



Nubian Consulting

Petroleum Systems &
Play Fairway Analysis
Of the
Murzuq Basin, SW Libya

Updated EPSA IV(3) Version
January 2007

**PETROLEUM SYSTEM AND PLAY
FAIRWAY ANALYSIS OF
THE MURZUQ BASIN**

An assessment of the hydrocarbon exploration potential in the central and southern part of the Murzuq Basin with emphasis on the Tanezzuft-Haouaz/Memouniat petroleum system.

Prepared by
NUBIAN CONSULTING

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Summary

This report presents a comprehensive regional geological analysis of the Murzuq Basin, SW Libya. Recently available stratigraphic and structural information has been combined in an empirical reconstruction of the basins history, to identify three discrete petroleum systems. Each of these had a complex history of expulsion, migration, entrapment and dispersal of hydrocarbons through intermittent periods of uplift, exhumation and reburial. The northern petroleum system is now at a fairly mature stage of exploration. A large number of oil and gas fields have been already discovered with combined reserves of over 2.5Bbbls in middle to late Ordovician (Haouaz/Memouniat Formations) sandstone reservoirs. In distinct contrast, the central and southern part of the basin has been largely ignored over the last twenty years, with only a few scattered wells and limited seismic. Logistic constraints, remote location and technical uncertainty about the southern extent of the basal Silurian source responsible for the oil and gas fields to the north, have so far discouraged significant exploratory activity in this south-central part of the basin,. However the regional petroleum systems analysis included in this report, has highlighted its potential, with the possibility of oil reserves similar or greater than those found to the north. Analogue field size distributions adjusted for rather more favourable geological conditions suggest mean play reserves of 1.25MMbbls are quite possible. Comparatively few giant fields have been found anywhere in the world over the last few years. Even on a global basis, the south-central Murzuq stands out as one of exceptional promise.

Exploration interest in the central and southern Murzuq, revived in August 2004 with the announcement of the first EPSA IV licensing round. Three large blocks 131, 163 and 177 of between 10,381 -11317 sq kms were offered, in the central and southern part of the basin. These were eventually awarded to Occidental and Chevron in early 2005. Two (163 and 177) are in the south-east, located in a favourable position for charge, from a now proven Silurian basal Tanezzuft source just to the west. The chance of encountering flowing hydrocarbons was estimated to be 0.22-0.25, based upon a systematic risk assessment of the Tanezzuft-Memouniat/Haouaz play identified on the two blocks.

The second EPSA IV round was announced in May 2005. Six Murzuq blocks or grouped blocks 146-1, 147-3 and 4, 161-1, 161-2 and 4, 176-3 and 176-4 were offered, with a bid

deadline of early October that year. A revised and updated version of this regional analysis incorporating critical new data, suggested Blocks 176-3 and 176-4 immediately to the west of EPSA IV(1) Blocks 163 and 171, might be exceptionally well placed, with even greater blue sky exploration potential. The chance of successfully testing flowing hydrocarbons was assessed at 0.24. The blocks were awarded to Hydro, Turkish Petroleum, ENI and Japex. Although they were a quarter to a third the size of the first round licences, they attracted far more aggressive bids. Blocks 146-1 and 147-3/4 received most attention, perhaps because of their proximity to existing discoveries.

The third EPSA IV round was announced in the summer of 2006, with four blocks in the larger Murzuq region on offer. These comprised Blocks 162-1 and 162-2 in the deepest, central part of the basin and 113-3 and 113-4 on the Atshan Arch to the north, with a bid deadline of 20th December 2006. Blocks 162-1/2 are well positioned in the optimum play fairway highlighted by this analysis, but their potential is somewhat discounted by their relatively small size. In contrast, Blocks 113-3 and 113-4 lie in a well explored region of severe post-charge uplift and unroofing, with a correspondingly reduced chance of success. The two grouped blocks were awarded to CPC and Inpex respectively. Additional acreage elsewhere in the basin will be offered in future EPSA IV rounds. The region immediately to the south of Blocks 161-1/2 and 176-3 extending across the border into Niger holds most promise, with other perhaps less attractive areas in the north central and northern part of the basin.

Any assessment of this kind is of course weakly constrained and so inevitably rather subjective at a local or prospect specific level. Nevertheless it is based upon a comprehensive regional perspective, with critical insights into more general geological trends and controls governing Palaeozoic hydrocarbon distribution on the Saharan Platform. Consequently it should provide a robust framework with which to rank exploration opportunities within the Murzuq Basin and compare with competing prospects elsewhere.

A reconnaissance economic analysis of a notional 1.0Bbbl field in the larger south-central Murzuq, suggests a commercially attractive project. On the basis of 'reasonable assumptions', a field or field cluster of this size might generate an NPV of US\$280-340MM with a ROR of over 20%

List of Contents

CHAPTER 1	1
Introduction	
1.1 Aims and Objectives	1
1.2 Structure of the Report	7
1.3 History of Oil and Gas Exploration in Libya	9
1.4 Status of Recent Libyan Licence Rounds	12
CHAPTER 2	21
Regional Hydrocarbon Environment of south-eastern Algeria and Western Libya	
2.1 Regional Stratigraphic and Structural History	21
2.2 Palaeozoic-Sourced Petroleum Systems, Central North African Platform	29
2.3 Comparative Analysis: Eastern Algeria/Western Libya Petroleum Province.....	31
2.4 Critical factors controlling oil and gas entrapment and preservation.	43
CHAPTER 3	47
Murzuq Basin: Hydrocarbon Environment	
3.1 Petroleum Exploration in the Murzuq Basin	47
3.2 Northern Murzuq Basin Fields: Exploration Analogues	52
3.3 Structural and Stratigraphic History of the Murzuq Basin	63
3.31 Pre-Cambrian- early Cambrian Succession	68
3.32 Cambrian to middle Ordovician Supersequence	68
3.33 Late Ordovician (Hirnantian) to Silurian Supersequence	70
3.34 Devonian-Carboniferous Supersequence	95
3.35 Early-Middle Mesozoic Supersequence	104
3.36 Middle-late Cretaceous and lower Tertiary	107
3.4 Reservoir Characteristics: Distribution and Quality	112
3.41 Memouniat and Haouaz Reservoirs	112
3.42 Intra-Tanezzuft tempestite and turbidite sandstones	120
3.43 Devonian Reservoirs	122
3.5 Source Facies: Distribution and Quality	122

3.6	Oil Families and Oil-Source Correlations	126
3.7	Seal Rocks	127
3.8	Trapping Styles	128
3.9	Source Maturation: Empirical Generative Basin Modelling	129
3.91	METHODOLOGY	129
3.92	MATURATION AND EXPULSION	139
3.10	Post-charge Modification: Preservation versus Dispersal	141
 CHAPTER 4		148
Petroleum Systems Analysis		
4.1	ATSHAN PETROLEUM SYSTEM I	152
4.2	SOUTH-CENTRAL PETROLEUM SYSTEM II	155
4.3	GHAT PETROLEUM SYSTEM III	163
 CHAPTER 5		166
Exploration Opportunities		
5.1 EPSA IV(3) Licence Round Blocks		166
5.11	EPSA IV(3) CPC Blocks 162-1 and 162-2 (3757 km ²).....	167
5.12	EPSA IV(3) Inpex Blocks 113-3 and 113-4 (5494 km ²).....	168
5.13	EPSA IV(3) Tatneft Blocks 98-2 and 98-4 South Ghadamis Basin (5218 km ²) .	172
5.2 Residual Open Acreage		173
5.21	Atshan Saddle (former M13, G06 & NC190 area), Northern Murzuq	173
5.22	NC174 Relinquishment, north central Murzuq.....	176
5.22	Brak Bin Ghanimah Arch (former M07 Area), Central Northeast Murzuq.....	180
5.23	Southwestern Murzuq.....	183
5.24	Southern Murzuq (and northern Djado Basin).....	187
5.25	Eastern Murzuq and dor El Gussa Trough (former M09, M10 & M11 area)	190
5.3 First EPSA IV License Round and Block Evaluation		191
5.31	EPSA IV(1): Occidental Block 163 (11,236 km ²)	191
5.32	EPSA IV(1): Chevron Block 177 (11317 km ²)	196
5.33	EPSA IV(1): Occidental Block 131 (10381 km ²)	198
5.4 Second EPSA IV License Round and Block Evaluations.....		202
5.41	EPSA IV(2): Hydro Block 146-1:Tiririne Arch (2444 km ²).....	202

5.42	EPSA IV(2): Turkish Petroleum Blocks 147-3 & 4 (2270 km ²).....	204
5.43	EPSA IV(2): ENI Blocks 161-1(2750 km ²) & 161-2/4 (3900 km ²).....	207
5.44	EPSA IV(2): ENI Block 176-3 (2750 km ²) & Japex Block 176-4 (2750 km ²).....	209
 CHAPTER 6		212
Southern Murzuq Model Play Concept: Geological Evaluation		
6.1	Geological Chance of Success	212
6.2	Play Reserves	216
6.3	Chance of finding mean play reserves	218
 CHAPTER 7		219
Southern Murzuq Play Concept: Commercial Evaluation		
7.1	Exploration Programme Assumptions and Costs	219
7.2	Appraisal Programme Assumptions and Costs	220
7.3	Development Programme Assumptions and Costs	221
7.4	Economic Assessment: alternative models	222
 CHAPTER 8		227
Contractual and Fiscal Analysis		
8.1	Historical Background.....	227
8.2	EPSA I (1974 – 1980).....	228
8.3	EPSA II (1981 - 1987)	229
8.4	EPSA III (1988 to 2004)	230
8.6	EPSA IV (2004)	232
 CHAPTER 9		236
OPEC Regulations and Production Cap		
 CHAPTER 10		239
Conclusion		239

Bibliography	243
Appendix 1: Elephant Oil Field, F-NC174	257
Introduction	257
Bir Tlacsin (Reservoir Zone 1)	260
Memouniat (Reservoir Zones 2, 3 and 4)	260
Haouaz Formation (Reservoir Zone 7)	261
Tanezzuft ‘hot’ Shale Source Rock Distribution	261
Appendix 2: Ordovician Reservoir Characteristics	264
Appendix 3: DATABASE	278
Appendix 4: Reconnaissance ECONOMIC ANALYSIS	280

LIST OF ENCLOSURES

- 1 Solid (pre-Pleistocene) Geological Map: Murzuq-Djado Basin
- 2 Satellite Image of Major Geological Features: Murzuq-Djado Basin
- 3 Database: well logs, scout data, open-file outcrop and seismic control
- 4 Regional N-S Structural Section, Ghadamis and Murzuq Basin, Western Libya.
- 5 Regional E-W Structural Section, Central Murzuq Basin
- 6 Regional E-W Structural Section, Southern Murzuq and Djado Region, SW Libya and Niger
- 7 Top Basement Time Structure (Sikander 2003, after Bell and Sikander 1997)
- 8 Top Cambro-Ordovician Time Structure (Sikander 2003, after Bell and Sikander 1997)
- 9 Top Devonian Time Structure (Sikander 2003, after Bell and Sikander 1997) Top Ordovician Depth Structure (metres subsea)
- 11 Palaeozoic Stratigraphic Correlation: Western Margin of the Murzuq Basin
- 12 Palaeozoic Stratigraphic Correlation: Southern Margin of the Gargaf Arch
- 13 Lower Palaeozoic Stratigraphic Correlation, Djado Sub-Basin, Niger.
- 14 Generalized regional distribution and thickness of Late Ashgillian low-stand sequence (metres). Bir Tlacin, Memouniat, Tasghart and Melaz Chograne Formations.
- 15 Stratigraphic architecture of the Ashgillian-basal Silurian succession, western flank of the Murzuq Basin
- 16 Regional Distribution of Tanezzuft Shale Formation and Basal 'hot' Shale Source Facies.
- 17 Lower Silurian) Thickness and Basal 'hot' Shale Distribution: Tanezzuft Formation (Llandovery – S₁)
- 18 Upper Silurian Distribution and Thickness: Acacus Formation (Wenlockian to Ludlovian? – S₂)
- 19 Top Ordovician to top Silurian Thickness
- 20 Lower Devonian Distribution and Thickness: Tadrart and Oaun Kasa Formations (Seigenian to Emsian/intra-Eifelian - D₁)
- 21 Top Ordovician to top Lower Devonian Thickness

- 22 Middle-Upper Devonian Distribution and Thickness: Aouinet Ouenine Formation (intra-Eifelian to Famennian - D₃₋₂)
- 23 Middle-Upper Devonian Stratigraphic Correlation: Southern flank of the Qarqaf Massif
- 24 Top Ordovician to top Devonian Thickness
- 25 Lower to Upper Carboniferous Distribution and Thickness: M'rar , Assedjefar and Dembaba Formations (Upper Tournaisian to Westphalian - C₁₋₃)
- 26 Top Ordovician to top Westphalian Thickness
- 27 Upper Carboniferous Distribution and Thickness: Tiguentourine Formation (Stephanian – C₄)
- 28 Top Ordovician to top Carboniferous Thickness
- 29 Basin Margin Unconformities: Hercynian, base Jurassic and base Cretaceous Erosional Unroofing Events.
- 30 Stratigraphic Correlation: Austrian Unconformity and late Cretaceous Transgressive (onlap) Sequence: Atshan Saddle, Northern Gargaf and the Dor El Gussa Trough
- 31 Austrian (intra-Aptian) Unconformity and Restored Upper Cretaceous-early Tertiary Transgressive (onlapping) Sequence.
- 32 Regional Hercynian Unconformity to Lower Cretaceous Thickness: Restored thicknesses preceding and following Austrian unroofing, Ghadamis and Murzuq Basins.
- 33 Top Ordovician to top Lower Cretaceous (intra-Aptian) Thickness: Reconstructed thickness preceding Austrian erosional unroofing.
- 34 Top Ordovician to top Lower Cretaceous (intra-Aptian) Thickness: Reconstructed thickness following Austrian erosional unroofing.
- 35 Regional Late Cretaceous to Early Tertiary (Eocene) Thickness: Restored thickness preceding mid to late Tertiary unroofing, Ghadamis and Murzuq Basins.
- 36 Top Ordovician to Eocene Thickness: Reconstructed thickness preceding mid-late Tertiary erosional unroofing.
- 37 Estimated Maximum Uplift and Erosional Unroofing: Reconstructed from well maturity profiles.
- 38 Top Ordovician to Surface Total Thickness
- 39 Top Ordovician Estimated Maximum Burial Depth: Restored depths from top Ordovician-Surface thickness corrected for uplift/erosional unroofing.
- 40 Middle-Late Ordovician (Haouaz and Memouniat Formations) Aquifer.

- 41 Pre-Austrian (Tanezzuft –Memouniat/Haouaz) Petroleum Systems
- 42 Pre-mid/late Tertiary (Tanezzuft –Memouniat/Haouaz) Petroleum Systems
- 43 Composite (Tanezzuft –Memouniat/Haouaz) Petroleum Systems Synthesis
- 44 Bocks 147-3 and 147-4: Haouaz Play Trend, Central Murzuq
- 45 Play Trend Map, Southern Murzuq, SW Libya
- 46 Oil and Gas Pipelines, Western Libya
- 47 Libya Licence Map 2005

Note: The information used in compiling this report was often ambiguous and sometimes conflicting. Where possible, it was tested by comparison with alternative independent sources, but the assessment on which is it based is necessarily only weakly constrained and speculative in part.