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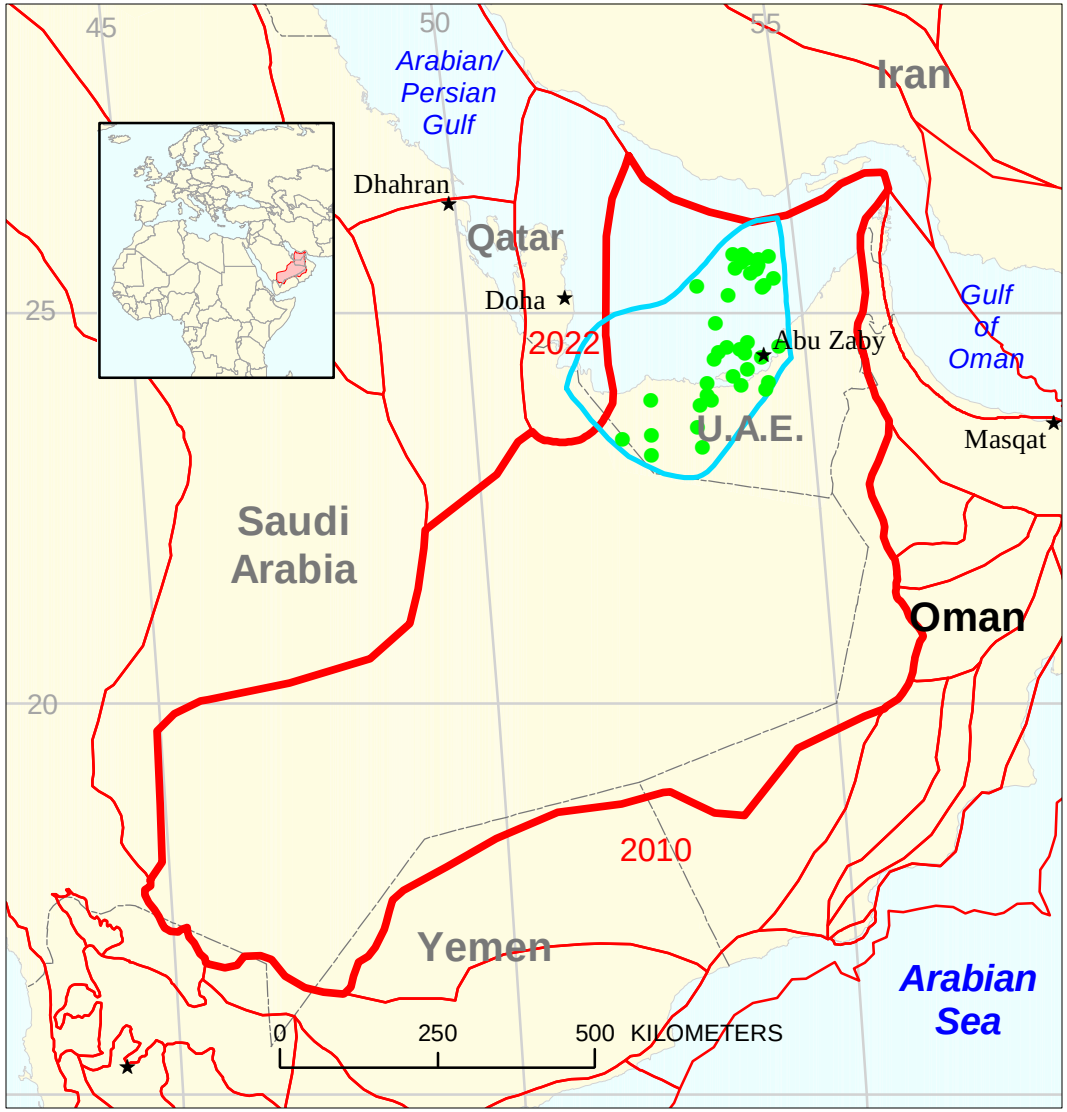
Cretaceous Reservoirs in South Gulf Suprasalt Structural Assessment Unit 20190102



Cretaceous Reservoirs in South Gulf Suprasalt Structural Assessment Unit 20190102

Rub Al Khali Basin Geologic Province 2019

Other petroleum system boundary

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: Rub Al Khali Basin (2019)–Petroleum system is centered in the Rub 'al Khali Basin province but extends into the southeast corner of province 2022-Qatar Arch.

GEOLOGIST: R.M. Pollastro

TOTAL PETROLEUM SYSTEM: Cretaceous Thamama/Wasia (201901)

ASSESSMENT UNIT: Cretaceous Reservoirs in South Gulf Suprasalt Structural (20190102)

DESCRIPTION: Assessment unit is defined mostly by the geographic extent of the underlying Hormuz Salt. The northern two thirds of the unit is offshore and the southern one third is onshore and bounded to the south-southeast by the Dibba transform fault, to the west by the Qatar Arch, Omani Foredeep to the east, and Zagros Fold Belt to the north. The unit is characterized by a primary north-south structural anticlinal grain often involving underlying salt and (or) basement fault blocks and also salt diapirs. Cretaceous reservoirs are assessed separately recognizing possible overlap with Jurassic and Paleozoic.

SOURCE ROCKS: Three source rocks are recognized in this assessment unit: (1) organic-rich, basinal facies (as thick as 100 ft) of the Shu'aiba Formation, (2) a series of argillaceous dense layers (as thick as 500 ft net source) both of the Early Cretaceous Thamama Group, and (3) the Shilaif (Khatiyah) Formation basinal facies, Middle Cretaceous Wasia Group. These source rocks contain Type II and I organic matter with about 1 to 10 weight percent TOC, the Shu'aiba being the richest. Jurassic oils also mix with Cretaceous oils along the eastern edge of the Hith evaporite.

MATURATION: Thamama source rocks are presently mature (Ro > 0.65) for oil generation along the basin axis of the Rub 'al Khali basin. Cretaceous oils in the assessment unit range from 26° to 45° API gravity. More mature oils of 40° or greater are produced from Asab and Shah fields adjacent to the Falaha syncline where Thamama source rocks are presently in the gas window. Shu'aiba source rocks started generating oil as early as the Eocene (65 Ma) with major expulsion of petroleum from the Falaha syncline and Oman foreland basin commencing about 40 Ma; both of these areas are presently in the gas generation window. The remaining portion of the assessment unit is presently in the oil generation window.

MIGRATION: The Thamama has good carrier beds below the regional Nahr Umr Shale seal for lateral migration of oils. Earliest oil migration occurred mainly from the Falaha syncline to adjacent fields (Bab, Bu Hasa, Asab, Shah) and westerly out from the Omani foredeep to fields (Fateh, Zakum, Jarn Yaphour, Safah, Lekhwair). Short vertical migration is mostly into porous Shu'aiba reefal or other rudistid buildups.

RESERVOIR ROCKS: Primary reservoirs are the cyclic, shallow-water, platform and shelf carbonate grainstones, and packstones of the Lower Cretaceous Shu'aiba Formation and bioclastic shoal buildups of the Middle Cretaceous Mishrif Formation. Minor reservoirs are the Habshan and

Leckhwar Formations. Some fields also produce Silurian-sourced gas from the Permo-Triassic Khuff Formation.

TRAPS AND SEALS: Traps are mainly structural and most are anticlinal or salt domes and diapirs (crest and flank traps); some combination structural/stratigraphic traps along a north-southeast trending, secondary leached shelfal limestone. Some anticlines drape basement horst blocks and faulted due to compression and wrenching from Oman and Zagros Stress. Regional seals are the Nahr Umr and Laffan Shales.

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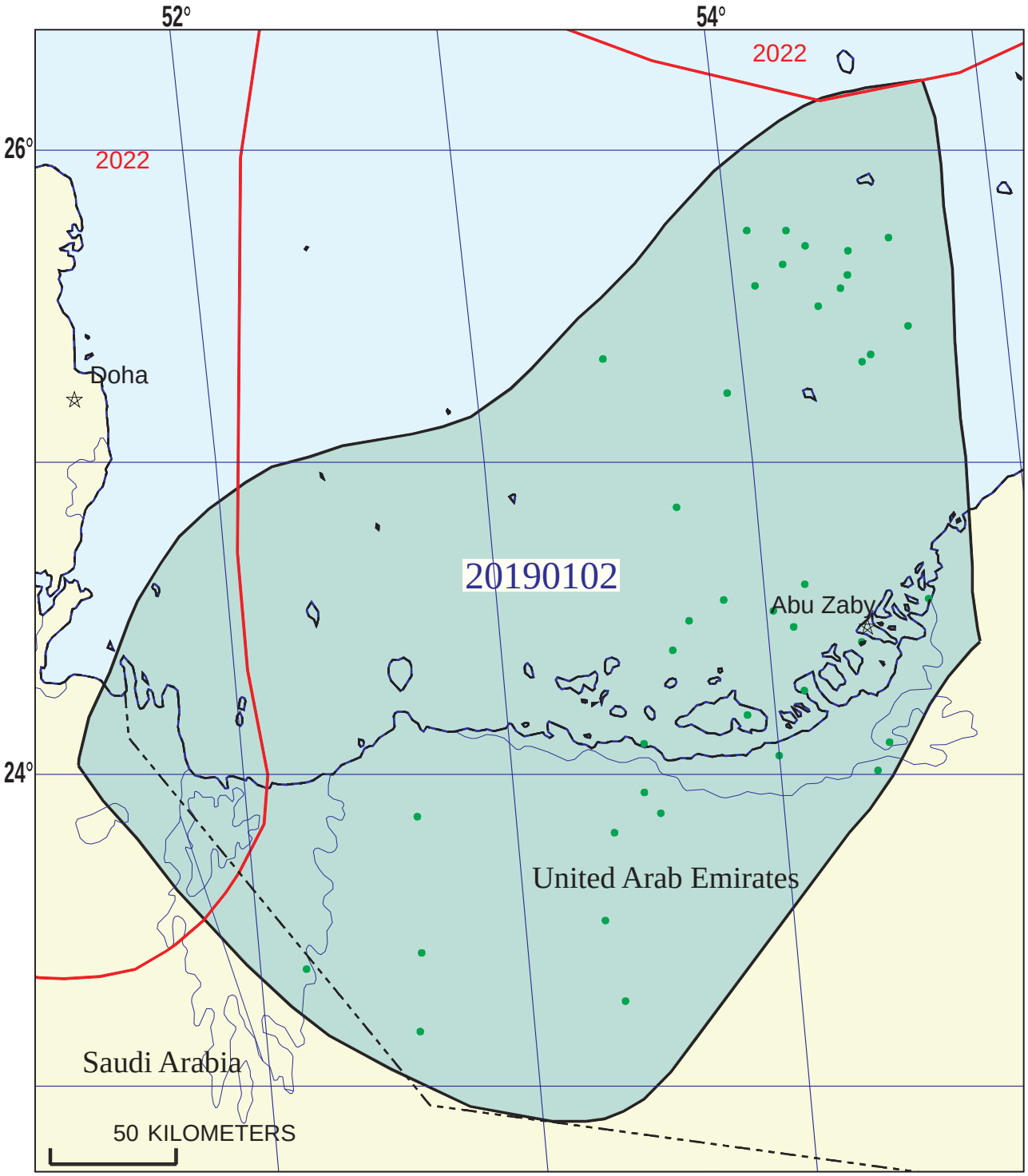


Cretaceous Reservoirs in South Gulf Suprasalt Structural Assessment Unit - 20190102

EXPLANATION

- Hydrography
- Shoreline
- 2019 — Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 20190102 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

USGS science for a changing world

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

Date:……..	12/8/99		
Assessment Geologist:……..	R.M. Pollastro		
Region:……..	Middle East and North Africa	Number:	2
Province:……..	Rub Al Khali Basin	Number:	2019
Priority or Boutique……	Priority		
Total Petroleum System:……	Cretaceous Thamama/Wasia	Number:	201901
Assessment Unit:……..	Cretaceous Reservoirs in South Gulf Suprasalt Structural	Number:	20190102
* Notes from Assessor	Lower 48-all growth function. This is an assessment of Cretaceous reservoirs (assessed separately from other reservoirs), recognizing possible overlap of Jurassic and Paleozoic.		

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: 34 Gas: 0
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 227 2nd 3rd 564 3rd 3rd 192
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)	10	median no.	45	max no.	100
Gas fields:……min. no. (>0)	1	median no.	5	max no.	10

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	30	max. size	3000
Gas in gas fields (bcfg):……min. size	60	median size	150	max. size	2000

Assessment Unit (name, no.)
Cretaceous Reservoirs in South Gulf Suprasalt Structural, 20190102

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	400	800	1200
NGL/gas ratio (bngl/mmcfg)……	30	60	90

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	22	44	66
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)……	24	38	49
Sulfur content of oil (%)……	1	1.2	2.4
Drilling Depth (m) ……	1200	2700	3700
Depth (m) of water (if applicable)……	0	75	100

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……	0.1	4.6	8
Hydrogen-sulfide content (%)……	0.1	2	5
Drilling Depth (m)……	2500	3000	4000
Depth (m) of water (if applicable)……	0	75	100

Assessment Unit (name, no.)
Cretaceous Reservoirs in South Gulf Suprasalt Structural, 20190102

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

1. Saudi Arabia represents 5 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		5	
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):...		0	
Portion of volume % that is offshore (0-100%).....		0	

2. United Arab Emirates represents 87 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		87	
Portion of volume % that is offshore (0-100%).....		70	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		85	
Portion of volume % that is offshore (0-100%).....		65	

3. Iran represents 8 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		8	
Portion of volume % that is offshore (0-100%).....		100	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		15	
Portion of volume % that is offshore (0-100%).....		100	

4. Province 2019 represents 92 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		92	
Portion of volume % that is offshore (0-100%).....		70	

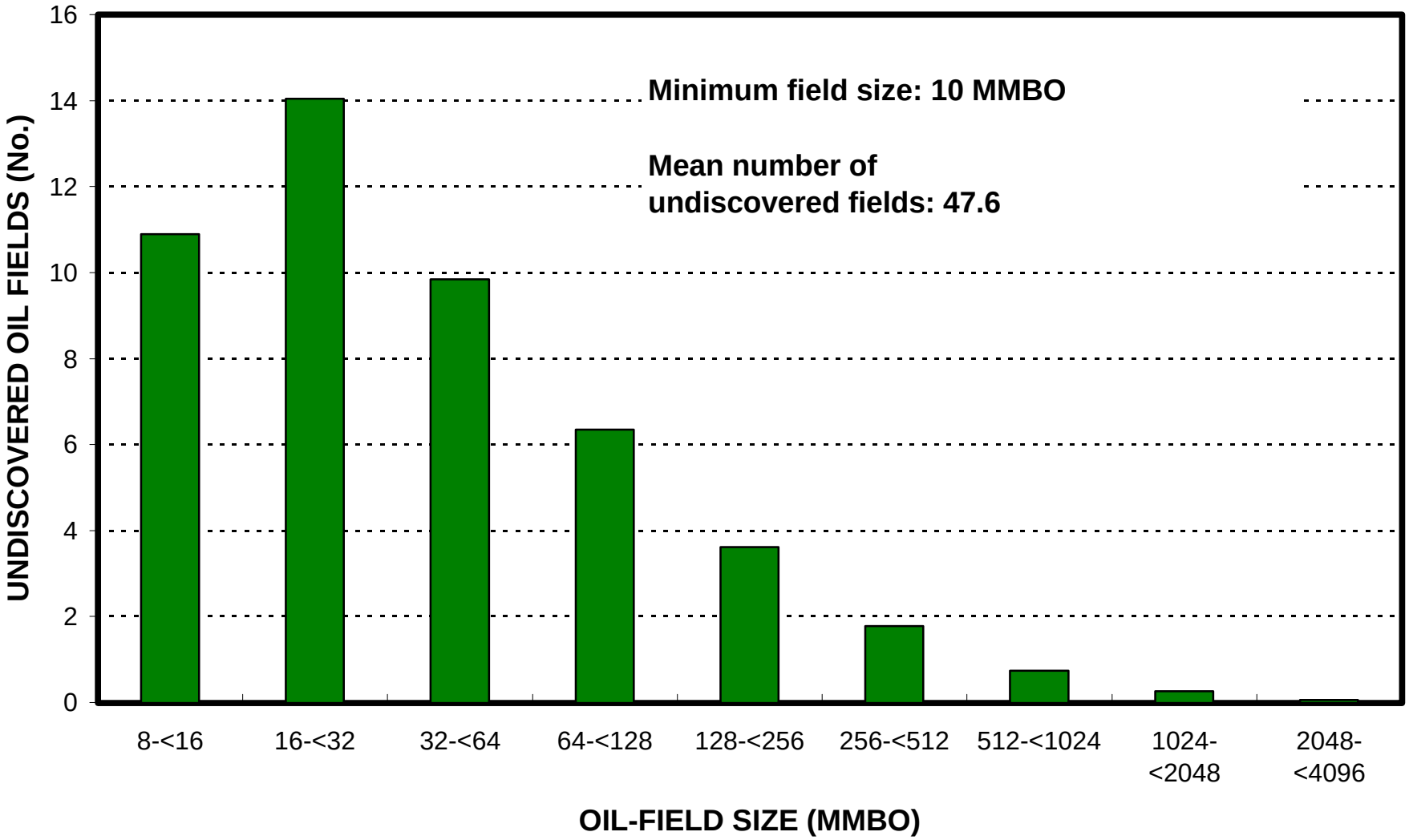
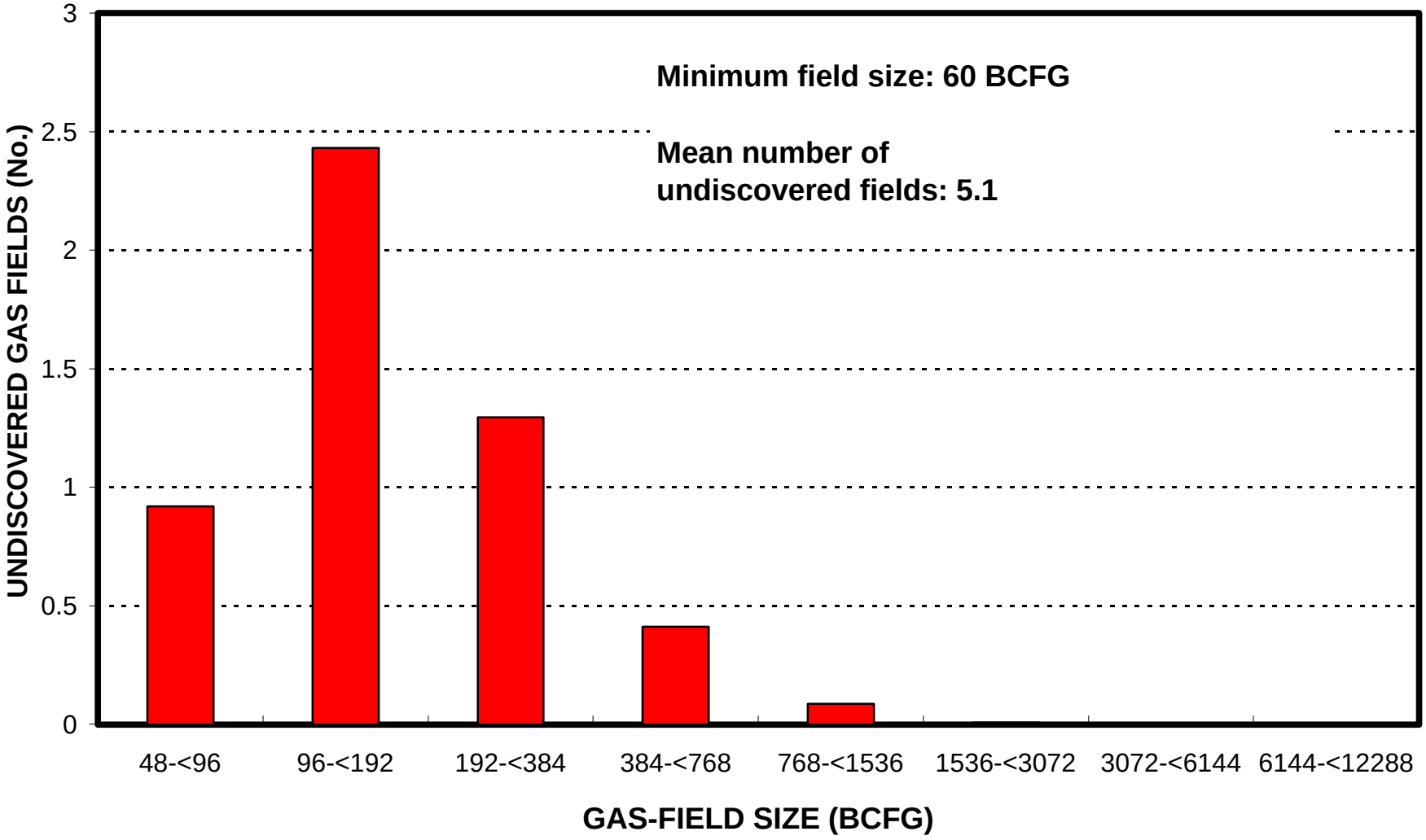
Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		100	
Portion of volume % that is offshore (0-100%).....		70	

5. Province 2022 represents 8 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		8	
Portion of volume % that is offshore (0-100%)……		60	

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

Cretaceous Reservoirs in South Gulf Suprasalt Structural, AU 20190102, Undiscovered Field-Size Distribution



Cretaceous Reserviors in South Gulf Suprasalt Structural, AU 20190102, Undiscovered Field-Size Distribution