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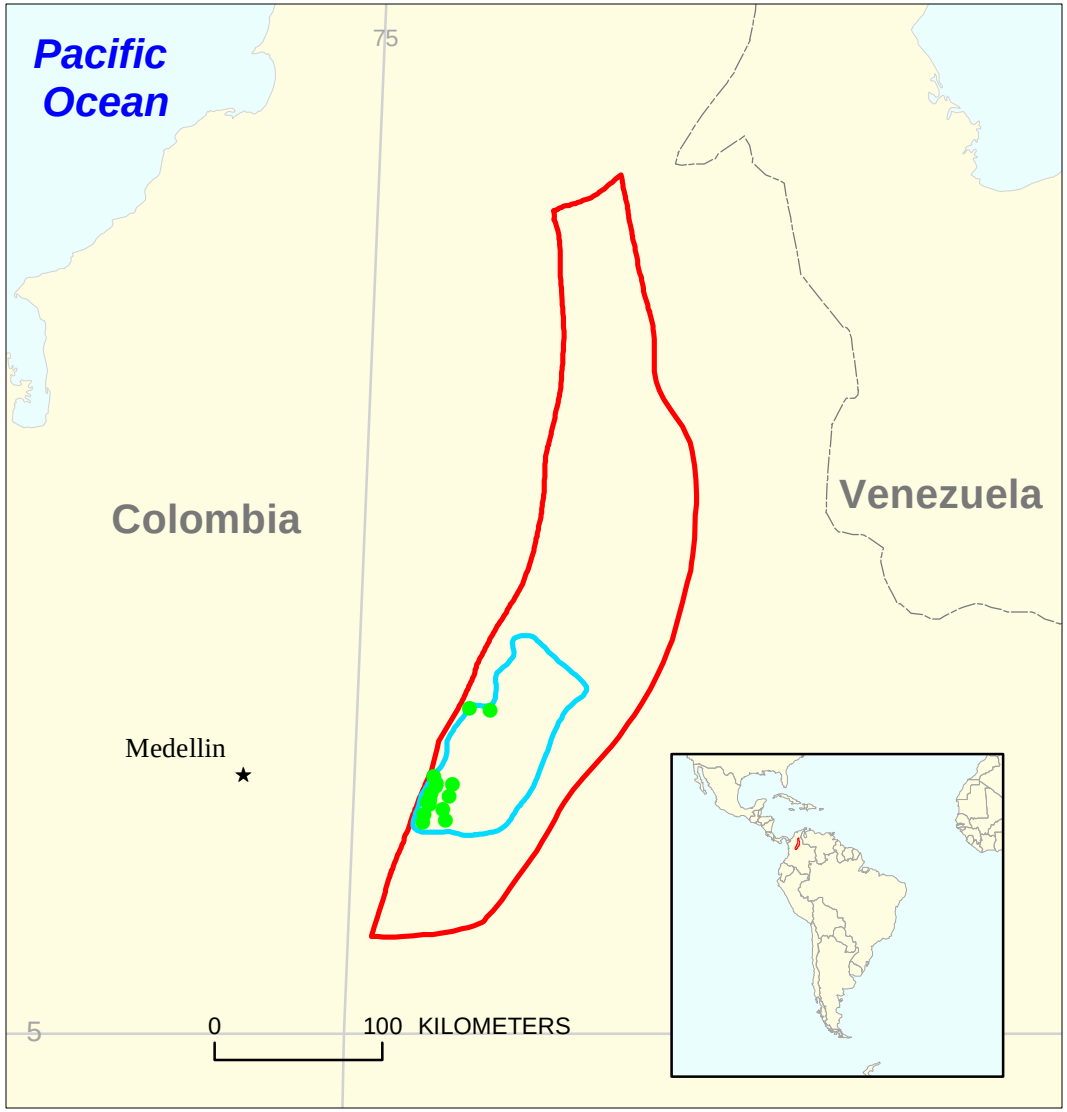
Southern
Assessment Unit 60900102



Southern Assessment Unit 60900102
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: Southern (60900102)

DESCRIPTION: This assessment unit includes the traps in the southern part of the La Luna-La Paz 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.

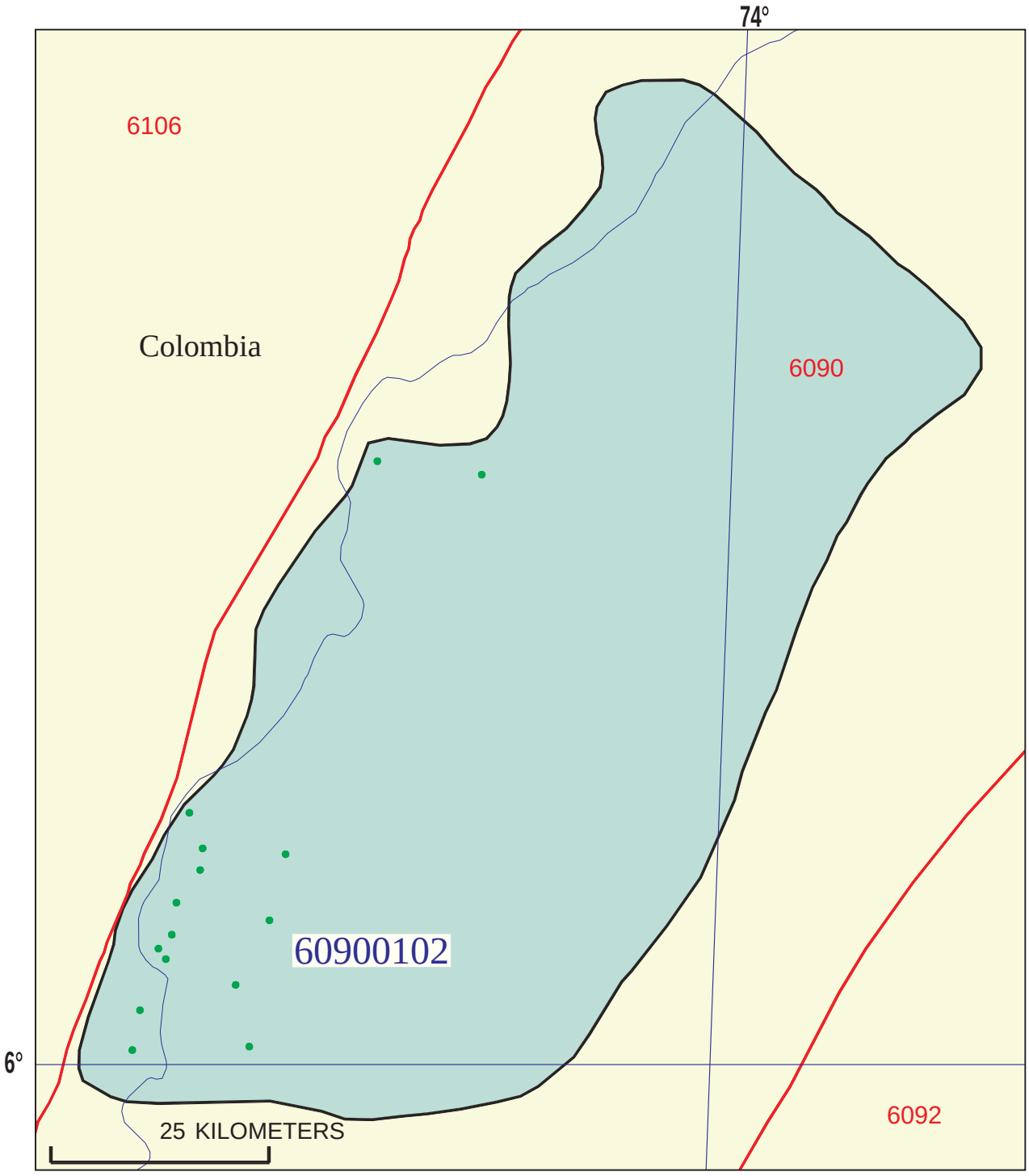
RESERVOIR ROCKS: Siliciclastic reservoir rocks of Tertiary age were derived mostly from the craton on the east and cannalalized from the developing fold-and-thrust belt. Rock units include the La Paz, Esmeraldas, and Mugrosa formations. Gross reservoir thickness ranges from 71 to 610 m and net thickness ranges from 2 to 152 m. Reservoir properties range from 24 to 32 percent porosity and 500 to 1000 mD permeability.

TRAPS AND SEALS: Traps are mostly faults (7) and monoclinal folds (3). 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.



Southern
Assessment Unit - 60900102

EXPLANATION

- Hydrography
- Shoreline
- 6090 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 60900102 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:……..	Southern	Number:	60900102
* Notes from Assessor	Lower 48 growth factor. Remaining potential is perceived to be primarily heavy oil.		

CHARACTERISTICS OF ASSESSMENT UNIT

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

What is the minimum field size?……. 5 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: 7 Gas: 0

Established (>13 fields) _____ Frontier (1-13 fields) X Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 175.6 2nd 3rd 69.0 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)	2	median no.	8	max no.	20
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	5	median size	15	max. size	250
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)……	100	200	400
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)……	13	17	28
Sulfur content of oil (%)……	0.1	1.8	2.8
Drilling Depth (m) ……	200	500	1800
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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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