppvugs
SP005	1340.00	-	-	-	0.60	-	-	-	0.049	-	2710	2850	-	-	dol vf-cxln ppvugs
SP006	1695.00	-	-	-	223 *	-	-	-	0.072	-	2640	2840	-	-	dol vf-fxln vugs frac
SP007	1725.00	-	-	-	0.30	-	-	-	0.072	-	2640	2850	-	-	dol vf-fxln vugs
SP008	1870.00	-	-	-	295 *	-	-	-	0.088	-	2590	2840	-	-	dol vf-fxln vugs frac
SP009	1890.00	-	-	-	0.71	-	-	-	0.065	-	2650	2840	-	-	dol vf-fxln vugs
SP010	2080.00	-	-	-	1.35	-	-	-	0.079	-	2620	2840	-	-	dol vf-mxln molds

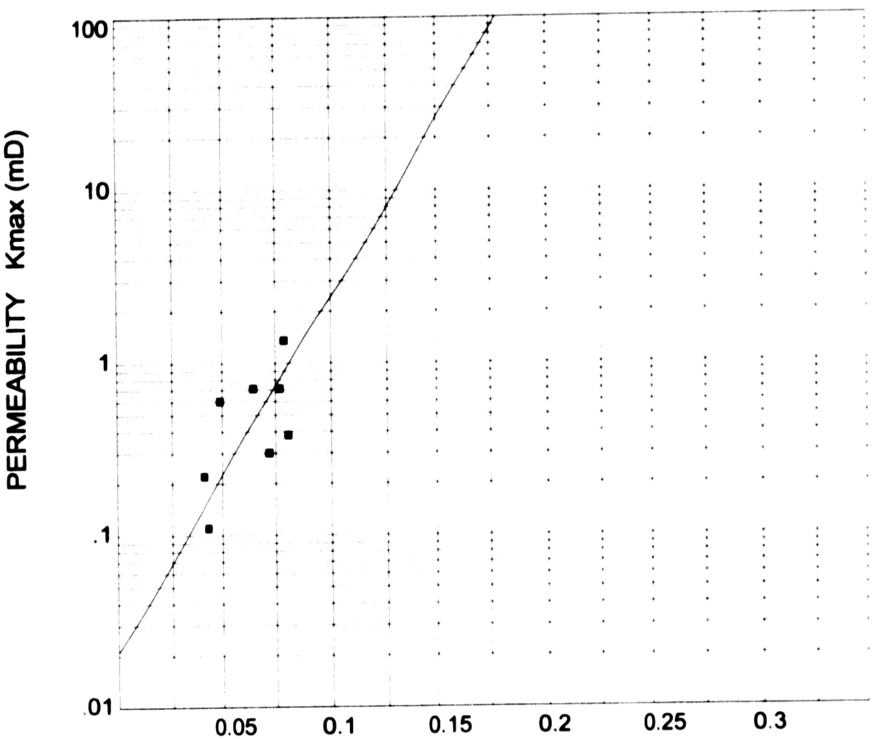
* - affected by fracture or crack as mentioned in remarks

AGAT Laboratories

Company : CANADIAN FOREST OIL LTD.
Location : DUSKY
Interval : 30.00 - 2080 Ft
Formation : MT. KINDLE

FIGURE : 1
W/O RC8365
Date : 09-20-1999

POROSITY-PERMEABILITY CORRELATION



× - Full Diameter ▪ - Small Plug

Equation of Line : Log (Kmax) = -1.68 + 20.62* Porosity
Correlation Coefficient r = 0.63

AGAT Laboratories

SAMPLE HANDLING

AGAT LABORATORIES CORE SERVICES

SAMPLE HANDLING AND ANALYSIS INFORMATION

Company : CANADIAN FOREST OIL LTD.
Well : FIELD SAMPLES
Location : DUSKY

Coring Equipment : Diamond
Coring Fluid : Water Base Mud

W/O Number : RC8365
Date : 09-20-1999

HANDLING

Core Transported in : Boxes
Cutting Solution : Water
Drying Equipment : Convection oven
Drying Time/Temp : 48 hours @ 108°C

ANALYSIS

Grain volume measured by Boyle's Law using helium
Bulk volume measured by calipering on right-cylindrical samples
Permeability measured on 38.1mm diameter drilled plugs

REMARKS

SURFACE FIELD SAMPLES

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ABBREVIATIONS

COMMON ABBREVIATIONS

abnt	Abundant
abv	Above
Alg	Algae (al)
alt	Altered (ing)
amor	Amorphous
Amph	Amphipora
ang	Angular
anhy	Anhydrite (ic)
app	Appear
apr	Apparent
aprox	Approximate (ly)
arg	Argillaceous
ark	Arkose (ic)
asph	Asphalt (ic)
AST	Assigned similar to (no actual sample taken)
apha	Aphanitic
bcm	Become (ing)
bd	Bed
bdd	Bedded
bdg	Bedding
Belm	Belemnites
bent	Bentonite (ic)
bf	Buff
biocl	Bioclastic
bioturb	Bioturbated
bit	Bitumen (inous)
bl	Blue (ish)
blk	Black
blky	Blocky
bnd	Band (ed)
Brac	Brachiopod
brec	Breccia (ted)
bri	Bright
brit	Brittle
brn	Brown
Bry	Bryozoa
bulb	Bulbous
bur	Burrowed
C	Coarse (ly)
calc	Calcite (areous)
carb	Carbonaceous
cbl	Cobble (64-256 mm)
Ceph	Cephalopod
cgl	Conglomerate
chk	Chalk (y)
chlor	Chlorite
cht	Chert
chty	Cherty
cl	Clastic
cln	Clean
clr	Clear
cly	Clay (ey)
com	Common
coq	Coquina
Cor	Coral
crbnt	Carbonate
Crin	Crinoid (al)
crm	Cream
crpxl	Cryptocrystalline
ctc	Contact
deb	Debris
decr	Decrease (ing)
desi	Desiccation
dism	Disseminated
dk	Dark (er)
dns	Dense (er)
dol	Dolomite (ic)
drsy	Drusy
dtrl	Detrital (us)
elg	Elongate
euhed	Euhedral
f	Fine (ly)
fau	Fauna
Fe	Iron-Ferruginous
Fe-mag	Feromagnesian
fenst	Fenestral
fis	Fissile
fl	Fill (ed)
fld	Feldspar (thic)
flk	Flake
flky	Flaky
flor	Fluorescence
flt	Fault (ed)
fltg	Floating
foram	Foraminifera
fos	Fossil (iferous)
fr	Fair
frac	Fracture (ed)
frag	Fragment (al)
fri	Friable
frmwk	Framework
fros	Frosted
g	Good
Gast	Gastropod
gl	Glass (y)
glau	Glauconite (ic)
gn	Green
gr	Grain (ed)
gran	Granular
grd	Grade (ed)
grnl	Granule (2-4 mm)
gy	Grey
gyp	Gypsum (iferous)

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COMMON ABBREVIATIONS (CONTINUED)

hd	Hard
hfrac	Horizontal Fracture
hi	High
hrtl	Horizontal
hvy	Heavy
hydc	Hydrocarbon
ig	Igneous
imbed	Imbedded
imp	Impression
incl	Included (sion)
incr	Increase
indst	Indistinct
intbd	Interbedded
intcl	Intraclast (s)
intfrag	Interfragmental
intgran	Intergranular
intlam	Interlaminated
intr	Intrusion (ive)
intv	Interval
intxl	Intercrystalline
ireg	Irregular
ird	Iridescent
intrsk	Intraskeletal
kao	Kaolin
lam	Laminated
lchd	Leached
len	Lentil (cular)
lith	Lithographic
lmy	Limy
lrg	Large (er)
ls	Limestone
lse	Loose
lstr	Lustre
lt	Light (er)
m	Medium
mar	Maroon
mas	Massive
mat	Material, matter
mica	Mica (ceous)
mic	Micro
mky	Milky
mnr	Minor
mnrl	Mineral (ized)
mnut	Minute
Mol	Mollusca
mot	Mottled
mrly	Marly
mtx	Matrix
n	No,none,non
nod	Nodule
num	Numerous
o	Oil
occ	Occasional
od	Odor
ool	Oolite (ic)
op	Opaque
org	Organic
orng	Orange
orth	Orthoclase
Ost	Ostracod
ovgth	Overgrowth
ox	Oxidized
p	Preliminary (as suffix)
pbl	Pebble (4-64 mm)
pel	Pellet
perm	permeability
pet	Petroleum (iferous)
phos	Phosphate (ic)
pk	Pink
plag	Plagioclase
plcy	Pelecypod
pl	Plant
plty	Platy
por	Porous (sity)
pos	Possible (ility)
p-p	Pin-Point
pred	Predominant (ly)
prim	Primary
prob	Probable (ly)
prom	Prominent (ly)
pt	Part (ly)
ptch	Patch (es)
ptg	Parting
purp	Purple
pyr	Pyrite (ic) (ized)
pyrbit	Pyrobitumen
qtz	Quartz
qtzc	Quartzitic
qtzs	Quartzose
rd	Round (ed)
repl	Replaced (ing) (ment)
rexl	Recrystallized
rmn	Remains (nant)
rr	Rare
rsns	Resinous
rthy	Earthy
s	Small
sa	Salt (y)
S	Sulphur
s&p	Salt & Pepper
sat	Saturated
sb	Sub

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COMMON ABBREVIATIONS (CONTINUED)

sc	Scales
scat	Scattered
sd	Sand (1/16 - 2mm)
sdy	Sandy
sec	Secondary
sed	Sediment (ary)
sft	Soft
sh	Shale
shad	Shadow
shy	Shaly
sid	Siderite (ic)
sil	Silica
sks	Slickensided
sl	Slight (ly)
sln	Solution
slt	Silt
sltst	Siltstone
slty	Silty
sm	Smooth
SP	Small Plug (as prefix)
sp	Spot (ted) (ty)
spec	Speck (led)
spl	Sample
srt	Sort (ed) (ing)
strg	Stringer
Strom	Stromatoporoid
stromlt	Stromatolite
struc	Structure
styl	Stylolite (ic)
suc	Sucrosic
sug	Sugary
sup	Supported
surf	Surface
sz	Size
tab	Tabular
tex	Texture
Tham	Thamnopora
thk	Thick
thn	Thin
thru	Throughout
tr	Trace
trnsl	Translucent
trnsp	Transparent
tt	Tight
tub	Tubular
uncons	Unconsolidated
unident	Unidentifiable
up	Upper
v	Very
var	Variable
vcol	Varicolored
vfrac	Vertical Fracture
vgt	Varigated
vn	Vein
vrtl	Vertical
vug	Vug (gy) (ular)
w	Well
wh	White
wk	Weak
wthrd	Weathered
wtr	Water
wvy	Wavy
wxy	Waxy
wsrt	Well sorted
xbd	Cross-bedded
xbdg	Cross-bedding
xl	Crystal (line)
xlam	Cross-laminated
yel	Yellow
zn	Zone
*	Broken core
/	With
>10000	Permeability over 10000 mD
<0.01	Permeability less than 0.01 mD
CC	Cracked Core
DR	Drilled
LC	Lost Core
RU	Rubble
mD	milliDarcy

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APPENDIX 2

Thin section study

Canadian Forest Oil Limited

PETROGRAPHIC STUDY OF TEN MT. KINDLE FORMATION FROM DUSKY LOCATION

Work Order No. A7997

September, 1999

AGAT Laboratories

3801 - 21st Street N.E.
Calgary, Alberta
T2E 6T5

AGAT

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EXECUTIVE SUMMARY

This study describes the petrographic and reservoir characteristics of ten outcrop samples of the Silurian, Mt. Kindle Formation.

The Mt. Kindle Formation represented by the ten samples had undergone pervasive replacement dolomitization. The ten samples are fine to coarse crystalline dolostones. Crystal sizes ranges from fine (20 µm) to very coarse (over 1000 µm), and generally increase in size towards pore spaces. Dolomite crystals are commonly anhedral, non-planar and interlocked. Primary depositional textures in most samples had been obliterated, except for samples F99-P-1 1258', F99-B-1 1870' and F99-F-1 2080' where remnants of bioclasts can be recognized. General depositional facies ranges from mudstone to bioclastic packstone, representing a low energy shallow water subtidal depositional environment with sufficient sediment supplies from carbonate factory.

The replacement dolomitization took place at shallow burial and relatively early diagenetic stage, which is suggested by pressure solution postdating the dolomitization. Recrystallization plus the various primary textures may account for the wide ranges of dolomite crystal sizes. Pore system is dominated by intercrystalline, micro-vuggy and moldic pores. Porosities may have been generated during and after replacement dolomitization. Pore-filling diagenetic phases include minor to trace amounts of dolomite and calcite cements, and pyrite. Dolomite cement in most samples are zoned, and the outmost zonings are detached to some extent. Two types of calcite cements are recognized; blocky, inclusion-free and fibrous, crust-like calcite cements, which indicate distinct diagenetic environments. Both calcite cements show corroded endings, suggesting a later dissolution process. Major factors controlling pore system and reservoir quality include primary depositional facies, concomitant and later dissolution of calcitic components with respect to pervasive dolomitization. Dolomite and calcite cementation, dissolution, and pyrite precipitation further modified the pore system.

Most samples have porosity ranging from 3 to 8%, pore sizes from 20 to 3000 μm, poor to fair interconnectivities and reservoir quality. Potential problems with regards to reduction of reservoir quality of the Silurian Mt. Kindle dolostone include migration of remnant dolomite upon hydrochloric acid treatment.

PETROGRAPHIC STUDY OF TEN MT. KINDLE FORMATION

INTRODUCTION

This study describes the petrographic and reservoir characteristics of ten Mt. Kindle Formation samples collected during the 1999 Northern Canada Field Trip.

METHODS OF ANALYSIS

Samples were first impregnated with blue epoxy, then stained with a combination of Alizarin Red-S (for calcite) and potassium ferricyanide (for ferroan carbonate). Table 1 and 2 summarize the mineralogical compositions (based on visual estimate) and textural characteristics of the Mt. Kindle dolostones. Representative thin section photomicrographs with descriptions are provided at the end of this study (Plates 1-10, Appendix).

PETROGRAPHIC SUMMARY AND INTERPRETATION

The following petrographic summary and interpretation is presented according to the two essential rock types demonstrated by the ten samples: mud-wackestone and wacke-packstone.

Mudstone-wackestone facies:

This rock type includes five samples F99-T-1 30', F99-R-1 230', F99-B-1 1695', F99-P-1 1725' and F99-A-1 1890'. **Framework constituents** within these samples are mainly dolomite (100%), with trace amounts of pyrite. Dolomite crystal size ranges from fine to very coarse (20-1000μm), Crystal size tends to increase towards pore spaces. Mosaic dolomite crystals are anhedral, non-planar and interlocked. Pyrite occurs in tiny crystals, and scatter in dolomite framework (sample F99-R-1 230' Plate 2-3). Pore-filling **diagenetic minerals** include dolomite, calcite and pyrite. Minor to trace amounts of rhombohedral dolomite cements grow on inner walls of pore spaces, showing a sharp contact with their substrate dolomite. Dolomite cements are relatively clean, and generally have a large crystal size compared with their substrates. Dolomite cement crystals are zoned. Two to four zonings can be recognized, with the outmost zoning (about 10 μm thick) commonly detached, indicating a dissolution event after dolomite cementation. Trace amounts of calcite cements occur in the middle of pore spaces in most samples. Two types of calcite cements are identified, blocky, inclusion-free calcite and fibrous, crust-like calcite cements, suggesting most likely phreatic and vadose diagenetic zones respectively. Both types of calcite cements have been subjected to later dissolution, forming corroded crystal edges in pore spaces (Plates 1-4, 2-4, 6-3, 9-3). Euhedral pyrite are commonly found in pore spaces as well, which postdate dolomite cement, but the crosscutting relationship with calcite cement is not clear (Plates 1-3, 2-3). Micro-stylolites resulted from pressure solution are common in mudstone-wackestone facies, and postdate the pervasive replacement dolomitization. Evident termination of stylolites into pore spaces had not been observed, however micro-vugs do occur in adjacent to stylolites (Plate 2-1), suggesting a limited influence of pressure solution on micro-vug generation.

Visible thin section **porosities** in the mudstone-wackestone range from 3 to 8%, and pore system is dominated by intercrystalline pores and micro-vugs (Plates 1-2). Pore size is between 20 and 3000 μm, depending on types of pore spaces. Micro-vugs are 1000-3000 μm. However the interconnectivity of pore spaces is poor. Reservoir quality in mudstone-wackestone is considered poor to fair. Reservoir quality is controlled by 1) depositional environment, which controls the amounts of grain constituents and primary textures, 2) mechanisms of the pervasive replacement dolomitization and later alteration, which governs the crystal sizes, shapes and generation of intercrystalline pore spaces, and 3) later pore-filling diagenesis, including dolomite and calcite cementation, pressure solution and pyrite precipitation.

Wackestone-packstone facies:

This rock type includes also five samples F99-T-1 1112', F99-P-1 1258', F99-P-1 1340', F99-B-1 1870' and F99-F-1 2080'. Framework constituents include mainly bioclasts and lesser amounts of intraclasts. Frameworks are generally mud-supported. Mineralogically dolomite accounts for nearly 100% rock volume, with trace amounts of pyrite and calcite. Remnants of bioclasts are recognizable (Plate 4), but species can not be identified. Sizes of bioclasts varies from millimeter to centimeter. Skeletons had been completely replaced by coarse crystalline dolomite, and internal textures been entirely obliterated. Presence of intraclasts, e.g. peloids, can be only postulated in terms of the rounded shapes and sizes of micro-vugs (Plate 3-2). Dolomite crystal size ranges from 20 to 200μm in matrix, but from 800 to over 1000 μm in grain constituents. In general, crystal size tends to increase towards pore spaces, too. Matrix dolomite crystals are mosaic, anhedral, non-planar and interlocked. Pyrite is scattered in dolomite framework. The same pore-filling **diagenetic minerals** had been observed in wackestone-packstone facies, dolomite, calcite and pyrite, but the amounts of calcite cements are significantly low. Micro-stylolites tend to be more abundant in finer crystalline (matrix) portions.

Visible thin section **porosities** are between 4 to 6%, and pore system is dominated by intercrystalline pores, micro-vugs and molds within bioclasts (Plates 4-2, 4-3). Pore size is between 20 and 2000 μm, but the interconnectivity of pore spaces is poor to fair. Reservoir quality is considered poor to fair, and controlled by similar factors to those in mudstone-wackestone facies.

Potential problems with regards to reservoir quality of the Silurian Mt. Kindle dolostone include migration of remnant dolomite upon hydrochloric acid treatment.

Table 1
Petrographic Summary of Ten Samples from the
Mt. Kindle Fm. Silurian at Dusky

	F99-T-1 30' SP001	F99-R-1 230' SP002	F99-T-1 1112' SP003	F99-P-1 1258' SP004	F99-P-1 1340' SP005
FRAMEWORK GRAINS					
Dolomite	100	100	100	100	100
Calcite					
Anhydrite					
Quartz Silt					
Authigenic Silica					
Pyrite	-	TR	TR	TR	-
Phosphate					
Bitumen					
FAUNA					
GRAIN TYPES					
CRYSTAL TEXTURE	A	A	A	A	A
CEMENT TYPES					
Calcite	TR	TR	TR	TR	-
Anhydrite					
Gypsum					
Dolomite	TR	TR	2	-	TR
ROCK TYPE	MUD-WAC	WAC	WAC-PAC	PAC	WAC-PAC
ORIGINAL TEXTURE	UF-UC	LF-VC	UF-UC	VF-VC	F-UC
POROSITY TYPES	Ixl, V/M	Ixl, V/M	Ixl, V/M	Ixl, V/M	Ixl, V/M
CORE POROSITY (%)	4.3	8.1	7.7	4.1	4.9
TS POROSITY (%)	3	7	6	5	4
PERMEABILITY (md)	0.11	0.38	1	0.22	0.74
QUALITY	P	P	F	P	P

Table 2
Petrographic Summary of Ten Samples from the Mt. Kindle Fm. Silurian at Dusky

	F99-B-1 1695' SP006	F99-P-1 1725' SP00[illegible]	F99-B-1 1870' SP008	F99-A-1 1890' SP009	F99-F-1 2080' SP0010
FRAMEWORK GRAINS					
Dolomite	100	100	100	100	100
Calcite					
Anhydrite					
Quartz Silt					
Authigenic Silica					
Pyrite	TR	TR	TR	TR	TR
Phosphate	-	-	TR	-	-
Bitumen					
FAUNA					
GRAIN TYPES					
CRYSTAL TEXTURE	A	A	A	A	A
CEMENT TYPES					
Calcite	TR	-	-	TR	TR
Anhydrite					
Gypsum					
Dolomite	TR	TR	1	2	1
ROCK TYPE	MUD	MUD	WACK.	MUD	WAC-PAC
ORIGINAL TEXTURE	VF-UC	VF-UM	VF-M	F-UC	VF-LC
POROSITY TYPES	Ixl,V/M	Ixl,V/M	Ixl,V/M	Ixl,V/M	Ixl,V/M
CORE POROSITY (%)	7.2	7.2	8.8	6.5	7.9
TS POROSITY (%)	8	6	5	4	6
PERMEABILITY (md)	0.19	0.3	0.35	0.71	1.85
QUALITY	P	P	P	P	F

LIST OF ABBREVIATIONS

SKELETAL GRAINS

Bry - BRYOZOAN
Ech - ECHINODERM
Bra - BRACHIOPOD
Os - OSTRACOD
Cal - CALCISPHERES
Biv - BIVALVE
Moll - MOLLUSK
Foram - FORAMINIFERA
Strom - STROMATOPOROID
Cor - CORAL
Ga - GASTROPOD
Pele - PELECYPOD

CRYSTAL TEXTURE

Euh - EUHEDRAL
Sub - SUBHEDRAL
Anh - ANHEDRAL

ORIGINAL TEXTURE

GS - GRAINSTONE
PS - PACKSTONE
WS - WACKESTONE
MS - MUDSTONE
FS - FLOATSTONE
RS - RUDSTONE

NON-SKELETAL GRAINS

Pel - PELOID
Ooi - OOID

GRAIN SIZE

Cxl - COARSE CRYSTALLINE
Mxl - MEDIUM CRYSTALLINE
Fxl - FINE CRYSTALLINE
Vfxl - VERY FINE CRYSTALLINE

POROSITY TYPES

Mixl - MICROINTERCYSTALLINE
Ixl - INTERCRYSTALLINE
Mo - BIOMOLDIC
mV - MICROVUGGY
mF - MICROFRACTURE
Ig - INTERGRANULAR
Ip - INTERPARTICLE

QUALITY

G - GOOD
M - MODERATE
P - POOR

CEMENT TYPES

Syn - SYNTAXIAL OVERGROWTHS
Blo - BLOCKY
Poik - POIKILOTOPIC
Dru - DRUSY
SD - SADDLE DOLOMITE
Lath - ANHYDRITE LATHS
Grm - GROUNDMASS
Iso - ISOPACHOUS RIMS
Spa - SPARITE

THIN SECTION
PHOTOMICROGRAPHS AND DESCRIPTIONS

THIN SECTION DESCRIPTION: PLATE 1

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-T-1, 30'
Analyzed Porosity: 4.3%

Permeability: 0.11 md

1-2 Overview of a very fine to upper coarse (40-450 μm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. Primary textures had been entirely obliterated. Current pore system is dominated by intercrystalline (1:K1) and vuggy porosities (2:L12). Vugs are inferred to result from removal of certain grain constituents (e.g. peloids?). Depositional facies is inferred to be mud-wackestones. The sample shows low visible porosity (about 3%) and poor interconnectivities. **x25ppl** **x25ppl**

2-4 Detailed views of pore system. Isolated vuggy pore spaces are lined with dolomite cement (3:H6, 4:H1) and partly filled with calcite cements (3:J2, 4:H4). Note the differences in the calcite cement textures. The crust-like fiber-prismatic calcite cements (4:H4, 4:H7) grow on top of dolomite cement substrate, and show growth zonings and corrosive ends (4:G/H7). Similarly, inclusion-free calcite cement (3:I2) also show a corroded end. Dolomite cements have zoned texture and their outmost zonings had been broken off in various degrees (3:I7, 4:H1.5). Other pore filling diagenetic mineral includes pyrite (3:G11). **x63ppl** **x63ppl**

1	2
3	4

1 mm x25 | 400 μm x63 | 250 μm x100 | 100 μm x250

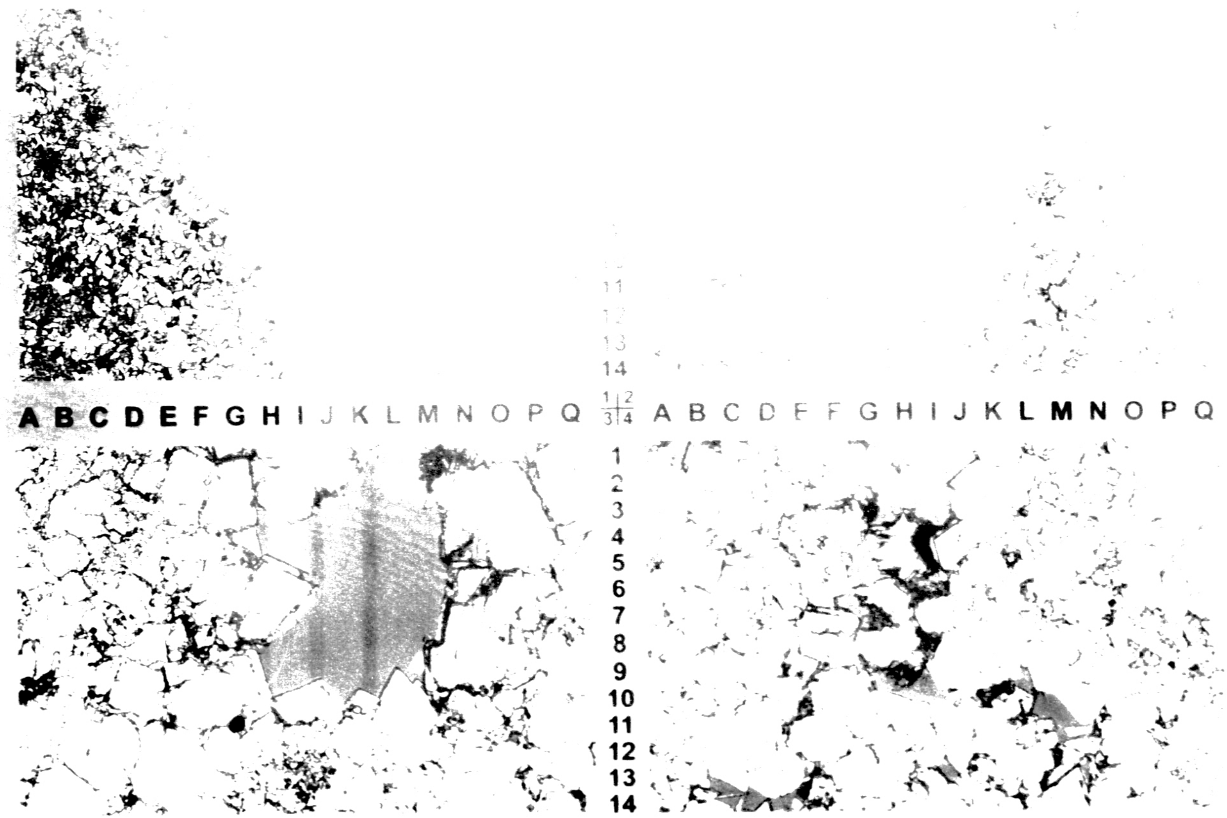

PLATE #1
F99-T-1, 30'

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THIN SECTION DESCRIPTION: PLATE 2

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-R-1, 230'
Analyzed Porosity: 8.1% **Permeability: 0.38 md**

1-2 Overview of a lower fine to very coarse (20-1000 μm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. Crystals increase in size and become more euhedral towards pore spaces. Primary textures had been obliterated. Pore system is dominated by vuggy (2:K2) and intercrystalline porosities (1:G11). Vugs are relatively isolated and similar in sizes, implying an origin of grain constituent dissolution. Stylolites crosscut dolomite crystals (1:M12) and go around the adjacent pore spaces. Depositional facies is inferred to be wackestone. The sample shows fair porosity (about 7%) and moderate interconnectivities. **x63ppl x25ppl**

2-4 Detailed views of pore system. Pore spaces are commonly filled with dolomite (3:I6, 4:K7), calcite (2:J8, 4:G4) and pyrite (3:J4). Two types of calcite cement textures are recognized. One is crust-like, fiber-prismatic and inclusion rich (4:K/L10), characterized by their growth zonings and corrosive ends; the other is spar and inclusion-free. Dolomite cements are also zoned (3:I4). **x63ppl x63ppl**

1	2
3	4

1 mm
x25

400 μm
x63

250 μm
x100

100 μm
x250

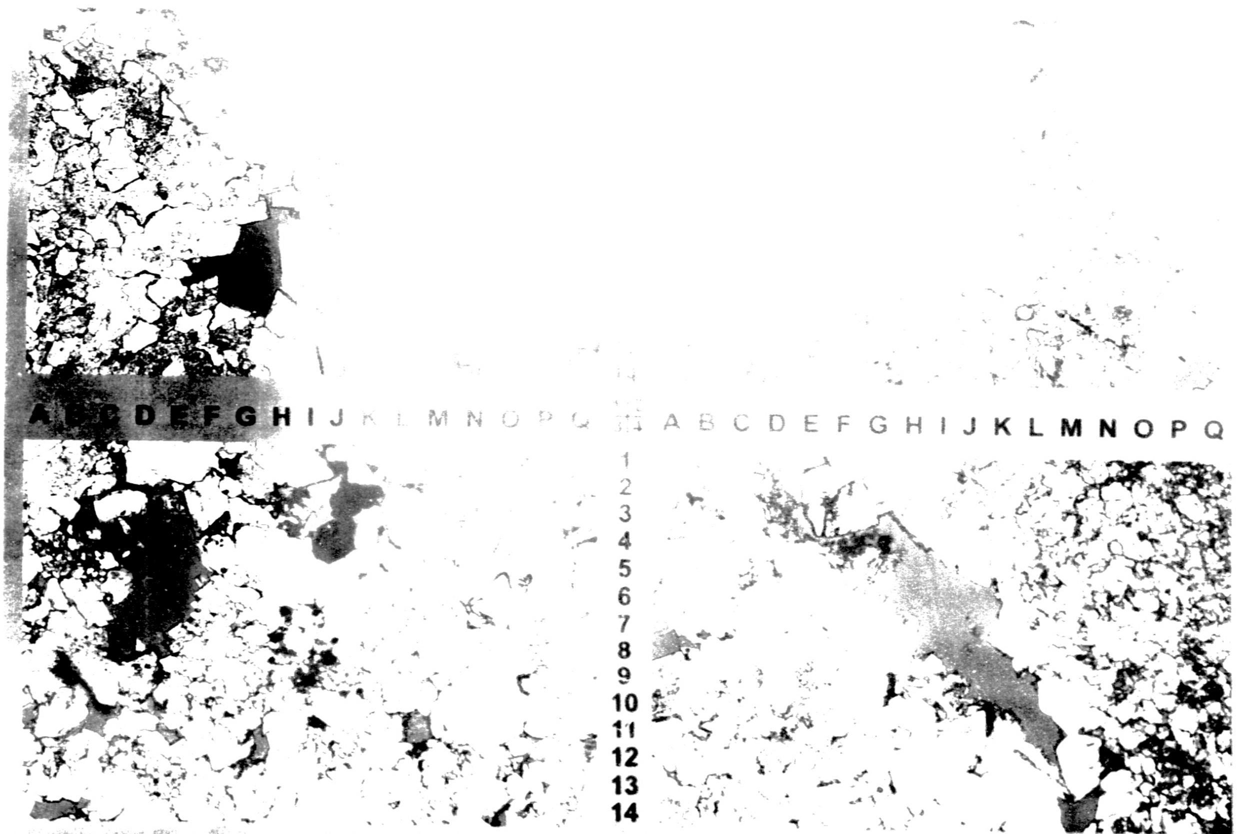

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PLATE #2
F99-R-1, 230'

THIN SECTION DESCRIPTION: PLATE 3

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-T-1 1112'
Analyzed Porosity: 7.7% **Permeability: 1.00 md**

1-2 Overview of an upper fine to upper coarse (400-600 µm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. Primary textures had been obliterated. Pore system is dominated by vuggy (2:F7) and intercrystalline porosities (1:H6). Vugs are relatively isolated and rounded, suggesting an origin of grain constituent dissolution. Depositional facies is inferred to be wacke-packstone. The sample has fair porosity (about 6%) and moderate interconnectivities. **x25ppl x25ppl**

2-4 Detailed views of pore system. Pore spaces are apparently filled with dolomite (3:H10, 4:H4), calcite (4:G6) and pyrite (3:L/M10.5). Crust-like calcite cement (4:G6) shows a change in growth patterns (from fiber-like to laminated, concentric coatings). Note dolomite cement does not show zoned texture. **x63ppl x63ppl**

1	2
3	4

1 mm x25   400 µm x63   250 µm x100   100 µm x250

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PLATE #3
F99-T-1, 1112'

THIN SECTION DESCRIPTION: PLATE 4

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-P-1, 1258'
Analyzed Porosity: 4.1% **Permeability: 0.22 md**

1 Overview of a very fine to very coarse (10-5000 µm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. The pervasive replacement dolomitization had obliterated most primary textures, but some fauna skeletons remain recognizable (H6). The irregular primary texture (bioclasts plus limemud matrix) dictated such a big range of crystal sizes after dolomitization. Depositional facies is inferred to be packstone. The sample has fair porosity (about 5%) and moderate interconnectivities. **x25ppl**

2-4 Detailed views of pore system which is dominated by intraparticle pore spaces (2:I6, 3:I4), intergranular pores (4:I3) and intercrystalline pores (4:F6). Pore spaces are apparently lined with dolomite cement (3:H10, 4:H4). Other pore filling phases, e.g. calcite cement (3:G7) and pyrite (3:K/L5) are rare. **x63ppl x25pplx63ppl**

1	2
3	4

1 mm x25 — 400 µm x63 — 250 µm x100 — 100 µm x250

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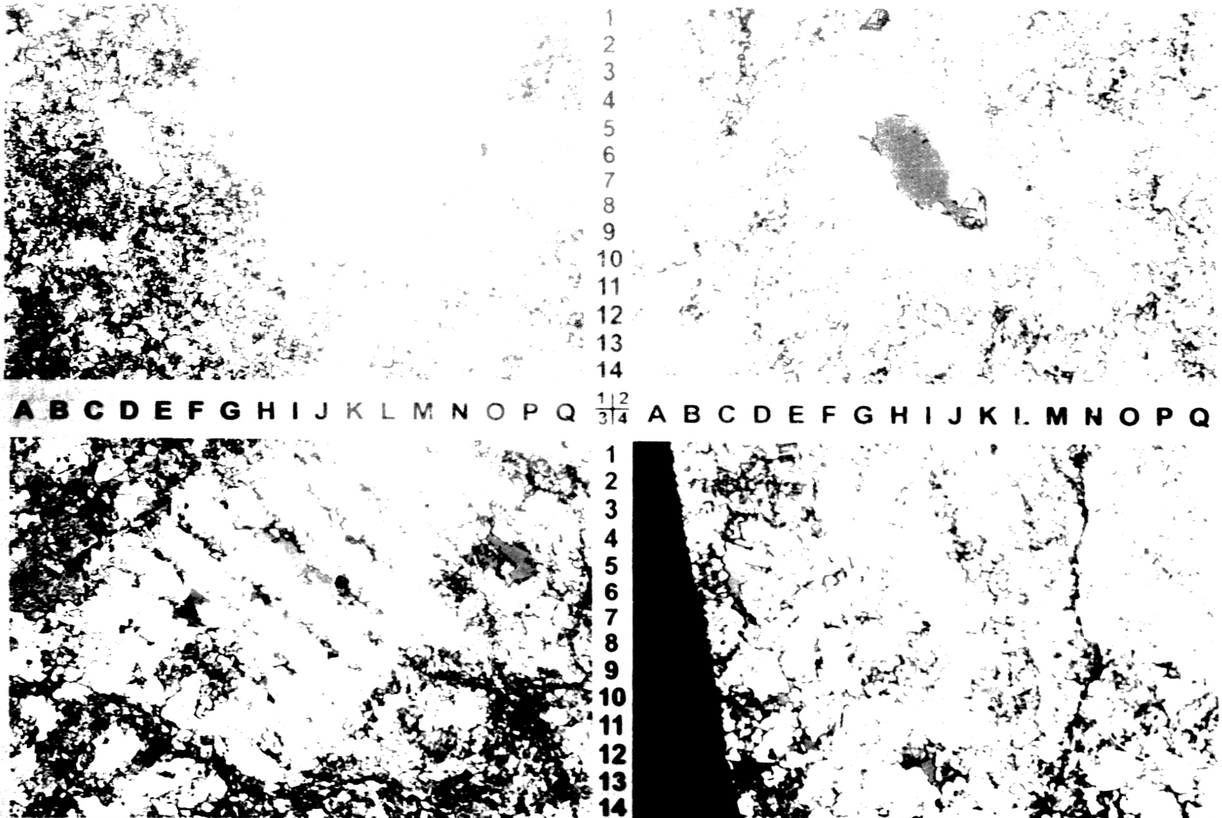

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PLATE #4
F99-P-1, 1258'

THIN SECTION DESCRIPTION: PLATE 5

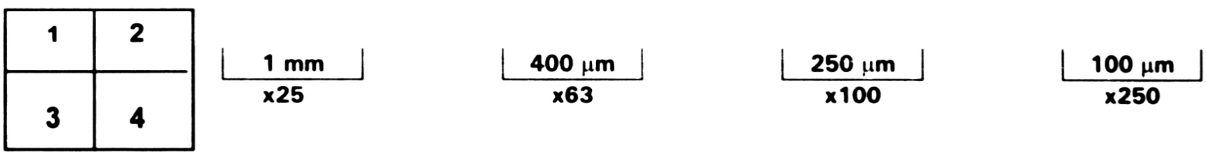
Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-P-1, 1348'
Analyzed Porosity: 4.9% **Permeability: 0.74 md**

1 Overview of a fine to upper coarse (40-600 μm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. The pervasive replacement dolomitization had homogenized the primary textures. Depositional facies is inferred to be peloidal wackestone. The sample has low porosity (about 4%) and poor interconnectivities. **x25ppl**

2-4 Detailed views of pore system and texture. The rock had been subjected to intensive pressure solution which reduced porosity significantly. Pore system is dominated by intercrystalline (2:G12) and vuggy porosities (2:P13, 4:K6). Vugs are relatively isolated, rounded and similar in sizes, suggesting an origin of grain constituent removal. Little pore filling phases had been noted in this sample except for trace amounts of dolomite cement. **x25pplx63ppl x25ppl**



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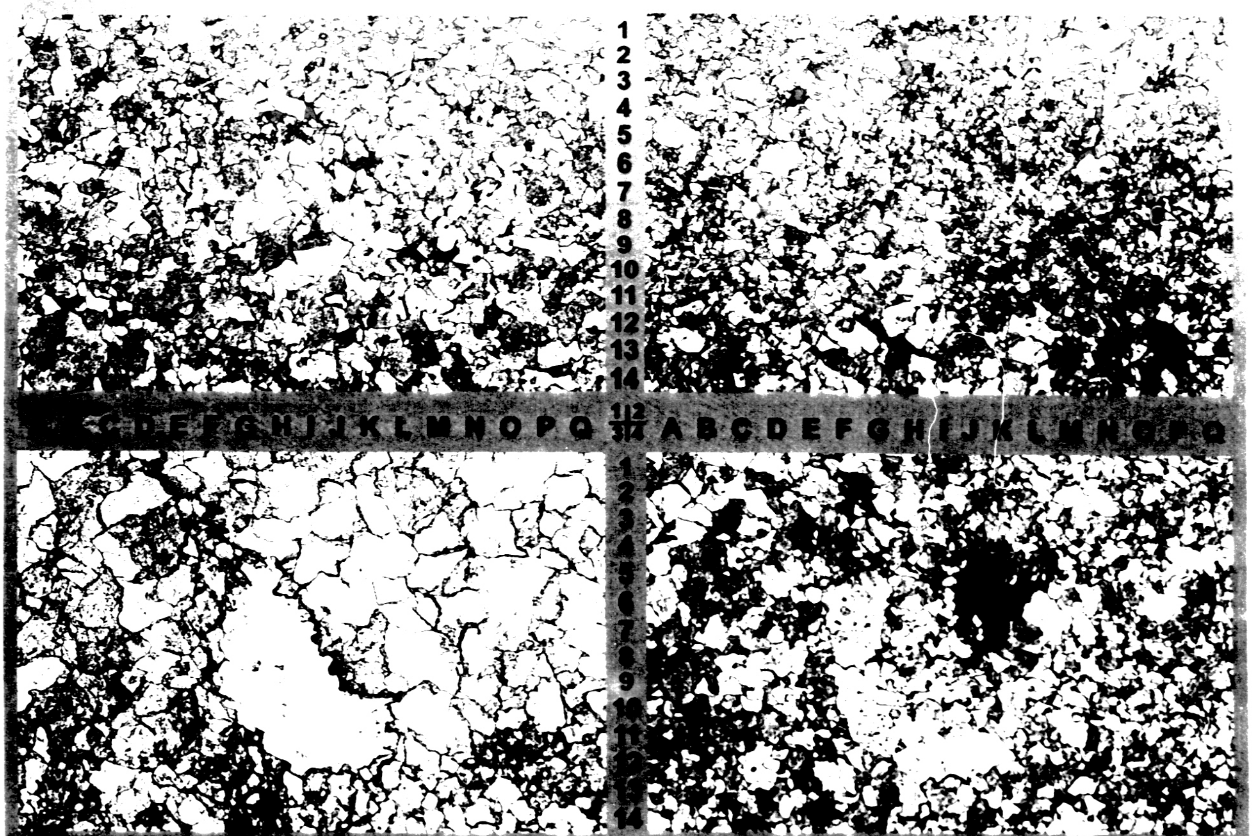

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PLATE #6
F99-P-1, 1340

THIN SECTION DESCRIPTION: PLATE 6

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-B-1, 1695'
Analyzed Porosity: 7.2% **Permeability: 0.19 md**

1 Overview of a very fine to lower medium (40-100 μm) crystalline dolostone. Mosaic dolomite crystals are anhedral and non-planar. Primary textures had been homogenized. Depositional facies is inferred to be mudstone. The sample has fair porosity (about 8%) and moderate interconnectivities. **x25ppl**

2-4 Detailed views of pore system. Pore system is dominated by intercrystalline (2:P13, 4:K9) and micro-vuggy porosities (3:K3). Vugs are relatively isolated and irregularly shaped. also suggesting an origin of grain constituent removal. Common pore filling phases include dolomite (3:J2), calcite (3:F9.5) and pyrite (4:E1). **x63pplx25ppl x63ppl**

1	2
3	4

1 mm x25

400 μm x63

250 μm x100

100 μm x250

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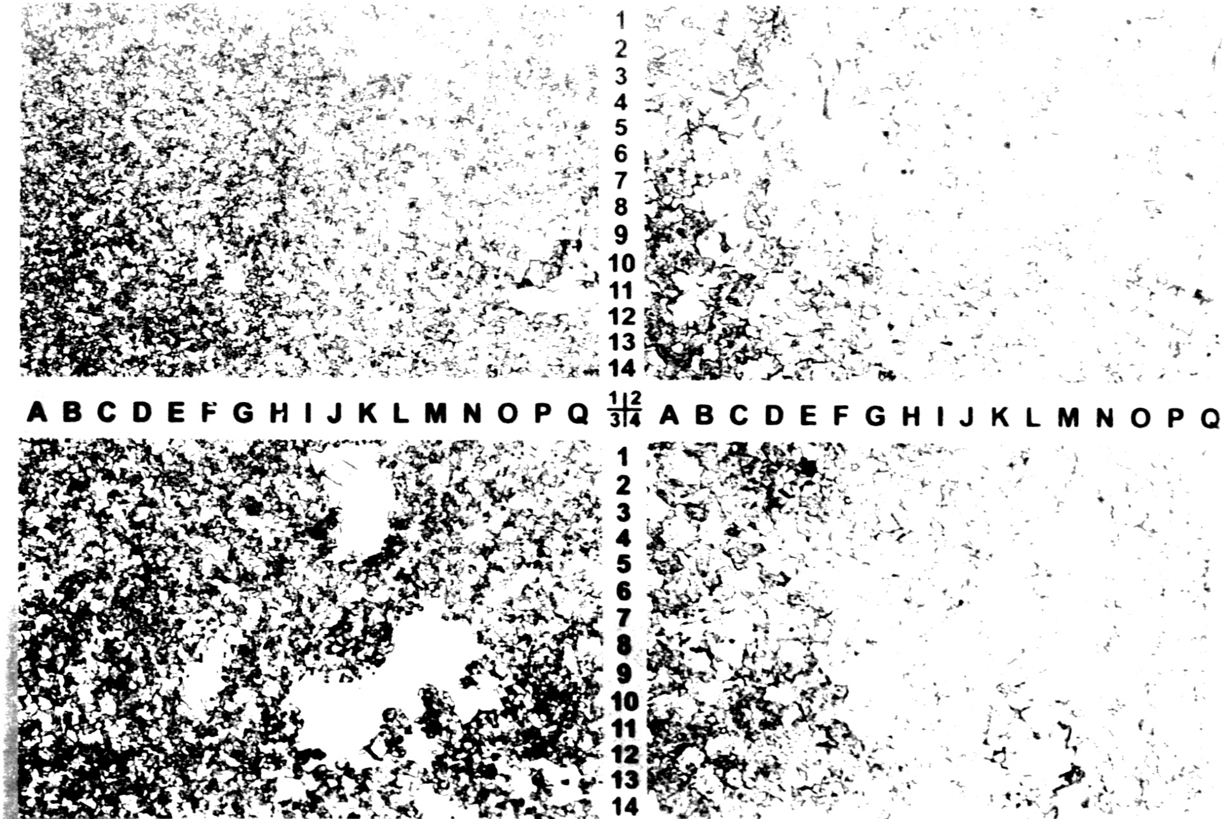

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PLATE #6
F99-B-1, 1695'

THIN SECTION DESCRIPTION: PLATE 7

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-P-1, 1725'
Analyzed Porosity: 7.2% **Permeability: 0.3 md**

1 Overview of a very fine to upper medium (20-200 μm) crystalline dolostone. Dolomite crystals are mosaic, anhedral and non-planar. Primary textures had been homogenized except for the presence of isolated micro-vugs (M11) which imply a removal of gain constituents. Depositional facies is inferred to be mudstone. The sample has fair porosity (about 6%) and poor interconnectivities. **x25ppl**

2-4 Detailed views of texture and pore system. Pore system is dominated by micro-vugs (3:K3). Common pore filling phases include dolomite (3:I6, 4:J8) and pyrite (4:G/H6). The shape of dolomite-filled pore space (4:G1-M12) reflects a pre-existing bioclast. Dolomite crystal size increases towards pore spaces (3:P7-L3). Micro-stylolite appears to terminate in micro-vugs (2:A/B8). **x63pplx63ppl x63ppl**

1	2
3	4

1 mm x25 | 400 μm x63 | 250 μm x100 | 100 μm x250

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PLATE #7
F99-P-1, 1725'

THIN SECTION DESCRIPTION: PLATE 8

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-B-1, 1870'
Analyzed Porosity: 8.8% **Permeability: 0.35 md**

1-2 Overview of a very fine to upper medium (20-200 μm) crystalline dolostone. Dolomite crystals are mosaic, anhedral and non-planar. Primary textures had been obliterated except for a few remnants of phosphate shell fragments (2:K11). In addition, presence of micro-vugs and molds also suggests a primary depositional facies to be bioclastic wackestone. The sample has low porosity (about 5%) and poor interconnectivities. **x25ppl**

3-4 Detailed views of texture and pore system. Pore system is dominated by micro-vugs (2:A12, 4:H8), intercrystalline (1:J6) and molds (3:E2-M12). Pores are partly filled with dolomite cement (3:I8, 2:C11) and pyrite (4:F/G2). Pore size ranges from 20 to 1500 μm, depending on types of pores. **x25pplx25ppl x63ppl**

1	2
3	4

1 mm x25 | 400 μm x63 | 250 μm x100 | 100 μm x250

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PLATE #8
F99-B-1, 1870'

THIN SECTION DESCRIPTION: PLATE 9

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-A-1, 890'
Analyzed Porosity: 6.5% **Permeability: 0.71 md**

1-2 Overview of a fine to upper coarse (40-400 μm) crystalline dolostone. Mosaic, anhedral and non-planar dolomite crystals are commonly interlocked. Uniform textures suggest a primary depositional facies to be mudstone. The sample has low porosity (about 4%) and poor interconnectivities. **x25ppl**

3-4 Detailed views of diagenesis and pore system. Pore system is dominated by micro-vugs (1-2 mm, 3:G5, 4:I6), intercrystalline (40-100μm 1:F/G12) and molds (2:G12-F/G4). Pores are partly filled with dolomite cement (3:J8), calcite cement (3:h8, 4:J3) and pyrite (4:K2). Note the corroded endings (3:H/17) and fibrous texture (3:F:3) of calcite cements. **x25pplx63ppl x25ppl**

1	2
3	4

1 mm x25 | 400 μm x63 | 250 μm x100 | 100 μm x250

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THIN SECTION DESCRIPTION: PLATE 10

Mt KINDLE FORMATION

DOLOSTONE

SAMPLE F99-F-1, 2080'
Analyzed Porosity: 7.9%

Permeability: 1.85 md

1 Overview of a very fine to coarse (20-400 µm) crystalline dolostone. Mosaic, anhedral and non-planar dolomite crystals are commonly interlocked, and subjected to pressure solution. Crystal sizes increase towards pore spaces. Primary depositional facies of bioclastic wacke-packstone is suggested by the presence of remnants of skeletons. The sample has fair porosity (about 6%) and moderate interconnectivities. **x25ppl**

3-4 Detailed views of pore system. Pore system is dominated by intraparticle pores (about 300 µm 3:K10, 4:H7) and intercrystalline pores (2:J7). Pores are partly filled with zoned dolomite cement (4:F3), calcite cement (3:F4) and pyrite (2:F/G13, 4:F/G2.5). Note the calcite cements also show corroded edges (3:G5). **x250pplx25ppl x63ppl**

1	2
3	4

1 mm x25 | 400 µm x63 | 250 µm x100 | 100 µm x250

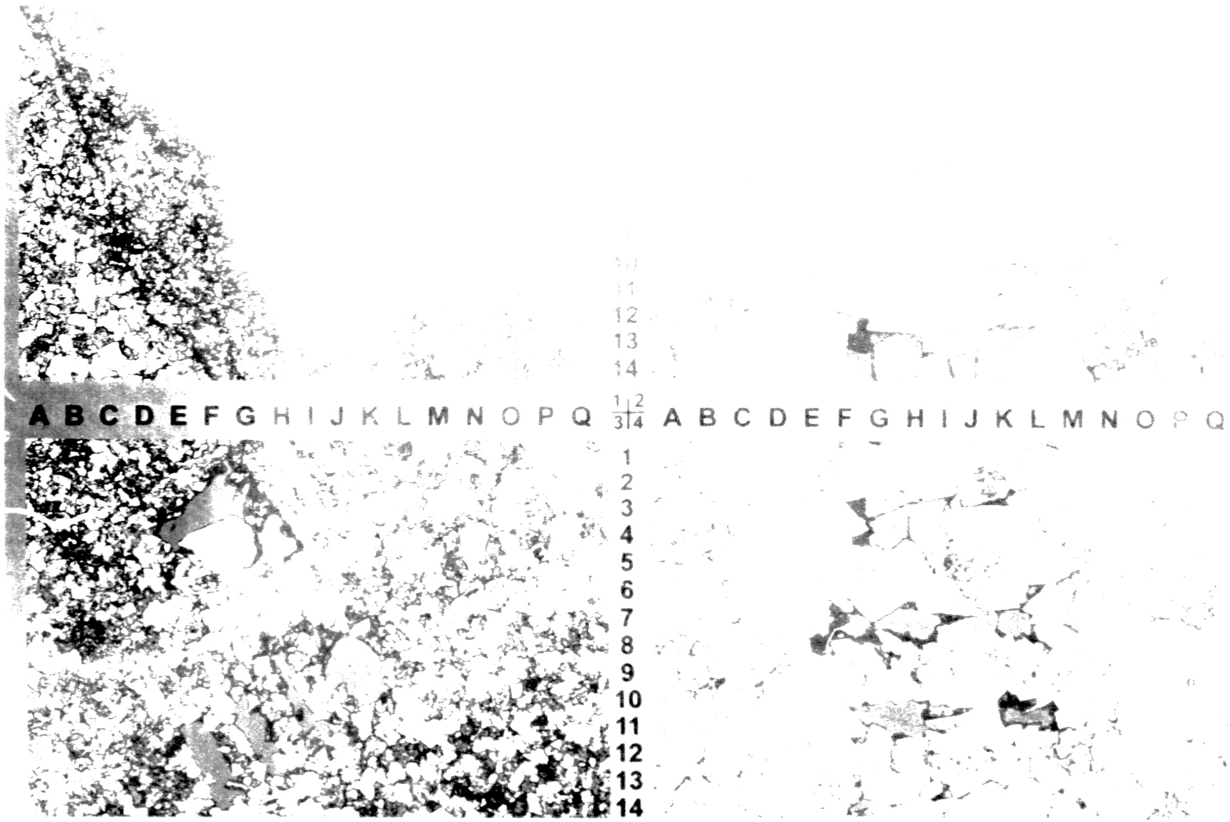

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PLATE #10
F99-F-1, 2080'

PERMIT TO PRACTICE
AGAT LABORATORIES LTD.
Signature Philip Hag
Date Sept. 28, 1999
PERMIT NUMBER: P 3989
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Tan Wenbin

Prepared by Wenbin Tan, Ph.D (Geol.)

APPENDIX 3

Geochemical Analysis

Humble Geochemical Services

Division of Humble Instruments & Services, Inc.

P.O. Box 789 • Humble, Texas 77347
218 Higgins Street • Humble, Texas 77338

Telephone: (281) 540-6050 Fax: (281) 540-2864 :Fax
E-mail: humble@humble-inc.com Web Site: http://www.humble-inc.com

FAXED

Geochemical Services for Exploration, Development and Production

FAX

To: James Taylor
Canadian Forest Oil Ltd.

Fax No.: 1-403-292-8060

From: Daniel M. Jarvie

Date: October 7, 1999

Number of Pages including this page: 4

James:

The following page details the result of the TOC and Rock-Eval analysis. The TOC values are generally low as are the Rock-Eval yields.

However, 2 samples from the Devonian Horn River do have over 1.00% TOC. There pyrolysis yields are very low and no reliable Tmax data for maturity assessment was obtained. It is likely that these are of high maturity (>1.4% Ro) based on the very low yields and resulting low hydrogen indices. Even if these were originally Type III kerogens we would expect an HI of 50-200, which at an HI of 200 would require an S2 of 4-6 for both samples. Original (low maturity) TOC values for Type III kerogens would only be slightly higher (about 0.50% higher); however, Type II kerogens would have been about 1.00% higher.

Also note the high S3 value on the 2.68% TOC sample; this is likely a result of weathering (oxidation). Oxidation will result in lower S2 yields due to the high concentration of carbon dioxide that is put through the Rock-Eval detector.

I hope this helps your assessment.

Best regards,

Dan

Humble Geochemical Services

Division of Humble Instruments & Services, Inc.

P.O. Box 789 • Humble, Texas 77347
218 Higgins Street • Humble, Texas 77338

Telephone: (281) 540-6050 Fax: (281) 540-2864 :Fax
E-mail: humble@humble-inc.com Web Site: http://www.humble-inc.com

Geochemical Services for Exploration, Development and Production

October 15, 1999

James Taylor
Canadian Forest Oil Ltd.
Suite 600-800-6th Avenue SW
Calgary, Alberta T2P 3G3
CANADA

Dear Dr. Taylor:

The following pages detail the TOC and Rock-Eval data for 19 samples, these results were faxed to you on October 7. Also included is an invoice for these services.

Please let me know if you have any questions or if I may be of further assistance.

Thank you for this opportunity to be of service.

Sincerely,

Daniel M. Jarvie (CB)

Daniel M. Jarvie

DMJ/cb

Total Organic Carbon (TOC) and Rock-Eval Report

CANADIAN FOREST OIL LTD.

REF: 1999 Northern Canada Field Trip
ATTN: James Taylor

HGS NO.	Serial No.	Sample # Interval or footage		Station	Location	Age	Formation	TOC AND ROCK-EVAL DATA TOC	S1	S2	S3	TMAX		INTERPRETIVE RATIOS HI	OI	S2/S3	PI	S1/TOC	NOTES Check	Pyrogram
18670	1	193		F99-S-1	Dusky	Silurian	Mt. Kindle	0.11	0.02	0.05	0.07	—	*	45	64	0.71	0.29	18	c	n
18671	2	410		F99-S-1	Dusky	Silurian	Mt. Kindle	0.14	0.02	0.07	0.26	361	*	50	186	0.27	0.22	14		n
18672	3	2390	2400	F99-S-1	Dusky	Silurian	Mt. Kindle	0.11	0.03	0.06	0.09	334	*	55	82	0.67	0.33	27		n
18673	4	2400	2410	F99-S-1	Dusky	Silurian	Mt. Kindle	0.11	0.04	0.09	0.14	375	*	82	127	0.64	0.31	36		n
18674	5	2410	2420	F99-S-1	Dusky	Silurian	Mt. Kindle	0.11	0.03	0.04	0.07	327	*	36	64	0.57	0.43	27		n
18675	6	2420	2430	F99-S-1	Dusky	Silurian	Mt. Kindle	0.11	0.05	0.07	0.18	332	*	64	164	0.39	0.42	45		n
18676	7	2430	2440	F99-S-1	Dusky	Silurian	Mt. Kindle	0.16	0.04	0.08	0.38	338	*	50	238	0.21	0.33	25		n
18677	8	2445		F99-S-1	Dusky	Silurian	Mt. Kindle	0.20	0.20	0.37	0.80	332	*	185	400	0.46	0.35	100	c	n
18678	9	0	10	F99-S-3	Tundra	Devonian	Funeral	0.27	0.00	0.00	0.57	—	*	0	211	0.00	—	0		n
18679	10	10	20	F99-S-3	Tundra	Devonian	Funeral	0.68	0.00	0.00	0.80	—	*	0	118	0.00	—	0		n
18680	11	20	30	F99-S-3	Tundra	Devonian	Funeral	0.24	0.00	0.00	0.19	—	*	0	79	0.00	—	0		n
18681	12	0	10	F99-S-4	North Prairie	Silurian	Road River	0.20	0.00	0.00	0.01	—	*	0	5	0.00	—	0		n
18682	13	10	20	F99-S-4	North Prairie	Silurian	Road River	0.24	0.00	0.01	0.12	—	*	4	50	0.08	0.00	0		n
18683	14	0	10	F99-S-5	North Prairie	Silurian	Road River	0.18	0.00	0.00	0.05	—	*	0	28	0.00	—	0		n
18684	15	10	20	F99-S-5	North Prairie	Silurian	Road River	0.29	0.01	0.01	0.02	—	*	3	7	0.50	0.50	3		n
18685	16	20	30	F99-S-5	North Prairie	Silurian	Road River	0.23	0.01	0.00	0.00	—	*	0	0	-----	1.00	4		n
18686	17	1		F99-S-6	Mine Airport	Silurian	Road River	0.71	0.00	0.03	0.25	341	*	4	35	0.12	0.00	0	c	n
18687	18	0	10	F99-S-7	Tetcela	Devonian	Horn River	1.87	0.07	0.02	0.59	—	*	1	32	0.03	0.78	4		n
18688	19	10	20	F99-S-7	Tetcela	Devonian	Horn River	2.68	0.01	0.03	1.55	—	*	1	58	0.02	0.25	0		n

199-738

* Tmax data not reliable due to low kerogen S2 value

TOC = weight percent organic carbon
S1,S2 = mg hydrocarbons/g rock
S3 = mg carbon dioxide/g rock
Tmax = °C

HI = S2*100/TOC
OI = S3*100/TOC
PI = S1/(S1+S2)
S1/TOC = S1*100/TOC

NOTES
Check
c = sample analysis confirmed
Pyrogram
n = normal

Humble Geochemical Services Division

KEROGEN QUALITY

Canadian Forest Oil Ltd.