

**PETROLEUM SYSTEMS
OF TUNISIA, EASTERN ALGERIA
AND WESTERN LIBYA**

**REGIONAL PETROLEUM GEOCHEMISTRY
OF CRUDE OILS FROM TUNISIA, EASTERN
ALGERIA AND WESTERN LIBYA**

GEOMARK
RESEARCH, INC.

A PROSPECTUS

EXECUTIVE SUMMARY

GeoMark Research, Inc. has recently completed a regional crude oil study of the Mediterranean. This study consists of the detailed geochemical analysis of 300 oil samples located throughout the southern Europe and North Africa. The study is being offered on a non-exclusive basis to participating companies.

One of the most interesting portions of this report was the combined detailed evaluation of the Tunisia, eastern Algeria and western Libya. Due to the large number of samples collected from this area and the exploration significance of the results, we have elected to offer this portion of the study as a separate report. We ask that you review the following proposal and consider participation.

Each of the oils from the region (a list is provided in Appendix A) was characterized by a detailed analytical program which includes quantitative biomarker analysis of terpanes and steranes and determination of stable carbon isotope composition of both saturate and aromatic hydrocarbon fractions. This information, integrated with a geological synthesis, allowed us to accomplish the following:

- Determine the number of genetically distinct oil families in the region.
- Map the stratigraphic and geographic distribution of the oil families and distinguish areas with single oil families (single sources) from those with multiple oil families (multiple sources).
- Utilize geochemical characteristics of the oil families to deduce their source facies, thermal maturity level, and degree of preservation.
- Determine the most likely source unit(s) in each basin by comparing the distribution of oil families and their inferred source facies with regional stratigraphy, and available source rock data.
- Estimate migrational directions by comparing oil family distributions with the location of known oil kitchens.
- Utilize the geographic, stratigraphic, and structural distribution of source rocks and genetically related oils to identify, map, and rank the petroleum systems in each basin and in the region as a whole.
- Identify underdeveloped and/or undiscovered exploration opportunities.

All of the analytical data generated from the oils have been compiled along with an interpretive report. The interpretive report includes full color, wall-size maps showing the distribution of oil family and associated petroleum systems.

The study is immediately available to participating companies. The cost of the study is US\$15,000.00.

INTRODUCTION

The purpose of the study was to geochemically evaluate crude oil samples from Tunisia, eastern Algeria and western Libya in order to predict source rock depositional environments, related oil families, thermal histories, and probable subsurface migrational directions. The field locations of the fifty-three (53) crude oil samples included in this study are shown in Figure 1. A detailed sample list is presented in Appendix A.

The samples analyzed for this study represent the end products of hydrocarbon generation, migration, and entrapment which has occurred within this which is one of the most prolific hydrocarbon-bearing regions in North Africa. A further understanding of the region, specifically the multiple petroleum systems operating in the area, is essential to future successful exploration efforts.

METHODOLOGY AND EXPLORATION APPLICATIONS

Crude oils from the entire region were geochemically evaluated in order to 1) determine the number and members of genetically related families: 2) predict the depositional environment and/or other characteristics of the corresponding source rock units, and 3) determine the thermal history of oils within each family. All the oils were analyzed with respect to bulk (e.g., API Gravity, % Sulfur, metal content), molecular (e.g., n-paraffin, sterane, and terpane biomarkers) and stable carbon isotopic parameters. The results were assessed using multivariate techniques including cluster and principal component analyses.

The results of this study have enabled us to develop an understanding of the source history of this portion of North Africa. This new understanding will enhance future exploration efforts in the region, and we feel confident, become the basis for the future development of the region.

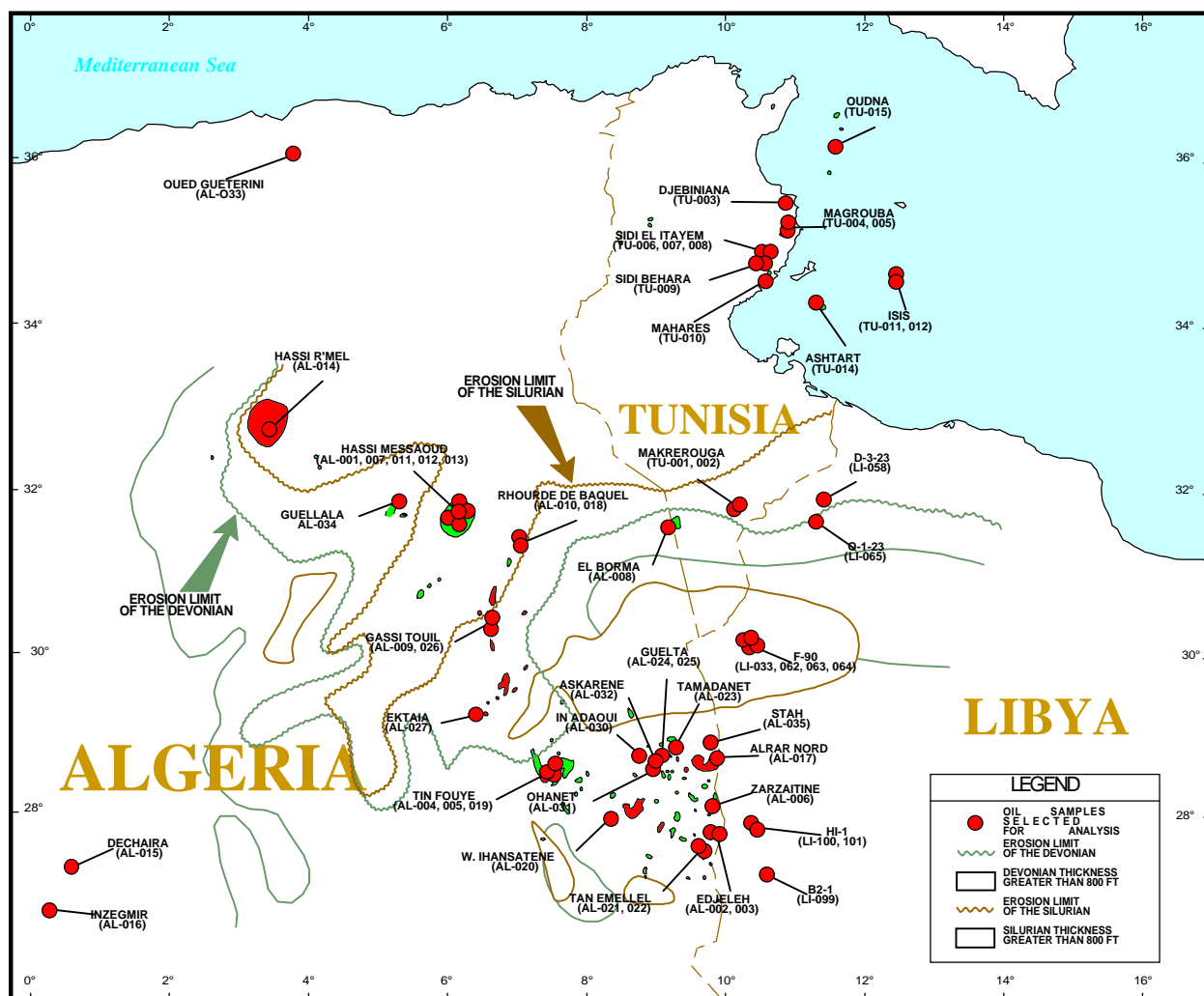


Figure 1. Location map showing distribution of samples analyzed for this study.

ANALYTICAL PROGRAM

The following techniques were employed on each of the oil samples:

- API Gravity
- % Sulfur
- C15+ vs. <C15+
- Deasphalting
- Liquid Chromatography (%Sat %Aro %NSO)
- Capillary GC of Whole Crudes
- Stable Carbon Isotopes for both Sat and Aro Hydrocarbon Fractions
- GC/MS of Saturates for Terpane/Sterane Distributions (quantitative)

PRESENTATION OF RESULTS

Results of the study are presented in both analytical and interpretive formats to insure that all findings are readily accessible to explorationists and research personnel. All of the analytical data are provided in hard copy and on personal computer disks. Raw data results of the whole oil chromatographic and gas chromatographic/mass spectrographic results are available on mini-tape cassettes.

Analytical data are presented within **Section Data Volumes**, and include the following:

- physical property data
- liquid chromatographic data
- gas chromatographic results
- stable carbon isotope data
- GC/MS mass chromatograms

A synthesis and interpretation of all information is presented in a comprehensive **Final Report**. For each of the areas studied, the **Final Report** includes sections for:

- regional geology
- differentiation of oil families by multivariate statistics
- inferred oil/source correlations
- oil generation and migration
- interpretation of oil characteristics
- overall exploration potential

PARTICIPATION

The cost of the study is US 15,000.00. The reports are complete and available for immediate delivery.

FOR ADDITIONAL INFORMATION CONTACT:

Mr. Stephen W. Brown
GeoMark Research, Inc.
9748 Whithorn Drive
Houston, TX 77095

Telephone: (281) 856-9333
Fax: (281) 856-2987

E-mail: sbrown@geomarkresearch.com

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APPENDIX A

Samples Analyzed for the Algeria-Tunisia Study

Basin	Well	Country	Basin	Well
Bas Sahara	Hassi Messaoud-15	Algeria	Saharan Atlas	Oued Gueterini
Ghadames	Edjeleh	Algeria	Bas Sahara	Guellala
Ghadames	Edjeleh	Algeria	Illizi	Stah?
Ghadames	Tin Fouye	Tunisia	Bas Sahara	Makrerouga-1
Ghadames	Tin Fouye	Tunisia	Bas Sahara	Makrerouga-1
Ghadames	Zarzaitaine	Tunisia	Sahel	Djebiniiana-1
Bas Sahara	Hassi Messaoud	Tunisia	Sahel	Magrouba-1
Bas Sahara	El Borma	Tunisia	Sahel	Magrouba-1
Bas Sahara	Gassi Touil-6	Tunisia	Sahel	Sidi el Itayem-1
Bas Sahara	Rhourde el Baguel-605	Tunisia	Sahel	Sidi el Itayem-3
Bas Sahara	Hassi Messaoud	Tunisia	Sahel	Sidi el Itayem-27
Bas Sahara	Hassi Messaoud	Tunisia	Sahel	Sidi Behara-1
Bas Sahara	Hassi Messaoud	Tunisia	Sahel	Mahares-1
Bas Sahara	Hassi R'Mel	Tunisia	Pelagian Platform	Isis-1
Cuvet de Sbaa	Dechaira-1	Tunisia	Pelagian Platform	Isis-2
Reggane	Inzegmir-101	Tunisia	Pelagian Platform	Ashtart
Ghadames	Alrar Nord-101	Tunisia	Pelagian Platform	Oudna-1
Bas Sahara	Rhourde el Baguel-3	Libya	Western	F-90
Ghadames	Tin Fouye-13	Libya	Western	D-3-23
Ghadames	West Ihansatene-1	Libya	Western	F-1-90
Ghadames	Tan Emellel-1	Libya	Western	F-7-90
Ghadames	Tan Emellel-3	Libya	Western	F-8-90
Ghadames	Tamadanet-101	Libya	Western	Q-1-23
Ghadames	Guelta-101	Libya	Ghadames	B2-1
Ghadames	Guelta-103	Libya	Ghadames	HI-1
Bas Sahara	Gassi Touil-3	Libya	Ghadames	HI-1
Bas Sahara	Ektaia-101	Morocco		Sidi Rhalem
Ghadames	Oued Ahara-101	Morocco		MO-2
Ghadames	Tesselit-101	Morocco		Mescala
Ghadames	In Adaoui-101	Morocco		Mescala
Ghadames	Ohanet-105	Morocco		Zrar Inferier
Ghadames	Askarene-101			