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World Petroleum Resources Project

Assessment of Undiscovered Conventional Oil and Gas Resources of North Africa, 2012

Using a geology-based assessment methodology, the U.S. Geological Survey estimated means of 19 billion barrels of technically recoverable undiscovered conventional oil and 370 trillion cubic feet of undiscovered conventional natural gas resources in 8 geologic provinces of North Africa.

Introduction

The U.S. Geological Survey (USGS) assessed the potential for undiscovered conventional oil and gas accumulations within priority geologic provinces of North Africa as part of the USGS World Petroleum Resources Project. Eight priority geologic provinces were assessed in this study, which represents a reassessment of North Africa last published in 2000 (U.S. Geological Survey World Energy Assessment Team, 2000). The eight geologic provinces include (1) Nile Delta Basin; (2) Sirte Basin; (3) Pelagian Basin; (4) Trias/Ghadames Basin; (5) Hamra Basin; (6) Illizi Basin; (7) Grand Erg/Ahnet Basin; and (8) Essaouira Basin (fig. 1). Resource estimates for the Nile Delta, Sirte, and Pelagian Basin provinces were published previously (Kirschbaum and others, 2010; Whidden and others, 2011), but are included here for a more complete view of undiscovered conventional oil and gas resources across North Africa.

The assessment methodology included a complete geologic framework description for each province based mainly on published literature and definitions of petroleum systems and assessment units (AU) within these systems. Exploration and discovery history data were a critical part of the methodology used to estimate sizes and numbers of undiscovered conventional accumulations. Each AU was assessed for undiscovered oil and nonassociated gas accumulations, and co-product ratios were used to calculate the volumes of associated gas (gas in oil fields) and volumes of natural gas liquids.

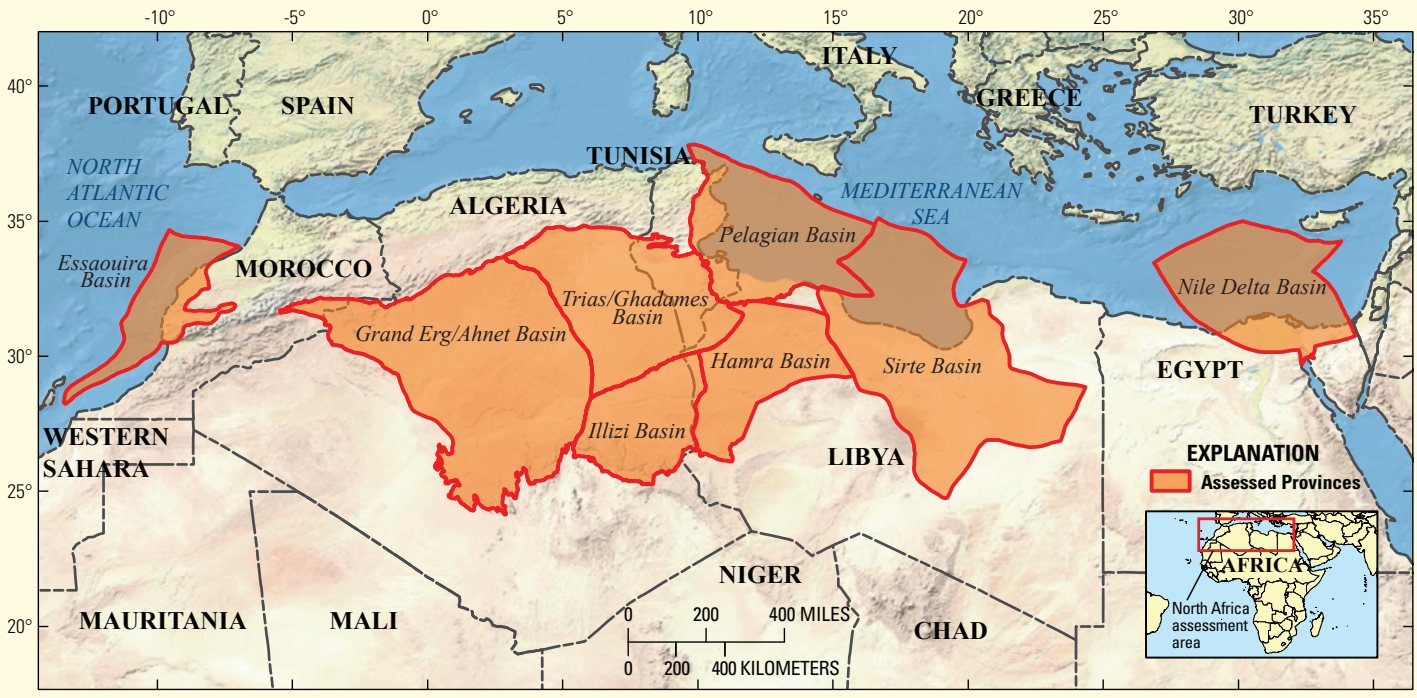

Figure 1. Locations of eight priority geologic provinces of North Africa assessed in this study of undiscovered conventional oil and gas resources.

Hoodoos (thin spires of rock) in the Sahara Desert, Egypt. Hoodoos are composed of fine-grained, chalky limestone. Photo by K.J. Whidden, 2005.

Resource Summary

The USGS assessed undiscovered conventional oil and gas resources in 18 AUs within eight geologic provinces, with the following estimated mean totals: (1) for conventional oil resources, 18,618 million barrels of oil (MMBO), with a range from 6,846 to 37,460 MMBO; (2) for undiscovered conventional gas, 370,375 billion cubic feet of gas (BCFG), with a range from 149,541 to 712,430 BCFG; and (3) for natural gas liquids (NGL), 12,553 MMBNGL, with a range from 4,809 to 24,785 MMBNGL.

Of the mean undiscovered conventional oil resource of 18,618 MMBO, about 41 percent (7,557 MMBO) is estimated to be in the Offshore Salt Structures AU, offshore Morocco. Other significant AUs for potential undiscovered oil include the Offshore Sirte Basin AU (2,267 MMBO), Onshore Sirte Carbonate-Clastic AU (1,278 MMBO), and the Berkine Paleozoic and Mesozoic Reservoirs AU (1,839 MMBO) of the Trias/Ghadames Basin. Of the mean undiscovered gas resource of 370,375 BCFG, about 59 percent (217,313 BCFG) is estimated to be in the Nile Cone AU. Other significant AUs for potential undiscovered gas resources include the Offshore Salt Structures AU of Morocco (45,208 BCFG), the Offshore Sirte Basin AU (22,637 BCFG), and the Gourara Paleozoic Reservoirs AU (15,559 BCFG) of the Grand Erg/Ahnet Basin Province. These four AUs encompass about 81 percent of the undiscovered gas resource.

Linear dune in the Sahara Desert, Egypt. Photo by K.J. Whidden, 2005.

Table 1. Assessment results for undiscovered conventional oil and gas resources for provinces of North Africa.

[MMBO, million barrels of oil; BCFG, billion cubic feet of gas; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas accumulations, all liquids are included as NGL (natural gas liquids) category. Undiscovered gas resources are the sum of nonassociated (gas in gas fields) and associated gas (gas in oil fields). 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 (TPS) and assessment units (AU)	Field type	Expected largest field size	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Nile Delta Basin Province, Mesozoic-Cenozoic Composite TPS														
Nile Margin Reservoirs AU	Oil	214	449	1,150	2,600	1,288	551	1,425	3,237	1,597	11	29	66	32
	Gas	766					698	2,193	5,750	2,574	21	68	181	80
Nile Cone AU	Oil	311	42	256	1,666	475	152	930	6,123	1,758	6	38	255	73
	Gas	17,194					91,213	197,850	410,825	217,313	2,413	5,269	10,962	5,789
Sirte Basin Province, Sirte-Rachmat Composite TPS														
Onshore Sirte Carbonate-Clastic AU	Oil	432	364	1,087	2,823	1,278	418	1,338	4,035	1,673	22	74	240	96
	Gas	2,042					1,267	4,179	12,569	5,169	44	151	478	192
Offshore Sirte Basin AU	Oil	857	563	1,838	5,457	2,267	633	2,250	7,677	2,972	34	124	454	170
	Gas	6,843					6,591	19,540	49,077	22,637	233	709	1,903	840
Pelagian Basin Province, Bou Dabbous-Cenozoic TPS														
Bou Dabbous-Cenozoic Structural/Stratigraphic AU	Oil	60	130	283	552	305	45	113	274	131	1	3	8	4
	Gas	616					1,443	2,933	5,405	3,119	37	75	140	80
Pelagian Basin Province, Jurassic-Cretaceous Composite TPS														
Jurassic-Cretaceous Structural/Stratigraphic AU	Oil	13	62	116	212	124	79	154	287	165	2	4	7	4
	Gas	569					1,044	2,409	5,023	2,643	32	73	154	80
Trias/Ghadames Basin Province, Paleozoic Composite TPS														
Oued Mya Paleozoic Reservoirs AU	Oil	96	631	1,004	1,539	1,035	480	768	1,180	791	20	32	49	33
	Gas	249					363	753	1,573	831	24	54	128	63
Melrhir Paleozoic Reservoirs AU	Oil	12	195	287	419	294	103	153	225	157	4	6	9	6
	Gas	65					571	861	1,270	883	52	79	117	81
Berkine Paleozoic and Mesozoic Reservoirs AU	Oil	194	1,101	1,786	2,777	1,839	2,484	4,169	6,792	4,338	130	221	365	231
	Gas	450					1,157	2,138	3,751	2,255	72	135	244	143
Hamra Basin Province, Silurian/Upper Devonian-Ghadames/Berkine Composite TPS														
Hamra Deep Structures and Subcrop AU	Oil	69	124	430	841	451	232	836	1,801	902	9	32	76	36
	Gas	378					556	2,010	4,088	2,130	51	195	437	213
Hamra Basin Margin Structures AU	Oil	73	42	190	499	220	79	369	1,042	439	3	14	43	18
	Gas	266					79	400	1,411	525	8	39	143	52
Al Atshan Saddle AU	Oil	44	13	66	232	87	25	130	476	174	1	5	20	7
	Gas	267					81	399	1,421	526	7	39	145	53
Sirte Basin Subcrop AU	Oil	19	0	18	86	26	0	35	175	52	0	1	7	2
	Gas						0	0	0	0	0	0	0	0
Illizi Basin Province, Paleozoic Composite TPS														
Illizi Paleozoic Reservoirs AU	Oil	177	537	973	1,650	1,017	1,998	3,673	6,456	3,884	35	65	115	69
	Gas	1,411					7,124	11,800	18,515	12,176	508	879	1,458	918
Grand Erg/Ahnet Basin Province, Paleozoic Composite TPS														
Gourara Paleozoic Reservoirs AU	Oil	22	125	217	365	227	275	493	846	518	5	9	15	9
	Gas	1,125					8,538	14,893	24,989	15,559	14	25	47	27
Ahnet Paleozoic Reservoirs AU	Oil		0	0	0	0	0	0	0	0	0	0	0	0
	Gas	155					2,419	3,994	6,571	4,176	3	4	7	4
Essaouira Basin Province, Paleozoic-Mesozoic Composite TPS														
Essaouira Basin AU	Oil	42	52	116	246	128	53	122	268	136	1	3	7	4
	Gas	253					315	691	1,474	766	10	22	49	25
Offshore Salt Structures AU	Oil	1,788	2,416	6,715	15,496	7,557	3,794	10,759	25,476	12,198	100	286	697	328
	Gas	10,778					14,681	40,352	92,348	45,208	896	2,482	5,759	2,791
Total conventional resources			6,846	16,532	37,460	18,618	149,541	335,112	712,430	370,375	4,809	11,244	24,785	12,553

References Cited

Kirschbaum, M.A., Schenk, C.J., Charpentier, R.R., Klett, T.R., Brownfield, M.E., Pitman, J.K., Cook, T.A., and Tennyson, M.E., 2010, Assessment of undiscovered oil and gas resources of the Nile Delta Province, Eastern Mediterranean: U.S. Geological Survey Fact Sheet FS 2010–3027, 4 p.

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Whidden, K.J., Lewan, M.D., Schenk, C.J., Charpentier, R.R., Cook, T.A., Klett, T.R., and Pitman, J.K., 2011, Assessment of undiscovered oil and gas resources of Libya and Tunisia, 2010: U.S. Geological Survey Fact Sheet FS 2011–3105, 2 p.

For Further Information

Supporting studies of the geologic models and the methodology used in the assessment of North African provinces are in progress. Assessment results are available at the USGS Energy Program Web site, *http://energy.cr.usgs.gov/oilgas/*.

North Africa Provinces Assessment Team:

Christopher J. Schenk, Timothy R. Klett, Katherine J. Whidden, Mark A. Kirschbaum, Ronald R. Charpentier, Troy A. Cook, Michael E. Brownfield, and Janet K. Pitman.

Sinuosity in a linear dune, Sahara Desert, Egypt. Note four-wheel drive vehicle for scale.
Photo by K.J. Whidden, 2005.