

**PETROLEUM SYSTEMS  
OF THE GHADAMES BASIN AND  
ILLIZI PLATFORM STUDY**

**REGIONAL PETROLEUM GEOCHEMISTRY OF  
THE GHADAMES BASIN AND ILLIZI PLATFORM**

**GEOMARK  
RESEARCH, INC.**

**A PROSPECTUS**

## **Petroleum Systems of the Ghadames Basin and Illizi Platform**

### **SUMMARY**

GeoMark Research, Inc. has completed a regional study of the petroleum systems of the greater Ghadames Basin-Illizi Platform of Algeria, Libya, and Tunisia. The purpose of the effort is to define, more clearly, the oil and gas potential of the region. This was accomplished by analyzing a suite of more than 800 cuttings and 70 crude oil samples. This represents a superb collection of Ghadames Basin samples and includes rock and oil samples from Anadarko's recent discoveries in the basin. This project is sanctioned by Sonatrach.

Data from the analyses of oils was used to define the number of distinct oil families, distribution of oil families, maturity differences between oils, and mixing of oil families. Correlation of the oil and source rock analyses was undertaken in the effort to identify the facies responsible for generating the oils reservoired in the region. The study seeks to convincingly separate and define oils derived from Paleozoic sources whose compositions are similar. This was facilitated using state-of-the-art analytical techniques and sophisticated statistical clustering and classification methods. The results of the oil geochemistry can be used to constrain an analysis of the basin's petroleum systems. Particular emphasis was placed on these exploration issues:

- ◆ Identify the number and nature of the sources responsible for the oils.
- ◆ Estimate the number of source kitchens for oils derived from a common source interval.
- ◆ Define criteria by which mature oils from compositionally similar sources in the Ghadames Basin can be distinguished.
- ◆ Determine if any reservoirs in the Ghadames contain mixed oils.
- ◆ Ensure that oils that have undergone secondary alteration are identified and assigned to their proper families.
- ◆ Consider the implications of oils having significantly different "maturities" with respect to the location and timing of their source kitchens.

All of the analytical data generated from the oils are included in a set of Data Volumes together with a bound interpretive report. The final interpretive report includes wall-sized, full color maps/montages showing the distribution of oil families and associated petroleum systems.

The cost of the study is US \$32,500.

## DISCUSSION

The regional stratigraphic and tectonic framework, petroleum potential, and geochemical characteristics of the Ghadames Basin-Illizi Platform and the petroleum potential of the area has been considered by many authors (for example, Ali, 1975; Balducci and Pommier, 1970; Bennacef et al., 1971; Bishop, 1975; Byramjee and Vasse, 1968; Clifford, 1986; Correia et al., 1968; Klemme 1958; Magloire, 1970; Peterson and Wilson, 1987; and, Tissot et al., 1973). Additionally, many proprietary reports have been prepared for the area by service companies and individual oil companies interested in the potential of the Ghadames Basin. These efforts provide a rich context into which more detailed geochemical considerations can be placed.

GeoMark Research, Inc. has assembled an excellent collection of oil and source rock samples for the purpose of accelerating understanding of this complex area. A map showing the distribution of oils and wells selected for analyses is presented in Figure 1. Tables providing specific data for the samples are attached as Appendices A and B.

Each oil was characterized by a detailed analytical program that includes bulk compositional data, quantitative biomarker analysis of steranes, terpanes, aromatic biomarkers, and determination of stable carbon and deuterium isotopic compositions. Data from these analyses was interpreted using traditional methods, well understood in the geochemical literature, as well as contemporary multivariate statistical techniques. Mapping of the areal and stratigraphic distribution of the compositionally distinct oil families is a necessary prerequisite to the interpretation of their origin. The strength of the project lies partly in the size of the oil collection and in the discriminatory efficiency of the multivariate techniques used in isolating compositionally meaningful oil families (Zumberge, 1987).

The rock geochemistry includes total organic carbon (TOC), standard Rock-Eval pyrolysis, kerogen description, vitrinite reflectance (Ro), and thermal alteration analyses (TAI). Selected samples exhibiting source potential were extracted and the saturate fraction subjected to an analytical program similar to that applied to the oil samples.

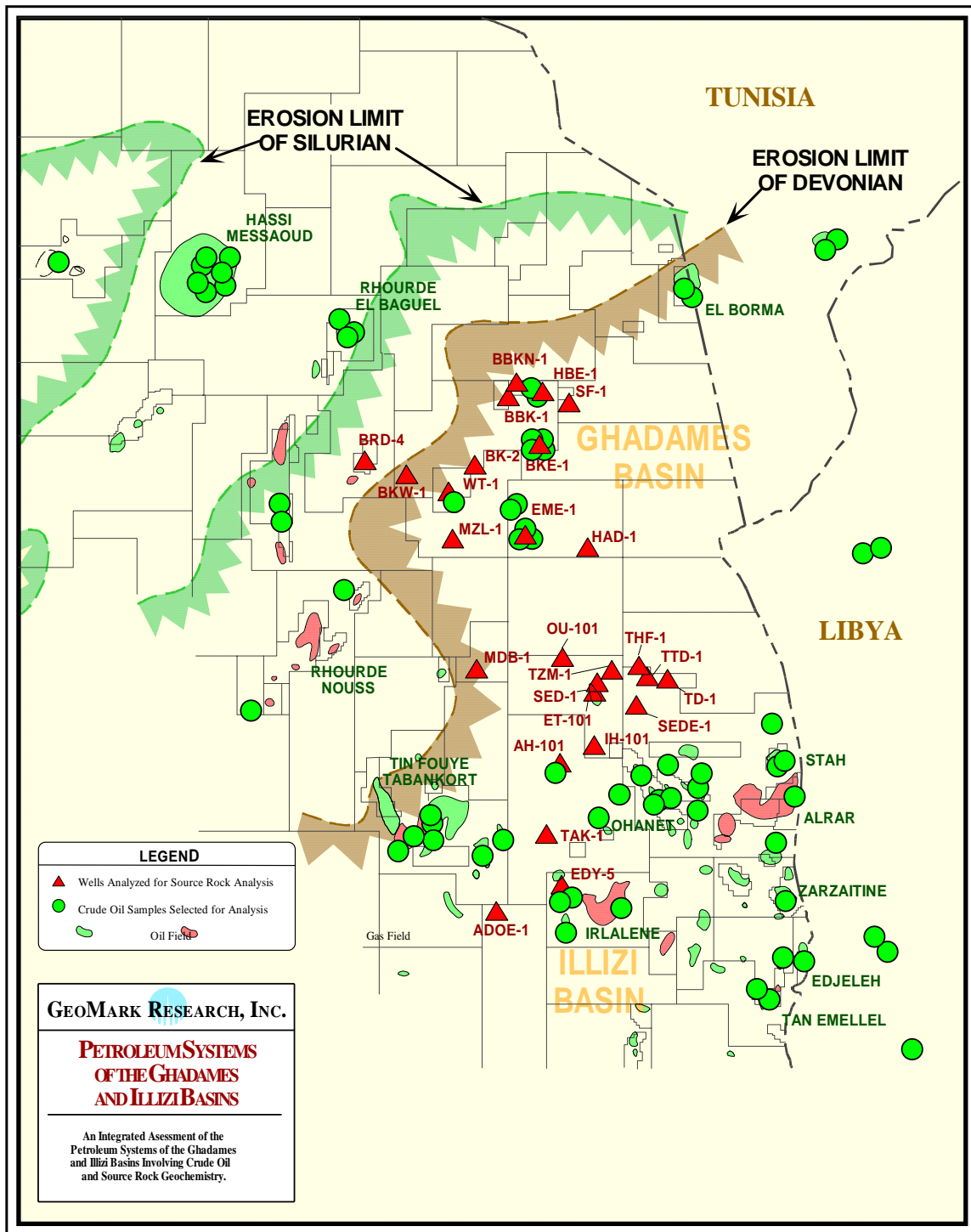


Figure 1. Location map showing distribution of samples analyzed for this study.

## **ANALYTICAL PROGRAM**

### **SOURCE ROCK SAMPLES**

The source rock samples are analyzed by the following techniques:

- Lithological Description
- Total Organic Carbon (TOC)
- Rock-Eval Pyrolysis
- Kerogen Maceral Analysis (TAI)
- Vitrinite Reflectance (% Ro)
- Bitumen Analysis (This includes all the analytical procedures listed below for oils, with the exception of API gravity, Ni/V and %S)

### **OIL SAMPLES**

The following techniques have been employed on each of the oil samples:

- API Gravity
- % Sulfur
- Nickel/Vanadium concentrations
- C15+ vs. <C15+
- Deasphalting (% Asph)
- 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)

## **PARTICIPATION**

The complete study costs (US) \$32,500.00 US dollars. Participants in GeoMark's Algeria/Tunisia Oil Study (Volume II of the Mediterranean Oil Study), will receive a \$5,000.00 discount.

## **TIMING**

This project is complete and available for immediate delivery.

### **For Additional Information Contact:**

**Mr. Stephen W. Brown**  
**GEOMARK RESEARCH, INC.**  
**9748 Whithorn Drive**  
**Houston, Texas 77095**  
**USA**

**Telephone: (281) 856-9333**

**Fax: (281) 856-2987**

**E-mail: [sbrown@geomarkresearch.com](mailto:sbrown@geomarkresearch.com)**

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## APPENDIX A

## Crude Oil Location and Reservoir Data

OILS Well	OILS Well	ROCKS* Well	ROCKS* Well
<b>Cuvet de Sbaa</b>	<b>Illizi</b>	<b>Ghadames/Illizi</b>	<b>Ghadames/Illizi</b>
Dechaira-1	Stah	Bir Berkine-1	Berkine-2
<b>Ghadamas</b>	Djoua Ouest-1	Bir Berkine Nord-1	Berkine-2
BKE-1	Edeyen-3	Berkine-2	Brides-4
BKE-1	Hassi Mazoula-5	Berkine-2	Menzel Lejmet-1
BKE-1	In Adaoui-101	Brides-4	Menzel Lejmet-1
EME-1	Irlalene-3	Brides-4	Sif Fatima-1
EME-1	Ohanet-116	Haiad-1	Sif Fatima-1
EME-1	Stah-40	Sif Fatima-1	Sif Fatima-1
HBN-1	Tin Fouye-19	Sif Fatima-1	Wadi el Teh-1
El Borma-19	Tin Fouye Tabankort-24	Menzel Lejmet-1	Wadi el Teh-1
Mereksen-12	<b>Trias</b>	Wadi el Teh-1	Wadi el Teh-1
Bir Seba	Hassi Messaoud-15	Wadi el Teh-1	Wadi el Teh-1
Edjeleh	Hassi Messaoud	Oued Ahara-101	Oued Ahara-101
Edjeleh	El Borma	Oued Ahara-101	Oued Ahara-101
Tin Fouye	Gassi Touil-6	Oued Ahara-101	Oued Ahara-101
Tin Fouye	Rhourde el Baguel-605	In Houdet-101	In Houdet-101
Zarzitaine	Hassi Messaoud	In Houdet-101	In Houdet-101
Alrar Nord-101	Hassi Messaoud	Takouazet-1	In Houdet-101
Tin Fouye-13	Hassi Messaoud	Takouazet-1	Takouazet-1
West Ihansatene-1	Hassi R'Mel	Takouazet-1	Mederba-1
Tan Emellel-1	Rhourde el Baguel-3	Takouazet-1	Mederba-1
Tan Emellel-3	Gassi Touil-3	Mederba-1	Mederba-1
Tamadanet-101	Eaktaia-101	Adouhoum Est-1	Mederba-1
Guelta-101	Guellala	Adouhoum Est-1	Mederba-1
Guelta-103	Hassi Messaoud-76	Adouhoum Est-1	Mederba-1
Oued Ahara-101	Rhourde el Baguel-12	Adouhoum Est-1	Adouhoum Est-1
Tesselit-101	Rhourde Hamra-2	Edeyen-5	Adouhoum Est-1
In Adaoui-101	<b>Saharan Atlas</b>	Edeyen-5	Adouhoum Est-1
Ohanet-105	Oued Gueterini	Tin Zemane-1	Adouhoum Est-1
Askarene-101	<b>Western</b>	Tin Zemane-1	Adouhoum Est-1
Makrerouga-1	F-90	Bir Berkine-1	Adouhoum Est-1
Makrerouga-1	D-3-23	Bir Berkine-1	Adouhoum Est-1
B2-1	F-1-90	Bir Berkine-1	Edeyen-5
HI-1	F-7-90	Bir Berkine Nord-1	Tin Zemane-1
HI-1	F-8-90	Berkine-2	Tin Zemane-1
<b>Reggane</b>	Q-1-23	Berkine-2	Takouazet-1
Inzegmir-101		Berkine-2	HBE-1
		Berkine-2	EME-1
		Berkine-2	BKE-1

\*Over 900 rock samples are included in the study, but only those listed were analyzed in detail.