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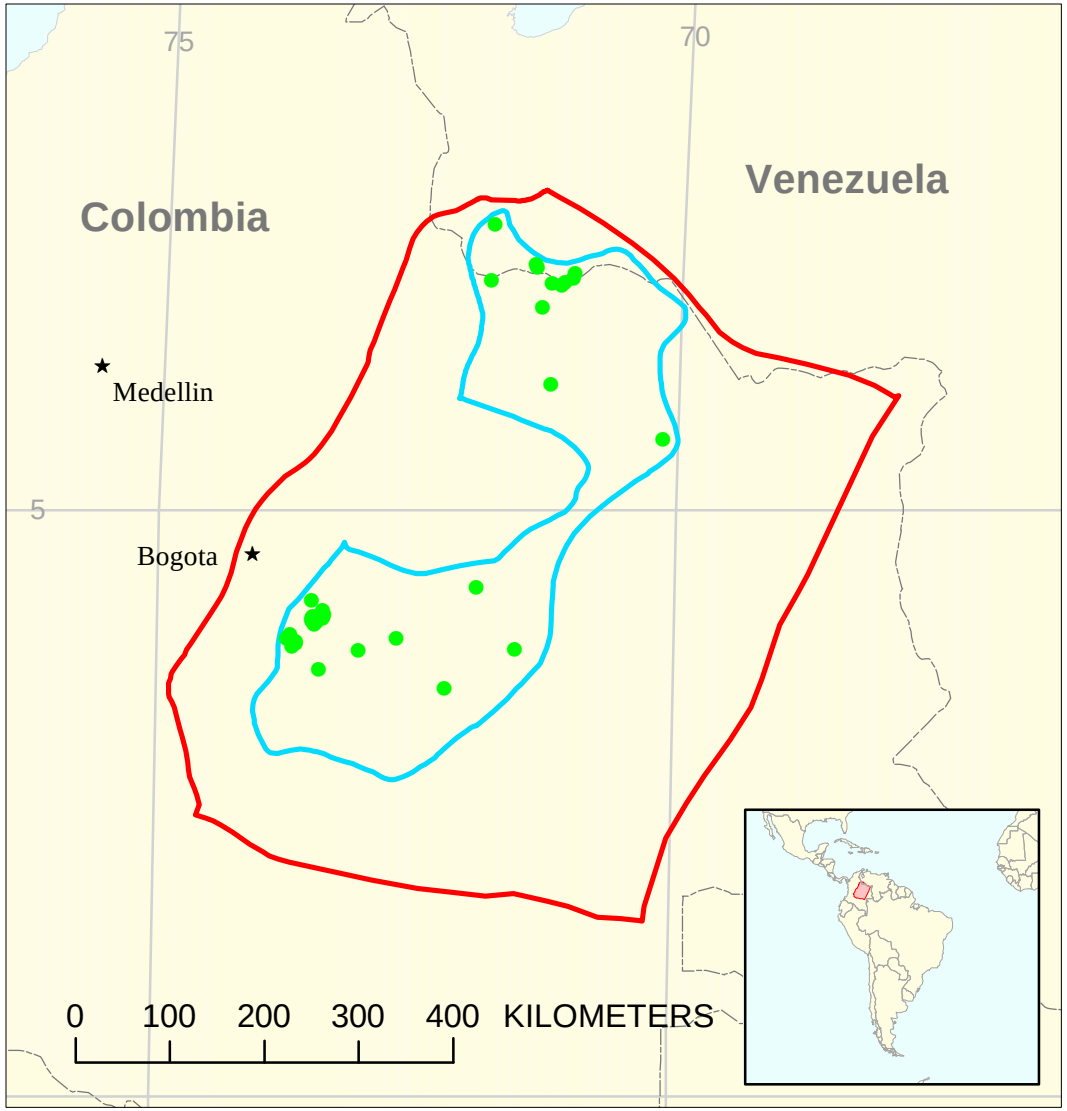
Peripheral
Assessment Unit 60960102



Peripheral Assessment Unit 60960102

Llanos Basin Geologic Province 6096

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: Llanos Basin (6096) **GEOLOGIST:** L.B. Magoon III

TOTAL PETROLEUM SYSTEM: Gacheta-Mirador (609601)

ASSESSMENT UNIT: Peripheral (60960102)

DESCRIPTION: This assessment unit includes the traps at either end of the fold-and-thrust belt and on the craton beyond the central part of the total petroleum system.

SOURCE ROCK: The source rock is the Gacheta Formation (Late Cretaceous, 85-90 Ma), an age equivalent of the La Luna Formation. In the thrust-and-fold belt, a Tertiary source rock is probably contributing to the hydrocarbon charge.

MATURATION: The thermal maturity (0.6 percent Ro) of the source rock was sufficient to began and ended generating petroleum in Late Miocene time (~10 to ~5 Ma).

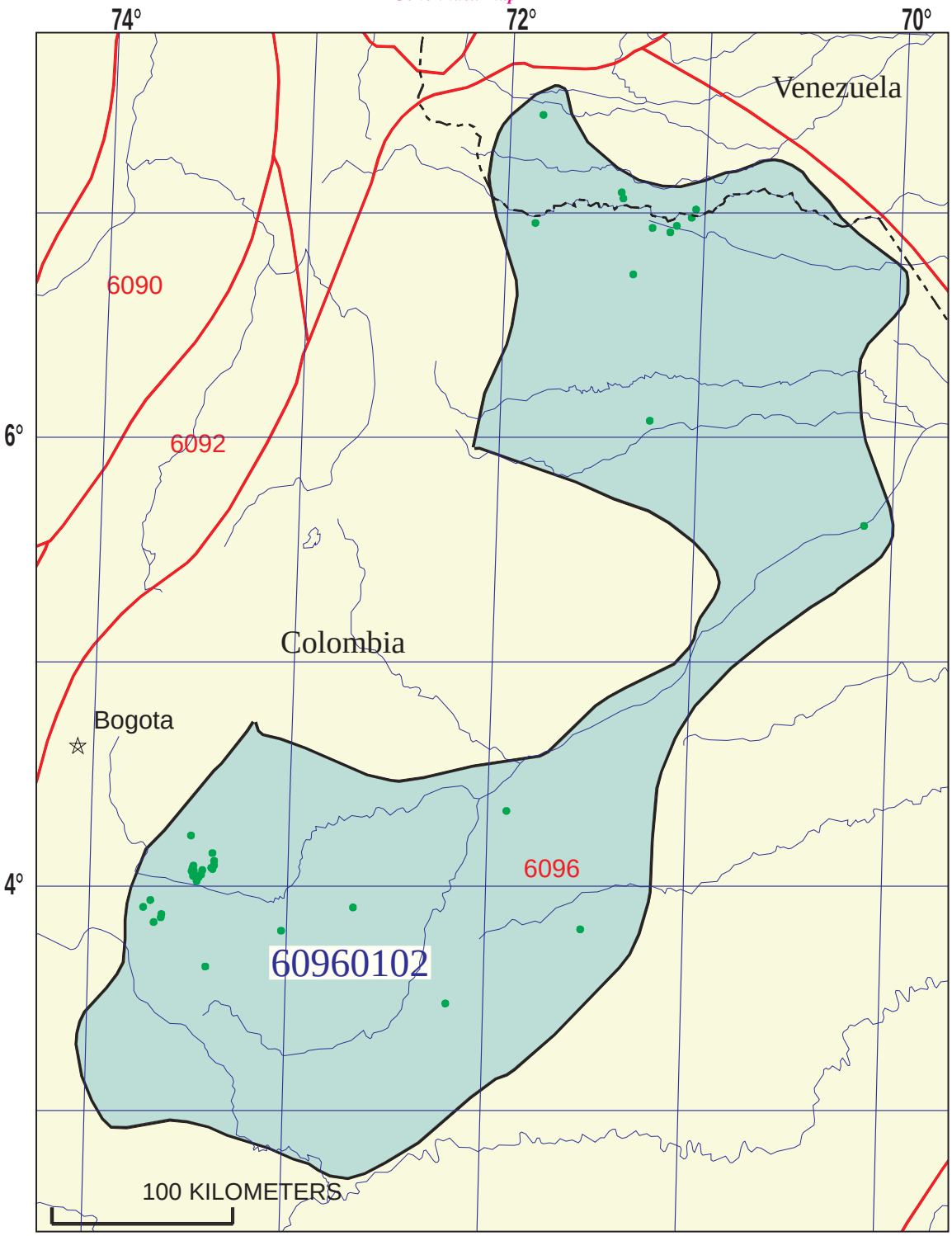
MIGRATION: Migration path is complex because petroleum migrated from a single source rock into seven different reservoir rocks. Petroleum migrated mostly eastward, and updip toward the craton. Petroleum filled and spilled from fault-bounded and anticlinal traps well beyond the edge of the thermally mature source rock to some stratigraphic traps.

RESERVOIR ROCKS: Siliciclastic reservoir rocks of Late Cretaceous and Tertiary age were derived mostly from the craton on the east and cannibalized from the developing fold-and-thrust belt. Rock units include Arauca Member, Guafita, Barco, Chuchilla, Mirador, Guadalupe Formation (K1, K2 members), and the Carbonera (C4, C5, T1, T2 members) formations. Gross reservoir thickness ranges from 5 to 205 m and net thickness ranges from 1 to 61 m. Reservoir properties range from 11 to 30 percent porosity and 60 to 9000 mD permeability.

TRAPS AND SEALS: Traps are mostly anticlines (10 traps), faults (9), fault blocks (5), domes (3), reverse faults (2), fold noses (1), and structural (1). Traps are faulted near the front of the fold-and-thrust belt and have a large stratigraphic component at the periphery of the assessment unit. The seal rocks are thick shales of regional extent that occur between the major reservoir rocks. The field size increases to the east where the traps are mostly stratigraphic. It is presumed that the trap-size also increases to the east.

REFERENCES:

Cooper, M.A., Addison, F.T., Alvarez, R., Coral, M., Graham, R.H., Hayward, A.B., Howe, S., Martinez, J., Naar, J., Peñas, R., Pulham, A.J., and Taborda, A., 1995, Basin development and tectonic history of the Llanos basin, Eastern Cordillera, and Middle Magdalena Valley, Colombia: American Association of Petroleum Geologists Bulletin, v. 79, p. 1421-1443.



Peripheral
Assessment Unit - 60960102

EXPLANATION

- Hydrography
- Shoreline
- 6096 — Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 60960102 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	6/30/99		
Assessment Geologist:……..	L.B. Magoon		
Region:……..	Central and South America	Number:	6
Province:……..	Llanos Basin	Number:	6096
Priority or Boutique……	Priority		
Total Petroleum System:……	Gacheta-Mirador	Number:	609601
Assessment Unit:……..	Peripheral	Number:	60960102
* 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?……. 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: 31 Gas: 0
Established (>13 fields) X Frontier (1-13 fields) Hypothetical (no fields)

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 139.2 2nd 3rd 4.6 3rd 3rd 8.6
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.	80	max no.	200
Gas fields:……min. no. (>0)	1	median no.	8	max no.	20

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	5	max. size	2000
Gas in gas fields (bcfg):……min. size	6	median size	90	max. size	4000

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AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	500	1000	2000
NGL/gas ratio (bngl/mmcfg)……	30	60	90

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	25	45	65
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)……	10	30	55
Sulfur content of oil (%)……	0.01	0.9	3
Drilling Depth (m) ……	250	2500	6000
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……			
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……	1000	3000	6000
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Peripheral, 60960102

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

1. Colombia represents 97 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		95	
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):…		95	
Portion of volume % that is offshore (0-100%)……		0	

2. Venezuela represents 3 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	

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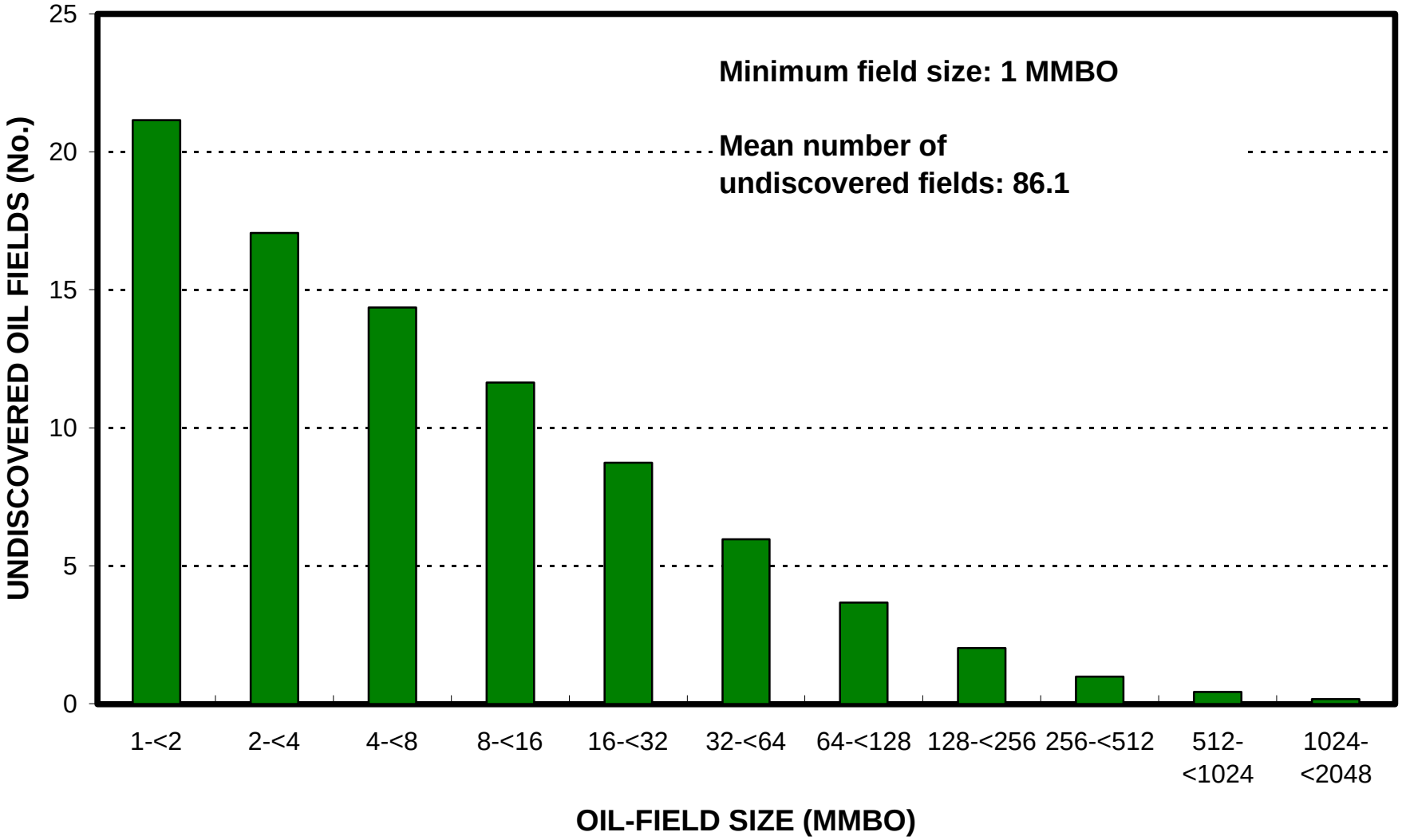
Undiscovered Field-Size Distribution



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Undiscovered Field-Size Distribution