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World Assessment of Oil and Gas Fact Sheet

Assessment of Undiscovered Petroleum Resources of the North and East Margins of the Siberian Craton, Russian Federation

Four geologic provinces located along the north and east margins of the Siberian craton were assessed for undiscovered crude oil, natural gas, and natural gas liquids/condensates resources as part of the U.S. Geological Survey's (USGS) Circum-Arctic Oil and Gas Resource Appraisal. Using a geology-based methodology, the USGS estimated the mean undiscovered, conventional petroleum resources in these provinces to be approximately 28 billion barrels of oil equivalent, including approximately 8 billion barrels of crude oil, 106 trillion cubic feet of natural gas, and 3 billion barrels of natural gas liquids.

Introduction

In 2007, the U.S. Geological Survey (USGS) completed an assessment of potential undiscovered, technically recoverable (assuming the absence of sea ice) crude oil, natural gas, and natural gas liquids (collectively referred to as petroleum) resources in the Yenisey-Khatanga Basin, Lena-Anabar Basin, Lena-Vilyui Basin (northern part), and the Zyryanka Basin Provinces of the Russian Federation (fig. 1). As with other areas and basins assessed in the USGS Circum-Arctic Oil and Gas Resource Appraisal (CARA) program, this area shares important characteristics with many Arctic basins, including sparse data, significant petroleum-resource potential, geologic uncertainty, and technical barriers that impede exploration and development. As defined for CARA, the Yenisey-Khatanga Basin Province includes approximately 391,000 km^2; the Lena-Anabar Basin Province, approximately 125,000 km^2; the northern Priverkhoyansk part of the Lena-Vilyuy Basin Province, approximately 55,000 km^2, and the Zyryanka Basin Province, approximately 56,000 km^2.

Assessment Units

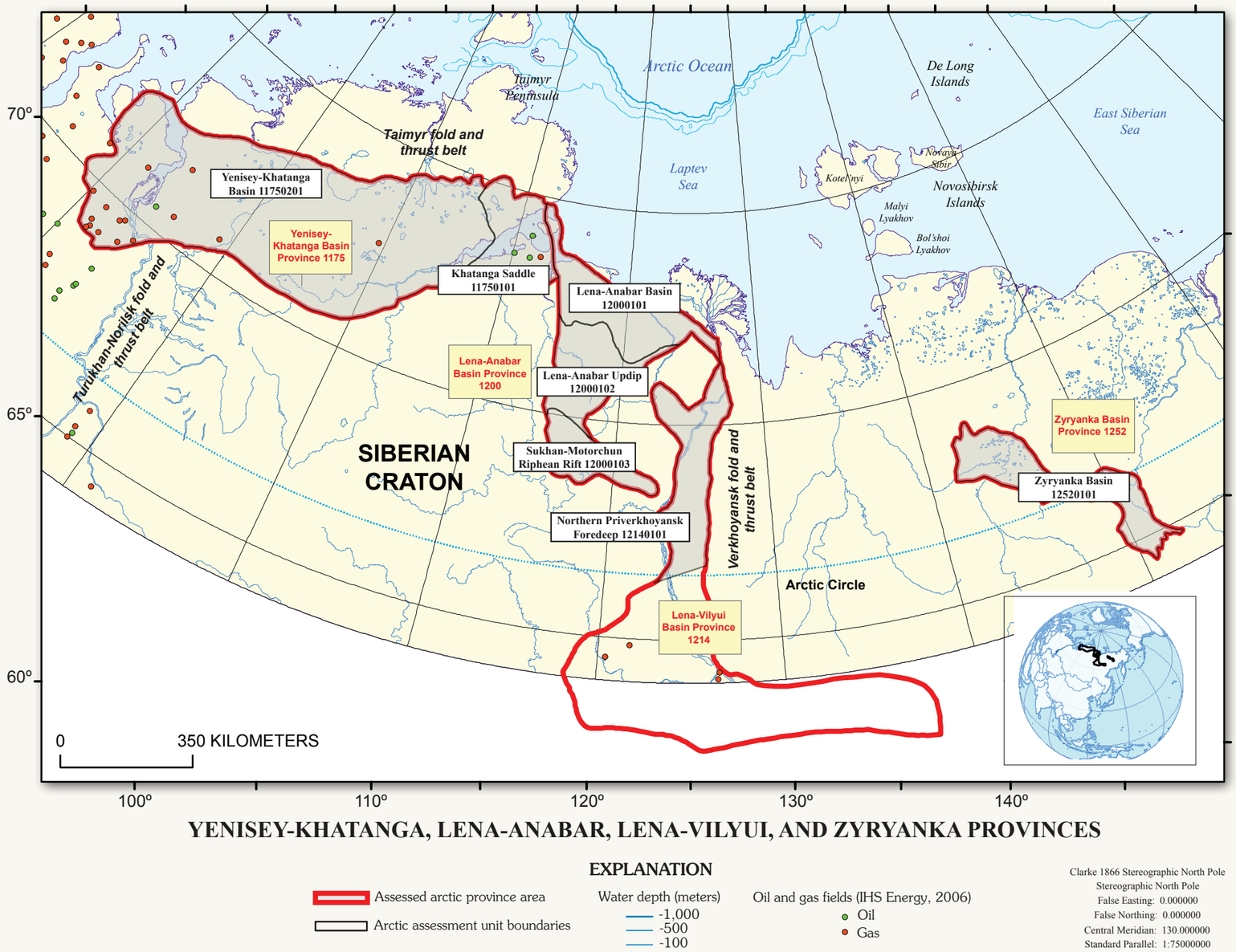
The Yenisey-Khatanga Basin, Lena-Anabar Basin, and Lena-Vilyui Basin Provinces formed on the margins of the Siberian craton and later underwent compressional deformation as a result of collision with other tectonic plates. The sedimentary successions of these provinces are similar because of their close proximity (fig. 1) and similar depositional histories. The Zyryanka Basin is a foreland basin that developed on top of a backarc basin formed during accretion and deformation of neighboring tectonic plates. This basin is bounded by extensively deformed rocks derived from oceanic/island arc terranes that, in part, were subjected to Cenozoic extension.

For purposes of assessment, the four provinces were subdivided into seven geologically distinctive assessment units (AUs) on the basis of structural style—the Khatanga Saddle, Yenisey-Khatanga Basin, Lena-Anabar Basin, Lena-Anabar Updip, Sukhan-Motorchun Riphean Rift, Northern Priverkhoyansk Foredeep, and Zyryanka Basin AUs (fig. 1). The Lena-Anabar Basin AU was evaluated using two mutually exclusive geological scenarios (table 1); the differences between them are such that the populations of undiscovered accumulations cannot be statistically combined into a single distribution. One scenario assumes that a thick lower Paleozoic section was deposited and subsequently removed by erosion before the Permian. This scenario allows for the possibility of Precambrian and Cambrian source rocks to have become thermally mature with respect to petroleum generation during the Paleozoic, and thus any accumulated petroleum would have been destroyed by the subsequent erosion. The other scenario assumes no early Paleozoic deposition and petroleum maturation probably occurred during the late Paleozoic and early Mesozoic. All of the AUs were quantitatively assessed.

Petroleum System Elements

Two total petroleum systems were defined in each of the Yenisey-Khatanga Basin, Lena-Anabar Basin, and Lena-Vilyui Basin Provinces—one with Proterozoic and Cambrian source rocks and the other with upper Paleozoic through Jurassic source rocks. However, because of suspected mixing of petroleum, the two systems were combined into the Proterozoic-Paleozoic-Mesozoic Composite Total Petroleum System (TPS) for these provinces. In addition, a Mesozoic Composite TPS was defined within the Yenisey-Khatanga Basin Province to exclude Proterozoic and Paleozoic rocks with low petroleum-source potential. A Paleozoic-Mesozoic Composite TPS was identified in the Zyryanka Basin Province. This TPS, which incorporates the Zyryanka Basin AU (table 1), contains sedimentary rocks that are different from those in the other provinces. The greatest geologic uncertainty for the assessment of all AUs is with respect to the timing of petroleum charge and preservation of accumulations.

Analyses of crude oil and natural gas from producing wells, shows, seeps, and bitumen indicate the presence of mature source rocks in all of the AUs. Major reservoir rocks include Proterozoic and lower Paleozoic carbonate and clastic rocks and upper Paleozoic and Mesozoic clastic rocks. Postulated traps for petroleum accumulations include compressional structures (folds and thrust faults) and updip pinchouts, as well as other stratigraphic traps.



YENISEY-KHATANGA, LENA-ANABAR, LENA-VILYUI, AND ZYRYANKA PROVINCES

Figure 1. *Map showing location of geologic provinces and assessment units along the northern and eastern margins of the Siberian craton north of the Arctic Circle.*

Resource Summary

The USGS assessed undiscovered conventional, technically recoverable petroleum resources (discovered reserves not included), resulting in the estimated mean volumes of a probability distribution of approximately 8 billion barrels (1 billion metric tons) of crude oil, 106 trillion cubic feet (3 trillion cubic meters) of natural gas, and 3 billion barrels (400 million metric tons) of natural gas liquids (table 1). The largest volume of undiscovered petroleum is estimated to be in the Yenisey-Khatanga Basin AU.

Reference

IHS Energy, 2006, International petroleum exploration and production database [includes data current through December, 2006]: IHS Energy; database available from IHS Energy, 15 Inverness Way East, Englewood, CO 80112, U.S.A.

For Further Information

Assessment results are available at the USGS Central Energy Team website, *http://energy.usgs.gov/arctic*, or contact Donald L. Gautier, Task Leader for the USGS Circum-Arctic Oil and Gas Resource Appraisal (gautier@usgs.gov).

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Table 1. *Assessment results of geologic provinces along the north and east margins of the Siberian craton (conventional undiscovered resources).*

[MMB, million barrels; BCF, billion cubic feet. Results shown are fully risked estimates. For gas fields, all liquids are included under the natural gas liquids (NGL) category. F95 denotes 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. TPS, total petroleum system; AU, assessment unit. Gray shading indicates not applicable]

Total Petroleum Systems *and Assessment Units*	AU Probability	Field Type	Total Undiscovered Resources: Oil (MMB)				Gas (BCF)				NGL (MMB)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
YENISEY-KHATANGA BASIN PROVINCE (1175)														
Proterozoic-Paleozoic-Mesozoic Composite TPS (117501)														
Khatanga Saddle AU (11750101)	0.500	Oil	0	0	1,376	327	0	0	932	206	0	0	25	6
		Gas					0	0	6,764	1,797	0	0	182	48
Mesozoic Composite TPS (117502)														
Yenisey-Khatanga Basin AU (11750201)	1.000	Oil	2,200	4,847	9,716	5,257	11,604	26,571	55,375	29,078	305	710	1,528	786
		Gas					38,629	66,089	108,413	68,884	1,009	1,754	2,929	1,835
Total undiscovered petroleum resources, Province 1175						5,584				99,965				2,675
LENA-ANABAR BASIN PROVINCE (1200)														
Proterozoic-Paleozoic-Mesozoic Composite TPS (120001)														
Lena-Anabar Basin AU (12000101) Scenario 1, 90% probability	0.480	Oil	0	0	7,451	2,074	0	0	6,174	1,628	0	0	169	44
		Gas					0	0	2,693	654	0	0	73	17
Lena-Anabar Basin AU (12000101) Scenario 2, 10% probability	0.320	Oil	0	0	2,611	526	0	0	2,143	416	0	0	58	11
		Gas					0	0	993	195	0	0	28	5
Lena-Anabar Basin AU (12000101) Aggregate *		Oil				1,919				1,507				41
		Gas								608				16
Lena-Anabar Updip AU (12000102)	0.800	Oil	0	0	524	56	0	0	338	44	0	0	9	1
		Gas					0	0	483	47	0	0	12	1
Sukhan-Motorchun Riphean Rift AU (12000103)	0.072	Oil	0	0	187	21	0	0	96	16	0	0	2	0
		Gas					0	0	465	39	0	0	11	1
Total undiscovered petroleum resources, Province 1200						1,996				2,261				60
LENA-VILYUI BASIN PROVINCE (1214) - Only one AU was assessed in this province														
Proterozoic-Paleozoic-Mesozoic Composite TPS (121401)														
Northern Priverkhoyansk Foredeep AU (12140101)	0.400	Oil	0	0	1,741	379	0	0	1,455	298	0	0	39	8
		Gas					0	0	4,341	1,044	0	0	117	28
Total undiscovered petroleum resources, assessed part of Province 1214						379				1,342				36
ZYRYANKA BASIN PROVINCE (1252)														
Paleozoic-Mesozoic Composite TPS (125201)														
Zyryanka Basin AU (12520101)	0.504	Oil	0	0	286	72	0	0	496	106	0	0	13	3
		Gas					0	942	7,746	2,176	0	22	209	58
Total undiscovered petroleum resources, Province 1252						72				2,282				61
Total undiscovered petroleum resources						8,031				105,850				2,832

* Aggregate means for the entire assessment unit equal the means times the scenario probability of each scenario.