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Self-Sourced Bazhenov Fractured Reservoirs Assessment Unit 11740102

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USGS PROVINCE: West Siberian Basin (1174) **GEOLOGIST:** G.F. Ulmishek

PETROLEUM SYSTEM: Togur-Tyumen (117402)

ASSESSMENT UNIT: Pre-Upper Jurassic (11740201)

DESCRIPTION: This assessment unit embraces the entire petroleum system. The unit encompasses the southern part of the basin and includes Lower-Middle Jurassic mainly continental rocks (Tyumen Formation and analogs) and weathered top of underlying Paleozoic and Triassic rocks. Oil reserves of the unit are substantial, but much smaller than that in the stratigraphically overlying Bazhenov-Neocomian petroleum system.

SOURCE ROCKS: The main source rocks are black organic-rich shales of the Toarcian Togur Bed. Apparently, the rocks were deposited during regional transgression in a system of lakes and estuaries connected with a marine basin to the north. Togur shales are characterized by mixed Types II and III kerogen, the TOC content ranging from 1 to 7.5 percent, and HI 200 to 600 mg HC/g TOC. Other Jurassic shales, and especially the Aalenian Rodom Bed, also could have generated some oil, but their source quality is poorer.

MATURATION: The maturity of the Togur Bed varies from oil window (Ro 0.7 to O.8 percent) in southern areas of the assessment unit to gas window in northern areas (Ro 1.3 to 1.5 percent).

RESERVOIR ROCKS: Main reservoir rocks are sandstones of the Lower-Middle Jurassic Tyumen Formation. The sandstones are laterally discontinuous and have poor reservoir properties. The only exception is a river-bed sandstone at base of the formation, which forms excellent reservoirs in the giant Talin field. Oil pools are also present at the weathered top of various underlying rocks from Devonian carbonates to Triassic volcanics.

TRAPS: Independently of their structural location, all hydrocarbon pools in the Tyumen Formation are strongly controlled by lateral distribution of reservoir rocks. Oil pools in pre-Jurassic rocks are found in erosional topographic highs (“buried hills”).

SEALS: Hydrocarbon accumulations are directly capped by various shale beds. Transgressive Callovian shales (Abalak and Vasyugan Formations) form the top regional seal that separates the Togur-Tyumen and Bazhenov-Neocomian petroleum systems.

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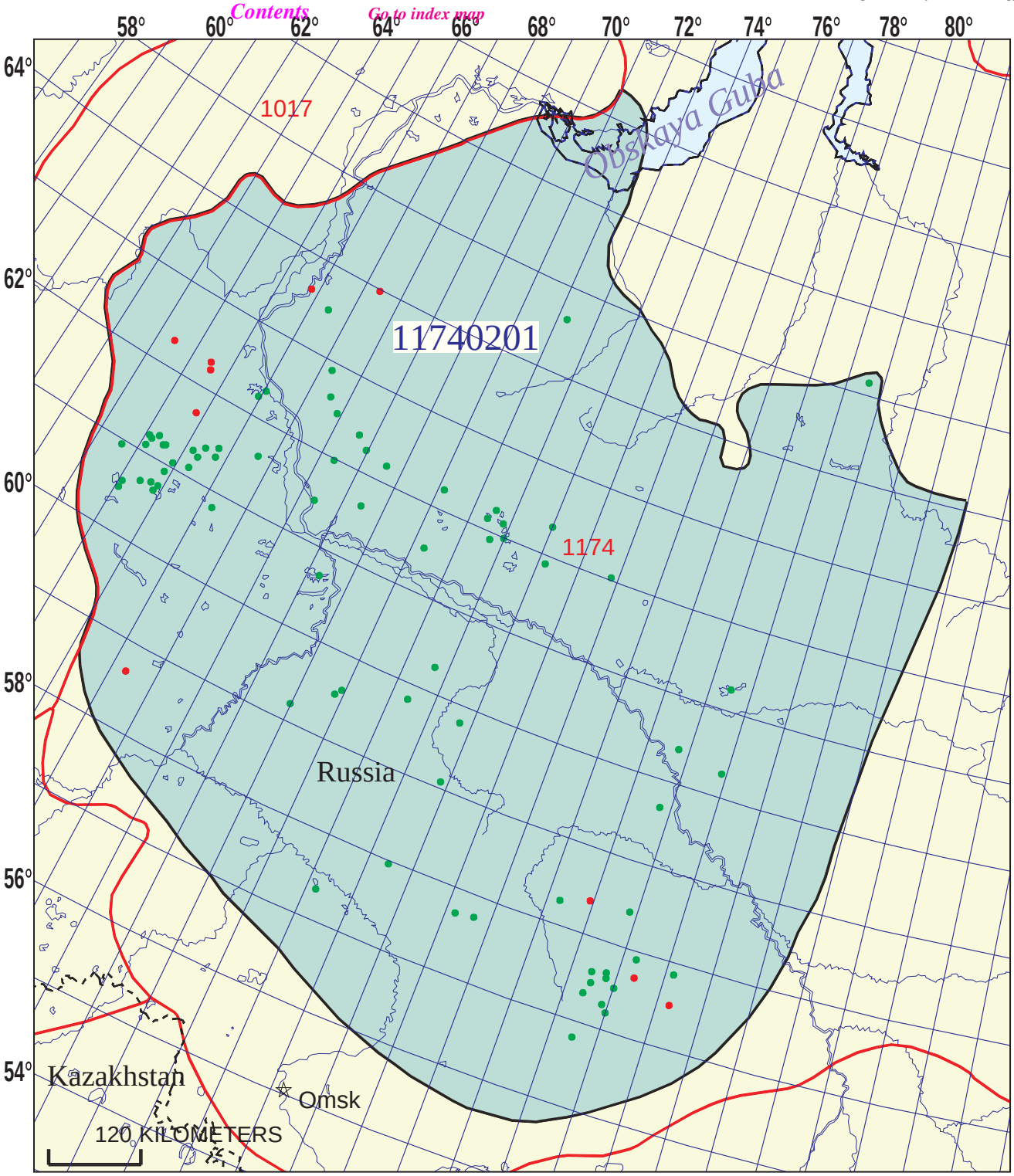
Surkov, V.S., Gurari, F.G., Smirnov, L.V., and Kazakov, A.M., 1993, Lower-Middle Jurassic rocks of the West Siberian plate, their framework and petroleum productivity, in Surkov, V.S., and Kontorovich, A.E., eds., Theoretical and regional problems of oil and gas geology (Teoreticheskiye i regionalnye problemy geologii nefti i gaza): Novosibirsk, Russia, Nauka, p. 101-110.

U.S. GEOLOGICAL SURVEY WORLD PETROLEUM ASSESSMENT 2000— DESCRIPTION AND RESULTS
U.S. Geological Survey World Energy Assessment Team



Pre-Upper Jurassic
Assessment Unit - 11740201

EXPLANATION

- Hydrography
- Shoreline
- 1174 — Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 11740201 — Assessment unit code and boundary

Projection: Equidistant Conic. Central meridian: 100. Standard Parallel: 58 30

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SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS

Date:……..	12/6/99		
Assessment Geologist:……..	G.F. Ulmishek		
Region:……..	Former Soviet Union	Number:	1
Province:……..	West Siberian Basin	Number:	1174
Priority or Boutique……	Priority		
Total Petroleum System:……	Togur-Tyumen	Number:	117402
Assessment Unit:……..	Pre-Upper Jurassic	Number:	11740201
* Notes from Assessor	No standard U.S. growth functions were applied; however, field growth is recognized.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Oil

What is the minimum field size?……. 5 mmboe grown (≥1mmboe)
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…….. Oil: 64 Gas: 10
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 30 2nd 3rd 31 3rd 3rd 12.4
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 56 2nd 3rd 200 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):…….. 1.0

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	50	median no.	300	max no.	800
Gas fields:……min. no. (>0)	2	median no.	10	max no.	25

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……min. size	5	median size	10	max. size	800
Gas in gas fields (bcfg):……min. size	30	median size	60	max. size	1000

Assessment Unit (name, no.)
Pre-Upper Jurassic, 11740201

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	300	600	1000
NGL/gas ratio (bngl/mmcfg)……	30	60	90

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	22	44	66
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……	28	38	55
Sulfur content of oil (%)……	0.1	0.2	0.4
Drilling Depth (m) ……	1500	2500	3800
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……			
CO_2 content (%)……			
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	1500	2500	3800
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Pre-Upper Jurassic, 11740201

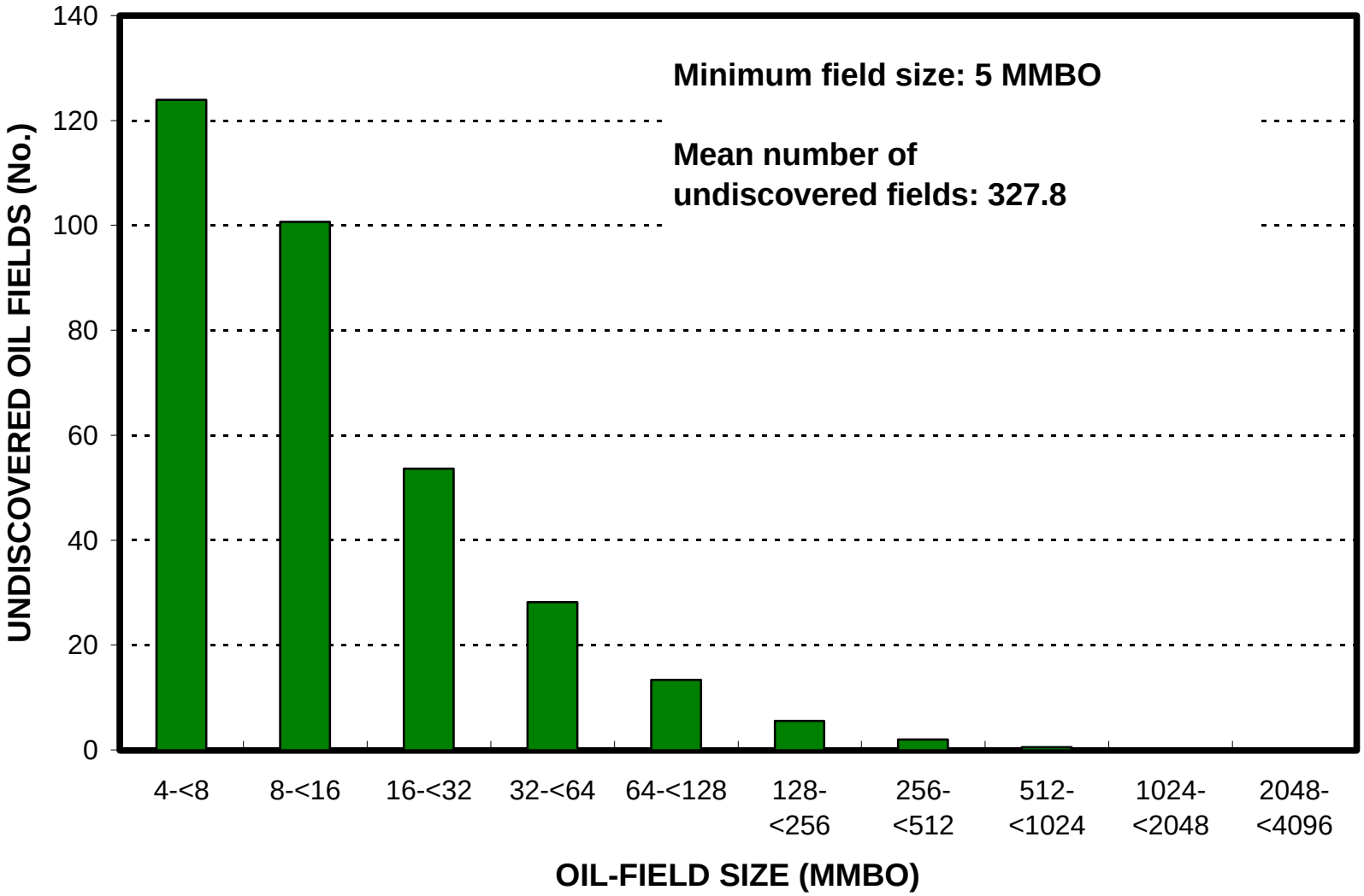
ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Russia represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

Pre-Upper Jurassic, AU 11740201
Undiscovered Field-Size Distribution



Pre-Upper Jurassic, AU 11740201
Undiscovered Field-Size Distribution