

National and Global Petroleum Assessment

Assessment of Undiscovered Conventional Oil and Gas Resources of the Greater Caspian Area, 2022

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean resources of 34.3 billion barrels of oil and 320 trillion cubic feet of gas in the Greater Caspian area.



Figure 1. Map showing the location of eight assessed geologic provinces in the Greater Caspian area.

Introduction

The U.S. Geological Survey (USGS) quantitatively assessed the potential for undiscovered, technically recoverable conventional oil and gas resources in eight geologic provinces in the Greater Caspian area (fig. 1). This assessment encompasses North Caspian Basin, North Ustyurt Basin, Middle Caspian Basin, Azov-Kuban Basin, South Caspian Basin, Kura Basin, Dnieper-Donets Basin, and Pripjat Basin Provinces.

The petroleum systems of the Greater Caspian area reflect the complex tectonic evolution of the continental margin of northeast Pangaea that bordered the Paleotethys and Neotethys



Oceans (Otto, 1997; Brunet and others, 2003; Golonka, 2007). The basins assessed in this study are largely polyphase in that their modern structural configurations are the result of several tectonic processes. Accommodation space in these provinces is formed by subsidence in regional rifts, back-arc basins, intra-arc basins, thermal sag basins, and foreland basins, or combinations of these structural elements (Otto, 1997; Golonka, 2007; Boote and others, 2018).

Total Petroleum Systems and Assessment Units

In the Greater Caspian area, the USGS defined a Paleozoic–Mesozoic Composite Total Petroleum System (TPS) in the North Caspian Basin Province; Paleozoic Composite TPS in the North Ustyurt Basin Province; Mesozoic Composite TPS in the North Ustyurt Basin Province; Mesozoic–Cenozoic Composite TPS in the Middle Caspian Basin Province; Mesozoic–Cenozoic Composite TPS in the Azov–Kuban Basin Province; Mesozoic–Cenozoic Composite TPS in the South Caspian Basin Province; Mesozoic–Cenozoic Composite TPS in the Kura Basin Province; Paleozoic Composite TPS in the Dnieper–Donets Basin Province; and Paleozoic Composite TPS in the Pripyat Basin Province. The TPS names reflect the major source rock ages. Paleozoic source rocks are present in the Dnieper–Donets Basin, Pripyat Basin, North Caspian Basin, and North Ustyurt Basin Provinces. Paleozoic petroleum source rocks are organic-rich marls in carbonate intraplatform basins, Devonian synrift and postrift organic-rich marine shales, Carboniferous marine shales and marls and coals, and carbonaceous shales (Ulmishek, 2001b; Okere and Toothill, 2012). Mesozoic and Cenozoic source rocks are present in the North Ustyurt Basin, Middle Caspian Basin, Azov–Kuban Basin, South Caspian Basin, and Kura Basin Provinces (Otto, 1997; Ulmishek, 2001a, 2001c; Okere and Toothill, 2012). Mesozoic source rocks are Jurassic and Cretaceous carbonate intraplatform organic-rich marls and Jurassic lacustrine shale, coal beds, and carbonaceous shale. Cenozoic source rocks are dominated by Oligocene to Miocene Maykop Formation organic-rich marine shales and possibly diatomites (Smith-Rouch, 2006; Sachsenhofer and others, 2018, 2021). Fifteen assessment units (AUs) were defined within the TPSs, and each AU was assessed for undiscovered conventional oil and gas resources. Key assessment input data are summarized in [table 1](#) and in Schenk (2025).

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered conventional oil, gas, and natural gas liquids resources within 15 AUs in the Greater Caspian area ([table 2](#)). The fully risked mean totals are 34,335 million barrels of oil (MMBO) or 34.3 billion barrels of oil, with an F95–F5 fractile range from 13,519 to 67,172 MMBO; 319,574 billion cubic feet of gas (BCFG), or 320 trillion cubic feet, with an F95–F5 range from 122,871 to 626,967 BCFG; and 7,421 million barrels of natural gas liquids (MMBNGL), or 7.4 billion barrels of natural gas liquids, with an F95–F5 range from 2,858 to 14,628 MMBNGL.

References Cited

- Boote, D.R.D., Sachsenhofer, R.F., Tari, G., and Arbouille, D., 2018, Petroleum provinces of the Paratethyan region: *Journal of Petroleum Geology*, v. 41, no. 3, p. 247–297, accessed September 25, 2023, at <https://doi.org/10.1111/jpg.12703>.
- Brunet, M.-F., Korotaev, M.V., Ershov, A.V., and Nikishin, A.M., 2003, The South Caspian Basin—A review of its evolution from subsidence modelling: *Sedimentary Geology*, v. 156, nos. 1–4, p. 119–148, accessed September 23, 2023, at [https://doi.org/10.1016/S0037-0738\(02\)00285-3](https://doi.org/10.1016/S0037-0738(02)00285-3).
- Golonka, J., 2007, Geodynamic evolution of the South Caspian Basin, chap. 7 of Yilmaz, P.O., and Isaksen, G.H., eds., *Oil and gas of the Greater Caspian area: AAPG Studies in Geology*, v. 55, p. 17–41, accessed September 25, 2023, at <https://doi.org/10.1306/1205844St551463>.
- Okere, D., and Toothill, S., 2012, New insights into hydrocarbon plays in the Caspian Sea, Kazakhstan: *Petroleum Geoscience*, v. 18, p. 253–268, accessed September 25, 2023, at <https://doi.org/10.1144/1354-079311-045>.
- Otto, S.C., 1997, Mesozoic–Cenozoic history of deformation and petroleum systems in sedimentary basins of Central Asia—Implications of collisions on the Eurasian Margin: *Petroleum Geoscience*, v. 3, p. 327–341, accessed September 25, 2023, at <https://doi.org/10.1144/petgeo.3.4.327>.
- Sachsenhofer, R.F., Bechtel, A., Gratzner, R., Enukidze, O., Janiashvili, A., Nachtmann, W., Sanishvili, A., Tevzadze, N., and Yukler, M.A., 2021, Petroleum systems of the Rioni and Kura Basins of Georgia: *Journal of Petroleum Geology*, v. 44, no. 3, p. 287–316, accessed September 25, 2023, at <https://doi.org/10.1111/jpg.12794>.
- Sachsenhofer, R.F., Popov, S.V., Coric, S., Mayer, J., Misch, D., Morton, M.T., Pupp, M., Rauball, J., and Tari, G., 2018, Paratethyan petroleum source rocks—An overview: *Journal of Petroleum Geology*, v. 41, no. 3, p. 219–245, accessed September 25, 2023, at <https://doi.org/10.1111/jpg.12702>.
- Schenk, C.J., 2025, USGS National and Global Oil and Gas Assessment Project—Greater Caspian Area—Assessment unit boundaries, assessment input data, and fact sheet data tables: U.S. Geological Survey data release, <https://doi.org/10.5066/P13GJMAQ>.
- Smith-Rouch, L.S., 2006, Oligocene–Miocene Maykop/Diatom Total Petroleum System of the South Caspian Basin Province, Azerbaijan, Iran, and Turkmenistan: *U.S. Geological Survey Bulletin* 2201–I, 27 p., accessed September 25, 2023, at https://pubs.usgs.gov/bul/2201/I/pdf/B-2201-I_508.pdf.
- Ulmishek, G.F., 2001a, Petroleum geology and resources of the Middle Caspian Basin, former Soviet Union: *U.S. Geological Survey Bulletin* 2201–A, 38 p., accessed September 25, 2023, at <https://pubs.usgs.gov/bul/2201/A/>.
- Ulmishek, G.F., 2001b, Petroleum geology and resources of the North Caspian Basin, Kazakhstan and Russia: *U.S. Geological Survey Bulletin* 2201–B, 25 p., accessed September 25, 2023, at <https://pubs.usgs.gov/bul/2201/B/b2201-b.pdf>.
- Ulmishek, G.F., 2001c, Petroleum geology and resources of the North Ustyurt Basin, Kazakhstan and Uzbekistan: *U.S. Geological Survey Bulletin* 2201–D, 14 p., accessed September 25, 2023, at <https://pubs.usgs.gov/bul/2201/D/>.

Table 1. Key input data for 15 conventional assessment units in the Greater Caspian area.

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

Assessment input data— Conventional AUs	North Caspian North and West Margin Presalt Reservoirs AU				North Caspian South and East Margin Presalt Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	40	80	41.0	1	90	180	92.2
Number of gas fields	1	80	160	82.0	1	60	120	61.5
Size of oil fields (MMBO)	5	8	200	12.2	5	10	10,000	80.8
Size of gas fields (BCFG)	30	60	6,000	149.3	30	72	50,000	487.6
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	North Caspian Postsalt Reservoirs AU				North Ustyurt Paleozoic Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	120	240	122.9	1	5	15	5.3
Number of gas fields	1	50	100	51.2	1	50	150	53.2
Size of oil fields (MMBO)	5	8	100	10.5	5	8	100	10.5
Size of gas fields (BCFG)	30	60	8,000	168.2	30	60	20,000	260.1
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	North Ustyurt Mesozoic–Cenozoic Reservoirs AU				Middle Caspian Central Basin–South Mangyshlak Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	20	60	21.3	1	80	160	82.0
Number of gas fields	1	40	120	42.5	1	100	200	102.5
Size of oil fields (MMBO)	5	8	2,000	28.0	5	8	1,800	26.6
Size of gas fields (BCFG)	30	60	10,000	185.7	30	60	20,000	260.1
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Middle Caspian North Caucasus Platform Reservoirs AU				Middle Caspian Terek Foredeep–North Apsheron Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	100	200	102.5	1	50	100	51.2
Number of gas fields	1	30	60	30.7	1	20	40	20.5
Size of oil fields (MMBO)	5	8	1,600	25.2	5	8	70	9.8
Size of gas fields (BCFG)	30	60	100	61.1	30	60	3,000	115.8
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Azov–Kuban Foredeep Reservoirs AU				Azov–Kuban Foreland Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	60	120	61.5	1	10	20	10.3
Number of gas fields	1	30	60	30.7	1	150	300	153.7
Size of oil fields (MMBO)	1	4	40	5.2	1	4	20	4.6
Size of gas fields (BCFG)	6	18	300	26.1	6	18	40	18.7
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	South Caspian Marginal Fold Belt Reservoirs AU				South Caspian Central Depression Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	120	240	122.9	1	130	390	138.2
Number of gas fields	1	80	160	82.0	1	130	390	138.2
Size of oil fields (MMBO)	1	6	4,000	43.8	5	8	15,000	89.5
Size of gas fields (BCFG)	6	36	40,000	357.0	30	72	90,000	696.5
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Kura Basin Reservoirs AU				Dnieper–Donets Paleozoic Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated Mean
Number of oil fields	1	70	140	71.7	1	60	120	61.5
Number of gas fields	1	30	70	31.1	1	240	480	245.9
Size of oil fields (MMBO)	5	8	100	10.5	1	3	10	3.2
Size of gas fields (BCFG)	30	60	500	74.0	6	24	1,000	46.3
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Pripyat Paleozoic Reservoirs AU							
	Minimum	Median	Maximum	Calculated mean				
Number of oil fields	1	50	100	51.2				
Number of gas fields								
Size of oil fields (MMBO)	1	2	10	2.3				
Size of gas fields (BCFG)								
AU probability	1.0							

Table 2. Results for 15 conventional assessment units in the Greater Caspian area.

[Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. Shading indicates not applicable. MMBO, million barrels of oil; BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids]

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
Paleozoic–Mesozoic Composite Total Petroleum System (North Caspian Basin Province)														
North Caspian North and West Margin Presalt Reservoirs AU	1.0	Oil	301	483	754	499	841	1,351	2,110	1,398	9	15	23	15
		Gas					6,686	11,755	19,604	12,261	87	153	255	159
North Caspian South and East Margin Presalt Reservoirs AU	1.0	Oil	2,668	6,511	15,339	7,443	3,996	9,740	22,987	11,163	64	156	368	179
		Gas					10,297	25,596	64,463	29,960	565	1,408	3,543	1,648
North Caspian Postsalt Reservoirs AU	1.0	Oil	850	1,255	1,835	1,288	674	1,003	1,478	1,030	8	12	18	12
		Gas					4,077	7,979	15,226	8,618	41	80	153	86
Paleozoic Composite Total Petroleum System (North Ustyurt Basin Province)														
North Ustyurt Paleozoic Reservoirs AU	1.0	Oil	25	50	107	56	25	50	107	56	0	0	1	0
		Gas					4,362	11,902	29,649	13,816	17	47	120	55
Mesozoic Composite Total Petroleum System (North Ustyurt Basin Province)														
North Ustyurt Mesozoic–Cenozoic Reservoirs AU	1.0	Oil	153	461	1,522	596	60	183	613	238	0	0	1	0
		Gas					2,769	6,952	16,138	7,867	33	83	194	94
Mesozoic–Cenozoic Composite Total Petroleum System (Middle Caspian Basin Province)														
Middle Caspian Central Basin–South Mangyshlak Reservoirs AU	1.0	Oil	1,043	2,023	3,830	2,178	2,608	5,058	9,577	5,444	52	101	192	109
		Gas					12,486	24,878	46,817	26,655	474	945	1,779	1,013
Middle Caspian North Caucasus Platform Reservoirs AU	1.0	Oil	1,311	2,433	4,325	2,576	1,700	3,161	5,633	3,349	39	73	130	77
		Gas					1,270	1,834	2,642	1,881	11	17	24	17
Middle Caspian Terek Foredeep–North Apsheron Reservoirs AU	1.0	Oil	330	491	724	504	592	885	1,304	908	5	7	11	7
		Gas					1,150	2,182	4,257	2,375	17	33	64	36
Mesozoic–Cenozoic Composite Total Petroleum System (Azov–Kuban Basin Province)														
Azov–Kuban Foredeep Reservoirs AU	1.0	Oil	206	310	459	318	349	527	782	541	4	5	8	5
		Gas					478	775	1,208	800	11	18	28	18
Azov–Kuban Foreland Reservoirs AU	1.0	Oil	29	46	70	47	31	50	77	52	1	1	1	1
		Gas					1,933	2,804	4,068	2,877	21	31	45	32
Mesozoic–Cenozoic Composite Total Petroleum System (South Caspian Basin Province)														
South Caspian Marginal Fold Belt Reservoirs AU	1.0	Oil	2,400	5,011	9,648	5,384	6,477	13,522	26,074	14,536	103	216	417	233
		Gas					10,182	25,711	60,167	29,225	224	566	1,322	643
South Caspian Central Depression Reservoirs AU	1.0	Oil	3,502	10,633	27,032	12,378	9,469	28,720	73,039	33,421	151	460	1,168	535
		Gas					30,807	85,447	197,056	96,099	646	1,793	4,138	2,018
Mesozoic–Cenozoic Composite Total Petroleum System (Kura Basin Province)														
Kura Basin Reservoirs AU	1.0	Oil	489	733	1,079	752	238	365	550	376	3	4	7	5
		Gas					1,353	2,221	3,561	2,307	27	44	71	46
Paleozoic Composite Total Petroleum System (Dnieper–Donets Basin Province)														
Dnieper–Donets Paleozoic Reservoirs AU	1.0	Oil	134	195	282	199	562	817	1,186	837	16	23	33	23
		Gas					7,337	11,101	16,460	11,391	227	344	511	353
Paleozoic Composite Total Petroleum System (Pripyat Basin Province)														
Pripyat Paleozoic Reservoirs AU	1.0	Oil	78	114	166	117	62	91	134	93	2	2	3	2
		Gas												
Total undiscovered conventional resources			13,519	30,749	67,172	34,335	122,871	286,660	626,967	319,574	2,858	6,637	14,628	7,421

For More Information

Assessment results are also available at the USGS Energy Resources Program website, <https://www.usgs.gov/programs/energy-resources-program>.

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