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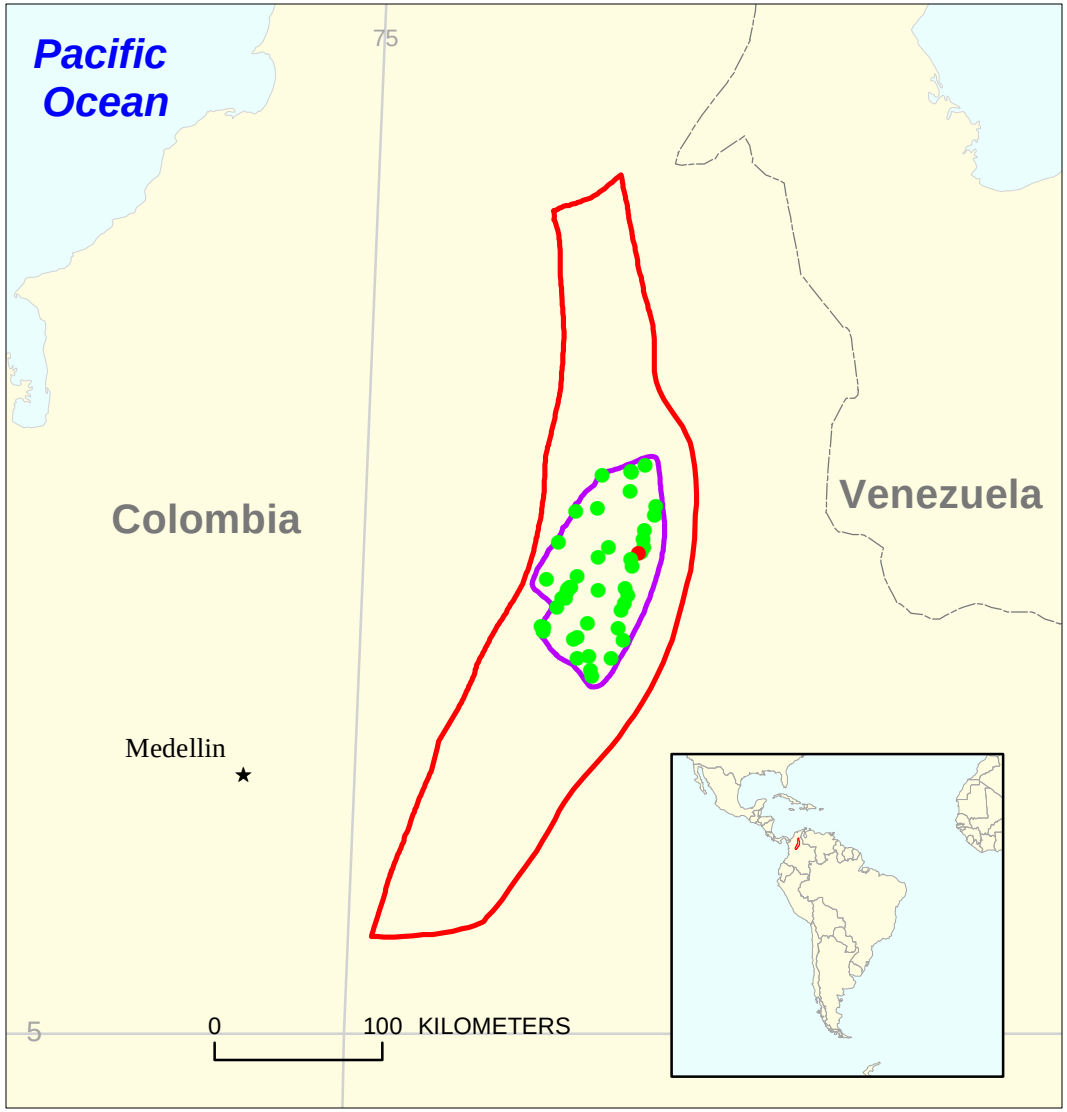
Northern
Assessment Unit 60900101



Northern Assessment Unit 60900101

Middle Magdalena Geologic Province 6090

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: Middle Magdalena (6090) **GEOLOGIST:** L.B. Magoon III

TOTAL PETROLEUM SYSTEM: La Luna-La Paz (609001)

ASSESSMENT UNIT: Northern (60900101)

DESCRIPTION: This assessment unit includes the traps in the northern part of the La Luna-LaPaz total petroleum system.

SOURCE ROCK: The source rock is the Late Cretaceous La Luna Formation.

MATURATION: The thermal maturity (0.6 percent Ro) of the source rock was sufficient to begin in the Eocene (~50 Ma) and was depleted in the Oligocene (~30 Ma).

MIGRATION: Migration path is complex because petroleum migrated from a single source rock across a major unconformity into four different reservoir rocks. Where the reservoir rocks onlaped a truncated thermally mature La Luna source rock, petroleum was able to migrate into the overlying traps.

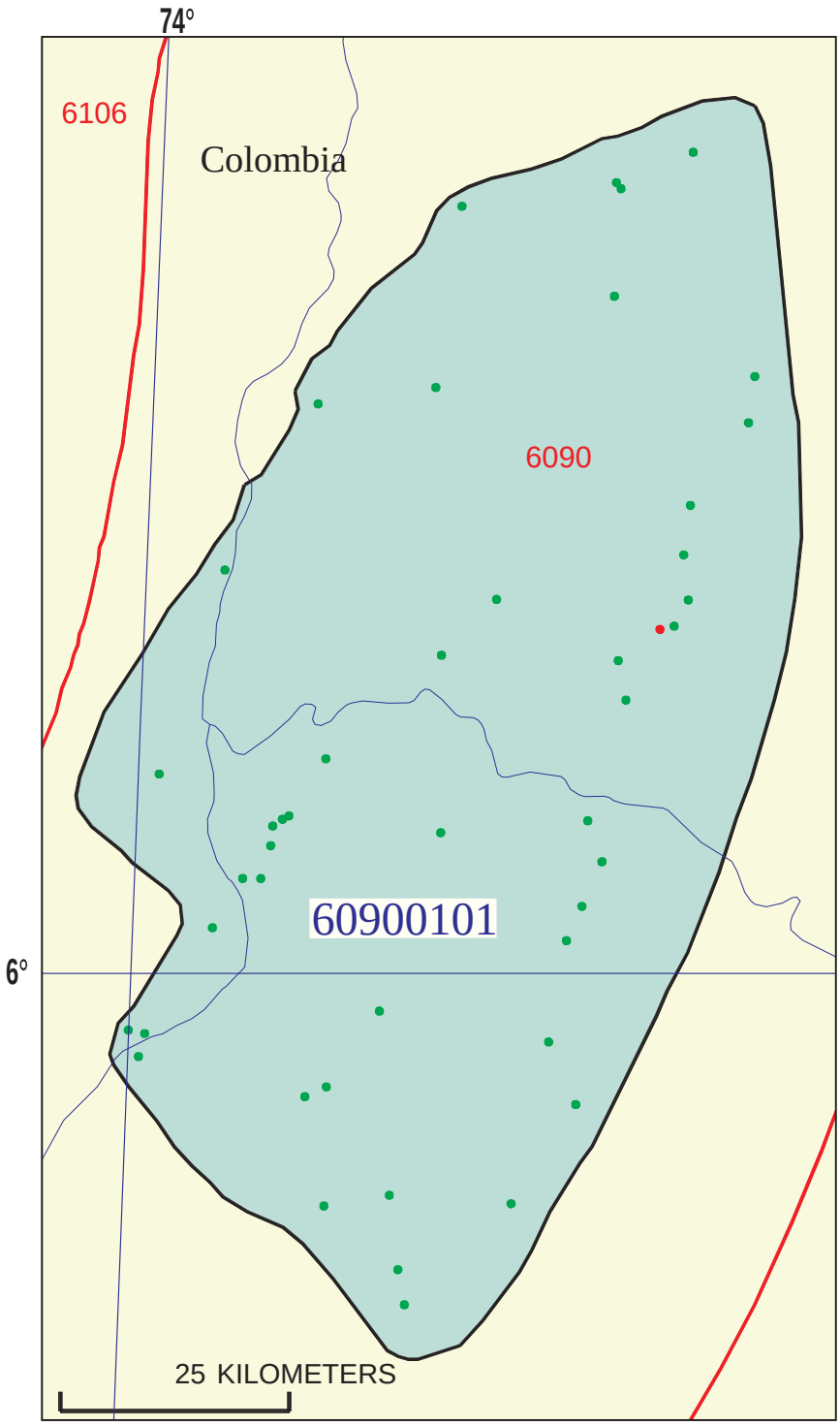
RESERVOIR ROCKS: Siliciclastic reservoir rocks of Late Cretaceous and Tertiary age were derived mostly from the craton on the east and cannabalized from the developing fold-and-thrust belt. Rock units include the La Paz, Esmeraldas, Mugrosa, and Lisama formations. Gross reservoir thickness ranges from 5 to 1219 m and net thickness ranges from 5 to 122 m. Reservoir properties range from 12 to 33 percent porosity and 33 to 4000 mD permeability.

TRAPS AND SEALS: Traps are mostly anticlines (19 traps), with some faults monoclinal folds (2), fault blocks (2), and a dome (1). Many of these traps formed very early and were continually rejuvenated. The seal rocks are thick shales of local extent that occur within the major reservoir rocks.

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.

Ramon, J.C., Dzou, L., and Giraldo, B., 1997, Geochemical evaluation of the Middle Magdalena basin, Colombia: Instituto Colombiano del Petróleo, Ciencia, TecnologÍa y Futuro, v. 1, no. 3, p. 47-66.



Northern
Assessment Unit - 60900101

EXPLANATION

- Hydrography
- Shoreline
- 6090 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 60900101 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	6/29/99		
Assessment Geologist:……..	L.B. Magoon		
Region:……..	Central and South America	Number:	6
Province:……..	Middle Magdalena	Number:	6090
Priority or Boutique……	Priority		
Total Petroleum System:……	La Luna-La Paz	Number:	609001
Assessment Unit:……..	Northern	Number:	60900101
* 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: 27 Gas: 0
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 8 3rd 3rd 5.6
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)	5	median no.	25	max no.	50
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	1	median size	4	max. size	150
Gas in gas fields (bcfg):……min. size		median size		max. size	

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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)……	400	600	1000
NGL/gas ratio (bngl/mmcfg)……	30	60	90

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)……	16	28	42
Sulfur content of oil (%)……	0.1	1	2.8
Drilling Depth (m) ……	200	1700	5000
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)……			

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Northern, 60900101

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

1. Colombia 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%)……			

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Undiscovered Field-Size Distribution