PETROLEUM SYSTEMS OF THE SIRTE BASIN

REGIONAL PETROLEUM GEOCHEMISTRY OF CRUDE OILS FROM THE SIRTE BASIN, LIBYA

GEOMARK RESEARCH, INC.

A PROSPECTUS

EXECUTIVE SUMMARY

GeoMark Research, Inc. has 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 detailed evaluation of the sirte Basin. Due to the large number of samples collected from this basin (73) and the exploration significance of the results, we have elected to offer this basin as a separate study. We ask that you review the following proposal and consider participation.

Each of the oils from the Basin (a list is provided in Appendix A, map shown as Figure 1) 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 complied by Dr. Chris Pratsch, allowed us to accomplish the following:

- Determine the number of genetically distinct oil families in the Basin
- Map the stratigraphic and geographic distribution of the oil families and distinguish basin 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$20,000.

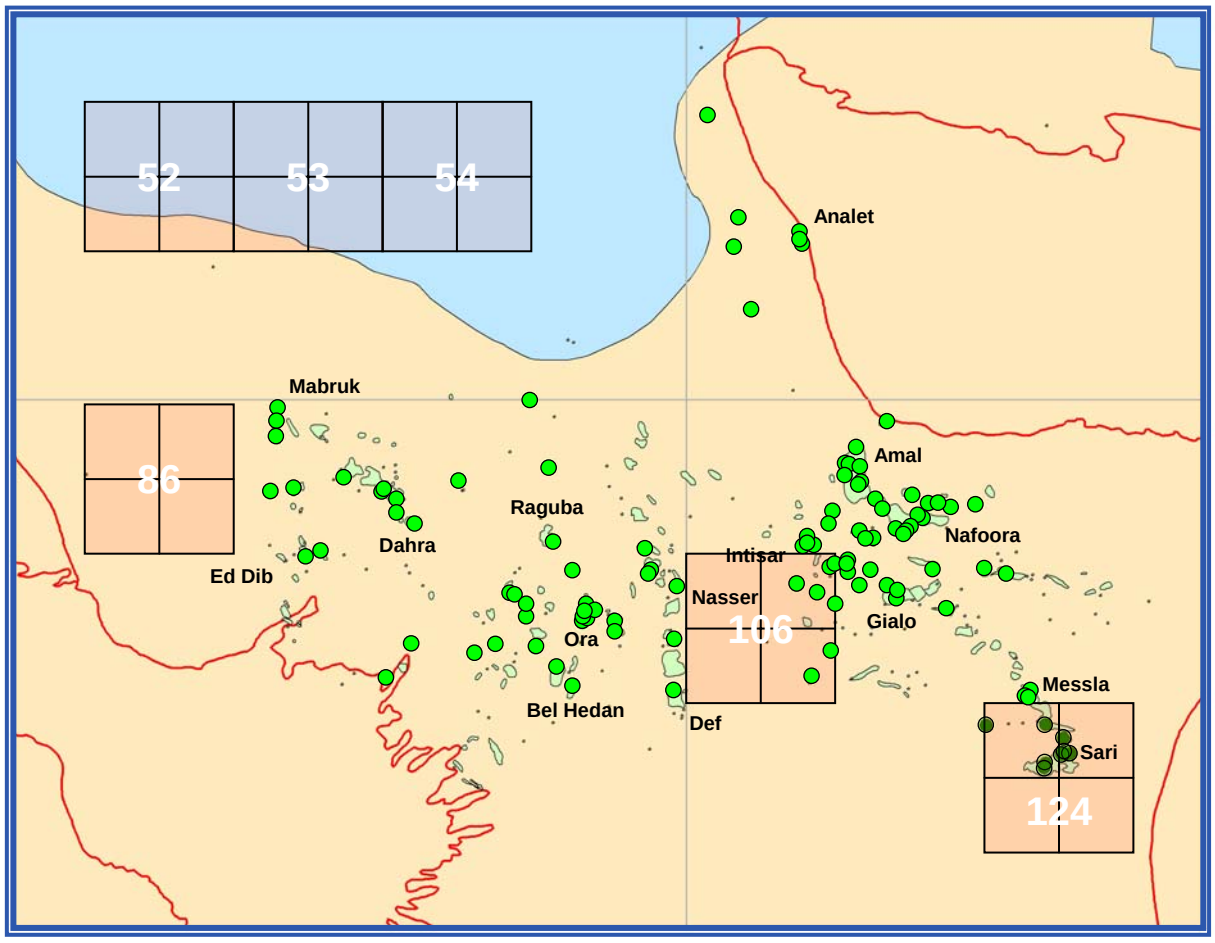

Figure 1. Location map showing distribution of samples analyzed for this study.

INTRODUCTION

The purpose of the study was to geochemically evaluate crude oil samples from the Sirte Basin in order to predict source rock depositional environments, related oil families, thermal histories, and probable subsurface migrational directions. The field locations of the 73 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 the entire Sirte Basin. This is the most prolific of all hydrocarbon-bearing regions in North Africa and contains over 25 billion barrels of proved oil reserves. 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 and Sirte Basin 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 the Sirte Basin. 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.

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 $20,000. The reports are completed and available for immediate delivery.

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APPENDIX A

Samples Analyzed for this Study

SampleID	Field	Well	U Depth(ft)	L Depth(ft)	Age	Formation	Lat	Long	Study
LI0001	Nafoora		2,257		Eocene	Tamit-H	29.27	21.31	Sirte I
LI0002	Nafoora		5,421		Paleocene	Najah	29.35	21.26	Sirte I
LI0003	Nafoora		3,049		Eocene	Tamet	29.35	21.26	Sirte I
LI0004	Nafoora		2,159		Eocene	Nafoora	29.16	21.48	Sirte I
LI0005	Nafoora		8,496		Cretaceous	Tagrifet	29.14	21.45	Sirte I
LI0006	Nafoora		9,974			Bahi	29.12	21.44	Sirte I
LI0007	Nafoora		9,874		Jurassic	Amal	29.14	21.40	Sirte I
LI0008	Gialo		2,725		Eocene	Gialo	28.77	21.34	Sirte I
LI0009	Gialo		2,256		Oligocene		28.77	21.34	Sirte I
LI0010	Amal		9,715		Jurassic	Amal	29.45	21.16	Sirte I
LI0011	Sarir		7,746		Lower Cretaceous	Sarir	27.64	22.52	Sirte I
LI0012	Sarir		8,030		Lower Cretaceous	Sarir	27.64	22.52	Sirte I
LI0013			3,100						Sirte I
LI0014	Beda	47B	3,900		Pre Upper Cretaceous	Hofra	28.36	19.00	Sirte I
LI0015			3,147						Sirte I
LI0016	Gialo		2,735		Eocene	Gialo	28.74	21.40	Sirte I
LI0017	Bel Hedan	V-59	7,100		Ord./CaMiddle	Hofra	28.10	19.24	Sirte I
LI0018	Samah	L1	6,300		Ord./CaMiddle		28.22	19.14	Sirte I
LI0019			5,478						Sirte I
LI0020	Waha	A1	6,500		Cretaceous	Waha	28.40	19.92	Sirte I
LI0021	Dahra	32	3,667		Paleocene	PL7	29.35	18.08	Sirte I
LI0022	Zaggut	M1	6,400		Paleocene	Beda	28.47	19.53	Sirte I
LI0023	Etel		7,015		Quaternary	Etel	28.53	19.52	Sirte I
LI0024	Ora		4,900			M59	28.52	19.31	Sirte I
LI0025	Facha	11	4,281		Paleocene	Mabruk A	29.42	17.39	Sirte I
LI0026	Ora	2	8,360			Aintobi	28.55	19.31	Sirte I
LI0027	Ora	1	7,326		Cretaceous	B	28.52	19.31	Sirte I
LI0028	Ora	1	7,058		UpperCretaceous	Sirte	28.52	19.31	Sirte I
LI0029	Hofra	1	2,000		Paleocene	Dahra B	29.40	17.98	Sirte I
LI0030	Dahra	1	2,440		Danian		29.49	17.72	Sirte I
LI0032	Concession 59	3			Eocene	Gialo	28.15	18.00	Sirte I
LI0034	Umm Farud		2,200		Paleocene	Dahra B	29.18	18.19	Sirte I
LI0035	Khuff	3	5,534		Cretaceous	ANF	28.38	18.73	Sirte I
LI0037	Ed Dib	1	3,698		Eocene	Gir, LI-A	28.99	17.57	Sirte I
LI0038	Ed Dib	1	2,666		Eocene	Gir, LI-P	28.99	17.57	Sirte I
LI0039	Farrud	1	3,245		Paleocene	Mabruk A	29.25	18.08	Sirte I
LI0040	Ora	3	8,948			Lidam	28.64	19.34	Sirte I
LI0041	Facha	11	3,076		Eocene	Gir, LI-G	29.42	17.39	Sirte I
LI0042	Sarir		8,000	8,500	Lower Cretaceous	Sarir	27.64	22.52	Sirte I
LI0043	Bel Hedan	V-59	7,100		Lower Ordovician	Samah	28.10	19.24	Sirte I
LI0044	Hamid	A-1-97	10,000		Upper Cretaceous	Lidam	28.62	21.73	Sirte II
LI0045	Tuama	C-1-97	14,000		Cretaceous	Calanscio	28.88	21.98	Sirte II
LI0046	Jakhira	A-1-96	11,000		Lower Cretaceous	Nubian	29.31	21.61	Sirte II
LI0047	Sarir	C-39-65	8,000	8,500	Lower Cretaceous	Sarir	27.75	22.51	Sirte II
LI0048	Sarir	C-110-65	8,000	8,500	Lower Cretaceous	Sarir	27.59	22.39	Sirte II
LI0049	Sarir	C-175-65	8,000	8,500	Lower Cretaceous	Sarir	27.65	22.50	Sirte II
LI0050	Sarir	C-262-65	8,000	8,500	Lower Cretaceous	Sarir	27.56	22.38	Sirte II
LI0051	Sarir	L-51-65	8,400		Lower Cretaceous	Sarir	27.84	22.39	Sirte II
LI0052	Messla	DD-15-80	8,500		Lower Cretaceous	Sarir	28.04	22.28	Sirte II
LI0053	Messla	DD-20-80	8,000		Lower Cretaceous	Sarir	28.04	22.26	Sirte II
LI0054	Messla	DD-26-80	8,200		Lower Cretaceous	Sarir	28.07	22.29	Sirte II
LI0055	Bu Attifel	A-1-100	13,000		Lower Cretaceous		28.85	22.12	Sirte II
LI0056	Khuff		4,300		Upper Cretaceous	Kalash	28.38	18.73	Sirte I
LI0057	Umm Farud	A-1-92	2,200		Upper Paleocene	Dahra B	29.18	18.19	Sirte I
LI0059	E-1-92	E-1-92	2,800		Upper Paleocene	Bu Chama	29.47	18.48	Sirte I
LI0060	E-5A-92	E-5A-92	2,500	3,000	Upper Paleocene	Bu Chama	29.47	18.48	Sirte I
LI0061	E-6-92	E-6-92	2,500	3,000	Upper Paleocene	Bu Chama	29.47	18.48	Sirte I
LI0066	Amal	B22-12	5,891	5,971	Eocene	Mesdar	29.58	21.07	Sirte I
LI0067	Rakb	A1-12	9,877	9,895	Cretaceous		29.14	21.15	Sirte I
LI0068	Amal	B1-12	9,832	9,867	Jurassic	Amal	29.45	21.16	Sirte I
LI0069	Hagfa	A1A-13	7,377	7,409	Eocene		29.55	19.09	Sirte I
LI0070	Hagfa	A1A-13	7,810	7,856	Paleocene	Hofra	29.55	19.09	Sirte I
LI0071	Hofra	A2-11	3,018	3,044	Paleocene	Dahra B	29.40	17.98	Sirte I
LI0072	Amal	B2-12	9,789	9,809	Jurassic		29.26	20.97	Sirte I
LI0073	Ed Dib	G1-11	8,106		Cretaceous	Hon	28.99	17.57	Sirte I
LI0074	Neggazza	C1-57	6,210	6,223	Cretaceous		28.32	18.59	Sirte I
LI0075	Muelah	D1-57	8,235	8,272	Cretaceous		28.38	18.17	Sirte I
LI0076	Kalash	K1-12	8,703	8,720	Ypresian		29.06	20.81	Sirte I
LI0077	Ora	I1-13	5,447	5,481	Paleocene		28.58	19.32	Sirte I
LI0078	Ora	I1-13	7,610	7,649	Jurassic		28.58	19.32	Sirte I
LI0079	Farigh	M1-12	10,500		Upper Cretaceous	Rakb	28.87	21.23	Sirte I
LI0080	Mabruk	A13-17	3,272		Paleocene	Dahra B	29.95	17.29	Sirte I
LI0081	Raguba	E7-20	5,695	5,728	Lower Cretaceous	Waha	29.06	19.11	Sirte I
LI0082	Zelten	C2-6	5,770	5,927	Paleocene	Ruaga C	28.85	19.76	Sirte I
LI0083	Idris	A-103	9,400		Paleocene	UpperSabil	29.03	20.77	Sirte I
LI0084	DST 1	RRR 1 11			Paleocene	Farrud	28.96	17.47	Sirte I
LI0085	Hofra	A2-11	3,042	3,099	Paleocene		29.40	17.98	Sirte I
LI0086	Haram	3	4,885		Cretaceous	Tagrifet	28.72	18.83	Sirte I

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SampleID	Field	Well	U Depth(ft)	L Depth(ft)	Age	Formation	Lat	Long	Study
LI0087	Intisar A	A-28-103	9,000		Paleocene	Upper Sabil	29.03	20.78	Sirte II
LI0088	Intisar B	B-3-103	9,200		Paleocene	Upper Sabil	29.10	20.80	Sirte II
LI0089	Intisar C	C-2-103	9,600		Paleocene	Upper Sabil	29.04	20.85	Sirte II
LI0090	Intisar D	D-13-103	8,500		Paleocene	Upper Sabil	28.90	20.96	Sirte II
LI0091	Intisar D	D-20-103	8,500		Paleocene	Upper Sabil	28.90	20.96	Sirte II
LI0092	Intisar L	L-2-103	9,000		Paleocene	Upper Sabil	28.72	20.87	Sirte II
LI0093	Kotla	47-C	4,900		Upper Cretaceous	Kalash	28.64	18.94	Sirte I
LI0094	Haram	47-S	4,100		Upper Cretaceous	Kalash	28.71	18.85	Sirte I
LI0095	Augila-Nafoora				Jurassic	Amal	29.27	21.31	Sirte I
LI0096	Defa	59-B	4,700		Danian	Defa	28.08	19.92	Sirte I
LI0097	Gialo	59-E			Eocene	Gialo	28.69	21.40	Sirte I
LI0098	Bel Hedan	V-59	6,400		Ordovician	Hofra	28.10	19.24	Sirte I
LI0102	NC 171	D1-NC 171	9,200		Upper Paleocene	Upper Sabil	28.92	21.08	Sirte II
LI0103	NC 171	C1-NC 171	8,600		Upper Paleocene	Harash	28.65	20.99	Sirte II
LI0104	NC 171	B1-NC 171	8,500		Upper Paleocene	Upper Sabil	28.86	21.08	Sirte II
LI0106	NC 171	E1A-NC-171	7,000		Eocene	Upper Gialo	30.60	20.43	Sirte II
LI0107	Shatirah	A-1NC-163	9,000		Upper Paleocene	Upper Sabil	28.78	20.73	Sirte II
LI0108	Shatirah	A-2NC-163	8,000		Upper Paleocene	Upper Sabil	28.77	20.73	Sirte II
LI0109	Wildcat	Amoses A7a-	160		Tertiary	Gedari	28.56	18.93	Sirte I
LI0110	Beda	B-1-47	3,874	4,085	Tertiary	Beda	28.36	19.00	Sirte II
LI0111	Rakb	D-1-12	9,533	9,582	Cretaceous		29.09	21.19	Sirte II
LI0112	Ora	I-6-13	7,072	7,102	Cretaceous		28.57	19.32	Sirte II
LI0113	Kalash	K1-12	9,171	9,202	Tertiary		29.06	20.81	Sirte II
LI0114	Amal	E-1-12	9,820	9,839	Jurassic		29.50	21.06	Sirte II
LI0115	Ora	I-1-13	7,821	7,906	Cretaceous		28.58	19.32	Sirte II
LI0116	Ora	I-2-13	5,345	5,404	Tertiary		28.62	19.33	Sirte II
LI0117	Ora	I-2-13	5,577	5,608	Tertiary		28.62	19.33	Sirte II
LI0118	Ora	I-2-13	7,587	7,674	Cretaceous		28.62	19.33	Sirte II
LI0119	Ora	I-2-13	7,674	7,761	Cretaceous		28.62	19.33	Sirte II
LI0120	Facha	L-1-11	3,069	3,138	Tertiary	Gir	29.42	17.39	Sirte II
LI0121	Facha	L-1-11	4,779	4,852	Tertiary		29.42	17.39	Sirte II
LI0122	Facha	L-1-11	3,076	3,086	Tertiary	Gir	29.42	17.39	Sirte II
LI0123	Hofra	A13-11	3,025	3,035	Tertiary	Dahra	29.39	17.98	Sirte II
LI0124	Rachmat	L-1-13	6,336	6,388	Cretaceous		28.87	19.25	Sirte II
LI0125		N-1-11	2,134	2,200	Tertiary		29.39	17.23	Sirte II
LI0126	Kalash	K1-12	10,900	10,928	Cretaceous		29.06	20.81	Sirte II
LI0127	Ora	I-8-13	7,850	7,925	Cretaceous		28.60	19.38	Sirte II
LI0128	Amal	B-10-12	5,300	5,396	Tertiary	Mesdar	29.57	21.08	Sirte II
LI0129	Amal	B-22-12	6,653	6,718	Tertiary	Abu Fas & Upper Sabil	29.43	21.15	Sirte II
LI0130	Amal	N-1-12	3,702	3,735	Tertiary		29.56	21.15	Sirte II
LI0131	Amal	N-1-12	10,102	10,152	Cretaceous	Maragh	29.56	21.15	Sirte II
LI0132	Bu Grea	A-3-5	2,471	2,490	Tertiary	Sheighega	30.00	18.96	Sirte II
LI0133	Raleh	DD-1 -6	7,737	7,786	Cretaceous	Waha	28.76	19.94	Sirte II
LI0135	Meghil	J-2-6	5,890	5,925	Tertiary	Ruaga	29.02	19.73	Sirte II
LI0136		F-1-31	8,466	8,482	Cretaceous	Maragh	29.86	21.33	Sirte II
LI0137		H-1-12	11,846	11,900	Triassic	Amal	29.18	20.95	Sirte II
LI0138	Kalash	K1-12	10,348	10,377	Tertiary	Amal	29.06	20.81	Sirte II
LI0139	Farigh	M-1-12	10,813	10,832	Cretaceous	Rakb	28.77	21.15	Sirte II
LI0140	Amal	N-1-12	6,574	6,639	Tertiary	Sabil	29.56	21.15	Sirte II
LI0141	Sarir	C-3-65			Cretaceous		27.64	22.49	Sirte II
LI0142	Amal	D-4-12	2,625	2,651	Tertiary	Gebel Akhdar	29.08	21.24	Sirte II
LI0143	Amal	R-1-12	10,250	10,289	Cretaceous	Maragh	29.69	21.13	Sirte II
LI0144	Gazeil	A-1-126	10,495	10,545	Jurassic	Nubian	28.16	20.83	Sirte II
LI0145	Nafoora	G-32-51	2,194	2,202	Tertiary	Gebel Akhdar	29.22	21.57	Sirte II
LI0146	Nafoora	G-21-51	3,054	3,059	Tertiary	Gialo	29.22	21.56	Sirte II
LI0147	Nafoora	G-33-51	8,479	8,702	Cretaceous	Rakb	29.22	21.55	Sirte II
LI0148	Nafoora	G-20-51	9,064	9,107	Cambrian		29.24	21.55	Sirte II
LI0149	Gazeil	I-1-126	12,900	12,933	Cretaceous	Nubian	28.33	20.96	Sirte II
LI0150	Ghani-Zenad	RRR-1-11	4,122	4,146	Tertiary	Facha	28.96	17.47	Sirte II
LI0151	NC-84	A-1	12,260		Lower Cretaceous	Nubian	29.37	21.50	Sirte II
LI0152	NC-84	A-1	11,528	11,624	Lower Cretaceous	Nubian	29.37	21.50	Sirte II
LI0153	NC-84	A-1	11,528	11,624	Cretaceous	Nubian	29.37	21.50	Sirte II
LI0154	NC 129	A1-NC-129			Upper Paleocene	Harash	31.22	20.34	Sirte II
LI0155	NC 129	A1-NC-129			Upper Paleocene	Harash	31.22	20.34	Sirte II
LI0157	NC-129	B1-NC-129	7,500		Upper Paleocene	Harash	31.02	20.31	Sirte II
LI0158	NC-152	B1-NC-152	8,000		Silurian	Acacus	31.89	20.14	Sirte II
LI0159	Sarir	C-239-65	8,000	8,500	Lower Cretaceous	Sarir	27.65	22.55	Sirte II
LI0160	Sarir	C-262-65	8,000	8,500	Lower Cretaceous	Sarir	27.56	22.38	Sirte II
LI0161	051-K-002	K-2-51	10,500		Lower Cretaceous	Nubian	29.29	21.76	Sirte II
LI0162	UU1 -65	UU-1 -65			Lower Cretaceous	Sarir	27.84	21.99	Sirte II
LI0163	UU1 -65	UU-1 -65			Lower Cretaceous	Sarir	27.84	21.99	Sirte II
LI0164	051E-V-001	V-1-51E	8,500		Triassic	Amal	29.31	21.92	Sirte II
LI0165	NC 171	A1-NC-171	9,200		Upper Paleocene	Upper Sabil	28.92	21.08	Sirte II
LI0166	NC 171	B1-NC-171			Upper Paleocene	Sabil	28.93	21.08	Sirte II
LI0167	Jakhira	A-3-96	12,000		Lower Cretaceous	Nubian	29.30	21.61	Sirte II
LI0168	Nakhia/G7 - 97	G-7-97	12,000		Lower Cretaceous	Calanscio	28.88	21.64	Sirte II
LI0169	As Sarah	B-15-96	12,000		Lower Cretaceous	Nubian	29.32	21.67	Sirte II
LI0170	Mabruk	A-15-17	2,500		Upper Paleocene	Dahra B	29.86	17.28	Sirte II
LI0171	Mabruk	A-17-17	2,600		Upper Paleocene	Dahra B	29.76	17.27	Sirte II