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World Petroleum Resources Project

Assessment of Undiscovered Oil and Gas Resources of the West Siberian Basin Province, Russia, 2010

The U.S. Geological Survey, using a geology-based assessment methodology, estimated mean volumes of technically recoverable, conventional, undiscovered petroleum resources at 8 billion barrels of crude oil, 670 trillion cubic feet of natural gas, and 21 billion barrels of natural gas liquids for the West Siberian Basin Province.

Introduction

The U.S. Geological Survey (USGS) recently assessed the undiscovered oil and gas resources of the West Siberian Basin Province in Russia as part of a program to estimate petroleum resources for priority basins around the world. This province is the largest petroleum basin in the world for petroleum volume, with an areal extent of about 2.2 million square kilometers (fig. 1). It is a large rift-sag feature (fig. 2) bounded to the west by the Ural fold belt; to the north by the Novaya Zemlya fold belt and North Siberian Sill; to the south by the Turgay Depression and Altay–Sayan fold belt; and to the east by the Yenisey Ridge, Turukhan–Igarka uplift, Yenisey–Khatanga Basin, and Taimyr High (fig. 1). The West Siberian Basin Province has total discovered recoverable oil and gas volume of more than 360 billion barrels of oil equivalent (Ulmishek, 2003). Exploration has led to the discovery of tens of giant oil and gas fields, including the Urengoy gas field with more than 350 trillion cubic feet of gas reserves and Samotlar oil field with reserves of nearly 28 billion barrels of oil (Ulmishek, 2003). This report summarizes the results of a recently completed reassessment of the undiscovered oil and gas potential of the entire province that had been assessed previously in 2000 (Ulmishek, 2000). The total petroleum systems (TPS) and assessment units (AU) defined by the USGS for the assessment in 2000 were adopted for this assessment.

Total Petroleum Systems and Assessment Units

Two TPSs, the Northern West Siberian Mesozoic Composite TPS and the Southern West Siberian Mesozoic Composite TPS, were defined for the West Siberian Basin Province (fig. 1 and table 1); each was defined to include strata of Jurassic and Cretaceous age. In the Northern West Siberian Mesozoic Composite TPS, several rock units might be potential source rocks; however, the true source of the gas resources remains uncertain (Ulmishek, 2003). More than 70 fields have been discovered in this TPS, most of which are gas fields. In the Southern West Siberian Mesozoic Composite TPS, primary source rocks include the Upper Jurassic Bazhenov Formation, Toarcian Togur Formation, and Aalenian Radom Bed. More than 450 fields have been discovered, most of which are oil fields. Thirty-eight of these oil fields are considered giants [larger than 500 million barrels of oil (MMBO)].

Three AUs were defined within the West Siberian Basin Province (fig. 1). The Northern West Siberian Onshore Gas AU includes primarily Cretaceous sandstone reservoirs in structural traps. The South Kara Sea Offshore AU, considered to be the offshore geologic extension of the Northern West Siberian Onshore Gas AU, includes similar traps and reservoirs. The Southern West Siberian Reservoirs AU also includes primarily Cretaceous sandstone reservoirs in structural traps. Each AU was evaluated in its entirety for undiscovered, technically recoverable, oil and gas resources.

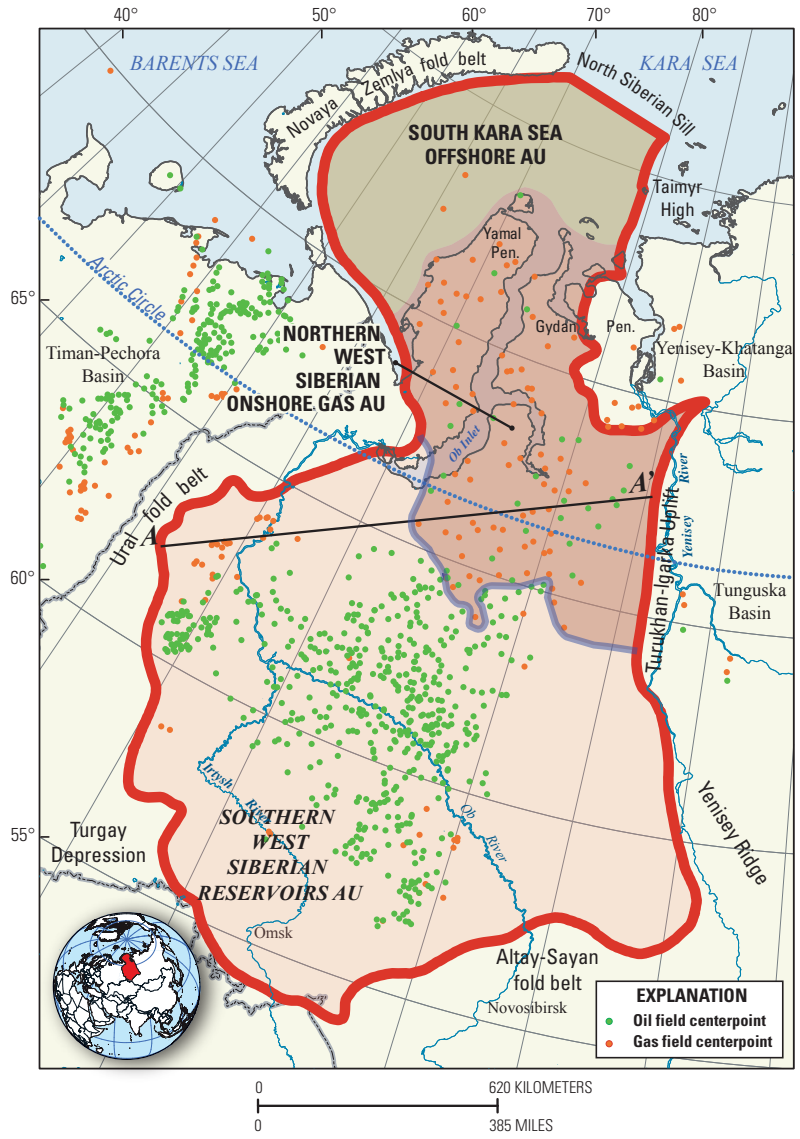

Figure 1. West Siberian Basin Province (red line), Russia. Three assessment units (AU) were defined in this study: Northern West Siberian Onshore Gas AU, South Kara Sea Offshore AU, and Southern West Siberian Reservoirs AU. Blue line represents the boundary between the Northern West Siberian Mesozoic Composite total petroleum system (TPS) and the Southern West Siberian Mesozoic Composite TPS.

Table 1. Assessment results for technically recoverable, conventional, undiscovered oil and gas resources of the West Siberian Basin Province, Russia, 2010.

[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 accumulations, all liquids are included as NGL (natural gas liquids). Undiscovered gas resources are the sum of nonassociated and associated gas. F95 represents a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly. AU probability is the chance of at least one accumulation of minimum size within the AU. Largest expected oil field size in MMBO; largest expected gas field size in BCFG. TPS, total petroleum system; AU, assessment unit. Gray shading indicates not applicable; oil field sizes in MMBO; gas field sizes in BCFG]

Total petroleum systems (TPS) and assessment units (AU)	AU probability	Field type	Largest expected field size	*Total undiscovered resources*											
				Oil (MMBO)				*Gas (BCFG)*				*NGL (MMBNGL)*			
				F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Northern West Siberian Mesozoic Composite TPS															
Northern West Siberian Onshore Gas AU	1.00	***Oil***	431	309	1,252	4,070	1,601	1,724	7,367	24,644	9,527	35	152	513	197
		Gas	5,560					8,669	26,154	70,336	31,136	269	825	2,241	984
South Kara Sea Offshore AU	1.00	***Oil***	712	572	2,053	6,023	2,507	3,183	12,064	36,779	14,933	64	248	763	308
		Gas	189,354					154,681	513,304	1,372,510	607,289	4,799	16,000	44,090	19,171
Southern West Siberian Mesozoic Composite TPS															
Southern West Siberian Reservoirs AU	1.00	***Oil***	175	1.911	3,634	6,780	3,892	2,220	4,452	8,557	4,790	50	102	199	110
		Gas	634					941	2,222	4,851	2,469	24	59	133	66
Total conventional resources							8,000				670,144				20,836

Assessment Results

The results of the quantitative assessment of undiscovered, technically recoverable, conventional oil and gas resources in the West Siberian Basin Province are listed in table 1. The total estimated means for undiscovered conventional oil and gas resources are 8,000 million barrels of oil (MMBO), 670,144 billion cubic feet of natural gas (BCFG), and 20,836 million barrels of natural gas liquids (MMBNGL). Of these volumes, the Northern West Siberian Onshore Gas AU accounts for 1,601 MMBO, 40,663 BCFG, and 1,181 MMBNGL; the South Kara Sea Offshore AU accounts for 2,507 MMBO, 622,222 BCFG, and 19,479 MMBNGL; and the Southern West Siberian Reservoirs AU accounts for 3,892 MMBO, 7,259 BCFG, and 176 MMBNGL. The large estimate for undiscovered gas in the South Kara Sea AU reflects the exploration immaturity compared to the Northern West Siberian Onshore Gas and Southern West Siberian Reservoirs AUs.

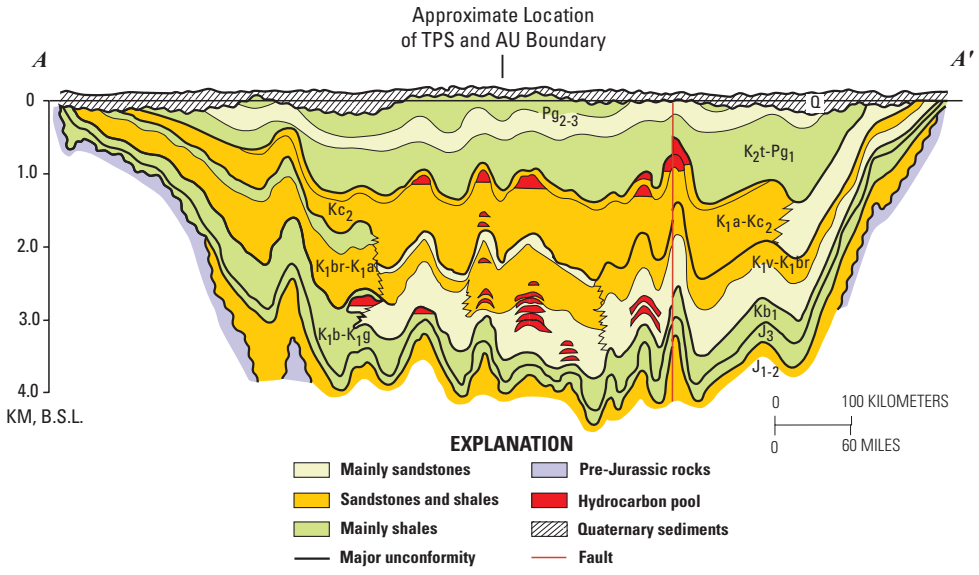

Figure 2. Line of cross section *A-A′* in the West Siberian Basin Province, Russia; location of section shown in figure 1. TPS, total petroleum system; AU, assessment unit; J_{1-2}, Lower to Middle Jurassic; J_3, Upper Jurassic; K_1b, Berrasian; K_1v, Valanginian; K_1g, Hauterivian; K_1br, Barremian; K_1a, Aptian; K_1al, Albian; K_2c, Cenomanian; K_2t, Turonian; Pg_1, Paleogene; Pg_{2-3}, Eocene-Oligocene; Q, Quaternary. B.S.L., below sea level. From Ulmishek (2000).

References Cited

Ulmishek, G.F., 2000, West Siberia Basin—Geologic Province 1174, *in* U.S. Geological Survey World Energy Assessment Team, U.S. Geological Survey World Petroleum Assessment 2000—description and results: U.S. Geological Survey Digital Data Series DDS–60, four CD–ROM set, Disk 1.

Ulmishek, G.F., 2003, Petroleum geology and resources of the West Siberian Basin, Russia: U.S. Geological Survey Bulletin 2201–G, 49 p.

For Further Information

Publications detailing the geology and the methodology for the West Siberian Basin Province and assessment results are available at the USGS Central Energy Resources Science Center web site, *http://energy.cr.usgs.gov/oilgas/*.

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