

## **Assessment of Undiscovered Oil and Gas Resources of the North Cuba Basin, Cuba, 2004**

Using a geology-based assessment methodology, the U.S. Geological Survey estimated a mean of 4.6 billion barrels of undiscovered oil, a mean of 9.8 trillion cubic feet of undiscovered natural gas (8.6 trillion cubic feet of associated-dissolved gas and 1.2 trillion cubic feet of non-associated gas), and a mean of 0.9 billion barrels of undiscovered natural gas liquids in the North Cuba Basin of Cuba.

### **Introduction**

The U.S. Geological Survey (USGS) recently completed an assessment of the undiscovered oil and gas resources of the North Cuba Basin of northwestern Cuba (fig. 1). The extent of the Jurassic–Cretaceous Composite Total Petroleum System (TPS) defines the assessment area in this study (fig. 1). The composite TPS boundary is the postulated extent of petroleum migration from thermally mature Jurassic and possibly Cretaceous source rocks. The assessment of the North Cuba Basin is based on available information on the geologic elements of the composite TPS defined in the basin, including petroleum source rocks (source-rock maturation, petroleum generation and migration), reservoir rocks (sedimentology and petrophysical properties), and petroleum traps (trap formation and timing). By using this geologic framework, the USGS defined the Jurassic–Cretaceous Composite TPS and three Assessment Units (AU) within the TPS, and we quantitatively estimated the undiscovered oil and gas resources within the three AUs (table 1).

The North Cuba Fold and Thrust Belt AU was defined to encompass all structures within the Late Cretaceous–Paleogene fold and thrust belt in northwestern Cuba (fig. 1). The North Cuba Foreland Basin AU includes all potential oil and gas accumulations in the foreland basin that formed in front of the thrust belt, and it includes oil and gas accumulations in potential rift-related structures below rocks of the foreland basin. The North Cuba Platform Margin Carbonate AU includes all potential oil and gas accumulations in carbonate platform-margin reservoirs, including reef, reef-slope, and base-of-slope reservoirs. The geologic model used in the assessment has oil and gas generated from thermally mature, organic-rich Jurassic and possibly Cretaceous mudstones in the thrust belt. Oil and gas in the model migrate to the northwest, and they accumulate in structures in the fold and thrust belt, in reservoirs in the foreland basin, and in reservoirs in the margin of the carbonate platform (fig. 2). The main geologic uncertainties in the assessment are (1) the efficacy of lateral migration of petroleum from the thrust belt to the foreland basin and platform margin, and (2) the preservation of petroleum in traps since the generation and migration of petroleum in the Paleogene.

## Resource Summary

The USGS assessed undiscovered conventional oil and gas resources in the North Cuba Basin, exclusive of reserve growth. The USGS estimated a mean of 4.6 billion barrels of oil (BBO), a mean of 9.8 TCF of natural gas (8.6 trillion cubic feet of associated-dissolved gas and 1.2 TCF of non-associated gas), and a mean total of 0.9 billion barrels of natural gas liquids for the three AUs (table 1). Of the mean of 4.6 BBO, about 0.49 BBO are in the North Cuba Fold and Thrust Belt AU, about 3.2 BBO are in the North Cuba Foreland Basin AU, and about 0.9 BBO are estimated to be in the North Cuba Platform Margin Carbonate AU (table 1). All of the non-associated gas (1.2 TCF; gas in gas fields) was assessed in the North Cuba Foreland Basin AU.

## For Further Information

Supporting geologic studies of the Composite Total Petroleum System and Assessment Units, and the methodology used in the North Cuba Basin assessment, are being prepared. Assessment results are available at the USGS Central Energy Resources Team Web site: <http://energy.cr.usgs.gov/oilgas/>.

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## Reference Cited

Magnier, C., Moretti, I., Lopez, J.O., Gaumet, F., Lopez, J.G., and Letouzey, J., 2004, Geochemical characterization of source rocks, crude oils, and gases of northwest Cuba: *Marine and Petroleum Geology*, v. 21, p. 195–214.

**Figure 1.** North Cuba Basin of northwestern Cuba. The Jurassic–Cretaceous Composite Total Petroleum System boundary (yellow line) encompasses the three assessment units (AU) defined and assessed in this study. Fine black lines on the ocean floor are faults; ball and bar on downthrown side.

**Figure 2.** Schematic northwest–southeast cross section in the North Cuba Basin showing possible migration pathways of petroleum from source rocks within the fold and thrust belt into structures and reservoirs in the fold and thrust belt, in the foreland, and in the carbonate platform (after Magnier and others, 2004).

**Table 1.** North Cuba Basin assessment results.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas fields, all liquids are included under the NGL (natural gas liquids) category. F95 denotes a 95 percent chance of at least the amount tabulated. Other fractiles are defined similarly. Fractiles are additive only under the assumption of perfect positive correlation. Gray shading indicates not applicable.]