

Assessment of Undiscovered Conventional Oil and Gas Resources in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of Northern Africa, 2026

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean conventional resources of 419 million barrels of oil and 5.5 trillion cubic feet of gas in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa.

Introduction

The U.S. Geological Survey (USGS) assessed the potential for undiscovered, technically recoverable conventional oil and gas resources in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa (fig. 1). During the early Paleozoic Era, northern Africa had a north-facing passive continental margin of the paleo-Tethys Ocean. Late Carboniferous to Permian contraction from the Hercynian orogeny—a series of continental and microplate collisions—reactivated regional fault systems that segmented the passive margin into a mosaic of basins and uplifts (Badalini and others, 2002; Dixon and others, 2010; Eschard and others, 2010; Galeazzi and others, 2010). The Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins and intervening Tihemboka Uplift, Talemzane Arch, Nefusn Uplift, and Qarqaf Arch resulted from the orogenic events. Silurian and Devonian source rocks deposited during the passive-margin phase are preserved in the basins but were largely eroded from the uplifts (Eschard and others, 2010). Variations in the magnitude of subsidence, uplift, and erosion among the basins led to temporal and spatial variations in thermal maturation of the source rocks (Underdown and Redfern, 2008; Bora and Dubey, 2015). In some basins, gas is interpreted to have been generated before or during Hercynian contraction, and in other basins, the source rocks reached the thermal window for oil or gas generation in the Mesozoic Era (Makhous and others, 1997; Boote and others, 1998; Davidson and others, 2000; Yahi and others, 2001; Makhous and Galushkin, 2003; Underdown and Redfern, 2008; Eschard and others, 2010; English and others, 2016; Jaeger and others, 2017).

Total Petroleum System and Assessment Units

The USGS defined the Paleozoic Composite Total Petroleum System (TPS) in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa. Seven conventional assessment units (AUs) were defined

within the TPS (table 1). The main source rocks for this composite system are the organic-rich lower Silurian Tanezzuft Shale (and equivalent shales; Boote and others, 1998; Cochran and Petersen, 2001; Hassan and Kendall, 2014; Albriki and others, 2024) and Upper Devonian Frasnian shales (Lüning and others, 2004; Hassan and Kendall, 2014; Albriki and others, 2024).

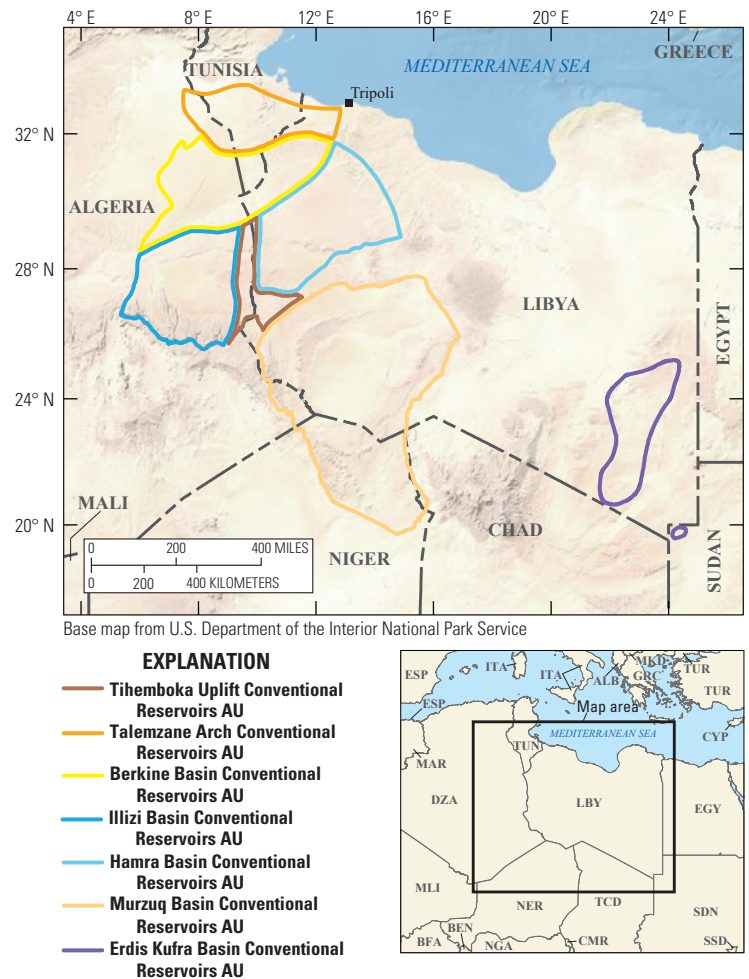


Figure 1. Map showing the location of seven conventional assessment units (AUs) in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa.

Petroleum generated from these shales was combined into a composite TPS for this assessment. Silurian shales contain an average of 2 weight percent (wt. pct.) residual total organic carbon (TOC) with as much as 24 wt. pct., have initial hydrogen index values as much as 530 milligrams of hydrocarbon per gram of TOC, and have shale thickness as much as 100 meters (Lüning and others, 2000; Kaced and Arab, 2012; Arfaoui and others, 2024). Devonian shales contain as much as 3 wt. pct. residual TOC and have shale thickness as much as 80 meters (Kaced and Arab, 2012). The extent and thermal maturity of the source rocks in the Erdis Kufra Basin are not known (Lüning and others, 1999).

The geologic model for the Paleozoic Composite TPS is for oil and gas to have been generated from Silurian and Devonian organic-rich shales, with generation possibly ranging from the Carboniferous through the Mesozoic. Oil and gas migrated into conventional reservoirs within stratigraphic and structural traps in the basins and migrated updip from the source rocks into conventional reservoirs along the flanks and crests of the intervening uplifts. Reservoirs in the basins and uplifts are characterized by complex spatial heterogeneity of facies and petrophysical properties (Dixon and others, 2010; Jabir and others, 2020). The assessment input data for the seven defined AUs are summarized in table 1 and Schenk (2026).

Table 1. Key input data for seven conventional assessment units in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa.

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

Assessment input data— Conventional AUs	Tihemboka Uplift Conventional Reservoirs AU				Talemzane Arch Conventional Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	2	4	2.1	1	3	6	3.1
Number of gas fields	1	20	40	20.5	1	10	20	10.2
Size of oil fields (MMBO)	5	7	20	7.5	5	7	60	8.5
Size of gas fields (BCFG)	30	48	180	52.6	30	48	150	51.6
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Berkine Basin Conventional Reservoirs AU				Illizi Basin Conventional Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	5	10	5.1	1	3	6	3.1
Number of gas fields	1	30	60	30.7	1	15	30	15.4
Size of oil fields (MMBO)	5	7	150	10.0	5	7	50	8.3
Size of gas fields (BCFG)	30	48	180	52.6	30	48	200	53.3
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Hamra Basin Conventional Reservoirs AU				Murzuq Basin Conventional Reservoirs AU			
	Minimum	Median	Maximum	Calculated mean	Minimum	Median	Maximum	Calculated mean
Number of oil fields	1	2	4	2.1	1	20	40	20.5
Number of gas fields	1	20	40	20.5				
Size of oil fields (MMBO)	5	7	20	7.5	5	7	20	7.5
Size of gas fields (BCFG)	30	48	120	50.5				
AU probability	1.0				1.0			
Assessment input data— Conventional AUs	Erdis Kufra Basin Conventional Reservoirs AU							
	Minimum	Median	Maximum	Calculated mean				
Number of oil fields	1	10	40	11.0				
Size of oil fields (MMBO)	5	10	300	16.5				
AU probability	0.72							

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered, technically recoverable conventional oil and gas resources in seven AUs (table 2) in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa. The estimated mean

resources are 419 million barrels of oil (MMBO), with an F95 to F5 fractile range from 177 to 810 MMBO; 5,451 billion cubic feet of gas (BCFG), or 5.5 trillion cubic feet of gas, with an F95 to F5 fractile range from 3,556 to 7,919 BCFG; and 230 million barrels of natural gas liquids (MMBNGL), with an F95 to F5 fractile range from 152 to 335 MMBNGL.

Table 2. Results for seven conventional assessment units in the Berkine, Illizi, Hamra, Murzuq, and Erdis Kufra Basins of northern Africa.

[Gray shading indicates not applicable. Results shown are fully risked estimates. F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. 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 Composite Total Petroleum System														
Tihemboka Uplift Conventional Reservoirs AU	1.0	Oil	12	15	23	16	7	9	14	9	0	0	0	0
		Gas					715	1,050	1,536	1,078	26	38	56	39
Talemzane Arch Conventional Reservoirs AU	1.0	Oil	13	24	45	26	27	48	92	52	3	5	9	5
		Gas					349	516	756	529	28	41	61	42
Berkine Basin Conventional Reservoirs AU	1.0	Oil	25	45	99	51	49	90	200	103	2	3	7	4
		Gas					1,086	1,581	2,298	1,621	54	79	115	81
Illizi Basin Conventional Reservoirs AU	1.0	Oil	13	24	43	26	40	72	129	77	1	2	4	2
		Gas					536	798	1,172	818	24	35	52	36
Hamra Basin Conventional Reservoirs AU	1.0	Oil	12	15	23	16	12	15	23	16	0	0	1	0
		Gas					695	1,011	1,464	1,035	14	20	29	21
Murzuq Basin Conventional Reservoirs AU	1.0	Oil	102	149	217	153	40	60	87	61	0	0	0	0
		Gas												
Erdis Kufra Basin Conventional Reservoirs AU	0.72	Oil	0	117	360	131	0	45	148	52	0	0	1	0
		Gas												
Total undiscovered conventional oil and gas resources			177	389	810	419	3,556	5,295	7,919	5,451	152	223	335	230

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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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