

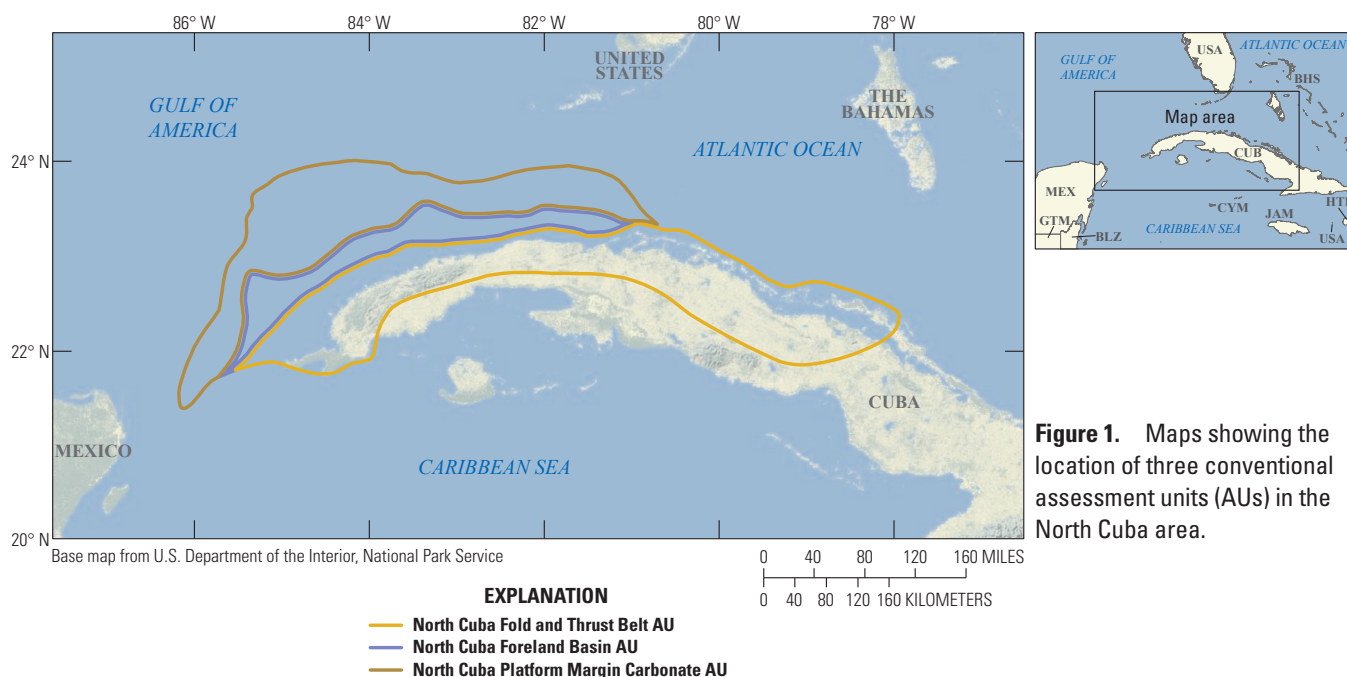
# Assessment of Undiscovered Conventional Oil and Gas Resources in the North Cuba Area, 2024

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean conventional resources of 4,098 million barrels of oil and 13,268 billion cubic feet of gas in the North Cuba area.

## Introduction

The U.S. Geological Survey (USGS) assessed the potential for undiscovered, technically recoverable conventional oil and gas resources within the North Cuba area (fig. 1). The assessment is based on an analysis of a composite total petroleum system (TPS) that developed in this area through a multiphase tectonic evolution (Saura and others, 2008; Stanek and others, 2009; Escalona and Yang, 2013; Ramos and Mann, 2023). Triassic–Early Jurassic rifting between the North American plate, the Yucatan block, and the South American plate began the fragmentation of Pangaea and led to rift basins filled with synrift fluvial-alluvial and lacustrine sediments, possibly including lacustrine source rocks. Intermittent access to the ocean as rifting continued during the Middle Jurassic (Bajocian) led to the deposition of as much as 2,000 meters of salt on extended continental crust (Pindell and others, 2021). As rifting waned, organic-rich Oxfordian and Tithonian source rocks were deposited on the Bajocian salt. Seafloor spreading began in the Oxfordian as the Yucatan block rotated counterclockwise, opening the Gulf of America. Spreading

formed proto-Caribbean oceanic crust between North America and South America. From the Berriasian to the Albian, thermal subsidence and open marine conditions led to the deposition of basinal organic-rich marl source rocks and extensive, stacked carbonate platforms along the passive margins. Transgression in the Late Cretaceous led to the drowning of the platforms and the deposition of organic-rich Upper Cretaceous (Cenomanian–Turonian) shale source rocks. The major tectonic event in the North Cuba area was the Late Cretaceous–Eocene progressive collision of the Greater Antilles arc with the passive margin of North America as proto-Caribbean oceanic crust subducted southwestward beneath the Caribbean plate. Northeast-directed contraction formed the North Cuba fold and thrust belt and the adjacent foreland basin. The stacked thrust sheets consist largely of synrift, postrift, and passive margin stratigraphic successions of the proto-Caribbean that include the major source rocks and reservoirs (Pszczółkowski and Myczyński, 2010). The foreland basin filled with as much as 5 kilometers of synorogenic and postorogenic clastic sediment.



**Figure 1.** Maps showing the location of three conventional assessment units (AUs) in the North Cuba area.

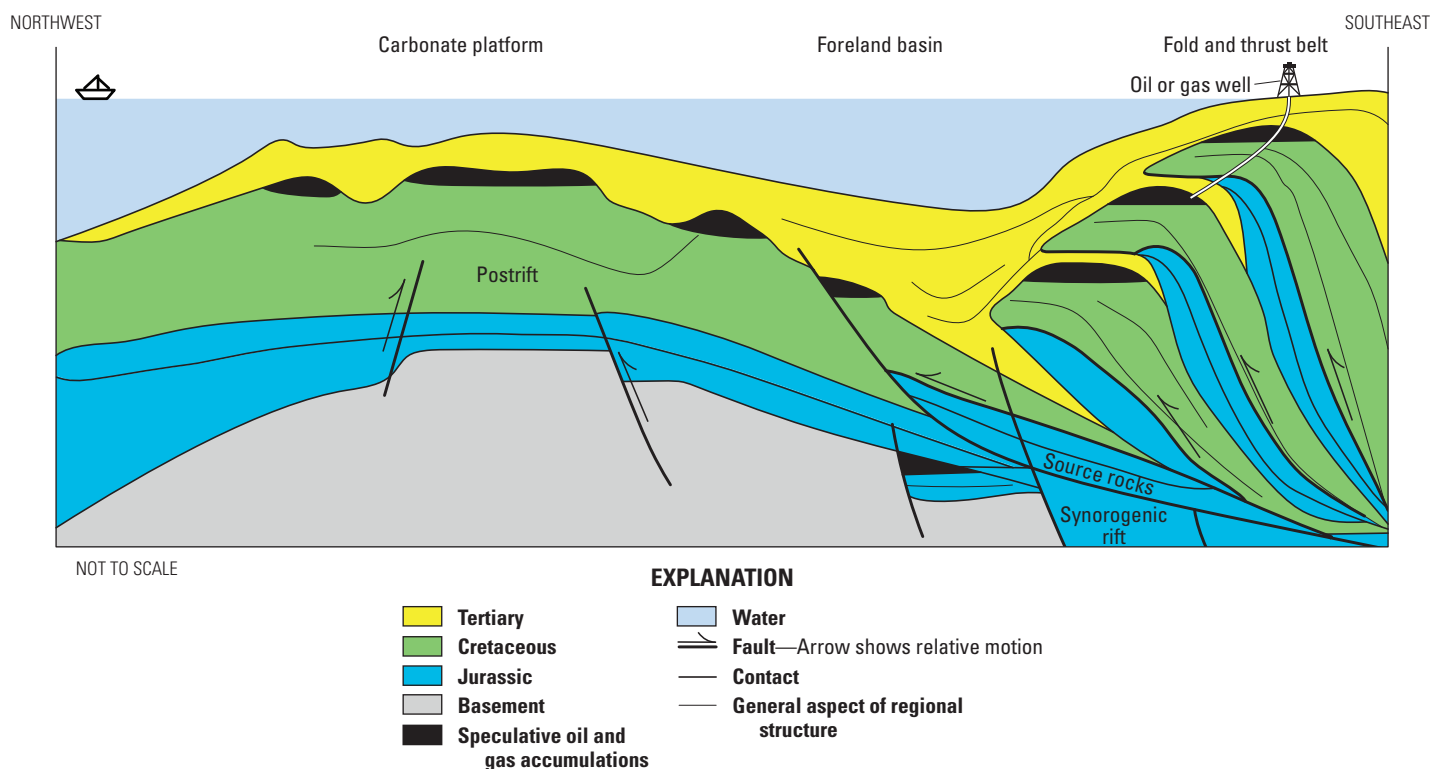
## Total Petroleum System and Assessment Units

The USGS defined a Mesozoic–Cenozoic Composite TPS to encompass oil and gas sourced from several organic-rich shales and marls. Petroleum source rocks in this composite TPS are Upper Jurassic (Oxfordian and Tithonian) marls, Lower Cretaceous marls, Cenomanian–Turonian shales, and possibly Paleogene shales (Jacques and Clegg, 2002; Moretti and others, 2003; Magnier and others, 2004; Zhang and others, 2023). Late Triassic–Early Jurassic synrift lacustrine shales are speculative source rocks. Organic-rich Oxfordian and Tithonian marls are interpreted to be the most substantial in terms of volumes of oil and gas generated, migrated, and potentially trapped (Jacques and Clegg, 2002; Moretti and others, 2003; Zhang and others, 2023). Thrust loading and foreland burial led to thermal maturation of speculative Jurassic and Cretaceous source rocks, whereas Paleogene source rocks in the foreland basin may not be thermally mature for oil generation.

Three conventional assessment units (AUs) were defined within the composite TPS based on the major structural elements in the North Cuba area: the North Cuba Fold and Thrust Belt AU, North Cuba Foreland Basin AU, and North Cuba Platform Margin Carbonate AU (fig. 1). The North Cuba Fold and Thrust Belt AU encompasses the onshore and offshore areas of the Late Cretaceous–Eocene fold and thrust belt. More than 30 oil fields have been discovered mostly in the onshore part of the AU, indicating that a petroleum system is or was active in

the North Cuba area. Main reservoirs are fractured fine-grained carbonates within structural traps, but progressive deformation may have breached some seals. The North Cuba Foreland Basin AU outlines the foreland basin adjacent to the fold and thrust belt and has the potential for oil and gas in sandstone reservoirs within synrift–postrift structural and stratigraphic traps. The North Cuba Platform Margin Carbonate AU is defined by oil and gas that may have migrated updip into a spectrum of platform-margin reservoirs such as karst, dolomites, reefs, mounds, and debris-flow breccias mainly in stratigraphic traps, and by similar reservoirs in rift-related structural traps along the Yucatan, Florida, and Bahamas Platforms.

The geologic model for this assessment is for oil and gas generated from several source rocks by Late Cretaceous–Eocene thrust loading and foreland burial to have migrated into carbonate reservoirs along the margins of the Yucatan, Florida, and Bahamas carbonate platforms; possible synrift clastic reservoirs and orogenic and postorogenic sandstone reservoirs in the foreland basin; and fractured carbonate reservoirs within the fold and thrust belt (fig. 2). Oil fields discovered in this composite TPS are within the North Cuba Fold and Thrust Belt AU, but little exploration has occurred in the North Cuba Foreland Basin AU, and none has occurred in the North Cuba Platform Margin Carbonate AU (Ananev and others, 2014). The assessment input data for three conventional AUs are summarized in table 1 and in Schenk (2025).



**Figure 2.** Schematic cross-section showing speculative oil and gas accumulations in the North Cuba fold and thrust belt, foreland basin, and carbonate platform reservoirs. Figure modified from Magnier and others (2004).

**Table 1.** Key input data for three conventional oil and gas assessment units in the North Cuba area.

[Gray shading indicates not applicable. AU, assessment unit; MMBO, million barrels of oil; BCFG, billion cubic feet of gas]

Assessment input data— Conventional AUs	North Cuba Fold and Thrust Belt AU				North Cuba Foreland Basin AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	50	150	53.2	1	15	45	16.0
Number of gas fields	1	30	90	31.9	1	15	45	16.0
Size of oil fields (MMBO)	1	4	2,500	27.3	1	4	8,000	56.0
Size of gas fields (BCFG)	6	24	10,000	130.3	6	24	40,000	298.6
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	North Cuba Platform Margin Carbonate AU							
	Minimum	Median	Maximum	Calculated mean				
Number of oil fields	1	50	150	53.2				
Number of gas fields	1	10	30	10.6				
Size of oil fields (MMBO)	1	4	3,500	33.3				
Size of gas fields (BCFG)	6	24	8,000	115.5				
AU probability	1.0							

## Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered conventional oil and gas resources in three AUs in the North Cuba area (table 2). The estimated mean undiscovered resources are 4,098 million barrels of oil (MMBO), or 4.1 billion barrels of oil,

with an F95–F5 range from 900 to 10,701 MMBO; 13,268 billion cubic feet of gas (BCFG), or 13.3 trillion cubic feet of gas, with an F95–F5 range from 2,308 to 39,404 BCFG; and 273 million barrels of natural gas liquids (MMBNGL), with an F95–F5 range from 43 to 854 MMBNGL.

**Table 2.** Results for three conventional assessment units in the North Cuba area.

[Gray shading indicates not applicable. Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. MMBO, million barrels of oil; BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids]

Total petroleum system and assessment units (AUs)	AU probability	Accumulation type	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Mesozoic–Cenozoic Composite Total Petroleum System														
North Cuba Fold and Thrust Belt AU	1.0	Oil	392	1,218	3,296	1,450	274	849	2,316	1,015	2	5	14	6
		Gas					1,012	3,337	10,154	4,153	20	67	203	83
North Cuba Foreland Basin AU	1.0	Oil	76	465	3,219	885	76	464	3,211	885	1	5	32	9
		Gas					456	2,585	17,013	4,754	14	78	511	143
North Cuba Platform Margin Carbonate AU	1.0	Oil	432	1,441	4,186	1,763	302	1,007	2,940	1,234	2	6	18	7
		Gas					188	808	3,770	1,227	4	16	76	25
Total undiscovered conventional oil and gas resources			900	3,124	10,701	4,098	2,308	9,050	39,404	13,268	43	177	854	273

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## For More Information

Assessment results are also available at the USGS Energy Resources Program website, <https://www.usgs.gov/programs/energy-resources-program>.

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