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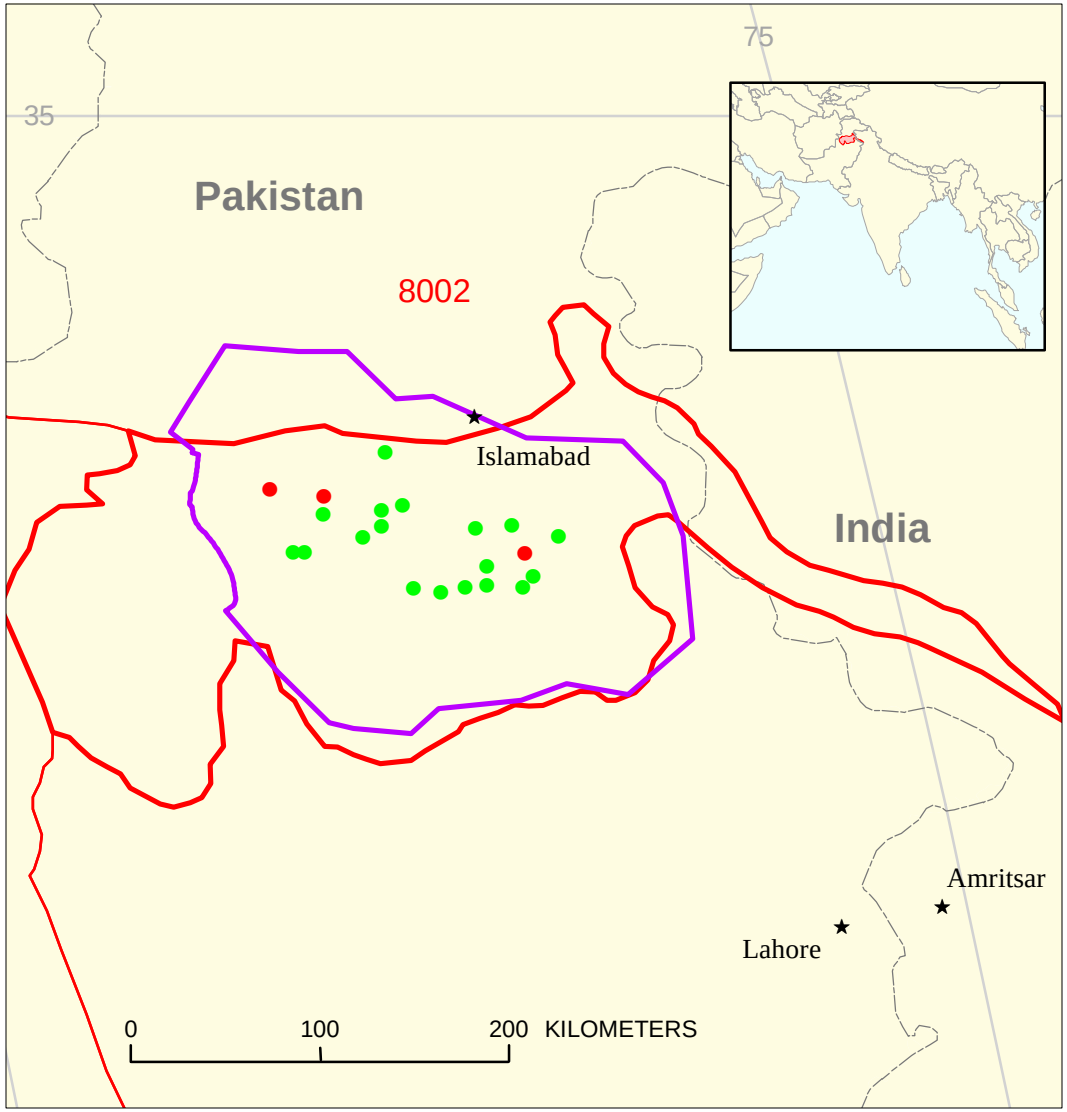
Kohat-Potwar Intrathrust Basin
Assessment Unit 80260101



Kohat-Potwar Intrathrust Basin Assessment Unit 80260101
Kohat-Potwar Geologic Province 8026
Other geologic province 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: Kohat-Potwar (8026) Pakistan. **GEOLOGIST:** C.J. Wandrey

TOTAL PETROLEUM SYSTEMS: Patala-Namal (802601)

ASSESSMENT UNITS: Kohat-Potwar Intrathrust Basin (80260101)

DESCRIPTION: This assessment unit is located in a structural basin in northern Pakistan. It is an oil prone onshore basin developed during collision of the Indian and Eurasian continental plates. The rocks that comprise this composite assessment unit include Eocambrian through Miocene source rocks and reservoirs. These rocks include sandstones, shales, and coals of deltaic to fluvial facies and carbonates and shales of shelf environments. While the Paleocene Patala Formation appears to be the major source of hydrocarbons there are many other potential source rocks that may be contributing in different parts of the basin.

SOURCE ROCKS: Source rocks include the Eocambrian shales, Lower Cretaceous Sembar, Permian Dandot, Triassic Wugali, and Paleocene Patala Formations. Total organic carbon content ranges from 0.5 percent to > 3.5 percent with an average of 1.4 percent and are Type II and III kerogens.

MATURATION: Maturities range from Ro 0.3 percent to >1.6 percent where sampled.

GENERATION AND MIGRATION: Generation most likely occurred from early Pliocene to the present. There may have also been at least one earlier generation phase in early Paleocene. Migration is primarily short, updip, and vertical into adjacent reservoirs and through faults and fractures associated with the plate collision and thrusting.

RESERVOIR ROCKS: Included are carbonates and sandstones of the Permian Torba and Wargal, Lower Cretaceous Lumshiwal, Upper Cretaceous Pab, Paleocene Namal, and Eocene Ghazij Formations. Porosities range from 9 percent to 30 percent and average 12 percent to 16 percent.

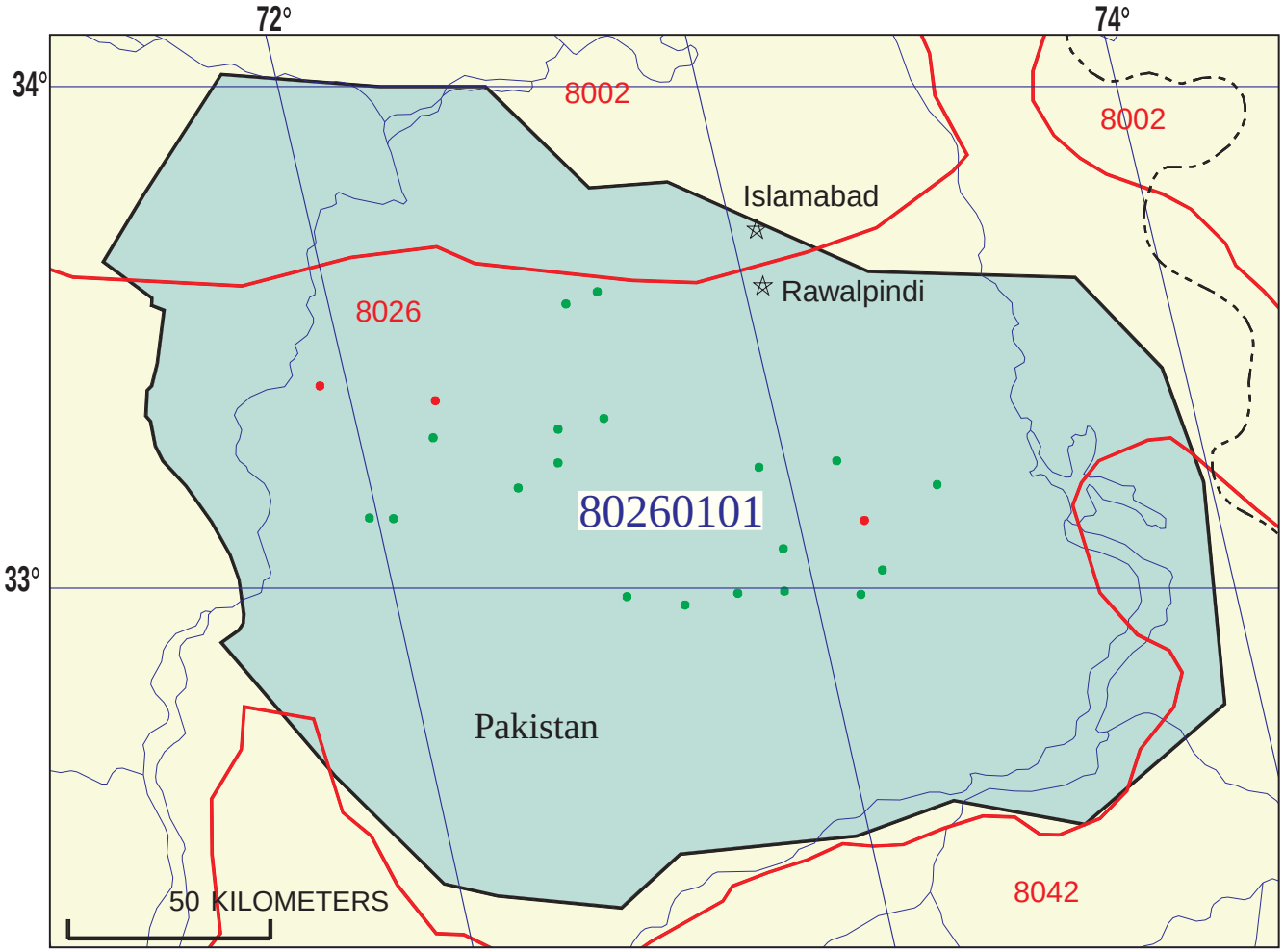
TRAPS AND SEALS: While most fields discovered to date are structural features such as anticlines and tilted fault blocks there may be stratigraphic traps yet to be discovered such as updip pinchouts on the flanks of the basin. Seals include interbedded shales and the thick shales and clays of the Miocene and Pliocene Siwaliks Group.

REFERENCES:

Ahmad, S., Alam, Z., and Khan, A.R., 1996, Petroleum exploration and production activities in Pakistan: Pakistan Petroleum Information Service, 72 p.

Kingston, J., 1986, Undiscovered petroleum resources of South Asia: U.S. Geological Survey Open-File Report 86-80, 131 p.

Johnson, E.A., Warwick, P.D., Roberts, S.B. and Khan, I.H., 1999, Lithofacies, depositional environments, and regional stratigraphy of the Lower Eocene Ghazij Formation, Balochistan, Pakistan: U.S. Geological Survey Professional Paper 1599, 76 p.



Kohat-Potwar Intrathrust Basin
Assessment Unit - 80260101

EXPLANATION

- Hydrography
- Shoreline
- 8026 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 80260101 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	10/12/99		
Assessment Geologist:……..	C.J. Wandrey		
Region:……..	South Asia	Number:	8
Province:……..	Kohat-Potwar	Number:	8026
Priority or Boutique……	Boutique		
Total Petroleum System:……	Patala-Namal	Number:	802601
Assessment Unit:……	Kohat-Potwar Intrathrust Basin	Number:	80260101
* Notes from Assessor	Lower 48-all growth function.		

CHARACTERISTICS OF ASSESSMENT UNIT

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

What is the minimum field size?……. 1 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: 15 Gas: 3
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 42.2 2nd 3rd 22.0 3rd 3rd 57.8
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 280 2nd 3rd 667 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.	20	max no.	40
Gas fields:……min. no. (>0)	1	median no.	5	max no.	12

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	1	median size	4	max. size	125
Gas in gas fields (bcfg):……min. size	6	median size	25	max. size	750

Assessment Unit (name, no.)
Kohat-Potwar Intrathrust Basin, 80260101

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	1100	2200	3300
NGL/gas ratio (bngl/mmcfg)……	30	60	90

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	20	35	50
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)……	15	34	51
Sulfur content of oil (%)……	0.05	0.4	2.3
Drilling Depth (m) ……	400	2000	5000
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……			
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……	400	2000	5500
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Kohat-Potwar Intrathrust Basin, 80260101

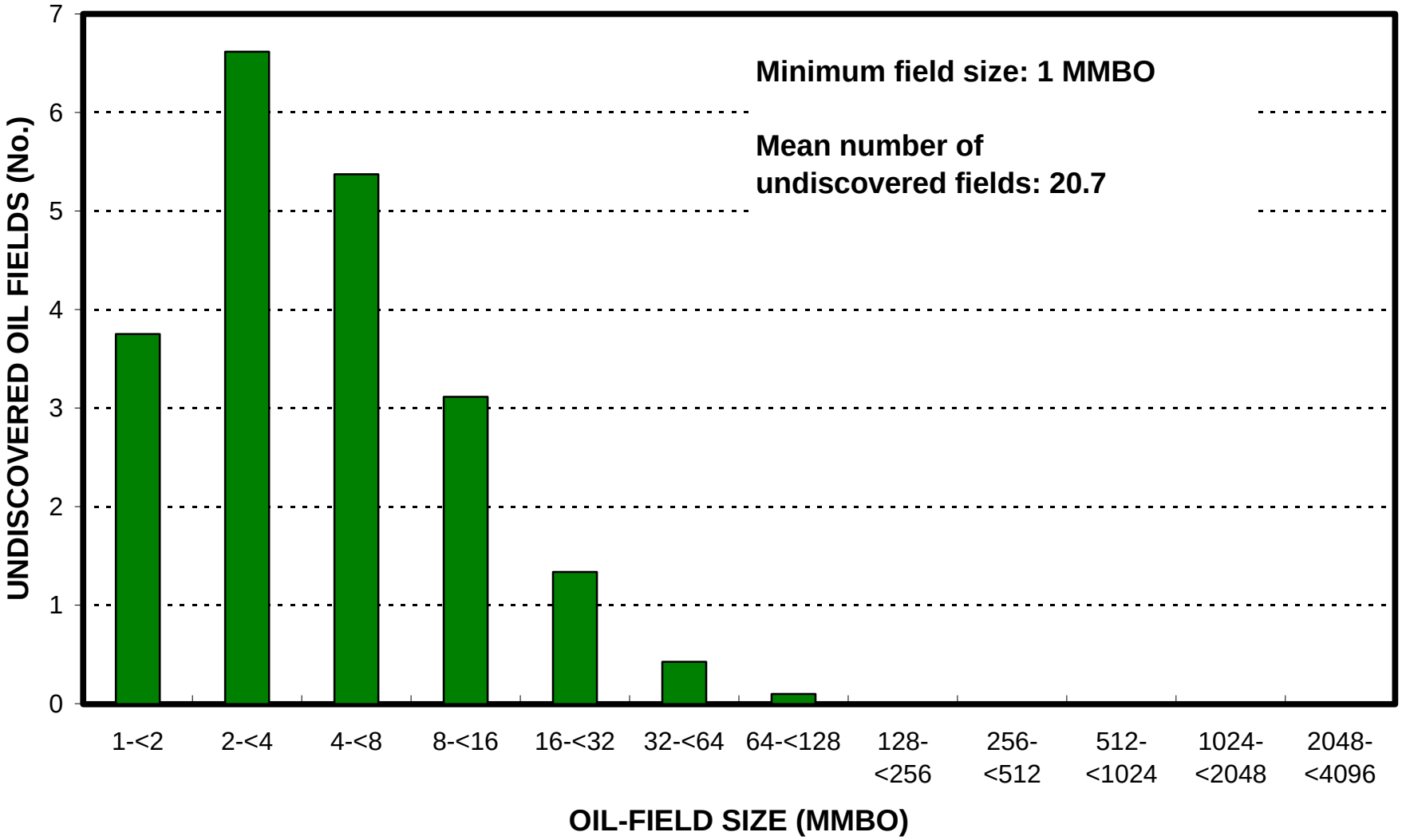
ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Pakistan 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):…		100	
Portion of volume % that is offshore (0-100%)……		0	

Kohat-Potwar Intrathrust Basin, AU 80260101
Undiscovered Field-Size Distribution



Kohat-Potwar Intrathrust Basin, AU 80260101
Undiscovered Field-Size Distribution