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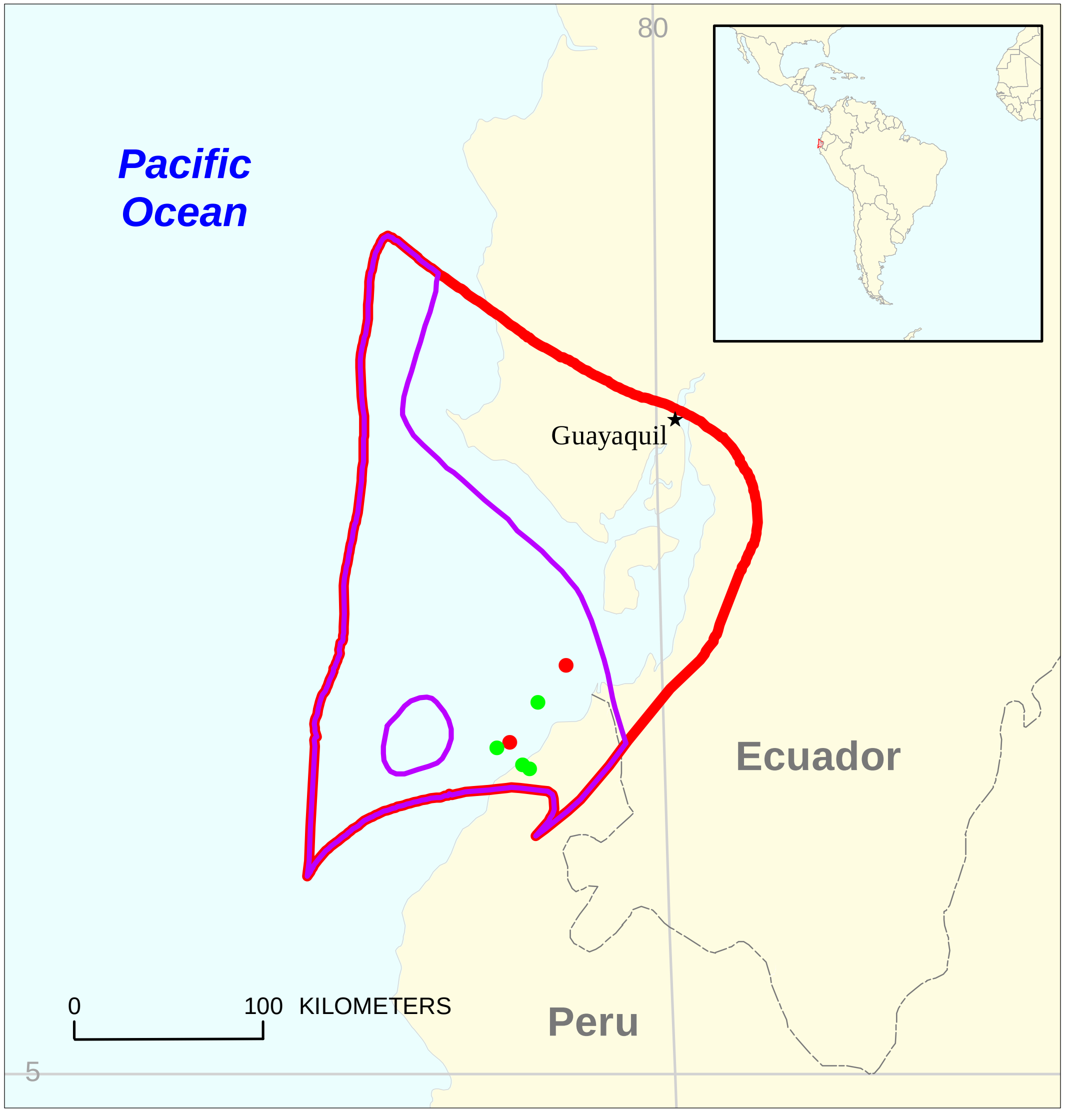
Neogene Pull-Apart Basin Assessment Unit 60830101



Neogene Pull-Apart Basin Assessment Unit 60830101

Progreso Basin Geologic Province 6083

Geologic Summary

Detailed map of this assessment unit

Assessment Input Data

Assessment Results

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

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

USGS PROVINCE: Progreso Basin (6083) **GEOLOGIST:** D.K. Higley

TOTAL PETROLEUM SYSTEM: Neogene (608301)

ASSESSMENT UNIT: Neogene Pull-Apart Basin (60830101)

DESCRIPTION: The Progreso-Tumbes-Santa Elena Basin is located along the coast of northern Peru and southern Ecuador. The basin is divided from north to south into the Paleogene Santa Elena sub-basin, and the Neogene Progreso and Tumbes sub-basins. The Peru Bank is part of the Cretaceous-Paleogene assessment unit. Progreso-Tumbes has been described as a pull-apart sub-basin. Oil and gas production from this Neogene assessment unit is primarily from Miocene-age sandstones in the Tumbes sub-basin. Travis and others (1975) estimate offshore-undiscovered resources of 335 MMBO for this Neogene assessment unit. While they were not assessed as part of this study, offshore Ecuador and Peru exhibit excellent potential for gas hydrate resources (Miller and others, 1991).

SOURCE ROCKS: The probable hydrocarbon source rocks are marine shales that are interbedded and overlie the reservoir intervals. No source rock geochemical studies have been published regarding which marine shales may have sourced oil and gas across this basin. Probable source rocks in the Progreso-Tumbes sub-basin are upper Oligocene to possibly early Miocene Heath Formation and the Miocene-age Cardalitos Formation (Zuniga-Rivero and others, 1998).

MATURATION: Paleozoic through Tertiary source rocks across Colombia, Ecuador, and Peru became thermally mature for oil generation during Neogene phases of basin development (Pindell and Tabbutt, 1995). Miocene and younger is the probable timing of source rock maturation for Tertiary and older reservoirs across the basin (Jaillard and others, 1995; Pindell and Tabbutt, 1995).

MIGRATION: Probable onset of migration is mid-Miocene time, after the opening of the Gulf of Guayaquil by movement along the Dolores-Guayaquil megashear and creation of the Progeso-Tumbes sub-basin. Close association of potential source and reservoir rocks suggests that emplacement of oil in reservoirs could have begun soon after the start of hydrocarbon generation.

RESERVOIR ROCKS: Primary oil and gas reservoirs of the Progreso-Tumbes sub-basin are marine sandstones of the Miocene-age Zorritos and Subibaja Formations, and the upper Oligocene to possibly early Miocene Heath Formation. Thickness range of the sedimentary section in the Tumbes basin is 6,000 to 12,000 m (20,000 to 40,000 ft), increasing seaward (AIPC, no date).

TRAPS AND SEALS: While the Progreso-Tumbes-Santa Elena Basin has been characterized as a forearc basin, it lies seaward of the Coastal range, which has been identified as a “trench-slope break” or “outer-arc ridge” environment; Kingston (1994) indicates a closer basin configuration might be named trench-slope basin. Evidence for growth faulting in the Progresso Basin is mostly in lower Miocene, Oligocene, Eocene, and Paleocene formations on top of the metamorphosed Pennsylvanian Amotape and Precambrian basement rocks (AIPC, no date). Some of the tectonic events that influenced hydrocarbon generation, migration, and trap formation are listed below:

1. Early-middle Eocene boundary–New fore-arc basins were created. This is attributed to collision of coastal Ecuador with the Andean margin.
2. Eocene–Inca Orogeny–This is the period of erosion of the Cretaceous section in Progreso and Tumbes that involves right-lateral and rotational movement associated with the Dolores-Guayaquil megashear and possibly the Troncho Mocho wrench fault. This Eocene event resulted in emergence of the southern coastline of Ecuador (Santa Elena peninsula) (Jaillard and others, 1995)
3. Upper Oligocene-Miocene time–Separation of the Nazca Plate from the South American Plate with active subduction at the Peru-Chile trench and creation of the Neogene (Tumbes, Progreso) fore-arc basins (Jaillard and others, 1995) and deposition of the thick Miocene section.
4. Middle Miocene–Block faulting across the Progreso and Talara basins and renewed growth of the Andes Mountains.
5. Mid-Pliocene–Horst and graben, gravity and basement-involved faulting, mostly in the Tumbes sub-basin (AIPC, no date).

Overlying and interbedded marine shales are the major reservoir seals, both for shallow and deepwater deposits. Lateral seals are (primarily normal) fault offsets, and lateral depositional or erosional pinchout of the mostly marine sandstones into shales. Sediment sources are mainly from the east, northeast, and southeast (Petroperu, 1999; Pindell and Tabbutt, 1995), depositional patterns associated with these fluvial, shoreline, turbidite, marine and other facies strongly influence types and locations of seals.

REFERENCES:

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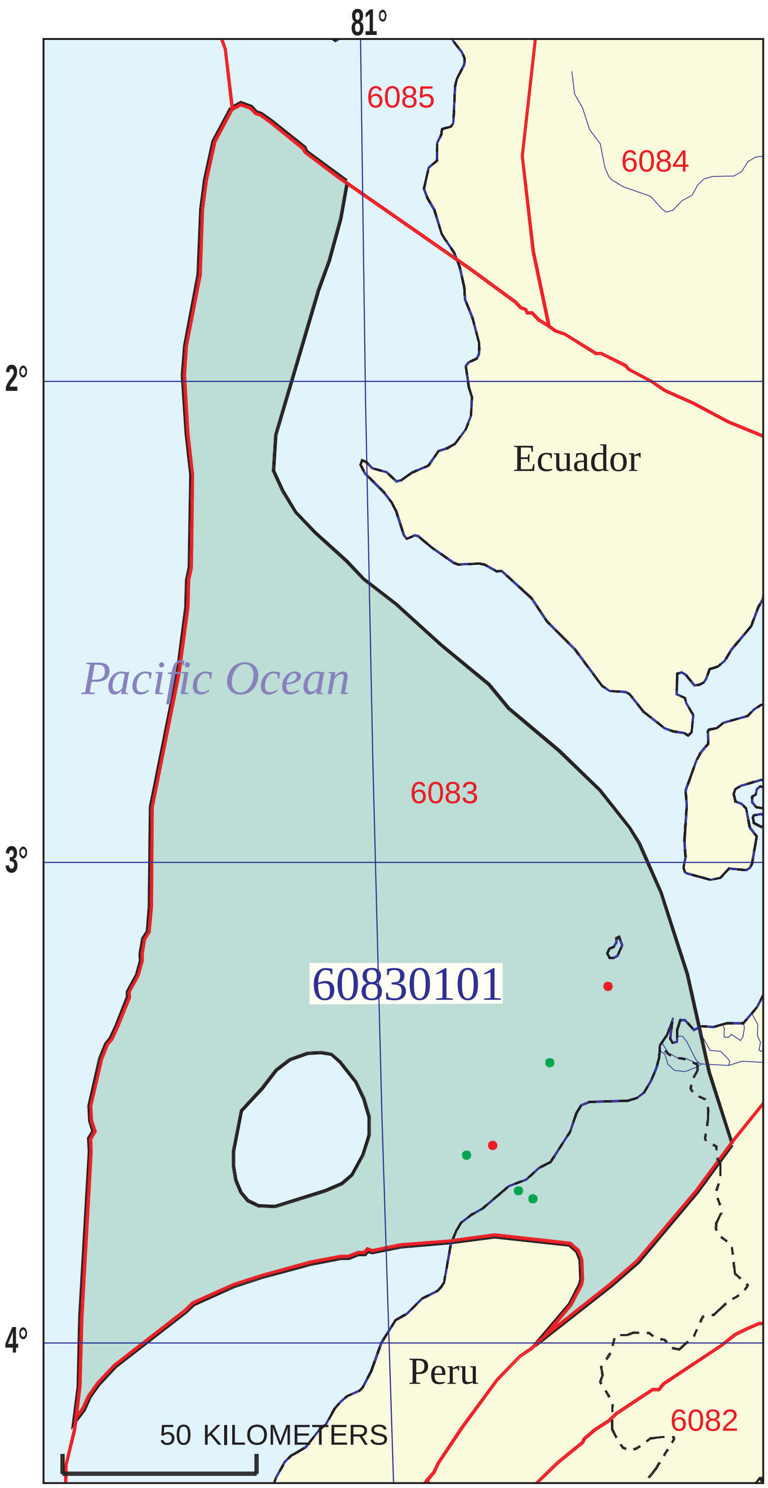

Neogene Pull-Apart Basin Assessment Unit - 60830101

EXPLANATION

- Hydrography
- Shoreline
- 6083 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 60830101 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

USGS PROVINCE: Progreso Basin (6083) **GEOLOGIST:** D.K. Higley

TOTAL PETROLEUM SYSTEM: Cretaceous-Paleogene (608302)

ASSESSMENT UNIT: Cretaceous-Paleogene Santa Elena Block (60830201)

DESCRIPTION: The Progreso-Tumbes-Santa Elena Basin is located along the coast of northern Peru and southern Ecuador. The basin is divided from north to south into the Paleogene Santa Elena sub-basin, and the Neogene Progreso and Tumbes sub-basins. The Peru Bank is part of the Cretaceous-Paleogene assessment unit. Mainly oil is produced from the Cretaceous-Paleogene assessment unit. Reservoirs are primarily Eocene-age sandstones of the Santa Elena sub-basin, a Paleogene structural feature. Although they were not assessed as part of this study, offshore Ecuador and Peru exhibit excellent potential for gas hydrate resources (Miller and others, 1991).

SOURCE ROCKS: The probable hydrocarbon source rocks are marine shales that are interbedded and overlie the reservoir intervals. No source rock geochemical studies have been published regarding which marine shales may have sourced oil and gas across this basin. A probable source rock for the Santa Elena sub-basin is marine shales of the middle Cretaceous Calentura Formation (Jaillard and others, 1995).

MATURATION: Paleozoic through Tertiary source rocks across Colombia, Ecuador, and Peru became thermally mature for oil generation during Neogene phases of basin development (Pindell and Tabbutt, 1995). Miocene and younger is the probable timing of source rock maturation for Tertiary and older reservoirs across the basin (Jaillard and others, 1995; Pindell and Tabbutt, 1995). Kingston (1994) believes that the onset of oil generation could have been during late Eocene time, based largely on thickness of the stratigraphic section in the basin.

MIGRATION: Probable onset of migration is mid-Miocene time, after the opening of the Gulf of Guayaquil by movement along the Dolores-Guayaquil megashear and creation of the Progeso-Tumbes sub-basin. Close association of potential source and reservoir rocks suggests that emplacement of oil in reservoirs could have begun soon after the start of hydrocarbon generation.

RESERVOIR ROCKS: The Santa Elena sub-basin produces from mostly Eocene reservoirs of the Altanta sandstone/Olistrostrome. Two fields in the Santa Elena sub-basin produce from both the Quaternary Tablazo Formation and Eocene formations; since Quaternary shales are probably immature for oil the source could have been Eocene or other Tertiary marine shales, or those of underlying Late Cretaceous shales. These formations are also potential reservoir rocks in the Peru Bank, a wedge of Paleogene-Paleozoic sediments that were isolated from the Neogene erosion that removed these strata from most of the Tumbes and Progreso sub basins. Sedimentary thickness at Peru Bank is about 16,000 m (52,000 ft) (Zuniga-Rivero and others, 1999).

TRAPS AND SEALS: While the Progreso-Tumbes-Santa Elena Basin has been characterized as a forearc basin, it lies seaward of the Coastal range, which has been identified as a "trench-

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slope break" or "outer-arc ridge" environment; Kingston (1994) indicates a closer basin configuration might be named trench-slope basin. Evidence for growth faulting in the Progresso Basin is mostly in lower Miocene, Oligocene, Eocene, and Paleocene formations on top of the metamorphosed Pennsylvanian Amotape and Precambrian basement rocks (AIPC, no date). Some of the tectonic events that influenced hydrocarbon generation, migration, and trap formation are listed below:

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Neogene Pull-Apart Basin, AU 60830101
Undiscovered Field-Size Distribution