National and Global Petroleum Assessment

Assessment of Continuous Oil and Gas Resources in the San Jorge Basin Province, Argentina, 2017

*U*sing a geology-based assessment methodology, the U.S. Geological Survey estimated mean undiscovered, technically recoverable resources of 78 million barrels of oil and 8.9 trillion cubic feet of gas in the San Jorge Basin Province, Argentina.

Introduction

The U.S. Geological Survey (USGS) completed an assessment of undiscovered, technically recoverable continuous oil and gas resources within the San Jorge Basin Province of Argentina (fig. 1). The structural configuration of the San Jorge Basin is the result of several phases of extension beginning in the Permian–Triassic related to the initial oblique rifting of South America from Africa and ending with final continental breakup and separation in late Early Cretaceous (Macdonald and others, 2003). Episodes of extension formed a series of east-west to northwest-southeast trending normal faults that define a deep central basin with shallower basin margins to the north and south (Fitzgerald and others, 1990; Sylwan, 2001; Foix and others, 2012; Paredes and others, 2013). Sediments deposited during the Late Jurassic–Early Cretaceous extension and thermal sag are mainly nonmarine fluvial and lacustrine sandstones, siltstones, and shales that include the principal petroleum source rocks in the province. Neogene compression related to Andean subduction inverted some extensional structures in a narrow band in the basin forming the nearly north-south trending San Bernardo fold belt (fig. 1).

Total Petroleum Systems and Assessment Units

For the San Jorge Basin Province, the USGS defined two total petroleum systems (TPSs): the D-129 Lacustrine TPS and the Callovian–Aptian Lacustrine Composite TPS (Rodriguez and Littke, 2001; Legarreta and Villar, 2011). The D-129 Lacustrine TPS was defined by the presence of thermally mature Hauterivian–Aptian organic-rich lacustrine shales of the D-129 Formation. These shales have total organic carbon values as much as 4 weight percent and a maximum thickness of 2,000 meters. Within this TPS are the D-129 Lacustrine Shale Oil Assessment Unit (AU) and the D-129 Lacustrine Shale Gas AU. The geologic model for these AUs is for recoverable oil or gas to have been retained within the D-129 Formation lacustrine shales following petroleum migration into conventional traps.

The Callovian–Aptian Lacustrine Composite TPS was defined to account for potential tight-gas resources sourced by lacustrine organic-rich shales of the Callovian–Berriasian Aguada Bandera Formation and lacustrine shales of the Hauterivian–Aptian D-129 Formation (Legarreta and Villar, 2011). In this composite TPS, total organic carbon values are as much as 4 weight percent, and maximum thickness of the shale interval is about 600 meters. The Eastern San Jorge Tight Gas AU and the Western San Jorge Tight Gas AU are within this TPS. The geologic model is for recoverable gas to have been trapped in a low-permeability matrix of alluvial, fluvial, and marginal lacustrine sandstones of the Neocomian synrift Matasiete Formation and in overlying sandstones of the Mina del Carmen Formation.

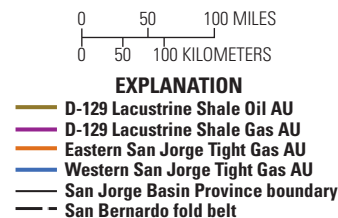Source: U.S. Department of the Interior National Park Service

EXPLANATION
- D-129 Lacustrine Shale Oil AU
- D-129 Lacustrine Shale Gas AU
- Eastern San Jorge Tight Gas AU
- Western San Jorge Tight Gas AU
- San Jorge Basin Province boundary
- San Bernardo fold belt

Figure 1. Location of the San Jorge Basin Province, Argentina, and the four assessment units (AUs) defined in this study.

Assessment input data for four continuous AUs are shown in table 1. Well drainage areas, estimated ultimate recoveries, and success ratios were guided by U.S. shale-oil, shale-gas, and tight-gas analogs.

Undiscovered Resources Summary

The USGS quantitatively assessed undiscovered, technically recoverable continuous oil and gas resources within the San Jorge Basin Province (table 2). The estimated mean totals for continuous oil and gas resources are 78 million barrels of oil (MMBO) with an F95–F5 range from 17 to 180 MMBO; 8,893 billion cubic feet of gas (BCFG), or 8.9 trillion cubic feet of gas, with an F95–F5 range from 1,802 to 20,869 BCFG; and 67 million barrels of natural gas liquids (MMBNGL) with an F95–F5 range from 13 to 165 MMBNGL.

For the mean total continuous gas resources of 8,893 BCFG, 3,440 BCFG (39 percent) are estimated to be shale-gas resources, and 5,453 BCFG (61 percent) are estimated to be tight-gas resources.

Table 1. Key assessment input data for four assessment units in the San Jorge Basin Province, Argentina.

[AU, assessment unit; %, percent; EUR, estimated ultimate recovery per well; MMBO, million barrels of oil; BCFG, billion cubic feet of gas. EUR, well drainage area, and success ratios are defined partly using U.S. shale-oil analogs. The average EUR input is the minimum, median, maximum, and calculated mean. Shading indicates not applicable]

Assessment input data	D-129 Lacustrine Shale Oil AU				D-129 Lacustrine Shale Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	1,600	266,500	533,000	267,033	1,200	846,600	2,822,000	1,223,267
Average drainage area of wells (acres)	80	160	240	160	40	80	120	80
Success ratios (%)	10	50	90	50	10	50	90	50
Average EUR (MMBO, oil; BCFG, gas)	0.04	0.08	0.3	0.092	0.1	0.4	1.2	0.441
AU probability	1.0				1.0			

Assessment input data	Eastern San Jorge Tight Gas AU				Western San Jorge Tight Gas AU			
	Minimum	Mode	Maximum	Calculated mean	Minimum	Mode	Maximum	Calculated mean
Potential production area of AU (acres)	800	1,411,000	2,822,000	1,411,267	800	554,500	1,109,000	554,767
Average drainage area of wells (acres)	40	80	120	80	40	80	120	80
Success ratios (%)	10	50	90	50	10	50	90	50
Average EUR (BCFG, gas)	0.1	0.4	1.2	0.441	0.1	0.4	1.2	0.441
AU probability	1.0				1.0			

Table 2. Assessment results for four continuous assessment units in the San Jorge Basin Province, Argentina.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; NGL, natural gas liquids; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas accumulations, all liquids are included in the NGL category. F95 represents 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. Shading indicates not applicable]

Total petroleum systems and assessment units (AUs)	AU prob-ability	Accu-mulation type	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
D-129 Lacustrine Total Petroleum System														
D-129 Lacustrine Shale Oil AU	1.0	Oil	17	66	180	78	12	49	137	58	0	1	2	1
D-129 Lacustrine Shale Gas AU	1.0	Gas					643	2,760	8,188	3,382	6	27	85	34
Callovian–Aptian Lacustrine Composite Total Petroleum System														
Eastern San Jorge Tight Gas AU	1.0	Gas					825	3,339	9,011	3,921	5	20	56	23
Western San Jorge Tight Gas AU	1.0	Gas					322	1,299	3,533	1,532	2	8	22	9
Total undiscovered continuous resources			**17**	**66**	**180**	**78**	**1,802**	**7,447**	**20,869**	**8,893**	**13**	**56**	**165**	**67**

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For More Information

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

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