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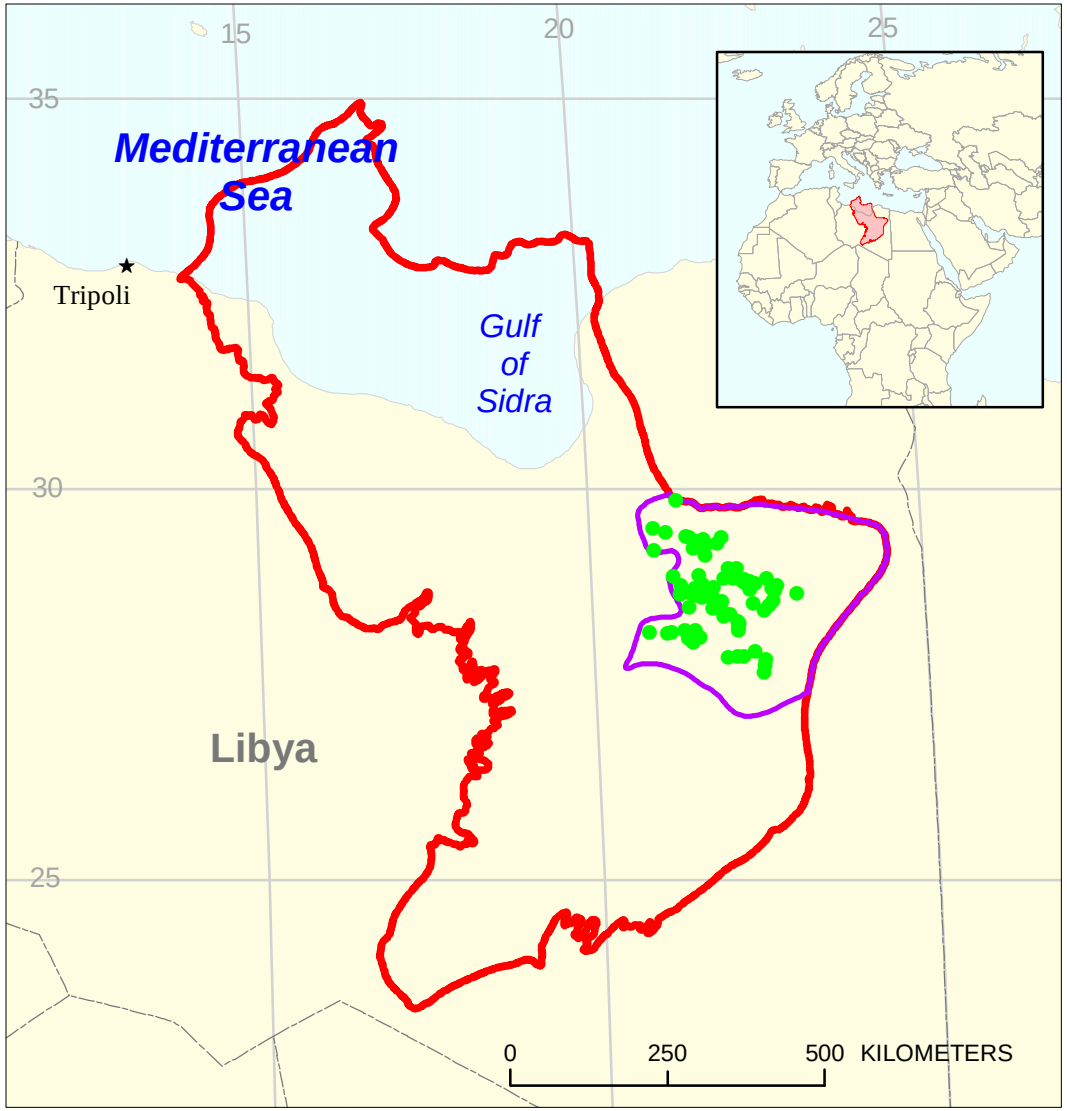
Southeast Sirte Clastics Assessment Unit 20430101



Southeast Sirte Clastics Assessment Unit 20430101
Sirte Basin Geologic Province 2043

Geologic Summary

Detailed map of this assessment unit

Exploration/Discovery-History Data
- Plots of Known Field Sizes
- Plots of Grown Resources
- Tables

Assessment Input Data

Assessment Results
- Assessment Unit Summary
- Detailed Assessment Results
- Undiscovered Field-Size Distributions

USGS PROVINCE: Sirte Basin (2043) **GEOLOGIST:** T.S.Ahlbrandt

TOTAL PETROLEUM SYSTEM: Sirte-Zelten (204301)

ASSESSMENT UNIT: Southeast Sirte Clastics (20430101)

DESCRIPTION: There is one dominant petroleum system in the Sirte Basin sourced by the Cretaceous (Campanian) Sirte Shale. In the southeastern portion of the Sirte Basin, clastics of Early Cretaceous age are the primary reservoirs in 72 fields. These reservoirs are fluvial and alluvial sandstones mostly of the Nubia or Serir sandstones. There is some production from Paleozoic clastics and Precambrian basement fractured zones in a few of these fields. Giant oil fields in this unit include Messla, Sarir, Amal, and Abu Attifel. Some authors consider these clastic intervals part of a megasequence related to pre-rift and early rift filling of grabens in the Sirte basin. Spectacular combination stratigraphic/stuctural traps are documented in this unit (for example, Sarir and Messla giant fields).

SOURCE ROCKS: The upper Cretaceous (Campanian) Sirte Shale of the Rakb Group is by far the dominant source rock. Geochemical data of 81 oils from the GeoMark database and published literature demonstrate that the Sirte Shale generates a low sulfur, high gravity oil with low gas oil ratios.

MATURATION: Generation is thought to have begun in Eocene time (variously timed at 50 Ma to 40 Ma) and continues to present. Onshore the petroleum generated is dominantly oil; however, in the offshore Gulf of Sirte, increased thermal gradients and deeper burial suggest higher gas oil ratios and natural gas potential there.

MIGRATION: Petroleum commenced migration in the Eocene from regional grabens into adjacent horsts. Migration is dominantly vertical. Exploration has focused on the horst blocks although there are recent discoveries within the grabens.

RESERVOIR ROCKS: Alluvial and fluvial sandstones of the Nubia or Sarir sandstones (early Cretaceous) are by far the dominant reservoirs in this unit. However, Precambrian fractured basement rocks, Cambro-Ordovician clastics, and Triassic through Lower Cretaceous clastic reservoirs are known. The age of the Nubia Sandstone is debated with estimates ranging from Triassic to Lower Cretaceous. Average porosities of 18 to 28 percent are documented in the fields with permeabilities of several hundred millidarcies for the Cretaceous reservoirs.

TRAPS AND SEALS: The Eocene (Ypresian) Gir Formation, particularly the Hon Evaporite Member is considered to be the dominant seal in the Sirte Basin. The Gir Formation is as thick as 1,305 m and halite forms 35 percent of the total section in some grabens.

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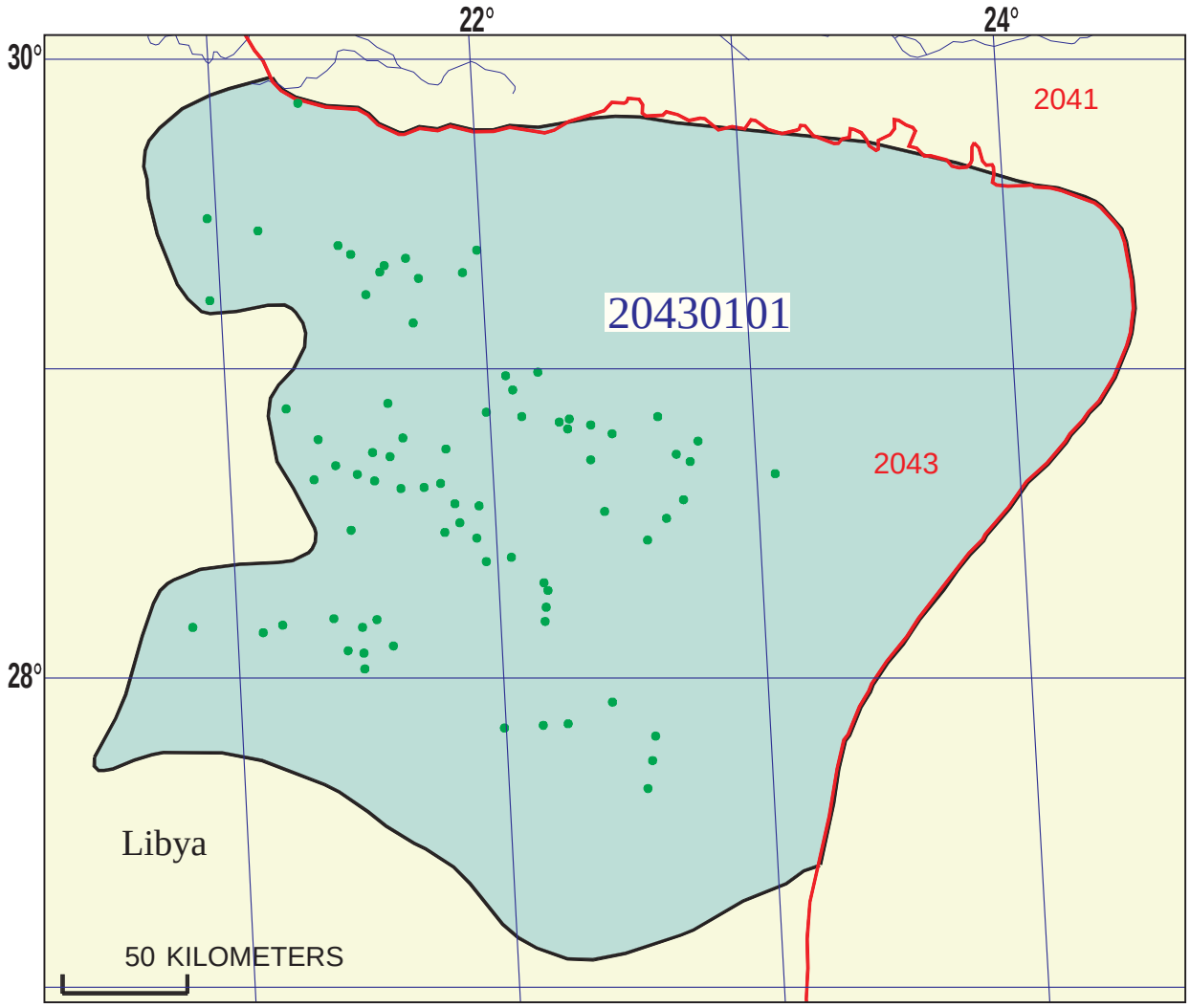

Southeast Sirte Clastics Assessment Unit - 20430101

EXPLANATION

- Hydrography
- Shoreline
- 2043 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 20430101 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS

Date:……..	6/18/98		
Assessment Geologist:……..	T.S. Ahlbrandt		
Region:……..	Middle East and North Africa	Number:	2
Province:……..	Sirte Basin	Number:	2043
Priority or Boutique……	Priority		
Total Petroleum System:……	Sirte-Zelten	Number:	204301
Assessment Unit:……..	Southeast Sirte Clastics	Number:	20430101
* Notes from Assessor	Lower 48 growth factor.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Oil

What is the minimum field size?……. 10 mmboe grown (≥1mmboe)
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…….. Oil: 56 Gas: 0
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 126.7 2nd 3rd 35.9 3rd 3rd 63.8
Median size (grown) of discovered gas fields (bcfg):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):…….. 1.0

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	5	median no.	30	max no.	60
Gas fields:……min. no. (>0)	_____	median no.	_____	max no.	_____

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)…… min. size	10	median size	50	max. size	1000
Gas in gas fields (bcfg):…… min. size	_____	median size	_____	max. size	_____

Assessment Unit (name, no.)
Southeast Sirte Clastics, 20430101

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	100	310	800
NGL/gas ratio (bngl/mmcfg)……	50	60	70

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……			
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……	27.7	38	54
Sulfur content of oil (%)……	0.08	0.3	2.89
Drilling Depth (m) ……	1800	3200	5500
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……			
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……			
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Southeast Sirte Clastics, 20430101

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Libya represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Southeast Sirte Clastics, AU 20430101
Undiscovered Field-Size Distribution