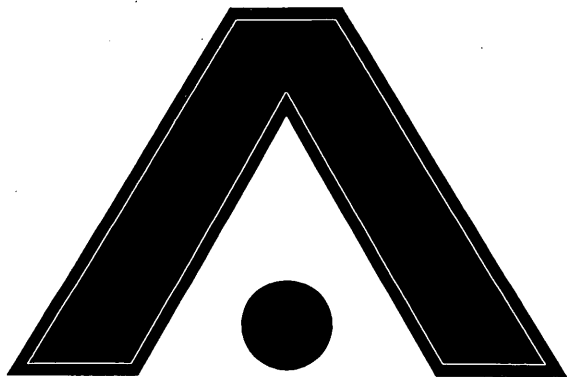


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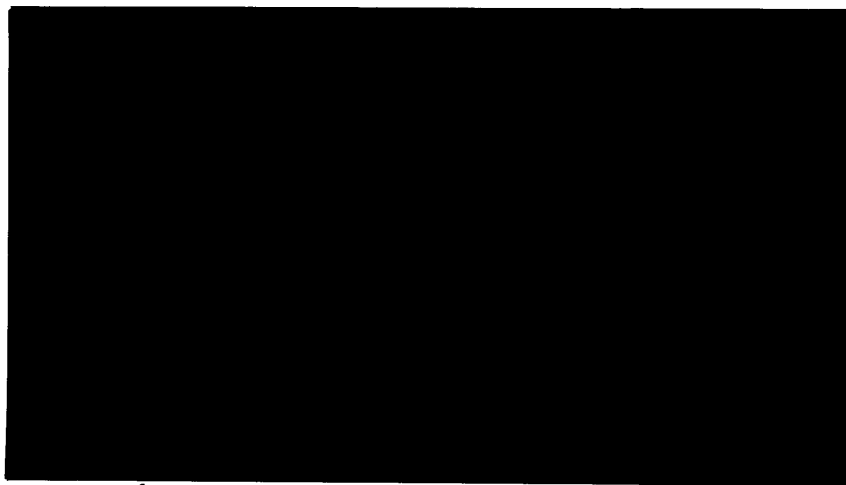
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(Page 2 of 21)



**DETAILED MODAL ANALYSIS and
PETROGRAPHIC PHOTOGRAPHY**

PETROLEUM DIVISION
BLACKBACK-A-1A

for **25 JAN 2000**

ESSO AUSTRALIA LTD

by

ACS LABORATORIES PTY LTD



6 July 1999

Esso Australia Ltd
Esso House
12 Riverside Quay
SOUTHBANK VIC 3006

Attention: Mr. R. J. Lyons

FINAL REPORT: 0419-01

CLIENT REFERENCE: Contract No. 2710080 RFS No. 5
MATERIAL: 9 plug sample offcuts
LOCALITY: Blackback A-1A
WORK REQUIRED: Detailed Modal Analysis
and Petrographic Photography

Please direct technical enquiries regarding this work to the signatories below under whose supervision the work was carried out.

A handwritten signature in black ink, appearing to read 'Peter Crozier', with a long horizontal line extending to the right.

PETER CROZIER
Operations Manager

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CONTENTS

<i>CHAPTERS</i>	Page
1. INTRODUCTION	1
2. METHODS	1
3. MODAL ANALYSIS RESULTS.....	2
4. REFERENCES	7

APPENDIX**I. PHOTOMICROGRAPHS**

1. INTRODUCTION

Esso Australia Ltd submitted 9 core sample off-cuts from Blackback A-1A well for a petrographic study involving detailed modal analysis (point count) and photomicrographs.

2. METHODS

Thin sections were cut perpendicular to the bedding plane. All samples were impregnated with blue-stained araldite prior to thin section preparation in order to facilitate porosity recognition. The modal composition for all samples was determined using standard techniques (Zuffa, 1985; Pettijohn et al. 1987) and image analysis using video camera.

All thin sections were stained with Alizarin Red-S and potassium ferricyanide to aid different carbonate assemblages identification (Dickson, 1965) and were stained with sodium cobaltinitrite to differentiate potassium feldspar from plagioclase (Lainz et al. 1964).

CHAPTER 3

MODAL ANALYSIS RESULTS

SAMPLE NUMBER	B1	B2	B3	B5	B6	B7	B8	B9	B10
Depth (m)	3172.50	3176.00	3178.00	3182.10	3185.08	3189.00	3194.50	3195.90	3196.90
Framework Grains (TOTFWG)									
QUARTZ (TOTQTZG)									
Mono (QZMO)	38.2	35.2	49.8	48.2	23.2	47.6	44.8	50.6	55.4
Poly (QZPO)	1.8	1.0	1.4	1.6	0.2	2.4	1.2	1.6	2.2
Undif. (QZUD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FELDSPAR (TOTFSP)									
K-Spar (KSKF)	8.8	7.6	12.2	13.8	9.2	10.2	8.2	10.4	9.8
Plag. (FSPL)	2.4	2.2	1.8	1.0	1.0	1.2	3.6	3.2	2.8
Plutonic (FSPR)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Intergrowths (FSIG)	0.2	0.2	0.0	0.0	0.0	0.0	Tr	0.0	0.2
Undif. (FSUD)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROCK FRAGMENTS (TOTRKF)									
SEDIMENTARY (TOTSRKF)									
Carbonate (RSCB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clay-Rich (RSCL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chert (RSCT)	1.0	1.2	0.8	0.6	0.8	0.8	0.2	0.6	0.6
Quartz-Rich (RSQZ)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (RSUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
METAMORPHIC (TOTMRKF)									
Mica-Poor (RMMP)	0.0	0.4	0.4	0.2	0.8	0.6	0.8	1.2	0.8
Mica-Rich (RMMR)	4.6	3.6	4.4	5.6	7.4	13.2	5.2	4.6	2.8
Undif. (RMUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VOLCANIC (TOTVRKF)									
Felsic (RVFS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mafic (RVMF)	1.4	2.8	1.4	2.4	2.6	1.4	2.0	1.4	1.2
Undif. (RVUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (RFUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SAMPLE NUMBER	B1	B2	B3	B5	B6	B7	B8	B9	B10
Depth (m)	3172.50	3176.00	3178.00	3182.10	3185.08	3189.00	3194.50	3195.90	3196.90
OTHER GRAINS (TOTOGS)									
Glaucony (OGGL)	10.2	9.6	5.4	5.2	4.6	1.6	5.8	8.8	6.8
Fossils & Shells (OGFL)	1.8	0.2	0.0	0.0	1.4	0.0	0.0	0.0	0.0
Heavy/Opaque (OGHV)	0.2	0.4	0.4	0.4	0.2	0.2	0.4	0.2	0.2
Biotite (OMBT)	1.2	2.2	2.4	2.6	3.0	2.4	1.2	2.8	1.6
Muscovite (OMMS)	2.8	1.6	1.8	1.4	2.4	1.8	1.0	1.6	1.2
Undif. Micas (OMUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphatic (OGPH)	0.4	0.4	Tr	0.0	0.4	Tr	0.0	0.0	0.0
Plant (OGPL)	1.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
UNDIFFERENTIATED (GRUN)									
TOTAL POREFILL (TOTPF)									
TOTAL MATRIX (TOTMXP)									
DETRITAL MATRIX (DEMTX)									
Carbonate (MXCB)	0.0	0.0	0.0	0.0	30.2	0.0	0.0	0.0	0.0
Clay (MXCL)	12.0	2.4	1.2	3.6	0.8	2.8	1.8	0.6	1.2
Organic (MXOR)	0.0	0.0	Tr	Tr	0.6	0.8	0.6	Tr	Tr
Siliceous (MXSI)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (MXUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUTHIGENIC CLAYS (TOTCLAY)									
Chlorite (CLCH)	0.0	2.0	1.2	1.8	Tr	1.2	1.2	0.8	1.2
Illite/Smectite (CLIS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kaolinite (CLKT)	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Undif. (CLUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL POREFILL CEMENTS (TOTPFCMT)									
CARBONATE CEMENTS (TOTCARB)									
Calcite (CBCA)	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
Dolomite (CBDO)	0.0	0.0	0.0	0.0	0.8	1.6	11.4	0.0	1.0
Siderite (CBSD)	0.0	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (CBUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SAMPLE NUMBER	B1	B2	B3	B5	B6	B7	B8	B9	B10
Depth (m)	3172.50	3176.00	3178.00	3182.10	3185.08	3189.00	3194.50	3195.90	3196.90
QUARTZ & FELDSPAR CEMENTS (TOTSIIL)									
Quartz (CMQZ)	0.0	0.8	0.2	Tr	0.0	0.2	1.0	0.2	0.4
Other Siliceous (CMSI)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feldspar (CMFS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER CEMENTS (TOTOCMT)									
Anhydrite/Gypsum (CMAN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydrocarbons (CMHC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrite (CMPY)	0.8	0.6	0.4	1.0	Tr	0.2	0.2	0.4	0.8
Iron Oxide (CM FE)	0.0	0.0	0.0	0.0	Tr	0.0	0.0	0.0	0.0
Zeolite (CMZE)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (CMUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REPLACEMENT (TOTREP)									
CARBONATE (TOTRCARB)									
Calcite (ICCA)	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Dolomite (ICDO)	0.0	0.2	0.0	0.0	4.0	0.2	0.8	0.0	Tr
Siderite (ICSD)	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (ICUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CLAYS (TOTCLAY)									
Chlorite (IRCH)	Tr	0.2	0.2	0.4	1.8	0.4	0.4	0.2	0.6
Kaolinite (IRKT)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Illite/Smectite (IRIS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (IRCL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SILICA (TOTRSILI)									
QTZ, CHERT, OPAL or Chalcedony (IRSI)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER (TOTORREP)									
Pyrite (IRPY)	5.4	2.8	3.2	3.0	3.2	1.2	1.4	1.6	2.2
Zeolite (IRZE)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Undif. (IRUN)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SAMPLE NUMBER	B1	B2	B3	B5	B6	B7	B8	B9	B10
Depth (m)	3172.50	3176.00	3178.00	3182.10	3185.08	3189.00	3194.50	3195.90	3196.90
POROSITY (TOTPORO)									
Primary Intergranular (PVIG)	4.0	4.8	8.8	5.8	Tr	6.2	5.2	6.2	4.8
Primary Intragranular (PVPR)	0.2	0.2	0.4	0.2	Tr	Tr	Tr	0.2	0.2
Fracture (PVFR)	0.2	Tr	0.4	0.2	Tr	0.2	0.2	0.4	0.4
Undif. (PVUN)	0.0	0.0	0.0	0.0	Tr	0.0	0.0	0.0	0.0
Secondary Intergranular (PVSE)	1.2	1.0	1.2	0.8	Tr	1.2	1.2	2.2	1.2
Secondary Intragranular (PVSC)	Tr	1.0	0.2	0.2	Tr	Tr	0.2	0.2	0.2

4. REFERENCES

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- Pettijohn, F. J., Potter, P. E. and Siever, R., 1987—*Sand and Sandstone*. New York, Springer-Verlag, 553 p.
- Zuffa, G. G., 1985—Optical Analysis of Arenites: Influence of Methodology on Compositional Results. In: Zuffa, G. G., (ed.), *Provenance of Arenites*, North Atlantic Treaty Organization (NATO), Advanced Study Institute Series, V. C. D. Reidel Publishing Company, Dordrecht, 168-189

APPENDIX I

PHOTOMICROGRAPHS

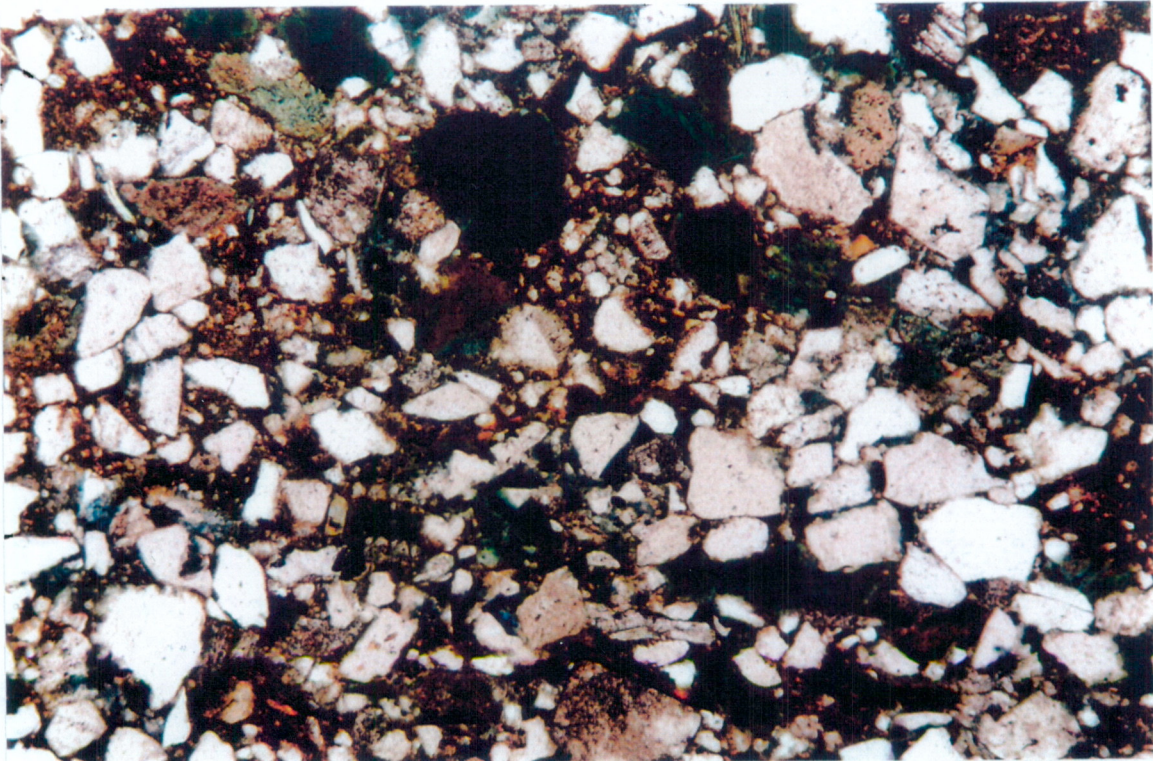


Plate 1: (Sample # B1, 3172.50 m): Thin section photomicrograph showing moderately sorted, angular to subrounded fine to medium-grained glauconitic sandstone. Visual porosity is very low due to the mechanical compaction and the presence of detrital depositional clay matrix. Plane polarised light. Scale bar = 500 μm .

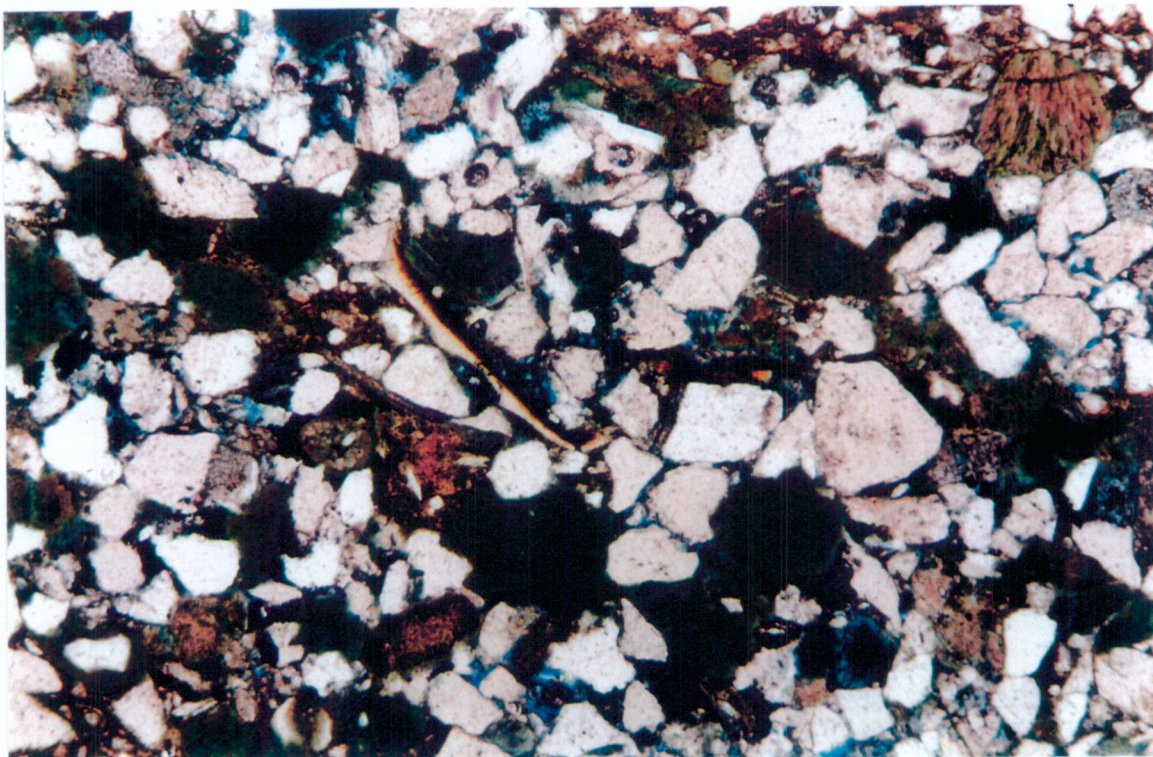


Plate 2: (Sample # B1, 3172.50 m): Thin section photomicrograph showing trace to minor visual porosity due to the presence of detrital matrix. Plane polarised light. Scale bar = 200 μm .

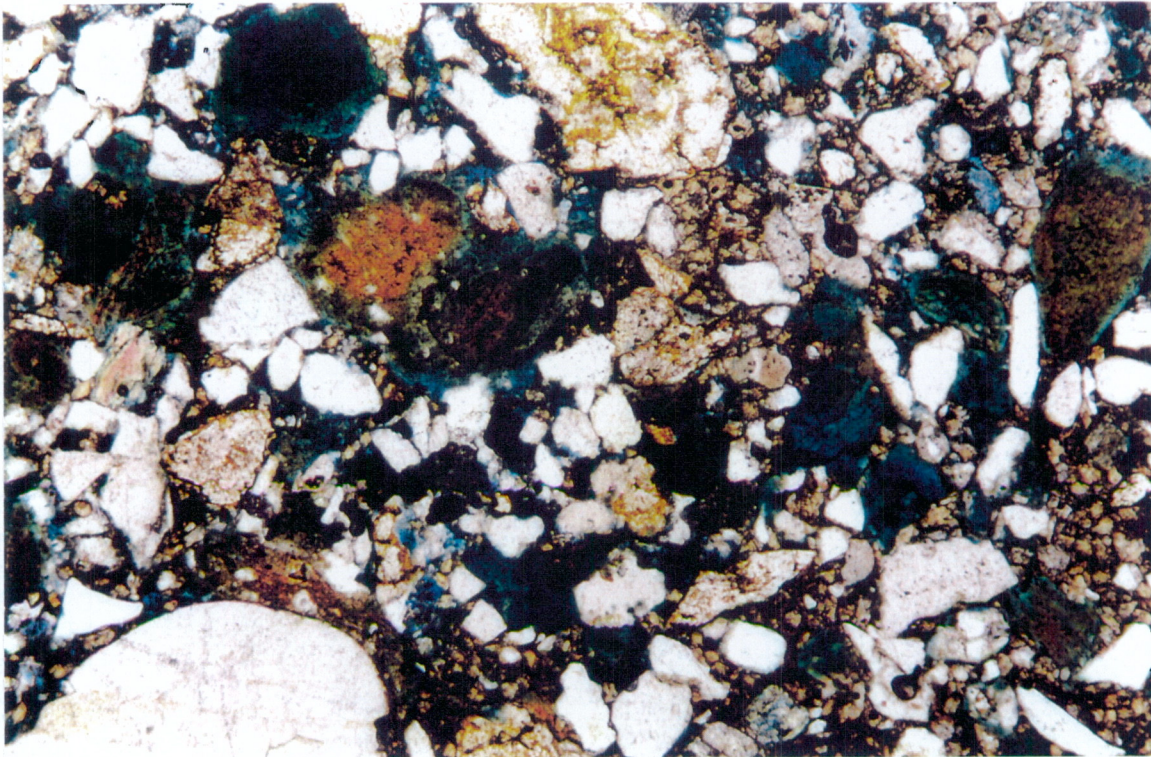


Plate 3: (Sample # B2 3176.00 m): Thin section photomicrograph showing glauconitic sandstone with abundant siderite cement. Siderite occurs as pore filling and as a replacive mineral. It replaces glaucony faecal pellets. Plane polarised light. Scale bar = 500 μm .

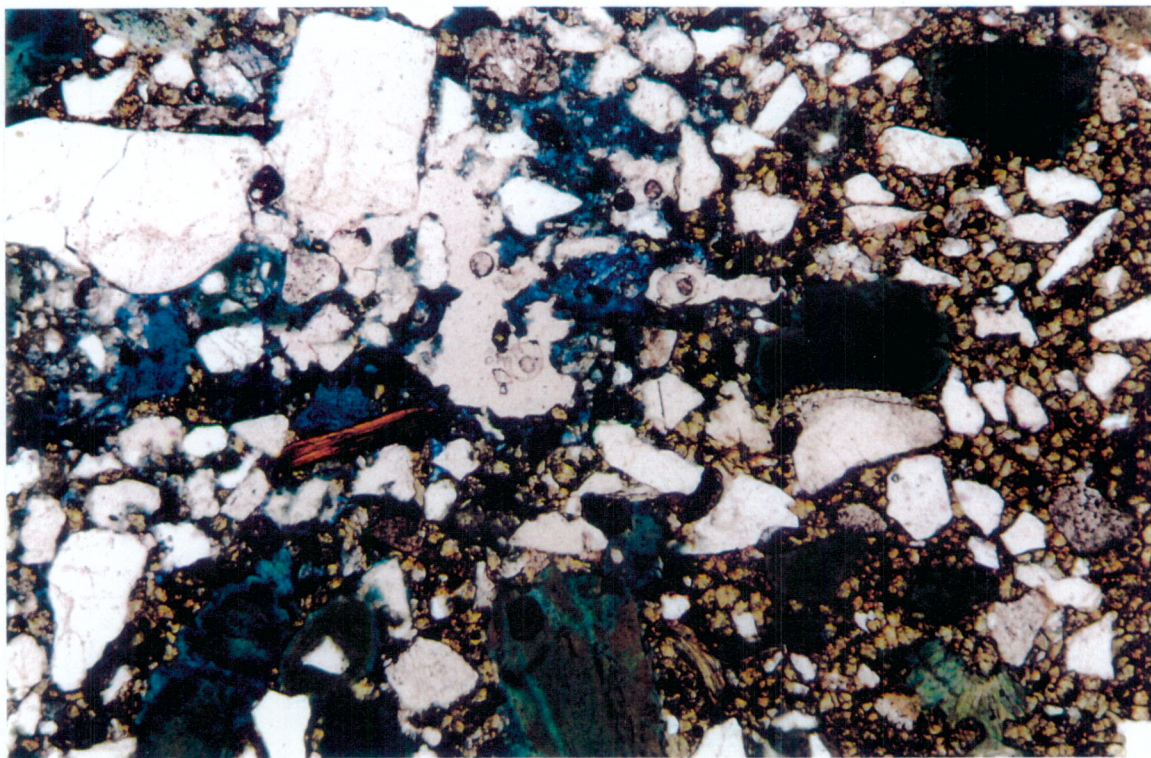


Plate 4: (Sample # B2 3176.00 m): Thin section photomicrograph showing minor amounts of visual porosity on the left side of the photo. Visual porosity on the right side is completely occluded by the presence of siderite cement. Plane polarised light. Scale bar = 500 μm .

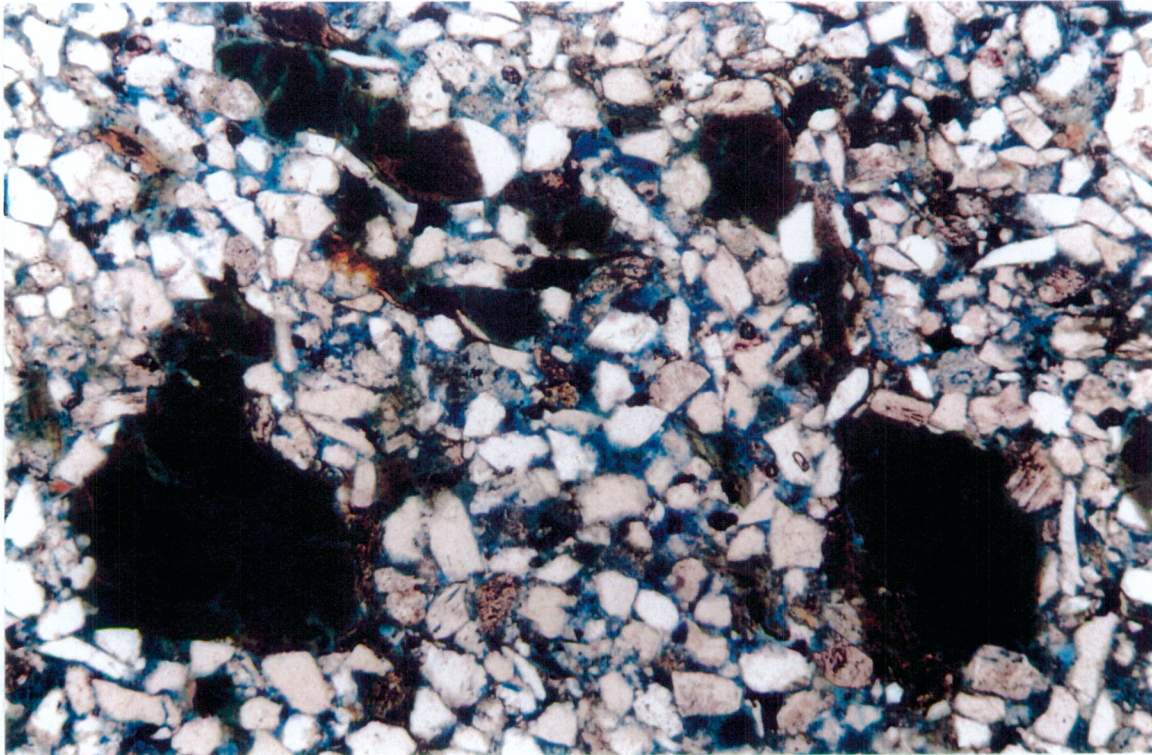


Plate 5: (Sample # B3, 3178.00 m): Thin section photomicrograph showing moderate amount of visual porosity. This sample contains less amounts of glaucony faecal pellets and detrital matrix. Plane polarised light. Scale bar = 500 μ m.

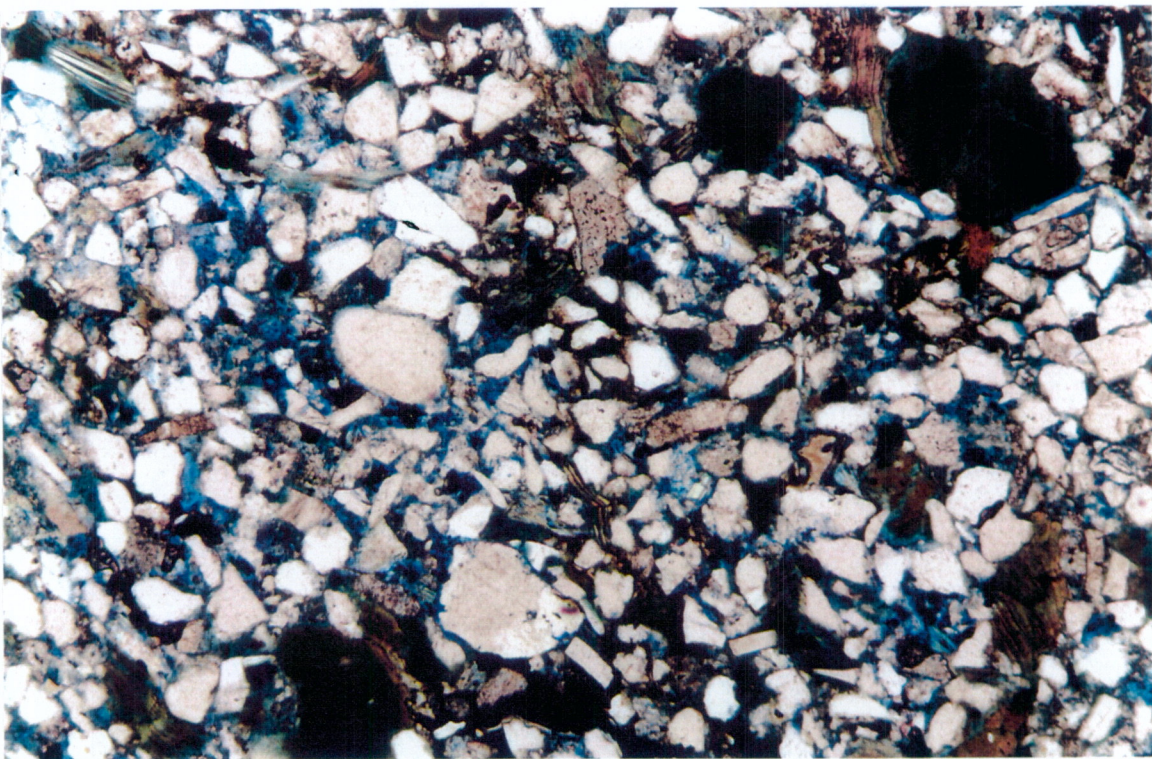


Plate 6: (Sample # B3, 3178.00 m): Thin section photomicrograph showing general view of the sample. The sample contains a higher proportion of visual porosity than the previous ones in the set. Note squeezed mica flakes and glaucony faecal pellets. Plane polarised light. Scale bar = 500 μ m.

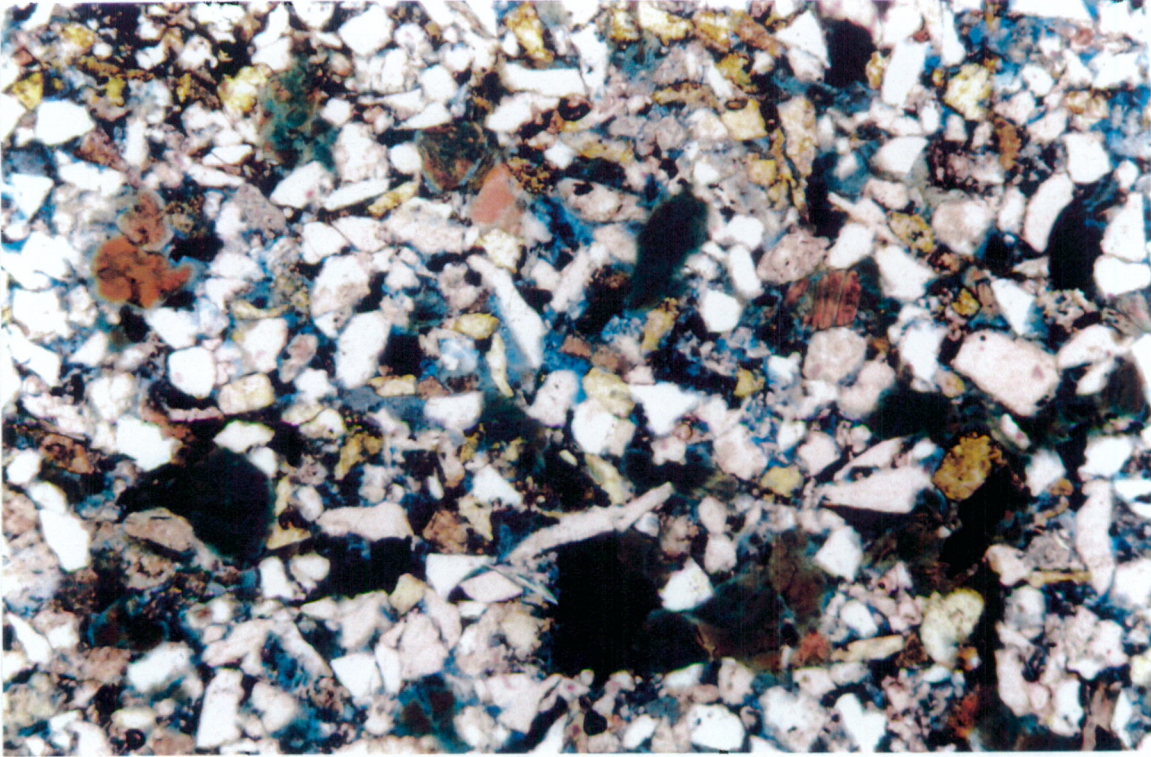


Plate 7: (Sample # B5, 3182.10 m): Thin section photomicrograph showing minor amounts of visual porosity and low glaucony. Note also that potassium feldspar (yellow) is a common framework component. Plane polarised light. Scale bar = 500 μm .

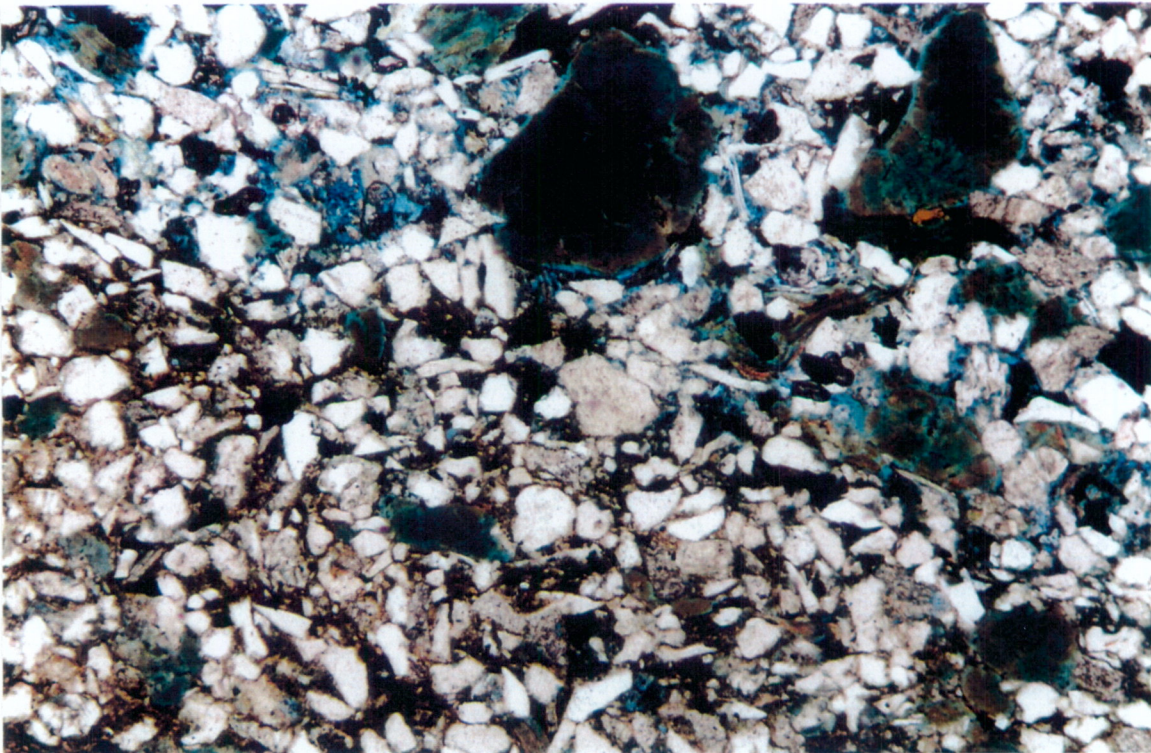


Plate 8: (Sample # B5, 3182.10 m): Thin section photomicrograph showing the border between the matrix rich part of the sample (lower half, with no visual porosity) and the clean part with considerable amounts of porosity. Plane polarised light. Scale bar = 500 μm .

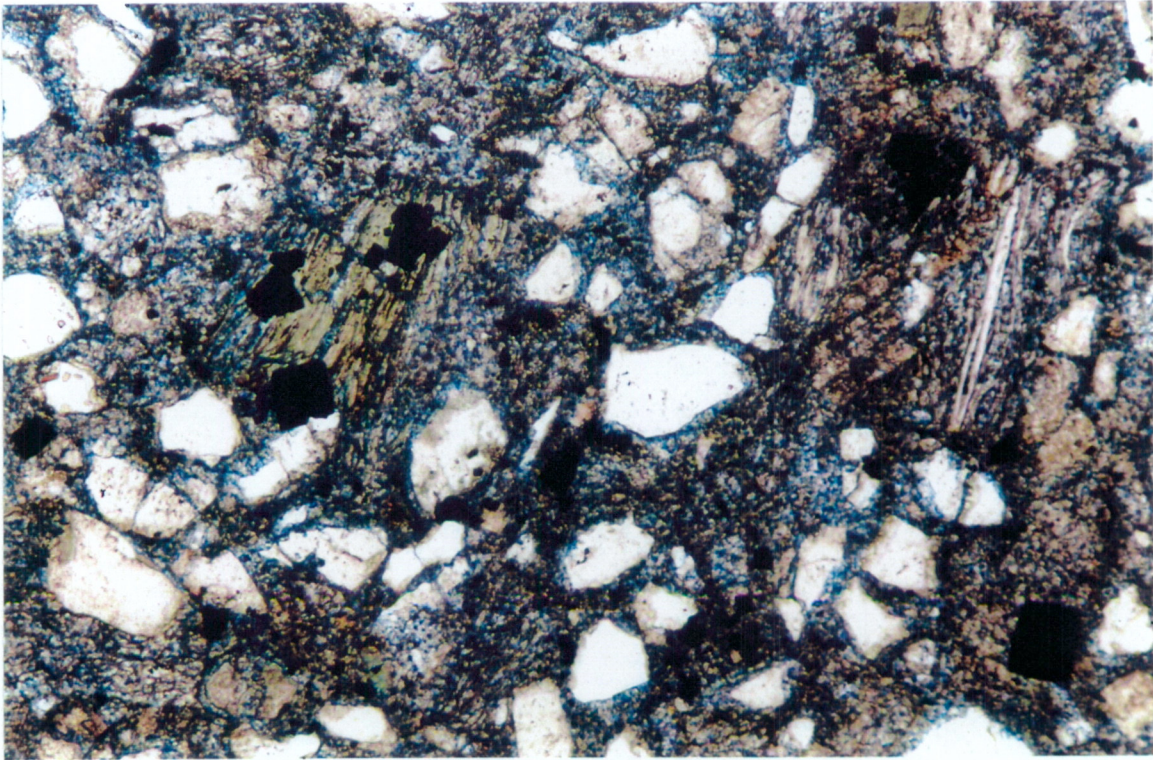


Plate 9: (Sample # B6, 3185.08 m): Thin section photomicrograph showing negligible amounts of visual porosity due to the cementation of carbonate. The sample is entirely cemented by ankerite (blue). Plane polarised light. Scale bar = 200 μm .

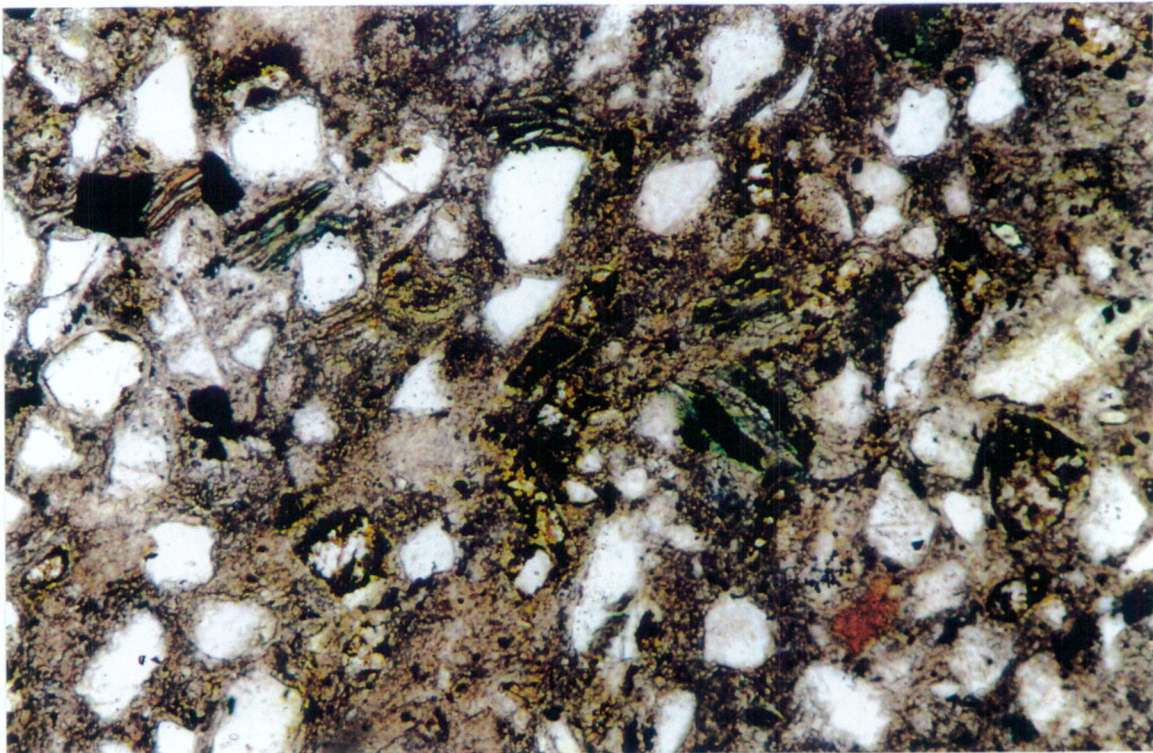


Plate 10: (Sample # B6, 3185.08 m): Thin section photomicrograph showing negligible amounts of visual porosity. The sample contains minor detrital matrix and a significant amount of ankerite cement to occlude the intergranular porosity completely. Plane polarised light. Scale bar = 200 μm .

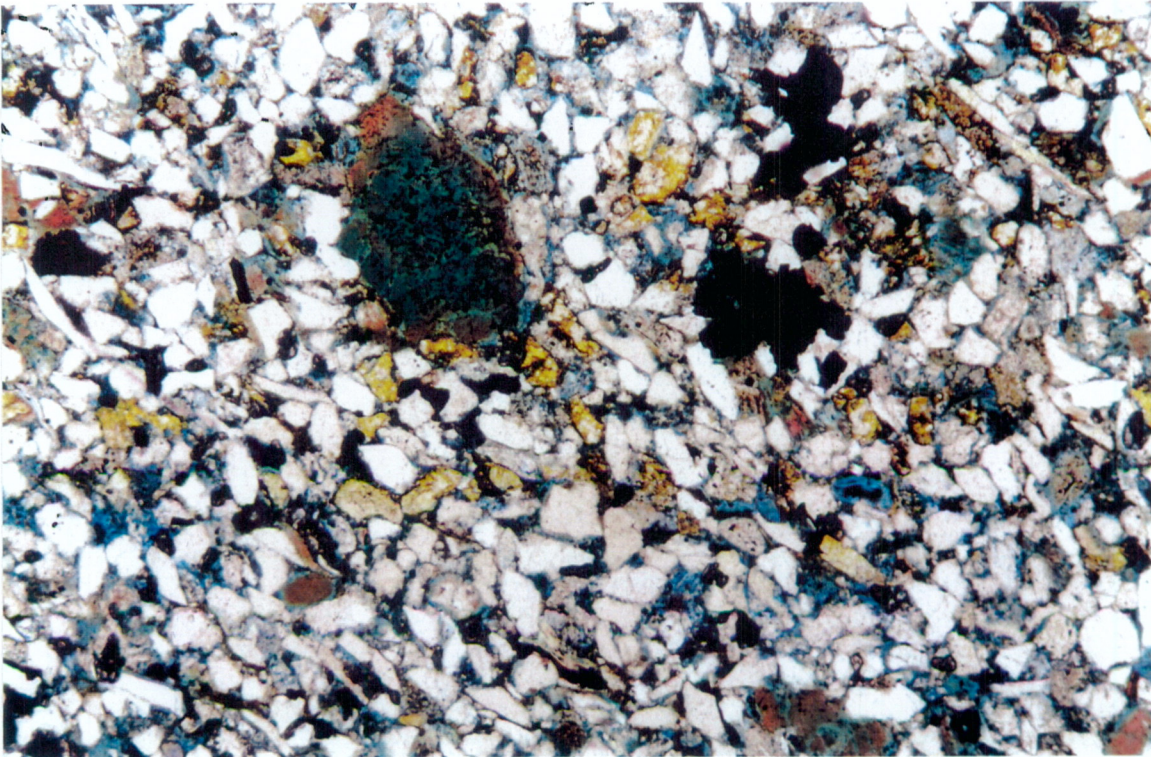


Plate 11: (Sample # B7, 3189.00 m): Thin section photomicrograph showing general view of the sample. The sample contains moderate amounts of visual porosity and less glaucony faecal pellets. Visual porosity occurs mostly as small triangles suggesting a primary intergranular origin. Plane polarised light. Scale bar = 500 μm .

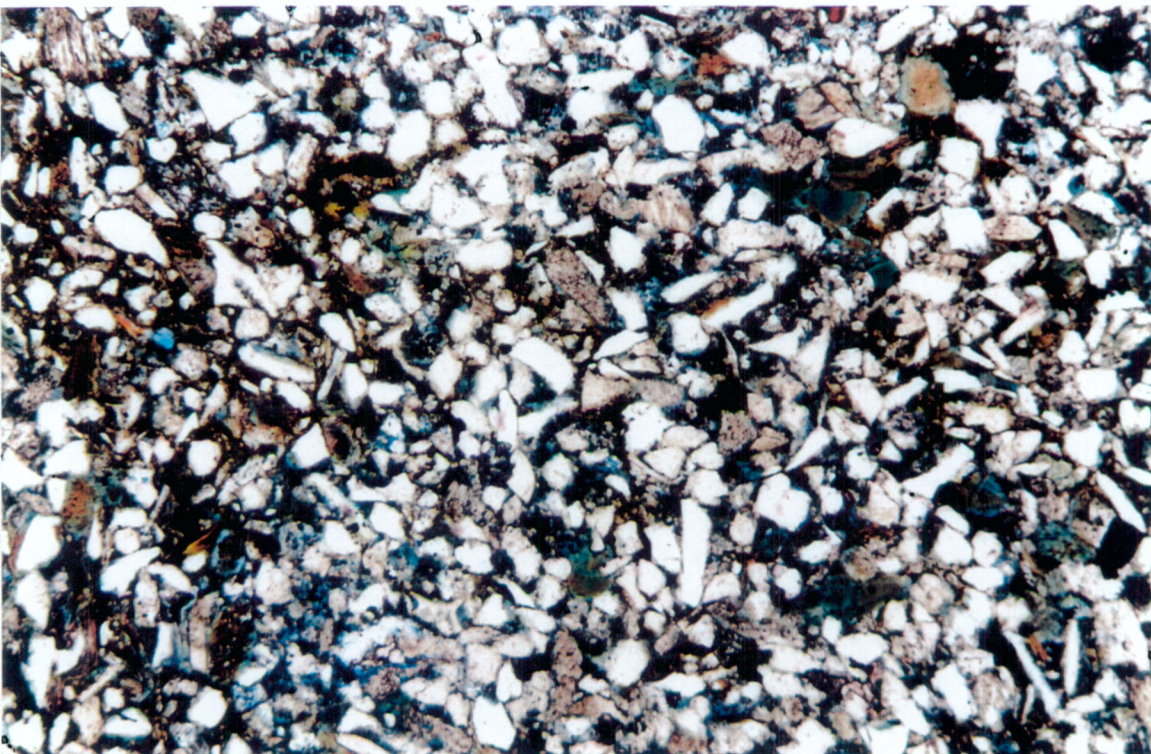


Plate 12: (Sample # B7, 3189.00 m): Thin section photomicrograph showing the dirty part of the sample (where depositional clay matrix is common). Note the visual porosity is much less than the cleaner part. Plane polarised light. Scale bar = 500 μm .

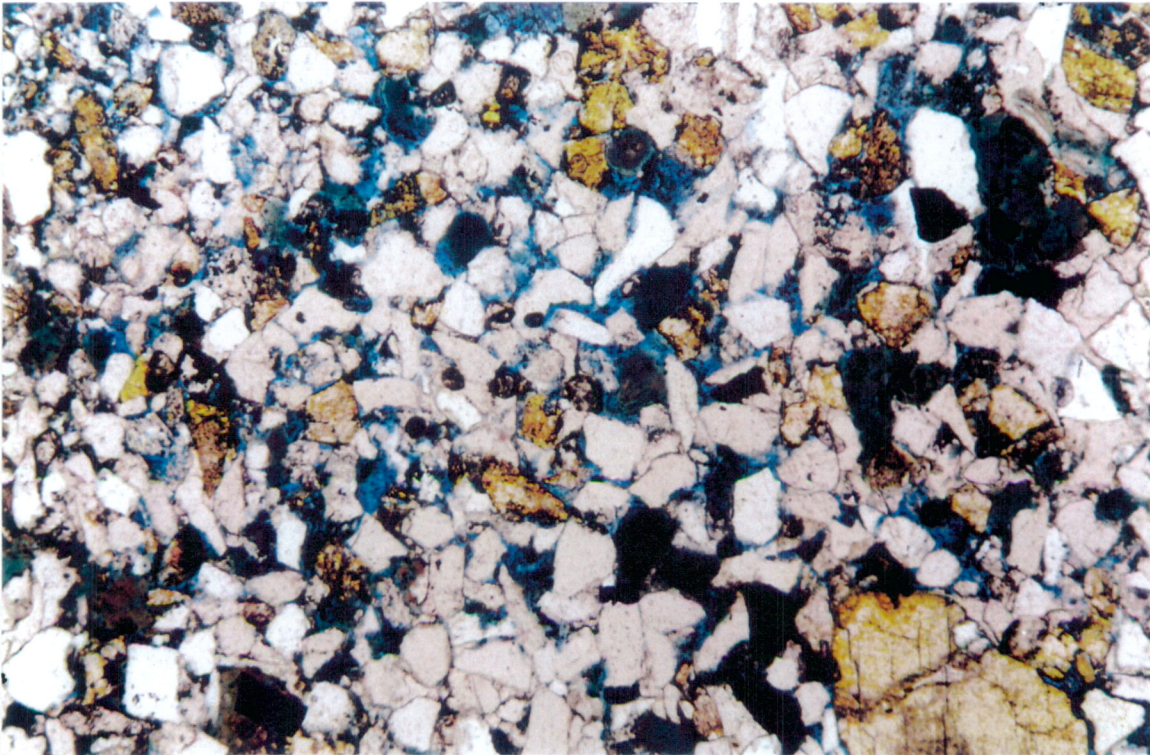


Plate 13: (Sample # B8, 3194.50 m): Thin section photomicrograph showing general view of the sample with considerable amounts of visual porosity. The sample contains a high proportion of potassium feldspar and less glaucony faecal pellets. Plane polarised light. Scale bar = 500 μm .

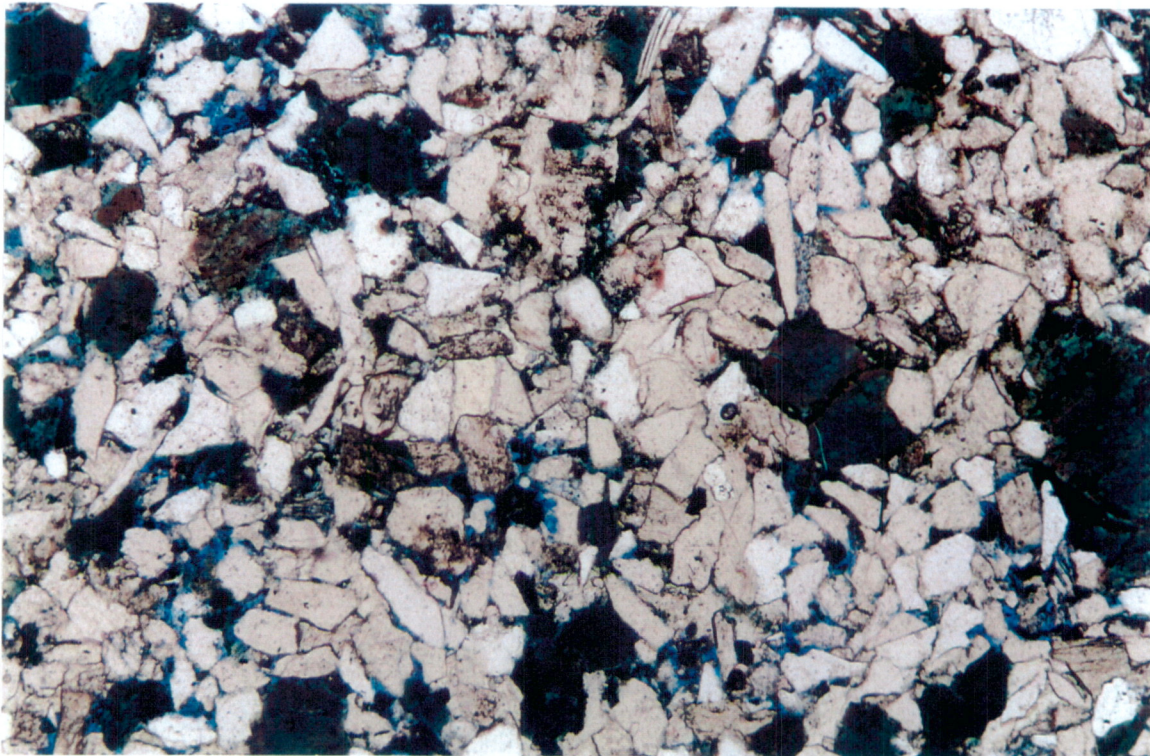


Plate 14: (Sample # B8, 3194.50 m): Thin section photomicrograph showing patchily distributed carbonate cement (ferroan dolomite to ankerite). Note that where carbonate cement is abundant visual porosity was largely occluded. Plane polarised light. Scale bar = 500 μm .

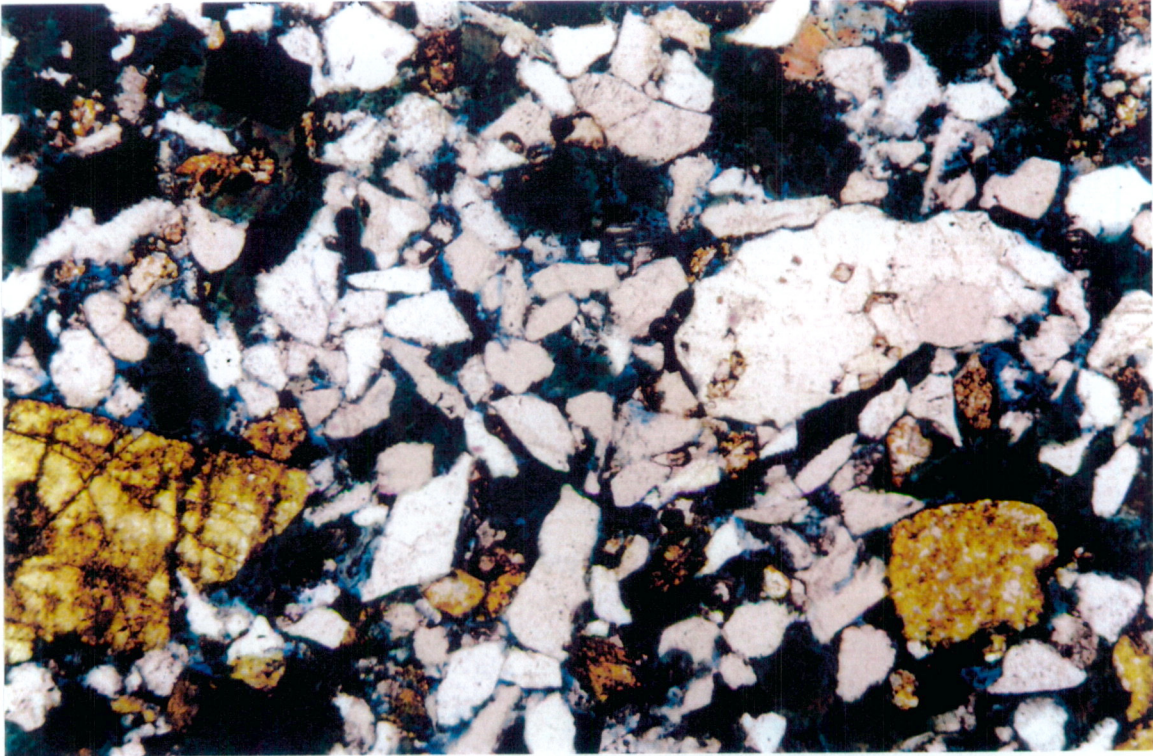


Plate 15: (Sample # B9, 3195.90 m): Thin section photomicrograph showing a general view of the sample. The sample is poorly to moderately sorted and contains moderate amounts of visual porosity. Visual porosity occurs mostly as small triangles suggesting a primary intergranular origin. Plane polarised light. Scale bar = 500 μm .



Plate 16: (Sample # B9, 3195.90 m): Thin section photomicrograph showing minor to moderate amounts of visual porosity. The sample also contains minor carbonate cement that reduced the visual porosity. Plane polarised light. Scale bar = 500 μm .

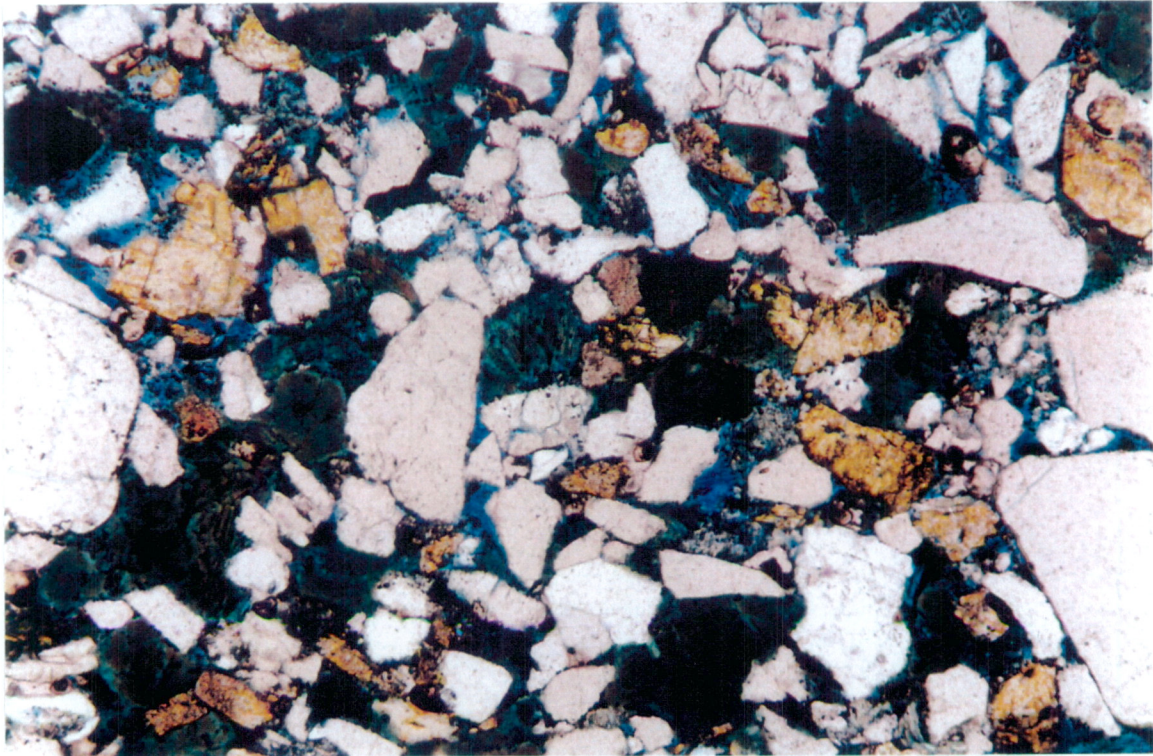


Plate 17: (Sample # B10, 3196.90 m): Thin section photomicrograph showing general view of the sample. This sample is similar to the previous one in the set and contains moderate to minor amounts of visual porosity. Plane polarised light. Scale bar = 500 μm .

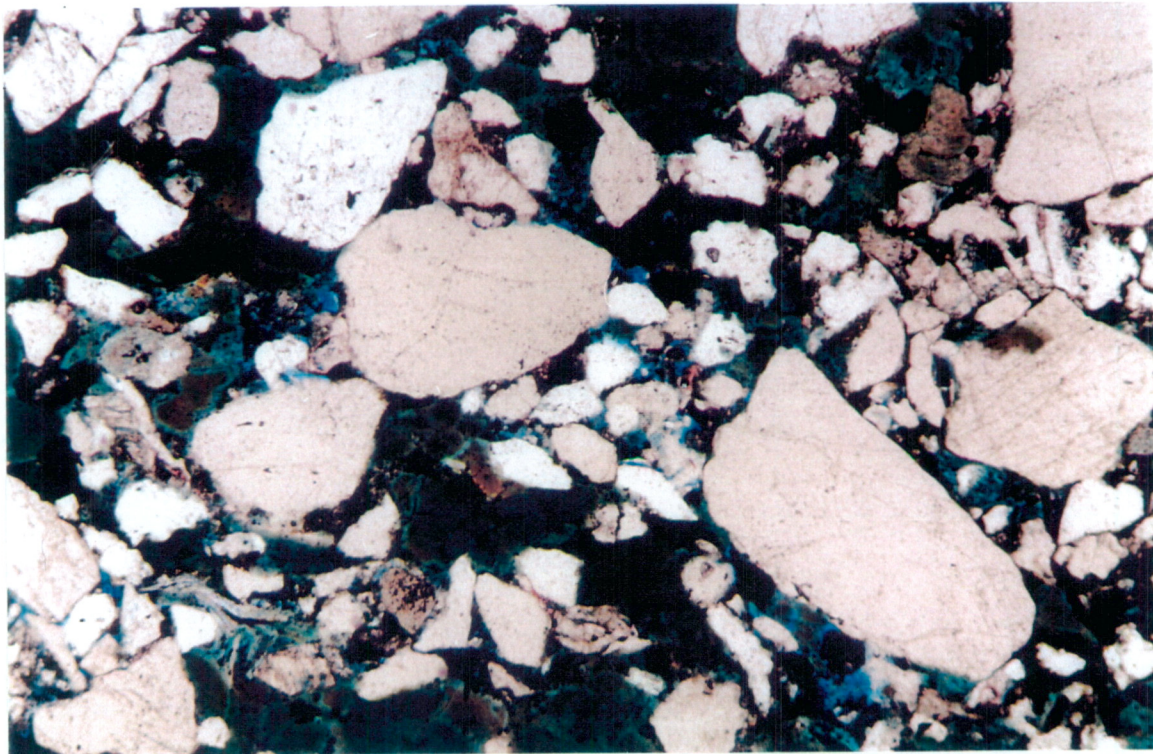


Plate 18: (Sample # B10, 3196.90 m): Thin section photomicrograph showing the poor texture nature of the sample. The sample contains minor amounts of glaucony and detrital depositional matrix that reduced the visual porosity. Both are squeezed between rigid grains. Plane polarised light. Scale bar = 500 μm .