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National and Global Petroleum Assessment

Assessment of Tight-Gas Resources in the Grand Erg/Ahnet Province of Algeria, 2019

Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean resources of 30.5 trillion cubic feet of tight gas in the Grand Erg/Ahnet Province of Algeria.

Introduction

The U.S. Geological Survey (USGS) completed an assessment of undiscovered, technically recoverable tight-gas resources within the Grand Erg/Ahnet Province of Algeria (fig. 1). For this assessment, a tight-gas reservoir is defined as a gas-bearing siliciclastic reservoir that generally exhibits less than 0.1 millidarcy permeability and requires stimulation of vertical wells for production. During the early Paleozoic, much of North Africa was a north-facing passive margin with siliciclastic systems prograding northwards into the paleo-Tethys Ocean (Boote and others, 1998; Dixon and others, 2010). Regressive clastics of the Ordovician Period formed a thin sedimentary cover across much of the passive margin. Demise of the Ordovician ice cap and associated meltwaters led to the formation of large, northward-flowing channels that incised into Ordovician clastics. A major transgression in the early Silurian resulted in the deposition of organic-rich petroleum source rocks within the paleochannels; the channel deposits were overlain by regressive clastics of the late Silurian. A major transgression in the Devonian also led to the deposition of organic-rich source rocks, and these were subsequently buried by regressive clastics of the Devonian and early Carboniferous. In the middle of the Carboniferous period, Hercynian compressional deformation segmented the passive margin into a mosaic of uplifts and basins (Eschard and others, 2010). The tight-gas assessment units (AUs) defined in this study are restricted to the post-Hercynian basinal areas, as the uplifts may have lost any hydrocarbons from exhumation and erosion.

Total Petroleum Systems and Assessment Units

The USGS defined the Silurian Total Petroleum System (TPS) with the Timimoun Basin Ordovician Tight Gas AU, the Sbaa Basin Ordovician Tight Gas AU, and the Ahnet Basin Ordovician Tight Gas AU. The Mouydir Basin Ordovician Tight Gas AU was defined but not quantitatively assessed. Shales of the Silurian TPS contain as much as 10 percent total organic carbon (TOC), have hydrogen index (HI) values as much as 380 milligrams of hydrocarbon per gram of total organic carbon (mg HC/g TOC), and have shale thickness as much as 100 meters (Logan and Duddy, 1998; El Diasty and others, 2017). The boundaries of the tight-gas reservoirs were largely drawn based on the thermal generation window for gas.

The Devonian TPS includes the Timimoun Basin Devonian Tight Gas AU, the Sbaa Basin Devonian Tight Gas AU, and the Ahnet Basin Devonian Tight Gas AU. Devonian shales contain as much as 14 percent TOC, have HI values as much as 580 mg HC/g TOC, and have shale thickness as much as 200 meters (Chaouche, 2013).

The geologic model for tight-gas systems is for hydrocarbons to have been generated from organic-rich Silurian and Devonian shales possibly as early as the lower Carboniferous (Lüning, and others, 2000). Oil would have cracked to gas in the Mesozoic (Logan and Duddy, 1998), and some of this gas was either retained within or migrated locally into Ordovician, Silurian, Devonian, and possibly early Carboniferous tight sandstones.

Key assessment input data are shown in table 1. Drainage areas, success ratios, and estimated ultimate recoveries are taken from U.S. tight-gas analogs.

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered, technically recoverable continuous tight-gas resources within six AUs in the Grand Erg/Ahnet Province (table 2) of Algeria. The estimated total mean resources are 30,474 billion cubic feet of gas (BCFG), or 30.5 trillion cubic feet of gas, with an F95–F5 range from 6,336 to 71,077 BCFG and 103 million barrels of natural gas liquids (MMBNGL) with an F95–F5 range from 18 to 262 MMBNGL.

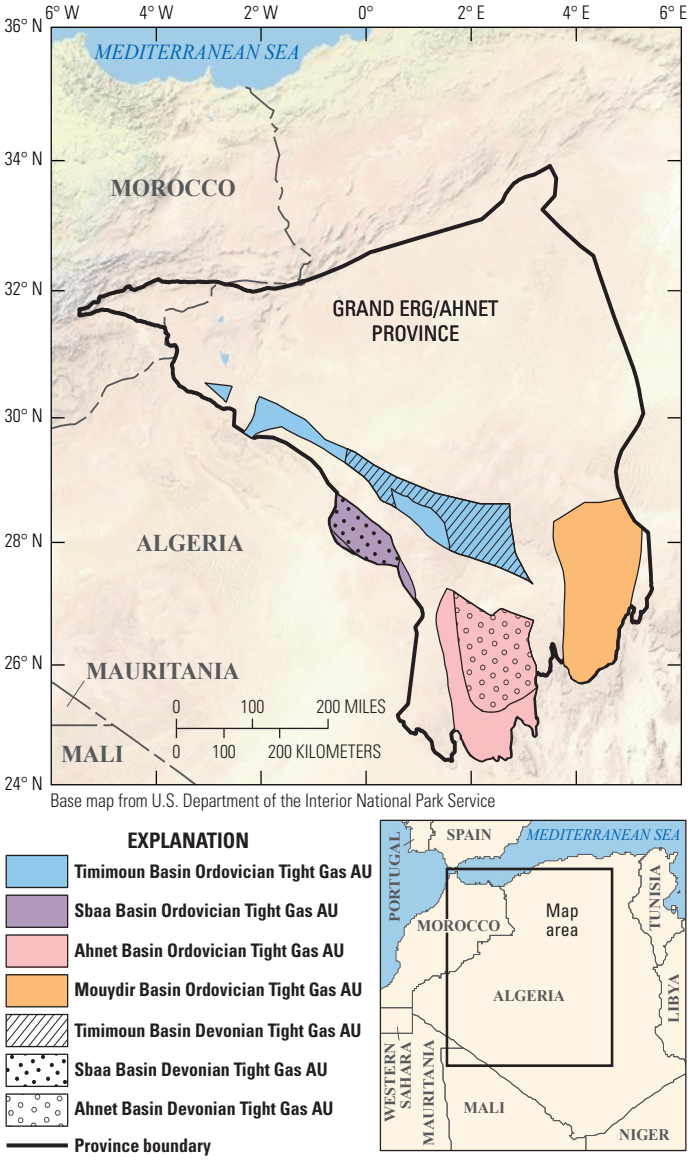

Figure 1. Location of the Grand Erg/Ahnet Province of Algeria and the six tight-gas assessment units (AUs) defined in this study.

Table 1. Key input data for six tight-gas assessment units (AUs) in the Grand Erg/Ahnet Province of Algeria.

[Results shown are fully risked estimates. Well drainage area, success ratio, and EUR are defined partly using U.S. tight-gas analogs. The average EUR input is the minimum, median, maximum, and calculated mean. Shading indicates not applicable. %, percent; EUR, estimated ultimate recovery; BCFG, billion cubic feet of gas]

Assessment input data—Continuous AUs	Timimoun Basin Ordovician Tight Gas AU				Sbaa Basin Ordovician Tight Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	10,000	3,895,500	7,791,000	3,898,333	10,000	1,199,500	2,399,000	1,202,833
Average drainage area of wells (acres)	80	120	160	120	80	120	160	120
Untested area in AU (%)	100	100	100	100	100	100	100	100
Success ratio (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG)	0.08	0.4	1.2	0.440	0.08	0.4	1.2	0.440
AU probability	1.0				1.0			
Assessment input data—Continuous AUs	**Ahnet Basin Ordovician Tight Gas AU**				**Timimoun Basin Devonian Tight Gas AU**			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,000	5,221,700	10,443,400	5,222,033	1,000	2,530,500	5,061,000	2,530,833
Average drainage area of wells (acres)	80	120	160	120	80	120	160	120
Untested area in AU (%)	100	100	100	100	100	100	100	100
Success ratio (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG)	0.08	0.4	1.2	0.440	0.08	0.4	1.2	0.440
AU probability	1.0				1.0			
Assessment input data—Continuous AUs	**Sbaa Basin Devonian Tight Gas AU**				**Ahnet Basin Devonian Tight Gas AU**			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,000	1,047,500	2,095,000	1,047,833	1,000	2,931,300	5,862,600	2,931,633
Average drainage area of wells (acres)	80	120	160	120	80	120	160	120
Untested area in AU (%)	100	100	100	100	100	100	100	100
Success ratio (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG)	0.08	0.4	1.2	0.440	0.08	0.4	1.2	0.440
AU probability	1.0				1.0			

Table 2. Results for six tight-gas assessment units in the Grand Erg/Ahnet Province of Algeria.

[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. BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids]

Total petroleum systems and assessment units (AUs)	AU probability	Accumulation types	Total undiscovered resources							
			Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean
Silurian Total Petroleum System										
Timimoun Basin Ordovician Tight Gas AU	1.0	Gas	1,463	5,952	16,519	7,058	4	19	59	23
Sbaa Basin Ordovician Tight Gas AU	1.0	Gas	459	1,846	5,093	2,190	1	6	18	7
Ahnet Basin Ordovician Tight Gas AU	1.0	Gas	1,955	7,944	21,930	9,427	6	25	79	31
Mouydir Basin Ordovician Tight Gas AU		Gas	Not quantitatively assessed							
Devonian Total Petroleum System										
Timimoun Basin Devonian Tight Gas AU	1.0	Gas	964	3,893	10,713	4,586	3	13	43	17
Sbaa Basin Devonian Tight Gas AU	1.0	Gas	405	1,613	4,467	1,913	1	6	18	7
Ahnet Basin Devonian Tight Gas AU	1.0	Gas	1,090	4,477	12,355	5,300	3	14	45	18
Total undiscovered continuous resources			**6,336**	**25,725**	**71,077**	**30,474**	**18**	**83**	**262**	**103**

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For More Information

Assessment results are also available at the USGS Energy Resources Program website at https://energy.usgs.gov.

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