

**Sedimentology, Sequence Stratigraphy and
Reservoir Quality of the Early Cretaceous
Murta Formation, Eromanga Basin,
Central Australia**

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Statement of Authenticity

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Homoud Al-Anzi
10/4/2008

To my parents and my family (*Zarefah, Deema and Basel*)

Abstract

The Eromanga Basin hosts the Early Cretaceous reservoir sediments of the Murta Formation and its basal McKinlay Member of prograding fluvio-lacustrine and deltaic origin that are characterized by low oil production and recovery factors which are heavily controlled by depositional facies. The integration of the concepts of facies associations, sequence stratigraphy and petrography enabled this study to map the continuity of the Murta Formation and to point out the effect of the diagenetic features on the reservoir quality. The diagenetic effects and spatial distribution of the depositional facies in the basin are essential in nominating locations of good quality reservoirs.

The aims of this study were: to characterize the chronostratigraphic depositional facies and distribution, to examine the affect of diagenesis on reservoir quality and to define those parts of the basin where potential reservoir sands are likely to be found.

A detailed analysis of depositional facies in the Murta Formation and its basal McKinlay Member was based on drill core analysis and regional wireline log correlations. The application of non-marine sequence stratigraphic concepts to the wireline logs and core description data have led to the identification of 7 chronostratigraphic units. This data was used in constructing a series of schematic palaeogeographic and isopach maps of the study area to predict the changes in depositional styles with time and space. Six depositional facies were identified in the study area with overall fine-grained sandstones, siltstones and mudstones. These depositional facies include; distributary channels, shoreline, protected shoreline, deltaic mouth bars, tempestites and turbidites deposits.

One particular unit, the transgressive systems tracts of the McKinlay Member, (Unit 7) is the best target for reservoir development because of relatively high proportion of pay sands, medium to coarse-grained sand sizes and good reservoir quality with low diagenetic affects. High stand systems tract units 2, 3 and 5 are considered to be secondary reservoir targets because of diagenetic affects and their fine-grained character. Units 1, 4 and 6 are not considered of economic value for oil production because of their extremely low reservoir quality and muddy lithologies.

The main diagenetic affects on sandstones (quartzarenites) in the study area are quartz overgrowths, formation of authigenic clay (kaolinite), carbonate cement (calcite and siderite), formation of microstylolites (pressure solution) and dissolution of the framework grains to form secondary pores.

The McKinlay Member of the Murta Formation in South Australia consists mainly of medium to coarse-grained sandstones of distributary channel origin (facies association 1). It has the highest recorded porosity and permeability (9.5% and 36.8mD respectively). Shoreline, protected shoreline, deltaic mouth bars and tempestites deposits, mainly from Jackson-Naccowlah Trend wells in Queensland, are of fine-grained sandstones (facies associations 2, 3, 4 and 5 respectively). They have adequate average porosity (7%), but the formation of microstylolites and associated mica parallel to the bedding planes inhibited vertical permeability and has been recorded to be as low as 3.1mD. Turbidites in the central basin are characterized by extremely low reservoir quality (2.6% and 0.25 mD) and muddy lithologies of facies association 6 that are severely degraded by diagenetic effects.

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TABLE OF CONTENTS

Abstract	I
Acknowledgments	III
Table of contents	IV
List of figures	VIII
List of tables	XII
List of abbreviations	XII
Chapter 1	Introduction and literature review
	1
1.1 Introduction	1
1.1.1 Rationale	1
1.1.2 Aims and significance	3
1.1.3 Objectives	3
1.1.4 Study area	4
1.1.5 Data support	5
1.1.6 Methodologies	6
1.1.7 Basin setting and tectonics	16
1.2 Literature review of Murta Formation	20
1.2.1 Definition of the Murta Formation	20
1.2.2 Murta Formation units	22
1.2.3 Sequence stratigraphy	24
1.2.4 Facies and reservoirs	26
1.2.5 Isopach maps and depositional models	28
1.2.6 Palaeoclimate and palaeogeography	31
Chapter 2	Sedimentology and facies analysis
	34
2.1 Review on lake sedimentation	34
2.2 Facies associations of the Murta Formation	37
2.2.1 Facies association 1	38
2.2.2 Facies association 2	42
2.2.3 Facies association 3	45
2.2.4 Facies association 4	47
2.2.5 Facies association 5	50
2.2.6 Facies association 6	54
2.3 Facies associations & depositional environments	57
2.4 Lake Murta sedimentation patterns & modern analogues	60

Chapter 3	Sequence Stratigraphy	67
3.1	Introduction	67
3.2	Lacustrine sequence stratigraphy	69
3.3	Murta Formation sequence stratigraphy	74
3.4	Description of chronostratigraphic intervals	78
3.4.1	Unit 7 (DC60-DC70)	78
3.4.2	Unit 6 (DC50-DC60)	84
3.4.3	Unit 5 (DC40-DC50)	88
3.4.4	Unit 4 (DC30-DC40)	94
3.4.5	Unit 3 (DC20-DC30)	100
3.4.6	Unit 2 (DC10-DC20)	107
3.4.7	Unit 1 (DC00-DC10)	112
Chapter 4	Petrographic Analysis	116
4.1	Introduction	116
4.2	Texture	117
4.2.1	Grain size	117
4.2.2	Sorting	118
4.2.3	Porosity, permeability and textural relationships	121
4.3	Composition	122
4.3.1	Quartz	125
4.3.2	Feldspar	127
4.3.3	Rock fragments (lithic)	129
4.3.4	Mica	129
4.3.5	Clay mineralogy	130
4.3.6	Carbonate and associated pyrite	132
4.3.7	Heavy minerals and opaques	134
4.4	Diagenetic features	135
4.4.1	Cementation	135
4.4.2	Formation of authigenic clays	137
4.4.3	Dissolution	141
4.5	Provenance Discussion and Interpretation	143
4.5.1	Discussion	143
4.5.2	Interpretation	145

Chapter 5	Reservoir Quality and Distribution	148
5.1	Introduction	148
5.2	Variations in reservoir quality	150
5.2.1	Non-reservoir sandstones	150
5.2.2	Secondary reservoir sandstones	151
5.2.3	Primary reservoir sandstones	152
5.3	Stratigraphic position of key reservoirs	155
5.3.1	Non-reservoir sandstones	155
5.3.2	Secondary reservoir sandstones	155
5.3.3	Primary reservoir sandstones	155
5.4	Variations in reservoir with geographic location	156
5.4.1	Non-reservoir sandstones	156
5.4.2	Secondary reservoir sandstones	156
5.4.3	Primary reservoir sandstones	157
Chapter 6	Discussion and Conclusions	158
References		161

Appendices

All the appendices are contained on the included CD-ROM. The CD-ROM files are in Microsoft word, document imaging, PowerPoint and Excel format.

Appendix 2.1: A detailed core description for all cored wells.

Appendix 2.2: Logging scheme.

Appendix 3.1: Definition of selected sequence stratigraphic terms.

Appendix 3.2: A-A' regional cross section from Harkaway Fault area in Queensland (N-NE) to Murteree Ridge in South Australia (S-SW).

Appendix 3.3: B-B' cross section through Tenaperra Trough, Murteree Ridge, Nappamerri Trough and Patchawarra Trough in South Australia.

Appendix 3.4: C-C' cross section through Patchawarra Trough, GMI Ridge and Tenaperra Trough in South Australia and part of SW Queensland.

Appendix 3.5: D-D' cross section of Jackson-Naccowlah Trend in Queensland.

Appendix 3.6: E-E' cross section of group of northeastern wells representing the thickest sand columns (sand input) in the study area close to Harkaway fault area in Queensland.

Appendix 4.1: Summary table of grainsize analysis showing grainsize in Phi and mm, degree of sorting and facies association of each sample.

Appendix 4.2: Standard grainsize chart, showing relationship between Phi (ϕ) and mm grain sizes.

Appendix 4.3: Facies associations probe permeability readings.

Appendix 4.4: Examples of silt content and permeability indirectly proportional relationship from all facies associations.

Appendix 4.5: A detailed thin section description/mineralogical results.

Appendix 4.6: Summary table of XRD analysis methods used in all facies associations.

Appendix 4.7: Clay mineralogy profile throughout the Cretaceous succession of Pelican 3 showing variations with depth.

LIST OF FIGURES

Figure 1.1: Geological summary of the Eromanga Basin.	2
Figure 1.2: Eromanga Basin location map.	4
Figure 1.3: Five regional cross sections across the Eromanga Basin showing the Murta Formation cored wells in South Australia and Queensland.	7
Figure 1.4: Regional log correlation between Gamay-1 in South Australia and Talgeberry-2 in Queensland showing Murta Formation key surfaces and units.	8
Figure 1.5: McKinlay-1 well (4086-4120') as an example of core to log correlation.	10
Figure 1.6: Example of Murta DC60-70 unit (McKinlay Mbr. of Murta Formation).	11
Figure 1.7: Schematic palaeogeographic map of Murta DC40-50 unit showing two sand inputs in Lake Murta.	13
Figure 1.8: Structural elements of the Cooper/Eromanga Basins.	16
Figure 1.9: Cross section through the Eromanga Basin.	18
Figure 1.10: Location of the Eromanga Basin hydrocarbon discoveries in the Cooper region.	19
Figure 1.11: Stratigraphic subdivision and lithologic features from Strzelecki-4 drill-log interpretation, McKinlay Member and Namur Sandstone type section.	21
Figure 1.12: West to east cross section from Nockatunga-5 to Thungo-4 showing Murta Member M1 to M6 units and Namur Sandstone Member N1 and N2 units.	22
Figure 1.13: Murta Formation units from: (A) Dullingari North-1 well, (B) Dullingari-9 well, (C) Nockatunga-3 well, and (D) Dullingari-40 well.	25
Figure 1.14: Murta Member lithofacies, Dullingari 9 and Jackson 1 (Ambrose <i>et al.</i> , 1986).	27
Figure 1.15: Generalised regional lithofacies interpretation, Murta Member, southern Eromanga Basin.	28
Figure 1.16: Isopach map of the Murta Member, southern Eromanga Basin.	29
Figure 1.17: Generalised depositional model, Murta Member, southern Eromanga Basin.	29
Figure 1.18: Murta Formation depositional model in southeastern Eromanga Basin.	31
Figure 1.19: Australia's position in the Early Cretaceous.	32
Figure 1.20: Palaeogeographic change through the Jurassic to Cretaceous.	33
Figure 2.1: Lake response to various forms of physical input.	36
Figure 2.2: Depositional elements in a hydrologically-open, freshwater lake.	36
Figure 2.3: Fluvial-dominated delta and its depositional elements.	40
Figure 2.4: Facies association-1 core photographs.	41

Figure 2.5: Facies association-2 core photograph.	43
Figure 2.6: Offshore profile locating foreshore, shoreface, and offshore.	44
Figure 2.7: Stratal characteristics of an upward-coarsening parasequence. This type of parasequence is interpreted to form in a beach environment on a sandy, fluvial or wave dominated shoreline.	44
Figure 2.8: Bioturbated “wave rippled” laminated sandstone of facies association-3.	46
Figure 2.9: Stratal characteristics of an upward coarsening parasequence. This type of parasequence is interpreted to form in a deltaic environment on a sandy, fluvial or wave dominated shoreline.	48
Figure 2.10: Facies association-4 core photographs.	49
Figure 2.11: Block diagram of hummocky cross stratification.	52
Figure 2.12: Facies association-5 core photographs.	53
Figure 2.13: Facies association-6 core photographs.	56
Figure 2.14: A conceptual diagram for the Murta Formation facies associations including the McKinlay Member.	59
Figure 2.15: Distribution mechanism and resulting sediment types proposed for clastic sedimentation in lacustrine environment.	62
Figure 2.16: Depositional patterns associated with friction-dominated river-mouth outflow.	62
Figure 2.17: Schematic diagram highlights major features of overfilled lake basins.	63
Figure 2.18: Fluvial-dominated delta example from Selenga River delta of the southeastern part of Lake Baikal.	65
Figure 2.19: The Kalawereena terminal splay complex in the dry of July 2003 looking SE.	66
Figure 3.1: Sediment accommodation space and its relationship to eustatic sea level and tectonic uplift and subsidence.	67
Figure 3.2: Lithostratigraphic and sequence stratigraphic interpretations of a gamma ray (GR) log.	68
Figure 3.3: Interplay between accommodation space and sediment supply.	70
Figure 3.4: Relationship between sediment+water supply and total subsidence rate and the resulting lake basin type.	72
Figure 3.5: The position of key surfaces in relation to systems tracts and their relationship to the ratio of accommodation to sediment supply.	73
Figure 3.6: Murta Formation sequence stratigraphy elements from Dullingari-40 well.	76
Figure 3.7: A regional cross section from Harkaway Fault area in Queensland (N-NE) to Murteree Ridge in South Australia (S-SW).	77

Figure 3.8: Isopach map overprint of Unit-7 with log profiles.	81
Figure 3.9-A: Schematic palaeogeographic map of Unit-7 representing the deposition of the McKinlay Member of the Murta Formation associated with the first transgression in Lake Murta.	82
Figure 3.9-B: Schematic palaeogeographic map of the upper McKinlay Member of the Murta Formation before the Maximum Flooding Surface (MFS).	83
Figure 3.10: Isopach map of Unit-6 to represent a high degree of accommodation or high rise in lake level.	86
Figure 3.11: Schematic palaeogeographic map of Unit-6 during the first Maximum Flooding Surface (MFS) of Lake Murta.	87
Figure 3.12: Isopach map overprint with log profiles that show a shallowing lake character of Unit-5.	91
Figure 3.13-A: Schematic palaeogeographic map of Unit-5 to illustrate the shallowing in Lake Murta.	92
Figure 3.13-B: Schematic palaeogeographic map of the localized incised valley fill cutting the lower part of Unit 4.	93
Figure 3.14: Lake Murta Isopach map shows a return to a deep lake conditions after flooding.	97
Figure 3.15-A: Schematic palaeogeographic map of the lower part of Unit-4 directly before flooding of the lake.	98
Figure 3.15-B: Schematic palaeogeographic map of the upper part of Unit-4 defining the second 3 rd order Maximum Flooding Surface MFS in Lake Murta.	99
Figure 3.16: Idealized sequence produced by regression in siliciclastic-dominated, hydrologically open lake, eastern Karoo Basin.	102
Figure 3.17: Contrast in timing of play-element deposition between lake types.	103
Figure 3.18: Isopach map of Unit-3.	104
Figure 3.19-A: Schematic palaeogeographic map of the lower part of Unit-3 directly after the second 3 rd order Maximum Flooding Surface (MFS) in Lake Murta.	105
Figure 3.19-B: Schematic palaeogeographic map of the upper part of Unit-3.	106
Figure 3.20: Isopach map of Unit-2 showing thick sediments deposited in the southwest part of the study area.	109
Figure 3.21-A: Schematic palaeogeographic map to characterize the deposition in early stages of Unit-2.	110
Figure 3.21-B: Schematic palaeogeographic map representing the deposition of sediments during late Unit-2.	111
Figure 3.22: Isopach map of Unit-1 during the maximum rise of the lake base level with little sediment input.	114

Figure 3.23: Schematic palaeogeographic map representing the deposition of muddy sediments during Unit-1.	115
Figure 4.1: Photomicrograph of associations 1 and 6. Carbonate cement with associated pyrite seen under cross polar light from Three Queens-1 @ 4809’.	119
Figure 4.2: Visual comparators for random sections through log-normally distributed sets of spherical grains.	120
Figure 4.3: Summary chart of mineralogy results from each facies association.	123
Figure 4.4: Summary histograms for each constituent identified in every facies association.	124
Figure 4.5: Classification of Murta Formation sandstones.	126
Figure 4.6: Well-developed rhombohedral crystal faces of quartz overgrowths seen under plane polar light from Merrimelia-6 @ 5185’ (facies association 1).	128
Figure 4.7: Petrographic images of feldspars in the Murta Formation.	128
Figure 4.8: Petrographic images of lithic grains in the Murta Formation.	131
Figure 4.9: Petrographic identification of carbonate minerals in the Murta Formation.	133
Figure 4.10: XRD traces show mineralogical abundances and diagenetic effects on a representative sample of each facies association.	136
Figure 4.11: Petrography of facies associations 1 and 2.	138
Figure 4.12: Petrographic identification of pore-lining clays in the Murta Formation.	140
Figure 4.13: Factors influencing porosity and permeability in the Murta Formation.	142
Figure 4.14: Provenance ternary plot of the Murta Formation sandstones.	146
Figure 4.15: Geographic provenance ternary plot.	147
Figure 5.1: Summary histograms of porosity readings from all facies associations.	154
Figure 5.2: Summary histograms of permeability readings from all facies associations.	154
Figure 5.3: Location map of the primary and secondary reservoir sandstones	158

LIST OF TABLES

Table 2.1: Summary table of facies associations of the Murta Formation with lithology and sedimentary structures interpretation.	37
Table 2.2: Representative attributes of three major lacustrine facies associations.	64
Table 2.3: Characteristics of lake-basin types: strata, source facies, and hydrocarbons.	64
Table 4.1: Grainsize averages for each facies association in the Murta Formation.	118
Table 4.2: Sorting classification, based on the standard deviation of the grain size (ϕ).	118

LIST OF ABBREVIATIONS

GR.....	Gamma Ray
DT.....	Sonic log
Sm.....	Massive sandstone
Sb.....	Bioturbated sandstone
Sr.....	Rippled sandstone
Ss.....	Storm sandstone
Sh.....	Laminated sandstone
Sd.....	Deformed sandstone (storm reworking)
St.....	Trough cross bedded sandstone
Stt.....	Thin sand sheets
Fl.....	Laminated mud
Fb.....	Bioturbated mud
F.A.....	Facies Association
LST.....	Low Stand System Tract
TST.....	Transgressive Stand System Tract
HST.....	High Stand System Tract
FS.....	Flooding Surface
TS.....	Transgressive Surface
MFS.....	Maximum Flooding Surface
mMFS.....	minor Maximum Flooding Surface
SB.....	Sequence Boundary
Q.....	Quartz
F.....	Feldspar
M.....	Mica
K.....	Kaolinite
I.....	Illite
S.....	Siderite
C.....	Calcite
D.....	Dolomite
XRD.....	X-Ray Diffraction
SEM.....	Scanning Electron Microscope