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National and Global Petroleum Assessment

Assessment of Undiscovered Conventional Oil and Gas Resources in the West Korea Bay–North Yellow Sea Basin, North Korea and China, 2017

Using a geology-based assessment methodology, the U.S. Geological Survey estimated mean undiscovered, technically recoverable conventional resources of 1.1 billion barrels of oil and 2.2 trillion cubic feet of gas in the West Korea Bay–North Yellow Sea Basin, North Korea and China.

Introduction

The U.S. Geological Survey (USGS) completed an assessment of undiscovered, technically recoverable, conventional oil and gas resources within the West Korea Bay–North Yellow Sea Basin of North Korea and China (fig. 1). The West Korea Bay–North Yellow Sea Basin is part of a structurally complex area that underwent multiple phases of extension and compression since the Triassic (Hao and others, 2007; Wan and Hao, 2010), producing a complex mosaic of horsts, grabens, and half grabens with varying degrees of structural inversion (Li and others, 2012). Crustal extension created synrift accommodation space that was filled with alluvial, fluvial, and lacustrine sediments that range from conglomerates to organic-rich black shales. Compression following thermal maturation of shales resulted in uplift and erosion that may have affected the preservation of conventionally trapped oil and gas. However, considerable geologic uncertainty remains in understanding the tectonic evolution of this region (Metcalfe, 2006). Organic-rich synrift lacustrine shales of the Upper Jurassic, Lower Cretaceous, and possibly Paleogene are potential petroleum source rocks in the basin, with the Upper Jurassic lacustrine shales of the Sim Uuju Formation cited as the most viable source rock for the conventional oil and gas resources based on total organic carbon, thickness, and levels of thermal maturation (Massoud and others, 1991; Massoud and others, 1993). Based on limited drilling and sampling, total organic carbon is as much as 6.87 weight percent with an average of 1.6 weight percent; thickness of the source-rock interval is as much as 550 meters; and thermal maturation is in the oil window for shallower areas and in the gas window for the deeper subbasins (Massoud and others, 1991; Massoud and others, 1993; Stewart, 1999).

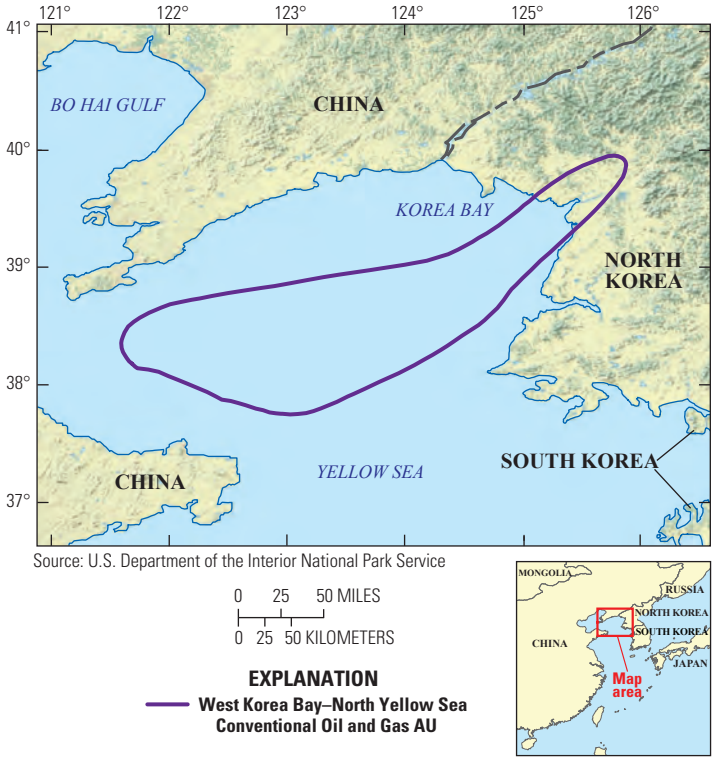

Figure 1. Location of the West Korea Bay–North Yellow Sea, North Korea and China, and the assessment unit (AU) defined in this study.

Total Petroleum System and Assessment Unit

For the West Korea Bay–North Yellow Sea Basin, the USGS defined the Mesozoic–Cenozoic Composite Total Petroleum System (TPS) and the West Korea Bay–North Yellow Sea Conventional Oil and Gas Assessment Unit (AU) within this TPS. The geologic model for the assessment is for oil and gas generated from organic-rich, lacustrine source rocks to have migrated along faults or carrier beds into structural traps or to have migrated into reservoir-quality facies in stratigraphic traps. The source of geologic risk in the AU is the potential for loss or remigration of petroleum from conventional traps during subsequent phases of uplift and erosion (Massoud and others, 1993; Cheng and others, 2015; Son and Park, 2015; Cheng and others, 2015). Assessment input data for the West Korea Bay–North Yellow Sea Conventional Oil and Gas AU are shown in table 1.

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered conventional oil and gas resources within the West Korea Bay–North Yellow Sea Basin (table 2). The estimated means are 1,136 million barrels of oil (MMBO), or 1.1 billion barrels of oil, with an F95–F5 range from 0 to 2,610 MMBO; 2,156 billion cubic feet of gas (BCFG),

or 2.2 trillion cubic feet of gas, with an F95–F5 range from 0 to 5,503 BCFG; and 37 million barrels of natural gas liquids (MMBNGL) with an F95–F5 range from 0 to 103 MMBNGL. The zero values for the F95 fractiles reflect the AU probability of 0.8, which suggests there is a possibility for no undiscovered oil or gas fields of minimum size (5 million barrels of oil equivalent) preserved in the assessment unit.

Table 1. Key assessment input data for one conventional assessment unit in the West Korea Bay–North Yellow Sea Basin, North Korea and China.

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

Assessment input data	West Korea Bay–North Yellow Sea Conventional Oil and Gas AU			
	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	50	150	53.2
Number of gas fields	1	14	50	15.2
Sizes of oil fields (MMBO)	5	10	1,200	26.8
Sizes of gas fields (BCFG)	30	60	4,000	127.9
AU probability	0.8			

Table 2. Assessment results for one conventional assessment unit in the West Korea Bay–North Yellow Sea Basin, North Korea and China.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas accumulations, all liquids are included in the NGL category. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. Fractiles are additive under the assumption of perfect positive correlation. Shading indicates not applicable]

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														
West Korea Bay–North Yellow Sea Conventional Oil and Gas AU	0.8	Oil	0	1,101	2,610	1,136	0	586	1,416	608	0	9	26	10
		Gas					0	1,347	4,087	1,548	0	20	77	27
Total undiscovered conventional resources			**0**	**1,101**	**2,610**	**1,136**	**0**	**1,933**	**5,503**	**2,156**	**0**	**29**	**103**	**37**

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For More Information

Assessment results are also available at the USGS Energy Resources Program website at https://energy.usgs.gov.

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