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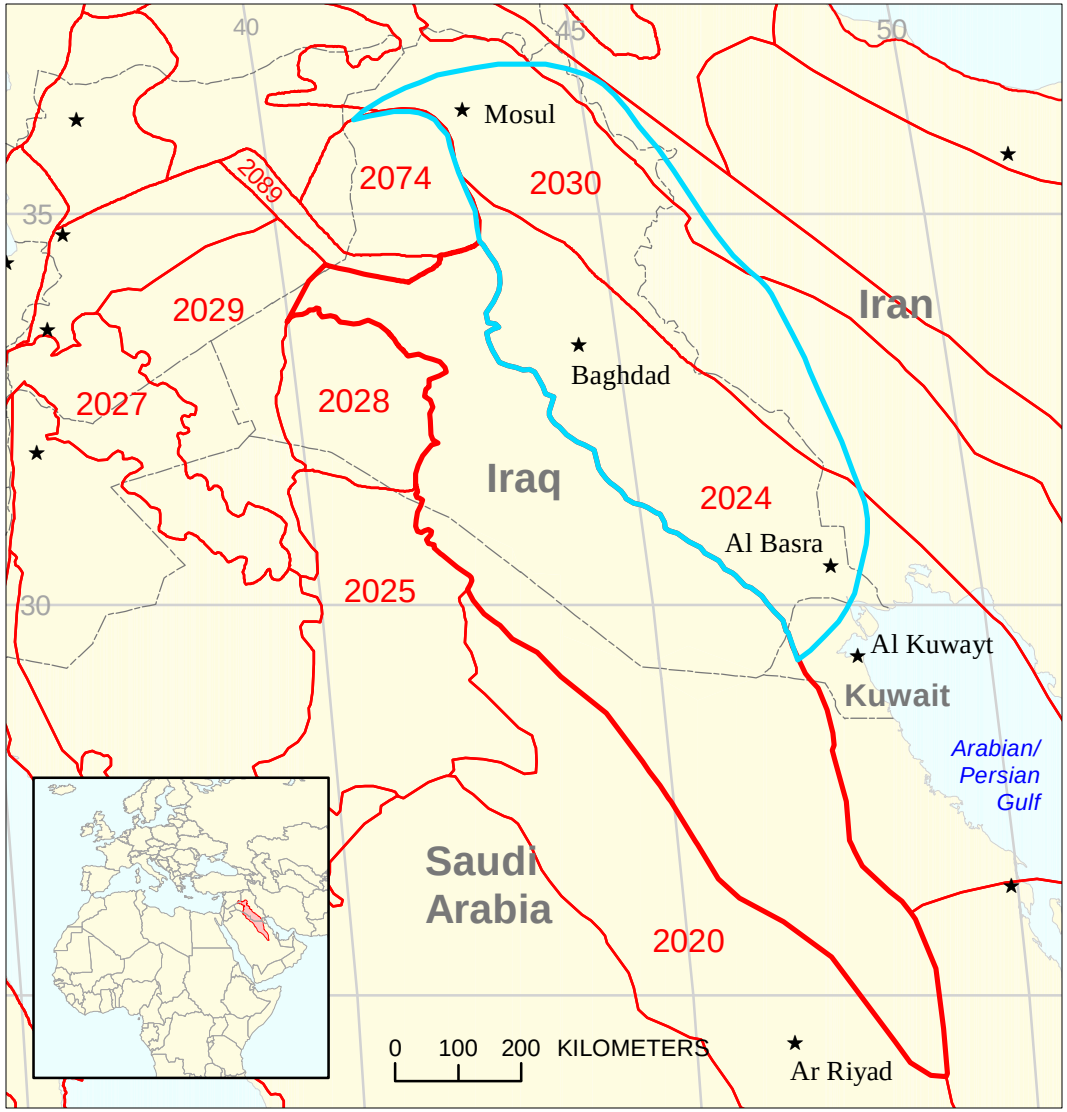
Basinal Oil and Gas Assessment Unit 20230202



Basinal Oil and Gas Assessment Unit 20230202
Widyan Basin-Interior Platform Geologic Province 2023
Other geologic province boundary

Geologic Summary

Detailed map of this assessment unit

Assessment Input Data

Assessment Results

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

USGS PROVINCE: Widyan Basin-Interior Platform (2023); Mesopotamian Foredeep Basin (2024); Zagros Fold Belt (2030); Zagros Thrust Zone (2031) Iraq and Iran

GEOLOGIST: J.E. Fox

TOTAL PETROLEUM SYSTEM: Jurassic Gotnia/Barsarin/Sargelu/Najmah (202302)

ASSESSMENT UNIT: Basinal Oil and Gas (20230202)

DESCRIPTION: Oil and gas occurs in Jurassic calcarenite lenses of bar or shelf margin origin that are locally interbedded with source rocks, in faulted and (or) folded structural traps. Hydrocarbons were expelled from organic-rich muddy lime source rocks deposited under anoxic and dysoxic conditions in the Gotnia Basin, a restricted intrashelf basin. Younger Jurassic seal rocks are distributed throughout the Total Petroleum System.

SOURCE ROCKS: Source of petroleum is cyclically bedded Callovian-Oxfordian-Kimmeridgian rocks that formed in the restricted intrashelf Gotnia Basin, a basin that formed after Permo-Triassic rifting on the passive margin platform of the Tethys. Source rocks occur primarily in the Sargelu Formation, which has a large quantity of organic matter of algal origin (amorphous alignite of Type II). Other source rocks are present in the Sargelu, Naokelekan, Gotnia, Barsarin and Chi Gara Formations. The TOC ranges from about 2 to 5 percent.

MATURATION: Maturation of the Upper Jurassic source-rock formations in Iraq (Sargelu and Naokelekan) began around 90 Ma, with peak generation from 85 to 13 Ma. Rapid maturation to the east followed the heavy loading by Mio-Pliocene molasse that raised the thermal gradient. Late Cretaceous and Miocene to Recent are the principal periods of structural growth in the fold belt.

MIGRATION: Petroleum moved updip into basement-related block-faulted structures that have grown, periodically, since the Precambrian. Such faults and associated fractures are good conduits for upward migration of fluids. In addition, Jurassic oil may be trapped in folded structures that formed primarily during the Tertiary. However, for this to happen, oil must have been sufficiently mature to migrate during the time of fold development, or upward through a thick overlying sequence of rocks. The extent to which upward migration occurs in the folds of the Zagros Fold Belt is uncertain.

RESERVOIR ROCKS: The best reservoirs are in cyclic Middle to Late Jurassic high-energy calcarenites and oolite facies marginal to the deeper intrashelf basins. The Namjah Limestone and Gotnia Formations have cycles of bituminous shale, oolitic limestone, dolomite, and anhydrite. Although cyclic, they have fewer cycles than equivalent strata in the Arabian Basin (Arab Formation).

TRAPS AND SEALS: Numerous prospects and structures have been identified in Iraq. Traps in this assessment unit are of two types, basement related and Zagros related. Oil and gas may be trapped in elongate north-south fault block anticlines over reactivated, deep-seated faults. In the second scenario, Late Cretaceous and Tertiary age folds of the Zagros, there may have been early entrapment when folds

were beginning to form, coincident with peak migration. Later, there may have been renewed oil generation (after its initial Early to Mid-Tertiary peak) associated with thick molasse deposition to the east during the Late Tertiary (Miocene-Pliocene). The Gotnia Formation has numerous anhydrite and evaporite beds and provides a tight seal for local oil and gas accumulations within the Gotnia and in the underlying Najmah Limestone.

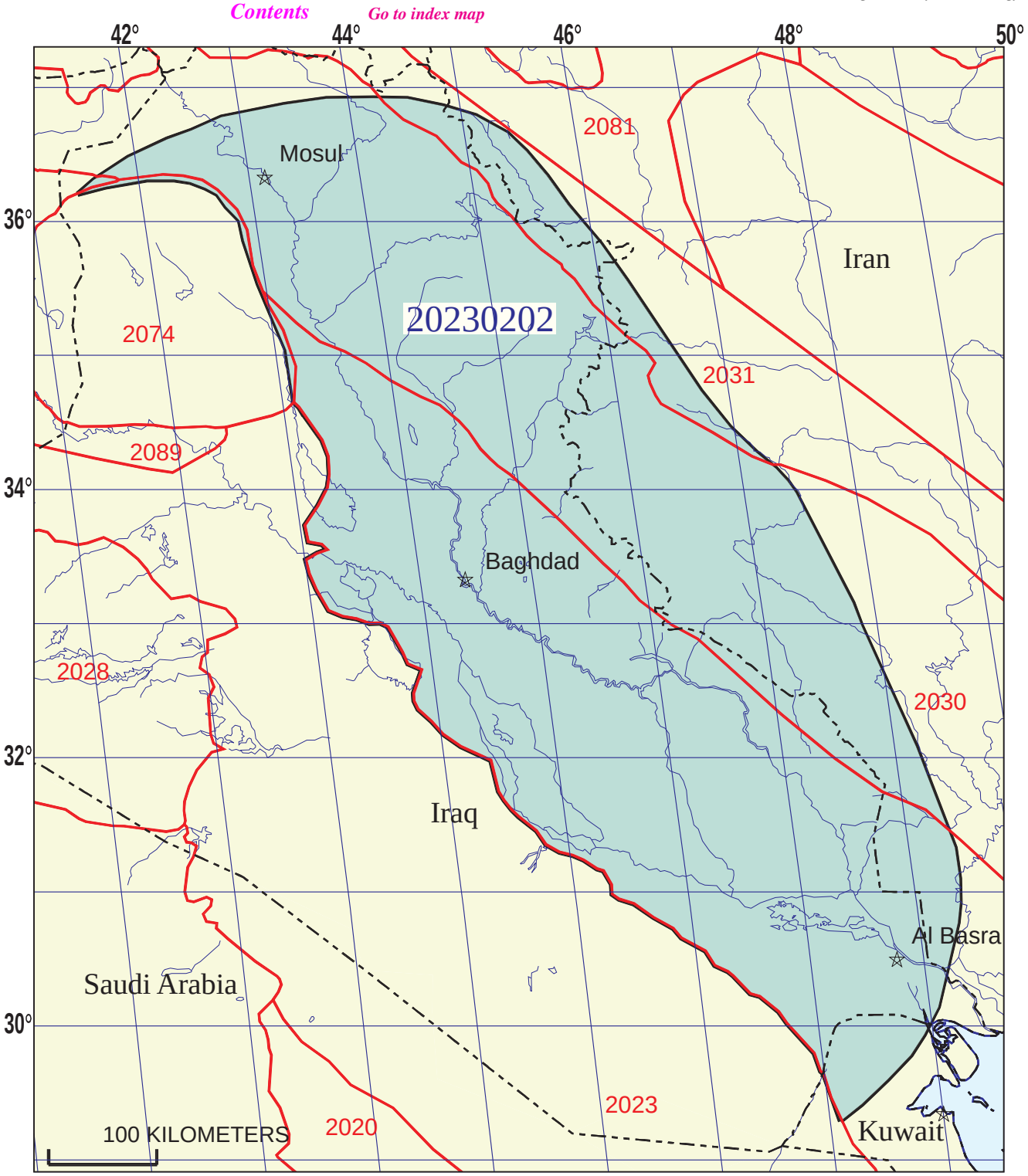
REFERENCES:

Alsharhan, A.S., and Kendall, C.G., 1986, Precambrian to Jurassic rocks of Arabian Gulf and adjacent areas—Their facies, depositional setting, and hydrocarbon habitat: American Association of Petroleum Geologists Bulletin, v. 70, no. 8, p. 977-1002.

Murris, R.J., 1986, Middle East stratigraphic evolution and oil habitat: American Association of Petroleum Geologists, v. 64, p. 597-618.

Sadooni, F.N., 1997, Stratigraphy and petroleum prospects of Upper Jurassic carbonates in Iraq: Petroleum Geoscience, v. 3, p. 233-243.

U.S. GEOLOGICAL SURVEY WORLD PETROLEUM ASSESSMENT 2000— DESCRIPTION AND RESULTS
U.S. Geological Survey World Energy Assessment Team



Basinal Oil and Gas Assessment Unit - 20230202

EXPLANATION

- Hydrography
- Shoreline
- 2023 — Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 20230202 — 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:……..	8/26/99		
Assessment Geologist:……..	T.S. Ahlbrandt		
Region:……..	Middle East and North Africa	Number:	2
Province:……..	Widyan Basin-Interior Platform	Number:	2023
Priority or Boutique……	Priority		
Total Petroleum System:……	Jurassic Gotnia/Barsarin/Sargelu/Najmah	Number:	202302
Assessment Unit:……..	Basinal Oil and Gas	Number:	20230202
* Notes from Assessor			

CHARACTERISTICS OF ASSESSMENT UNIT

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

What is the minimum field size?……. 20 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: 0 Gas: 0
Established (>13 fields) _____ Frontier (1-13 fields) _____ Hypothetical (no fields) X

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
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)	1	median no.	25	max no.	50
Gas fields:……min. no. (>0)	1	median no.	25	max no.	50

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	20	median size	50	max. size	1000
Gas in gas fields (bcfg):……min. size	120	median size	300	max. size	6000

Assessment Unit (name, no.)
Basinal Oil and Gas, 20230202

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	1000	1500	2000
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)……	20	35	45
Sulfur content of oil (%)……	0.5	2	4
Drilling Depth (m) ……	2500	4000	7500
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……			
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……	2500	4000	7500
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Basinal Oil and Gas, 20230202

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

1. Iran represents 25 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		25	
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):...		25	
Portion of volume % that is offshore (0-100%).....		0	

2. Iraq represents 70 areal % of the total assessment unit

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

3. Kuwait 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):...		5	
Portion of volume % that is offshore (0-100%).....		0	

4. Province 2024 represents 48 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		55	
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):...		42	
Portion of volume % that is offshore (0-100%).....		0	

5. Province 2030 represents 47 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		43	
Portion of volume % that is offshore (0-100%)……		0	

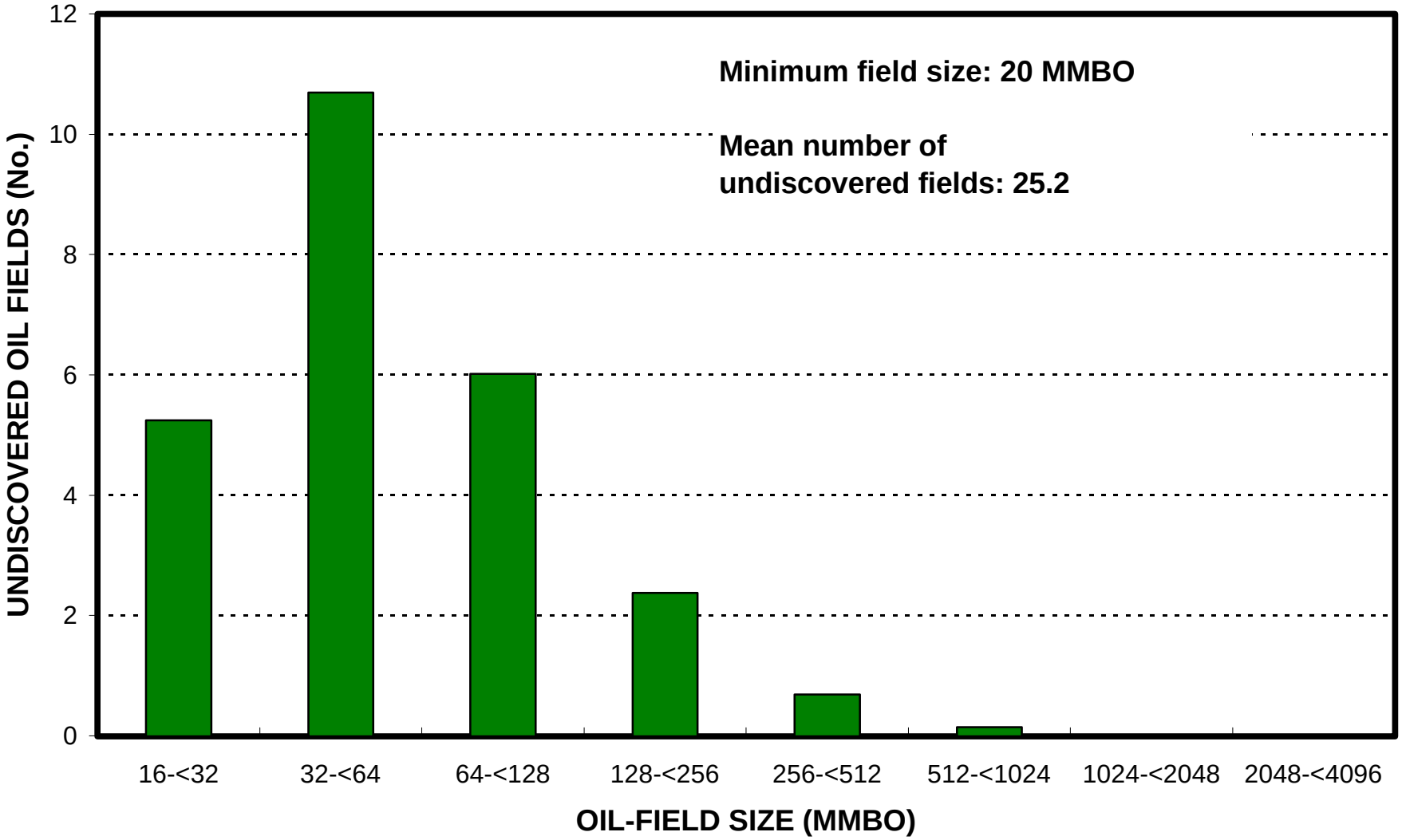
Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		50	
Portion of volume % that is offshore (0-100%)……		0	

6. Province 2031 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):…		2	
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):…		8	
Portion of volume % that is offshore (0-100%)……		0	

Basinal Oil and Gas, AU 20230202
Undiscovered Field-Size Distribution



Basinal Oil and Gas, AU 20230202
Undiscovered Field-Size Distribution