Statistics of Petroleum Exploration in the World Outside the United States and Canada Through 2015

Circular 1450

Statistics of Petroleum Exploration in the World Outside the United States and Canada Through 2015

By Emil D. Attanasi and Philip A. Freeman

Circular 1450

U.S. Department of the Interior
DAVID BERNHARDT, Secretary

U.S. Geological Survey
James F. Reilly II, Director

U.S. Geological Survey, Reston, Virginia: 2019

Contents

Figures

[Figures 11–55 follow table 7]

Tables

[Tables 4–7 follow References Cited]

Conversion Factors

Multiply	By	To obtain
Length		
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
meter (m)	3.281	foot (ft)
Area		
square mile (mi^2)	2.590	square kilometer (km^2)
Volume		
cubic foot (ft^3)	0.02832	cubic meter (m^3)
barrel (bbl; petroleum, 1 barrel=42 gallons)	0.1590	cubic meter (m^3)

Abbreviations

bbl	barrel
BBO	billion barrels of oil ($bbl \times 10^9$)
BCF	billion cubic feet ($ft^3 \times 10^9$)
BOE	barrel of oil equivalent
CO_2	carbon dioxide
EIA	U.S. Energy Information Administration
ft	foot
LNG	liquefied natural gas
m	meter
mi^2	square mile
MMBO	million barrels of oil ($bbl \times 10^6$)
MMBOE	million barrels of oil equivalent
OPEC	Organization of the Petroleum Exporting Countries
TCF	trillion cubic feet ($ft^3 \times 10^{12}$)

Definitions

Thousands	$= 10^3$
Millions	$= 10^6$
Billions	$= 10^9$
Trillions	$= 10^{12}$
1 BOE	= 1 barrel of crude oil (42 gallons)
	= 6,000 cubic feet of natural gas
	= 1.5 barrels of natural gas liquids

Acknowledgments

Statistics of Petroleum Exploration in the World Outside the United States and Canada Through 2015

By Emil D. Attanasi and Philip A. Freeman

Abstract

The world's future oil and gas supplies depend on existing reserves and the additions to those reserves that may result, in part, from ongoing exploration and new discoveries. This Circular summarizes available oil and gas exploration data for the world outside the United States and Canada (the study area) through 2015. It updates U.S. Geological Survey Circulars 981, 1096, and 1288 (by D.H. Root, E.D. Attanasi, and R.L. Turner, 1987; E.D. Attanasi and D.H. Root, 1993; and E.D. Attanasi, P.A. Freeman, and J.A. Glovier, 2007). The exploration measures focus on the search for undiscovered conventional oil and gas accumulations.

The goal of this compilation, presentation, and analysis of exploration and discovery data is to identify, at the reconnaissance level, the areas explored for oil and gas and to characterize their degree of exploration maturity. Maps and graphs provide a visual summary of the exploration maturity of an area. The maps include both land and offshore areas. The maps show delineated prospective areas, which are the industry-defined areas of interest in the search for undiscovered conventional oil and gas accumulations. The maps also show explored areas, which are areas where the density of exploration and development drilling rules out new discoveries of large conventional petroleum accumulations.

Whereas the maps show the static state of oil and gas exploration, the dynamic measures of exploration progress are characterized graphically. The graphs show the growth in the delineated prospective and explored areas as a function of wildcat drilling. The relation between the expansion of the delineated prospective area and the rate of wildcat drilling is determined by the siting of the wildcat wells. Additional graphs show the magnitude of discoveries tied to specific delineated prospective areas. These graphs provide a way to evaluate the quality, in terms of discovered oil and gas, of areas identified by the dates when each area became prospective.

From 2006 through 2015, the delineated prospective area within the study area expanded at a rate of about 48,100 square miles per year. This is slightly above the expansion rate of 46,200 square miles per year from 1996 through 2005. From 2006 through 2015, the explored area expanded at a rate of about 12,900 square miles per year, which is somewhat greater than the rate of 11,300 square miles per year for the period from 1996 through 2005. The delineated prospective area established by 1970 accounts for 35 percent of the delineated prospective area established through 2015 but contains 70 percent of the oil and 52 percent of the natural gas discovered through 2015. From 2006 through 2015, offshore discoveries accounted for 71 percent of the oil and 78 percent of the gas discovered in the study area and 40 percent of the offshore wildcat wells were drilled in deep offshore areas (deeper than 200 meters water depth).

The delineated prospective area and explored area calculated with oil and gas wells and fields at depths of at least 10,000 feet are less than half of the respective areas calculated with all oil and gas wells and fields. The discovery histories of most regions indicate that average discovery sizes are generally larger in deeper geologic horizons. To correctly interpret the exploration maturity of a deep horizon, drilling and discovery data must be considered in the context of the geology of the area. Such analyses should be prepared at the level of the petroleum basin or subbasin.

Introduction

Objectives and Methods

The creation of the Cabinet-level U.S. Department of Energy in 1977 and the maintenance of a strategic petroleum reserve during the last two decades of the 20th century demonstrated the U.S. Government's concern about oil supplies after the oil supply disruptions in the 1970s and 1980s. Those disruptions had significant effects on the domestic economy and regulatory environment, as well as on world energy markets. There still is considerable uncertainty with respect to future world oil supplies. One objective of this Circular is to contribute to the analysis of global oil and gas supplies by enhancing the availability of oil and gas exploration statistics for all areas outside the United States and Canada. This compilation of data, which includes tables, figures, and maps, will reduce costly and time-consuming replication of effort and permit researchers and decision makers access to basic exploration statistics for the formulation of energy and environmental policies.

A second objective is to present a visual summary of world oil and gas exploration at a broad scale. This Circular presents maps for countries outside the United States and Canada to show the spatial distribution of oil and gas exploration. Drilling densities vary immensely across regions. Resulting from this study is a method to characterize an area's level of exploration maturity and to identify areas where the intensity of exploration virtually precludes the possibility of large conventional oil and gas discoveries. Maps and graphs are presented to convey spatially and temporally the productivity of each area of exploration.

Hydrocarbon exploration culminates successfully with economically productive wells. Most of the petroleum exploration in areas outside the United States and Canada still focuses on conventional hydrocarbon accumulations. These accumulations are discrete deposits of oil and (or) gas that have well-defined downdip water contacts from which oil, gas, or natural gas liquids may be commercially extracted by using traditional development practices. This Circular shows the geographic extent of hydrocarbon exploration. The delineated prospective areas have expanded over the extremes of the natural environment, from deep waters to Arctic tundras. The intensity of drilling in areas designated as explored is such that commercial discoveries have likely been identified and developed within their boundaries. Exploration, discovery, and reserve statistics represent a set of indicators that foreshadow the future oil and gas production potential from conventional accumulations in these areas.

The production of oil and gas is from proved reserves. In North America, proved reserves are defined as estimated quantities of crude oil, natural gas, or natural gas liquids that geological and engineering data demonstrate with reasonable certainty to be economically recoverable from known reservoirs under existing economic and operating conditions. Reserves are proved if economic productivity is supported by actual production or conclusive formation tests (drill stem or wireline), or if the economic potential is supported by core analyses and (or) interpretations of electric or other logs (U.S. Energy Information Administration [EIA], 2000). Production at individual wells is physically constrained by the volume of hydrocarbons that may be accessed at any given time, and commonly no more than 10 to 15 percent of the proved reserves of individual fields may be extracted annually without risking reservoir damage and reducing ultimate field recovery (Schanz, 1978).

Currently, most of the world's proved reserves of oil and gas are in conventional accumulations. However, economic production of hydrocarbons in the United States and Canada is no longer tied tightly to conventional accumulations. Continuous-type accumulations are hydrocarbon accumulations that are pervasive throughout large areas and are not significantly affected by hydrodynamic influences (U.S. Geological Survey National Oil and Gas Resource Assessment Team, 1995). Resource plays, or alternatively, continuous accumulations, typically occur in formations that have very low permeability. Continuous accumulations

may be identified as the source rocks for the hydrocarbons that migrated into the structural or stratigraphic traps that then became conventional accumulations. The general location and stratigraphic position of these source rocks are commonly identified during the reconstruction of a region's geologic history to justify exploration for associated conventional accumulations.

Continuous accumulations commonly are not fully delineated. In the past, they have not been worth delineating because their contained hydrocarbons could not be produced commercially; however, the use of horizontal well and hydraulic fracture technologies has now made continuous accumulations economic targets for investment. These investments in drilling and the development of new technology are transferring these resources into the proven reserve category. For intensely drilled areas that contain commercial conventional discoveries, it is likely that the geologic literature can provide the general location and strata of the source rocks that charged those accumulations.

Globally, natural gas development and markets have continued to mature, especially in response to increased concerns about global warming and the desire to mitigate carbon dioxide (CO_2) production by substituting natural gas for coal. Traditionally, natural gas markets were tied to local demand where infrastructure was available to transport the gas from producing areas to consumers. Export of gas from a producing region generally requires a pipeline network that gathers and transports gas to other regions where it is consumed or to liquefaction plants that convert the gas to liquefied natural gas (LNG) for overseas export. In industrialized countries, the development of domestic markets or imports of natural gas have been motivated, in part, by the desire to partially or fully displace coal as a fuel for base-load electricity generation to mitigate the effects of pollution and greenhouse gas emissions. By 2015, the volume of LNG traded outside North America doubled from 2002 levels, and the volume of natural gas traded via pipeline increased by 86 percent during that same period (BP, 2003, 2016). Part of the expansion in gas supplies was from formerly stranded natural gas reservoirs and fields. Stranded gas accumulations are discovered conventional gas accumulations that cannot be commercially produced until markets develop to support building infrastructure and production. Attanasi and Freeman (2013) described in detail volumes of stranded gas in South America, Africa, Russia, Asia, and Australia.

Additional supplies of natural gas have resulted from the introduction of the new technology of hydraulic fracturing gas shales and producing the gas with horizontal wells. In North America, the application of this technology has created a surfeit of producible natural gas. Even with gas displacing coal as a base-load fuel for electric power generation, North America has begun exporting natural gas as LNG. Markets for LNG experienced historically low real prices during 2016, which encouraged the substitution of natural gas for coal in international markets.

This Circular presents basic statistics of petroleum exploration and discovery in areas outside the United States and Canada. It also presents analytical techniques that were applied to interpret the data. Initially, the Circular presents some background information on the institutional context and practices of modern exploration, and the petroleum discovery process is summarized (figs. 1 and 2; tables 1–4). The discussion then reviews the unique analytical techniques applied to display and interpret the exploration and discovery data at the country and regional levels (figs. 3 and 4). The summary results of the analysis of the exploration and discovery data at the regional level and for the entire study area are described (figs. 5–10; tables 5–7). These results are based upon the data from individual countries or small groups of countries, which are presented as maps, graphs, and tables in figures 11 through 55. The final section of the text considers the implications of the analysis for future discovery and production trends.

This Circular updates U.S. Geological Survey Circulars 981, 1096, and 1288 (Root and others, 1987; Attanasi and Root, 1993; Attanasi and others, 2007). Data reported in the latest Circular, Circular 1288, ended in 2001. This Circular focuses on the world outside the United States and Canada. Since the 1950s, the United States and Canada have accounted for most of the world's oil and gas wildcat wells but represent only a small fraction of the world's conventional oil and gas discoveries. The drilling and field-size data presented here are as of January 2016 and are from IHS Markit™ (2016). After 2002, IHS Markit added a significant amount of historical data to the database and provided more extensive wildcat well and production well coverage of the study area. For example, the cumulative number of wildcat wells drilled before 2002 in the 2016 version of the database is 35 percent greater than the cumulative number of wells in the 2002 version of the database.

Summary of Findings and Limitations of Study

For this analysis, the study area is defined as the world outside the United States and Canada. From 2006 through 2015, the delineated prospective area (that is, the search area for oil and gas) within the study area expanded at a rate of about 48,100 square miles per year. This rate is slightly higher than that of the previous decade (1996 through 2005) of 46,200 square miles per year but significantly below the rate of about 65,200 square miles per year for the decade from 1986 through 1995. From 2006 through 2015, the explored area expanded at a rate of about 12,900 square miles per year, which was slightly above the 11,300 square miles per year of the previous decade but significantly below the 19,500 square miles per year for the decade from 1986 through 1995. Expansion of these areas was driven by the number and location of wildcat wells drilled.

Since 1950, the search for oil and gas has moved offshore. In 1965, offshore wildcat wells accounted for 5 percent of the wildcat wells drilled in the study area, but by 2015, offshore wildcat wells accounted for 29 percent of all wildcat wells in the study area. Through 2015, offshore discoveries accounted for 23 percent of the oil discovered and 40 percent of the gas discovered, but during the decade from 2006 through 2015, offshore discoveries accounted for 71 percent of the oil and 78 percent of the gas discovered in the study area. For that same 10-year period, the average size, in terms of barrels of oil equivalent (BOE), of offshore discoveries was seven times the average onshore discovery size. With the exception of Russia, at least 10 percent of the wildcat wells in each major producing region were drilled offshore.

All oil and gas wells and fields in the study area were used in calculating the delineated prospective areas and the explored areas at the surface. Since 1950, there has been a gradual increase in the average depth of wildcat wells drilled in the study area. The delineated prospective areas and explored areas at a depth of 10,000 feet (ft) reported herein are based on the oil and gas wells and fields that are at least 10,000 ft in depth. For the study area, the delineated prospective area at a depth of 10,000 ft is 44 percent of the delineated prospective area at the surface. The explored area at a depth of 10,000 ft amounts to 36 percent of the explored area at the surface. The explored area is more intensely drilled than the prospective area and is more sensitive to the increased drilling costs associated with deep horizons. Discoveries in the deep horizons, that is, at depths of at least 10,000 ft, accounted for 32 percent of the total discovered oil and 49 percent of the discovered gas. From 2006 through 2015, the growth of the prospective area in the deep horizons amounted to about 57 percent of the growth of the prospective area at the surface. During the same decade, the average size, in terms of BOE, of discoveries at least as deep as 10,000 ft was five times the average discovery size in the shallower horizons. This difference is because the greater degree of exploration maturity associated with the shallow interval, that is, the greater number of penetrations than in the deeper horizons, precludes having missed large undiscovered accumulations and because the higher costs associated with deep discoveries increase the threshold size of commercial deposits.

Global estimates of consumption, production, and reserves of liquid hydrocarbons (crude oil, condensate, and natural-gas-plant liquids) and natural gas for 2015 are shown in table 1. According to BP (2016), the reserve estimates were acquired from a combination of official sources, published sources (such as World Oil and the Oil and Gas Journal), and third-party data from the Organization of the Petroleum Exporting Countries (OPEC) Secretariat. The balances between production and consumption for the world show that more oil was consumed than produced, and more natural gas was produced than consumed. The oil deficit may be explained by a drawdown of inventories or by refinery gain. Refinery gain refers to an increase in the volume of liquid hydrocarbon products above the volume of input crude oil. Alternatively, the volume of gas produced but not consumed was probably added to inventories, lost in pipeline transport, or flared.

Table 1.   Estimated world liquid hydrocarbon and natural gas consumption, production, and reserves for 2015.

[For these estimates, liquid hydrocarbon includes crude oil, condensate, and natural-gas-plant liquids. Data are from BP (2016). Region definitions in this table differ from those in the rest of this Circular and follow BP (2016). Because of rounding, some regional totals may differ slightly from the sum of the component estimates shown. Countries are listed alphabetically within each region. bbl/yr, barrels per year; ft³/yr, cubic feet per year; bbl, barrel; ft³, cubic feet]

Country	Annual consumption, 2015		Annual production, 2015		Reserves at end of 2015	
	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^9 bbl)	Gas (10^{12} ft³)
North America						
Canada	847	3,618	1,601	5,775	172.2	70.2
Mexico	703	2,938	945	1,879	10.8	11.4
United States	7,080	27,474	4,637	27,096	55.0	368.7
North America subtotal	**8,630**	**34,030**	**7,182**	**34,750**	**238.0**	**450.3**
South and Central America						
Argentina	248	1,679	232	1,289	2.4	11.7
Bolivia	*	*	*	737	*	9.9
Brazil	1,152	1,445	922	809	13.0	15
Chile	134	137	*	*	*	*
Colombia	121	372	368	389	2.3	4.8
Ecuador	92	22	198	*	8.0	*
Peru	89	265	41	441	1.4	14.6
Trinidad and Tobago	14	761	40	1,400	0.7	11.5
Venezuela	247	1,219	959	1,145	300.9	198.4
Other countries	488	272	54	93	0.5	2.2
South and Central America subtotal	**2,585**	**6,172**	**2,815**	**6,302**	**329.3**	**268.1**
Europe and Eurasia						
Austria	96	295	*	*	*	*
Azerbaijan	36	346	307	642	7.0	40.6
Belarus	53	608	*	*	*	*
Belgium and Luxembourg	241	534	*	*	*	*
Bulgaria	32	101	*	*	*	*
Czech Republic	73	254	*	*	*	*
Denmark	60	112	58	162	0.6	1.1
Finland	64	75	*	*	*	*
France	586	1,379	*	*	*	*
Germany	854	2,635	*	254	*	1.4
Greece	110	100	*	*	*	*
Hungary	56	315	*	*	*	*
Ireland	52	148	*	*	*	*
Italy	461	2,170	42	218	0.6	1.6
Kazakhstan	99	304	609	437	30.0	33.1
Lithuania	20	81	*	*	*	*
Netherlands	305	1,124	*	1,519	*	23.8
Norway	85	170	711	4,137	8.0	65.6
Poland	199	591	*	145	*	3.3
Portugal	89	153	*	*	*	*

Table 1.   Estimated world liquid hydrocarbon and natural gas consumption, production, and reserves for 2015.—Continued

[For these estimates, liquid hydrocarbon includes crude oil, condensate, and natural-gas-plant liquids. Data are from BP (2016). Region definitions in this table differ from those in the rest of this Circular and follow BP (2016). Because of rounding, some regional totals may differ slightly from the sum of the component estimates shown. Countries are listed alphabetically within each region. bbl/yr, barrels per year; ft³/yr, cubic feet per year; bbl, barrel; ft³, cubic feet]

Country	Annual consumption, 2015		Annual production, 2015		Reserves at end of 2015	
	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^9 bbl)	Gas (10^{12} ft³)
Europe and Eurasia—Continued						
Romania	70	365	31	364	0.6	3.9
Russia	1,136	13,825	4,008	20,246	102.4	1,139.6
Slovakia	29	151	*	*	*	*
Spain	447	974	*	*	*	*
Sweden	109	32	*	*	*	*
Switzerland	83	101	*	*	*	*
Turkey	305	1,539	*	*	*	*
Turkmenistan	53	1,212	95	2,557	0.6	617.3
Ukraine	67	1,017	*	614	*	21.3
United Kingdom	569	2,411	352	1,400	2.8	7.3
Uzbekistan	22	1,776	23	2,039	0.6	38.3
Other countries	247	539	138	221	2.1	7.0
Europe and Eurasia subtotal	**6,709**	**35,347**	**6,374**	**34,955**	**155.2**	**2,005.1**
Middle East						
Bahrain	*	*	*	549	*	6.1
Iran	711	6,753	1,431	6,797	157.8	1,201.4
Iraq	*	*	1,471	36	143.1	130.5
Israel	87	297	*	*	*	6.4
Kuwait	194	685	1,130	529	101.5	63.0
Oman	*	*	348	1,232	5.3	24.3
Qatar	118	1,595	693	6,408	25.7	866.2
Saudi Arabia	1,422	3,758	4,385	3,758	266.6	294.0
Syria	*	*	10	152	2.5	10.1
United Arab Emirates	329	2,441	1,424	1,969	97.8	215.1
Yemen	*	*	17	94	3.0	9.4
Other countries	633	1,782	77	297	0.2	0.2
Middle East subtotal	**3,493**	**17,311**	**10,986**	**21,821**	**803.5**	**2,826.6**
Africa						
Algeria	154	1,378	579	2,931	12.2	159.7
Angola	*	*	667	*	12.7	*
Chad	*	*	29	*	1.5	*
Republic of Congo (Brazzaville)	*	*	101	*	1.6	*
Egypt	301	1,688	264	1,610	3.5	65.2
Equatorial Guinea	*	*	106	*	1.1	*
Gabon	*	*	85	*	2.0	*
Libya	*	*	158	450	48.4	53.1
Nigeria	*	*	859	1,768	37.1	180.5

Table 1. Estimated world liquid hydrocarbon and natural gas consumption, production, and reserves for 2015.—Continued

[For these estimates, liquid hydrocarbon includes crude oil, condensate, and natural-gas-plant liquids. Data are from BP (2016). Region definitions in this table differ from those in the rest of this Circular and follow BP (2016). Because of rounding, some regional totals may differ slightly from the sum of the component estimates shown. Countries are listed alphabetically within each region. bbl/yr, barrels per year; ft³/yr, cubic feet per year; bbl, barrel; ft³, cubic feet]

Country	Annual consumption, 2015		Annual production, 2015		Reserves at end of 2015	
	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^6 bbl/yr)	Gas (10^9 ft³/yr)	Liquid (10^9 bbl)	Gas (10^{12} ft³)
Africa—Continued						
South Africa	237	177	*	*	*	*
South Sudan	*	*	54	*	3.5	*
Sudan	*	*	38	*	1.5	*
Tunisia	*	*	23	*	0.4	*
Other countries	727	1,540	96	720	3.7	38.8
Africa subtotal	**1,419**	**4,784**	**3,057**	**7,479**	**129.1**	**496.7**
Asia Pacific						
Australia	367	1,213	141	2,368	4.0	122.6
Bangladesh	41	947	*	947	*	8.2
Brunei	*	*	46	448	1.1	9.7
Burma	*	*	*	692	*	18.7
China	4,368	6,968	1,573	4,872	18.5	135.7
Hong Kong Special Administrative Region	134	115	*	*	*	*
India	1518	1,787	320	1,032	5.7	52.6
Indonesia	594	1,403	301	2,650	3.6	100.3
Japan	1,515	4,005	*	*	*	*
Malaysia	303	1,404	253	2,409	3.6	41.3
New Zealand	58	159	*	*	*	*
Pakistan	189	1,532	*	1,480	*	19.2
Papua New Guinea	*	*	*	*	*	5.0
Philippines	145	118	*	*	*	*
Singapore	489	400	*	*	*	*
South Korea	940	1,540	*	*	*	*
Taiwan	376	649	*	*	*	*
Thailand	490	1,867	174	1,406	0.4	7.8
Vietnam	154	376	132	376	4.4	21.8
Other countries	159	277	107	977	1.3	9.9
Asia Pacific subtotal	**11,842**	**24,761**	**3,046**	**19,658**	**42.6**	**552.6**
World total						
World total	34,678	122,494	33,460	124,966	1,697.6	6,599.4

*The quantity is not listed separately for an individual country but may be included in the "Other countries" category for the region if significant.

The production data in table 1 include the production of bitumen from Canadian tar sands, extra-heavy oil from Venezuela's Orinoco heavy oil belt, and oil and gas from other unconventional resources. In North America, about 1.4 billion more barrels of liquid hydrocarbons was consumed than produced. Europe, excluding Russia, consumed 4 billion more barrels of liquids than it produced, and the Asia-Pacific region consumed 8 billion more barrels of liquids than it produced. These deficits were offset by imports from South America, the Middle East, Russia, and central Asia. Europe and Asia were the leading importers of both pipeline gas and LNG.

For the study area, that is the world outside the United States and Canada, the data from table 1 indicate that about 26.8 billion barrels of liquid hydrocarbons was consumed and 27.2 billion barrels was produced in 2015; 91.4 trillion cubic feet (TCF) of natural gas was consumed and 92.1 TCF was produced in 2015. During the 30-year period from 1986 through 2015, the average annual volume of oil discovered in conventional accumulations amounted to about 11.4 billion barrels of oil (BBO) and the average annual volume of natural gas discovered in conventional accumulations amounted to 118.4 TCF (IHS Markit, 2016). Even if the resources in these conventional discoveries experience field growth during their productive lifetime, the average annual volume of oil discovered in conventional accumulations falls short of current oil consumption and production levels. The volumes of liquid hydrocarbons produced and consumed and the reserves listed in table 1, however, include both conventional sources of crude oil, condensate, and natural-gas-plant liquids and unconventional sources of oil, such as tar sands, extra-heavy oil, and oil in continuous-type accumulations. Since 2002, world production of liquid hydrocarbons has increased by 24 percent and natural gas production has increased by 40 percent. In 2015, almost 30 percent of the gas produced was traded internationally, of which roughly two-thirds was transported by pipeline and the remainder was transported by seagoing tankers as LNG (BP, 2016).

Outside the United States and Canada, international gas pipeline trade commonly involves a producer that is a governmental entity. The shipment of gas in international pipelines that traverse countries that are not the ultimate consumers (transit countries) is costly and risky. Transit countries may demand 4 to 6 percent of the gross value of the pipeline gas as transit fees, which add to costs for purchasers and (or) reduce revenues to producers. Risks include transport disruptions because of political instability inside the transit countries and potential contract conflicts with the transit countries. Conversion of gas to LNG and transport in seagoing tankers is not only costly in terms of the capital and operating outlays but also in the amount of gas consumed at liquefaction plants and in transportation processes. Therefore, suppliers that have installed gas transport facilities require long-term commitments in the form of take-or-pay contracts for initial gas purchasers. These provisions have resulted in some imbalances that have led to the emergence of a network of receiving terminals and the relaxation of contract provisions, allowing for the establishment of a sophisticated global spot LNG market (Hayes, 2006).

Before the latter part of the 20th century, natural gas, both associated with oil and in gas reservoirs, was not an economic commodity in most countries. Gas discoveries may have gone unreported, and gas associated with oil discoveries may have been flared. There is no obvious way to estimate the amount of gas that was flared. Drilling records outside the United States and Canada may be incomplete, especially for data prior to 1950. Progress continues to be made in documenting the historical growth of the oil and gas industry, particularly in those countries where drilling information was once considered critical to national security.

The well data used for the analyses presented in this Circular include well location, depth, well classification, spud date, completion date, and, for development wells, producing field (IHS Markit, 2016). The discovery data include field location and estimates of recoverable oil, natural gas, and condensate. The International Field File of the IHS Markit (2016) database was used as the basis for estimating discovered resources at the field level. IHS Markit (2016) documentation notes that, unless otherwise stated, the estimates of recoverable oil and gas volumes are associated with a probability of 50 percent (p50). For a p50 estimate, there is a 50-percent chance that the actual recoverable volume is less than the estimate and a 50-percent chance that the volume exceeds the estimate. By contrast, in the United States and Canada, the proved reserve estimates have a much tighter definition, with a 90-percent probability of the estimate being exceeded and a 10-percent chance of the recoverable volume falling short of the estimate. The phenomenon of field growth, also called reserves appreciation, is a dominant source of the additions to reserves in conventional fields in the United States and Canada because field-size estimates are based on proven reserves.

Estimates of the oil and gas recoveries reported in the International Field File of IHS Markit (2016) for fields outside the United States and Canada are from diverse sources, and revisions are reported on an irregular basis. Accordingly, field growth, if it exists at all, is much more subtle than in the United States and Canada. International oil companies may be constrained by financial regulators to submit estimates that are closer to the ideal of proved reserves, whereas national oil companies are under no such obligation to report the tighter estimates unless they enter capital markets independent of government assistance and must submit to financial regulation. National oil companies now control most of the world's conventional reserves outside the United States and Canada (EIA, 2016b). The instances of field growth that were observed were not sufficiently pervasive to characterize analytically, so no attempt was made to adjust the sizes of recent discoveries for reserve appreciation. However, one should keep in mind that estimates of recoverable oil and gas volumes for new discoveries are likely to change as the discoveries are developed.

Exploration and Discovery Process

Oil and Gas Exploration: Concepts and Nomenclature

As used in this study, exploration is the search for undiscovered discrete oil and gas accumulations that have development and production costs no greater than the costs associated with producing oil and gas from known accumulations and adding to reserves in known accumulations (Adelman, 1970, 1992). Exploration is only one of the methods of adding to reserves. For a given area, the search for hydrocarbons occurs in phases. It commonly begins with reviewing an area's geologic literature, followed by surveying of surface geology, processing and interpreting new or previously collected geophysical data to identify new prospects, acquiring mineral rights, collecting predrilling geophysical data, and finally drilling wells to test the commercial viability of a prospect.

There are no internationally accepted standards for computing and reporting reserves. In countries outside the United States and Canada, government authorities tend to define reserves without reference to economic recoverability; reserves are simply thought of as the inventory of technically recoverable oil and gas in identified reservoirs or fields. A reservoir or pool is a mass of porous, permeable rock that contains a natural accumulation of oil or gas, which is confined by impermeable rock or water barriers. The petroleum is contained by the natural pores of the reservoir rock. A field, as defined by the EIA (2000), is an area consisting of an individual reservoir or multiple reservoirs related to the same geologic structure and (or) stratigraphic condition.

Figure 1 shows different types of wells that lead to additions to reserves. The general categories are (1) shallow pool test well, (2) deep pool test well, (3) infill development well, (4) new pool test well, and (5) extension or outpost well. The risk or probability of a dry hole is highest in the drilling of new pool test wells, somewhat less for deep or shallow pool test wells, and lowest for infill development wells. Nevertheless, some infill development wells fail to contact the producing formation.

The concept of proved reserves (term "proven" was used in previous Circulars) ties the crediting of volumes of oil and gas to the outcome of both wildcat wells and development wells. Consequently, for countries that use this reserve definition, most of the additions to oil and gas reserves are made by drilling development wells in known fields. Inferred reserves are volumes of oil and gas that are expected to be added to proven reserves as fields are developed or as new methods are applied that would increase the recovery of the in-place resource. Alternatively, if reserves are very loosely or broadly defined and estimates are not tied to development wells, as is the case outside of the United States and Canada, reserve estimates are, in part, independent of production wells, so the phenomenon of field growth may not be observed.

At the level of the field, there is some ambiguity as to whether newly discovered accumulations should be classified as new fields or extensions of discovered fields. The definition of an oil or gas field is not exact. The EIA (2000) defined a field as an area consisting of a single reservoir or multiple
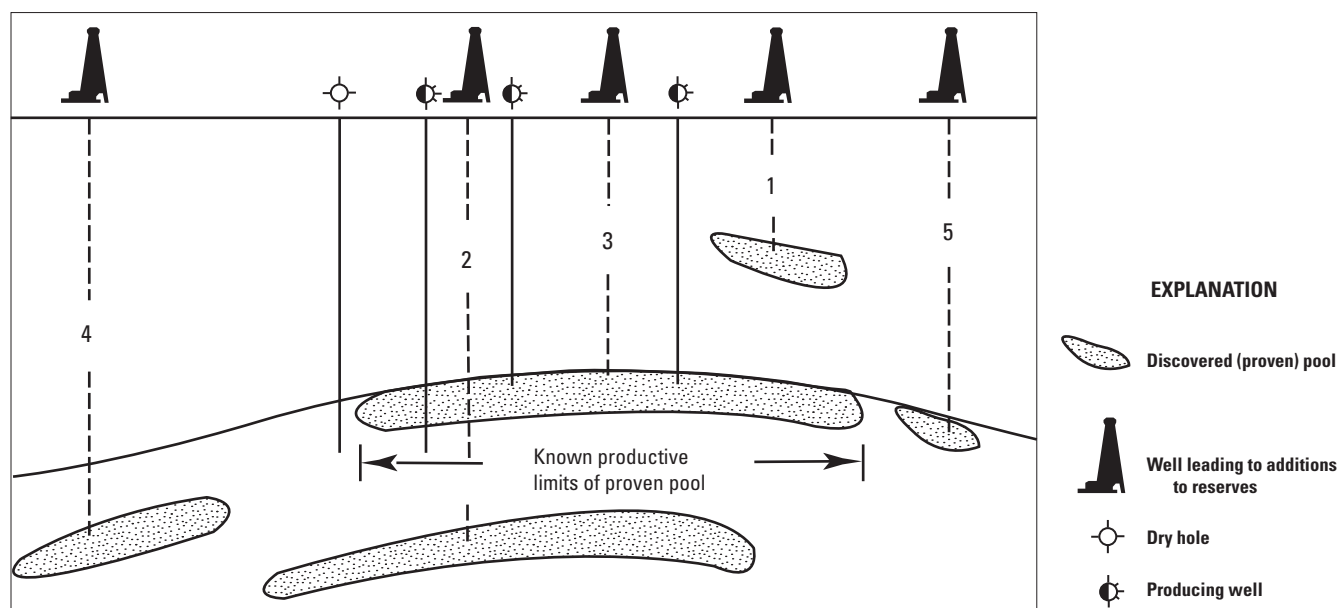
Figure 1.   Diagram of types of wells leading to additions to reserves in discovered fields. The wells (represented by derricks) are as follows: (1) shallow pool test well, (2) deep pool test well, (3) infill development well, (4) new pool test well, and (5) extension or outpost well. In practice, the operator or regulatory body may classify the accumulations penetrated by well types 1–5 as a single field or as more than one field. Recognition of the relations among the accumulations can be complicated by the order in which the wells are drilled. From Attanasi and others (2007, fig. 1), which was modified from Drew (1997).

reservoirs grouped on, or related to, the same geologic structure and (or) stratigraphic condition. In a single field, two or more reservoirs may be separated vertically and (or) laterally by impervious strata. In figure 1, there could be as many as five possible fields or as few as one field. In practice, the definition of a field may depend on the sequence of discovery, but ultimately it depends on the regulatory authority. The assignment of pools to fields may be based on geology or may simply be a matter of convenience for the regulatory authority.

Oil and Gas Exploration: Institutional Environment

Oil and gas exploration investments are made by firms attempting to locate unidentified but potentially commercial reservoirs and fields. Exploration may begin with a hypothesis about the formation of accumulations of hydrocarbons in a specific geologic setting. Reviews of the literature, geologic maps, geochemical data, geophysical data, and drilling history may be used to select a target area. Fieldwork in and seismic profiling of the target area may lead to the identification of specific drilling targets. Data are continuously collected and interpreted while drilling to maximize the probability of locating an unidentified accumulation of hydrocarbons. After an accumulation is encountered, tests and data collection continue to determine the potential of a commercial discovery.

Inside the United States

In the United States, the ownership of mineral rights may reside with private entities, the Federal Government, or State governments. Unless the minerals are in preservation areas, governments commonly transfer rights to the private sector for exploration, commercial evaluation, and production. Although various systems are used to transfer mineral rights to the private sector, their common goal is for the government to capture economic rents that may result from development of the resource. An analysis of these systems is beyond the scope of this study. Currently, however, where significant volumes of hydrocarbons are expected, competitive bidding systems are commonly used to transfer the mineral rights to the private sector.

Private ownership of mineral rights can result in what economists refer to as "market failures," and governments may intervene to remediate the failures. Oil and gas pools commonly extend beyond the boundaries of a single property. Upon the announcement of a discovery, under the rule of capture, competing property owners may quickly drill and produce the hydrocarbons beneath their properties to forestall the pool being drained by a neighbor. This practice results in extremely rapid development and production of the resource. Even if prices drop, production may not decline because owners fear that the resource below their property may be drained by a neighbor. Frequently, the accelerated production reduces the overall quantity of the resource that can be commercially

recovered from the pool. Economists call this situation the common property or pool externality. An economic externality occurs when the welfare of an individual depends directly not only on their actions but also on actions of some other economic agent. To remedy the common pool externality, government regulators in leading oil-producing States implemented a pro-rationing system that limited production for each well to an allowable rate per month and set minimum spacing requirements for production wells. For some production methods, regulators require that the extraction be unitized under a single operator to assure production proceeds in an efficient manner.

Outside the United States

Outside the United States, mineral rights are typically vested in the national governments. The rights to explore a concession area are negotiated with these governments. Although the European countries that owned North Sea mineral rights used an auction system to transfer those rights to the private sector, these countries still maintain strict control of resource development. Other countries such as Venezuela, most Middle Eastern countries, and Asian countries have national oil companies that allow international oil companies to act as minority partners or use international oil companies as contractors to develop and produce discoveries. The exploration and development phases may also be separated and completed by different firms.

National oil companies and government regulators may strive to assure that participation by an international oil company in any project results in the training and employment of local workers, the use of local firms for field infrastructure development, and the provision of social services to the local community. Governments commonly tailor provisions on an individual project basis.

Oil and Gas Discovery Process: Discrete Accumulations

Within a well-defined sedimentary basin with a single play, well-documented regularity in the oil and gas discovery process (Drew, 1997) enables the use of the discovery history to predict the nature and size distribution of future discoveries. The petroleum industry uses the concept of the petroleum play as a basis for classifying exploration targets (White, 1980; Baker and others, 1984). A play is defined as a set of known or postulated oil and (or) gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration patterns, timing, trapping mechanism, and hydrocarbon type. Plays include pools related to a specific rock unit that might represent single fields or parts of fields (Gautier and others, 1996).

In this Circular, field size is measured in terms of fluid volumes expressed in barrels of oil or natural gas liquids and in cubic feet of gas. On the basis of calorific heating values, it is assumed that 1 barrel of oil is equivalent (BOE) to 6,000 cubic

feet (ft^3) of natural gas; that is, 1 BOE = 1 barrel (bbl) of crude oil or 6,000 cubic feet of natural gas or 1.5 barrels of natural gas liquids.

The regularity of the discovery process occurs, in part, because the size distribution of accumulations within a confined play or basin is characterized by the likelihood that most of the resource is contained in a few large accumulations and that many small associated accumulations, in total, account for a relatively small share of the total resource. The typical size-frequency distribution is right skewed. The graph of such a distribution has the number of accumulations plotted on the vertical axis and deposit-size class or category on the horizontal axis.

If it is assumed that the planar surface expression of an oil or gas accumulation is proportional to hydrocarbon volume, then with random drilling, the average discovery size of discrete deposits will decline with equal increments of exploratory drilling. This decline will occur because the larger deposits with the larger surface expressions have a greater probability of being found with random drilling (Root and Schuenemeyer, 1980). As the larger accumulations are found and their undiscovered numbers are exhausted, it takes more wildcat wells to locate the smaller accumulations with much smaller surface expressions. Any improvement in exploration efficiency over purely random drilling just accelerates the discovery of the largest fields and the decline of the discovery rate (Root and Schuenemeyer, 1980).

The production of oil and gas generally exhibits substantial economies of scale that affect commercial viability of the discovery. Within a defined geographic and geologic area, the larger accumulations are less costly to find and produce, and their hydrocarbons are less costly, on a unit basis, to transport to market. The typical lifecycle of a multiplay basin is the following: after a large initial discovery, an influx of new competitive explorers creates high rates of drilling, which accelerate a decline in returns. Exploratory drilling will gradually decline as average discovery sizes become marginal. An initial discovery in a different play in the same basin, perhaps in a deeper horizon, if sufficiently large, may ignite another round of intense wildcat drilling in that new play. Again, exploratory drilling will eventually decline as the returns and average discovery sizes decline. Explorers are likely to test multiple horizons in such basins. New discoveries in new plays in the same basin will benefit from the existing oil and gas infrastructure. Eventually, new discoveries in other basins will signal potentially higher returns in plays in other basins, and exploration will shift to those plays.

Factors that affect the order in which plays and basins are explored and produced but not the regularity of the discovery process within a given area or play include exploration access, cost factors, distance from and maturity of markets, political stability, and technology. Distance from markets and the maturity of markets affect the costs and commercial value of oil and gas finds. Technological and legal access affect the feasibility of development if discoveries are identified.

Oil and Gas Provinces in the Study Area

The U.S. Geological Survey published outlines of 418 petroleum provinces (U.S. Geological Survey World Energy Assessment Team, 2000) in the study area. Fields in the study area were assigned to these provinces based on surface locations. Certain hydrocarbon resources, such as tar sand deposits, extra-heavy oil, oil shale deposits, hydrates, and natural gas in brines, were not included in this analysis of resources in the study area. Provinces were classified as significant if they had at least one discovery that contained 100 million barrels of oil (MMBO) or 600 billion cubic feet (BCF) of natural gas. Of the 418 provinces in the study area, 212 met this threshold. These significant provinces account for 99 percent of the discovered oil and gas reported in the study area. Figure 2 shows histograms of cumulative recoverable oil and gas in the 212 significant provinces.

The data upon which the histograms (fig. 2) are based show that even among this selected group of petroleum provinces, most of the discovered resources are concentrated in relatively few provinces. Table 2 lists the 40 most prolific provinces for oil and the 40 most prolific provinces for natural gas. These provinces account for 92 percent of all discovered oil and 84 percent of all discovered gas in the study area. The 5 and 10 most prolific provinces for oil account for 52 and 67 percent of the discovered oil, respectively, in the study area. Similarly, the 5 and 10 most prolific provinces for gas account for 48 and 59 percent of the discovered gas, respectively, in the study area. Table 2 also shows the year of the first discovery for this selected group of provinces. Overall, the significant provinces having discoveries before 1941 contain 59 percent of all oil and 24 percent of all gas discovered in the study area through 2015. In summary, conventional oil and gas fields discovered in the study area show a high degree of concentration of resource in relatively few provinces. These provinces not only had discoveries early in the history of the global oil and gas industry, but they were also accessible from both legal and technological standpoints.

Measures of Exploration Maturity

When the planar surface area of discrete deposits is roughly proportional to volume of the recoverable resource, then with random drilling, the average discovery size will decline with successive increments of wildcat drilling. In this study, exploration maturity is defined relative to a drilling density that implies an approximate threshold size of an undiscovered accumulation. An area is mature relative to a specified threshold size if the density of drilling indicates there is little chance that accumulations at least as large as the threshold size remain undiscovered. One motivation for governments to evaluate exploration maturity is to assess the remaining undiscovered conventional resources of a petroleum basin or province to formulate public policy pertaining to its development.

A

B
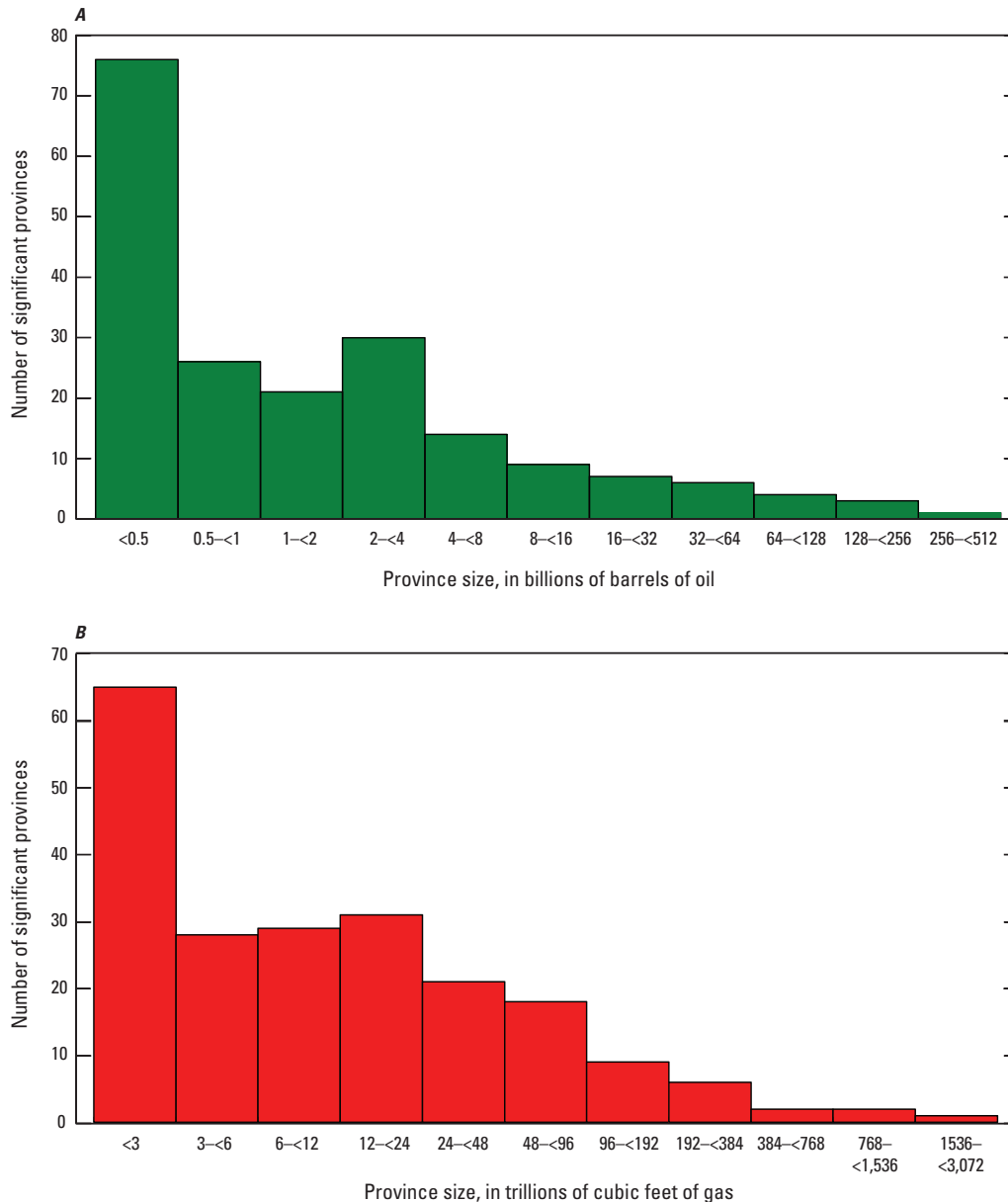
Figure 2.   Histograms showing the frequency distribution of cumulative recoverable volumes of (*A*) oil in billions of barrels of oil and (*B*) natural gas in trillions of cubic feet of gas discovered through 2015 in the 212 significant provinces of the study area, which is the world outside the United States and Canada. Significant provinces have at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of natural gas. In both histograms, the unequal intervals for size classes are defined in powers of 2 to allow all province sizes to fit on the graph. Field data are from IHS Markit (2016); province boundaries are from U.S. Geological Survey World Energy Assessment Team (2000). In the study area, 19 provinces have no reported oil discoveries but have gas discoveries of at least 600 billion cubic feet of gas.

Private sector exploration firms evaluate exploration maturity to facilitate the efficient allocation of exploration assets and efforts over various theaters of operation.

Wildcat or exploration well counts can be misleading measures of exploration maturity. However, the locations of all productive and dry wells and discoveries provide the basic data for developing the measure of maturity used here. Wildcat well locations represent the oil and gas industry's exploration strategy, whereas the discovery data reflect the exploration outcomes. The well location data permit the calculation of distances between wells. A minimum distance between wells is necessary for an accumulation of a given size to remain undetected. The distances between wells convey information about the likelihood of the occurrence of an undetected target accumulation in an area undergoing exploration.

In most countries, petroleum exploration is confined to a small fraction of the total land area. If the petroleum industry sited wildcat wells on a regular grid and confined drilling to a fixed area, then the probability of an undetected accumulation occurring would decline as the drilling density increased and the grid mesh became smaller. Therefore, for any given drilling density (mesh size), the exploration for larger accumulations is more advanced or mature than for smaller accumulations. The measure of exploration maturity for a fixed area is conditional on the distance between wells, the target size, and the spatial arrangement of wells.

While the exploration area is expanding, the discovery rate and average discovery size may not decline. In such areas, discovery rates and average discovery sizes may be highly irregular. Exploration areas may expand because of changes in legal restrictions, technological breakthroughs, or substantially improved economic conditions.

Well locations, field locations, distances between wells and fields, and the arrangement of wells and fields are all used

Table 2. Forty most prolific provinces for oil and gas in the study area and their year of first discovery and cumulative recoverable volumes of oil and gas in their petroleum discoveries through 2015.

[Provinces are ranked by the cumulative recoverable volumes of oil and gas in petroleum discoveries, which are the sum of past production and proved reserves of oil, gas, and natural gas liquids. Years and oil and gas volumes are from IHS Markit (2016); province names and code numbers are from the U.S. Geological Survey (USGS) World Energy Assessment Team (2000). BBO, billion barrels (bbl x 10^9) of oil; TCF, trillion cubic feet (ft^3 x 10^{12})]

Oil Rank	USGS province name and code number	Year of first discovery	Oil (BBO)	Gas (TCF)	Gas rank	USGS province name and code number	Year of first discovery	Oil (BBO)	Gas (TCF)
1	Mesopotamian Foredeep Basin, 2024	1938	442	445	1	West Siberian Basin, 1174	1953	172	1,647
2	Zagros Fold Belt, 2030	1905	175	585	2	Qatar Arch, 2022	1967	5	1,523
3	West Siberian Basin, 1174	1953	172	1,647	3	Amu-Darya Basin, 1154	1953	1	774
4	Greater Ghawar Uplift, 2021	1932	169	229	4	Zagros Fold Belt, 2030	1905	175	585
5	Rub Al Khali Basin, 2019	1954	117	290	5	Mesopotamian Foredeep Basin, 2024	1938	442	445
6	Volga-Ural Region, 1015	1929	81	102	6	Rub Al Khali Basin, 2019	1954	117	290
7	Niger Delta, 7192	1954	66	260	7	Niger Delta, 7192	1954	66	260
8	Maracaibo Basin, 6099	1914	64	70	8	Greater Ghawar Uplift, 2021	1932	169	229
9	North Sea Graben, 4025	1966	61	206	9	North Sea Graben, 4025	1966	61	206
10	Santos Basin, 6036	1979	50	113	10	North Caspian Basin, 1016	1892	28	200
11	Sirte Basin, 2043	1958	46	55	11	East Venezuela Basin, 6098	1867	38	192
12	Villahermosa Uplift, 5305	1954	44	55	12	Northwest German Basin, 4035	1856	3	160
13	East Venezuela Basin, 6098	1867	38	192	13	Northwest Shelf, 3948	1954	2	147
14	West-Central Coastal, 7203	1951	37	66	14	Tanzania Coastal, 7273	1974	<1	145
15	Widyan Basin-Interior Platform, 2023	1939	32	21	15	South Barents Basin, 1050	1983	0	126
16	Campos Basin, 6035	1972	29	19	16	Grand Erg/Ahnet Basin, 2058	1954	1	126
17	North Caspian Basin, 1016	1892	28	200	17	Greater Sarawak Basin, 3702	1953	1	123
18	South Caspian Basin, 1112	1869	25	109	18	Santos Basin, 6036	1979	50	113
19	Bohaiwan Basin, 3127	1961	25	20	19	South Caspian Basin, 1112	1869	25	109
20	Songliao Basin, 3144	1959	22	14	20	Volga-Ural Region, 1015	1929	81	102
21	Trias/Ghadames Basin, 2054	1956	21	47	21	Dnieper-Donets Basin, 1009	1936	3	94
22	Timan-Pechora Basin, 1008	1916	16	40	22	Anglo-Dutch Basin, 4036	1919	1	91
23	Central Sumatra Basin, 3808	1939	15	4	23	Nile Delta Basin, 2035	1966	<1	89
24	Middle Caspian Basin, 1109	1893	13	45	24	Sichuan Basin, 3142	1939	<1	78
25	Putumayo-Oriente-Maranon Basin, 6041	1963	12	3	25	Maracaibo Basin, 6099	1914	64	70
26	Red Sea Basin, 2071	1907	11	13	26	Ordos Basin, 3128	1907	8	70
27	Tampico-Misantla Basin, 5301	1904	10	18	27	Malay Basin, 3703	1969	5	66
28	Baram Delta/Brunei-Sabah Basin, 3701	1910	9	57	28	West-Central Coastal, 7203	1951	37	66
29	Bombay, 8043	1958	9	38	29	Tarim Basin, 3154	1958	3	64

Table 2. Forty most prolific provinces for oil and gas in the study area and their year of first discovery and cumulative recoverable volumes of oil and gas in their petroleum discoveries through 2015.—Continued

[Provinces are ranked by the cumulative recoverable volumes of oil and gas in petroleum discoveries, which are the sum of past production and proved reserves of oil, gas, and natural gas liquids. Years and oil and gas volumes are from IHS Markit (2016); province names and code numbers are from the U.S. Geological Survey (USGS) World Energy Assessment Team (2000). BBO, billion barrels (bbl x 10^9) of oil; TCF, trillion cubic feet (ft^3 x 10^{12})]

Oil Rank	USGS province name and code number	Year of first discovery	Oil (BBO)	Gas (TCF)	Gas rank	USGS province name and code number	Year of first discovery	Oil (BBO)	Gas (TCF)
30	Ordos Basin, 3128	1907	8	70	30	Santa Cruz-Tarija Basin, 6045	1924	<1	62
31	Llanos Basin, 6096	1948	7	11	31	Baram Delta/Brunei-Sabah Basin, 3701	1910	9	57
32	San Jorge Basin, 6058	1907	7	7	32	Kutei Basin, 3817	1897	4	57
33	Interior Homocline-Central Arch, 2020	1989	7	24	33	Villahermosa Uplift, 5305	1954	44	55
34	Carpathian-Balkanian Basin, 4061	1835	7	14	34	Sirte Basin, 2043	1958	46	55
35	Neuquen Basin, 6055	1922	6	40	35	Bonaparte Gulf Basin, 3910	1964	1	51
36	Sud, 7146	1975	6	1	36	Angara-Lena Terrace, 1209	1954	<1	51
37	Junggar Basin, 3115	1937	6	8	37	Illizi Basin, 2056	1956	5	50
38	Fahud Salt Basin, 2016	1962	5	14	38	Browse Basin, 3913	1971	<1	49
39	Malay Basin, 3703	1969	5	66	39	Nepa-Botuoba Arch, 1210	1962	4	47
40	Qatar Arch, 2022	1967	5	1,523	40	Trias/Ghadames Basin, 2054	1956	21	47

to delineate areas of interest in the search for undiscovered oil and gas accumulations. These characteristics are also used to determine the degree of exploration maturity of the delineated area of interest.

Delineated Prospective Area and Explored Area: Definitions

Within a country or group of countries, area is described mathematically as a set of grid points in a plane. The grid points are approximately 2.83 miles apart, and the area of each cell having grid points as vertices is approximately 8 square miles. The locations of grid points are identified by longitude and latitude.

The delineated prospective area for oil and gas exploration is represented as the set of all grid points that are within a specified distance to wells (producing and dry) that have penetrated to the depth where hydrocarbons are thought to occur and that are inside the area drilled. The procedure for

choosing the grid points that form the delineated prospective area is based on examination of all non-overlapping triangles, (see fig. 3) formed by wells at their vertices. A grid point is classified as being in the delineated prospective area if it is located within a triangle that is small enough to fit inside a circle that has a radius of 20 miles. The delineated prospective area, in square miles, is calculated as the combined (non-overlapping) area of those triangles having a well at each vertex and fitting inside a circle with a radius of 20 miles (see fig. 3). The delineated prospective areas are displayed on maps as closed polygons.

The 20-mile radius was chosen here and in the earlier editions of this Circular (Root and others, 1987; Attanasi and Root, 1993; Attanasi and others, 2007) because it provides a convenient scale for visual presentation of the area of interest for petroleum exploration. The 20-mile radius was also consistent with the precision of the location data for wells and discoveries. When a radius smaller than 20 miles is used, gaps (data-poor areas) appear in the prospective area; however,
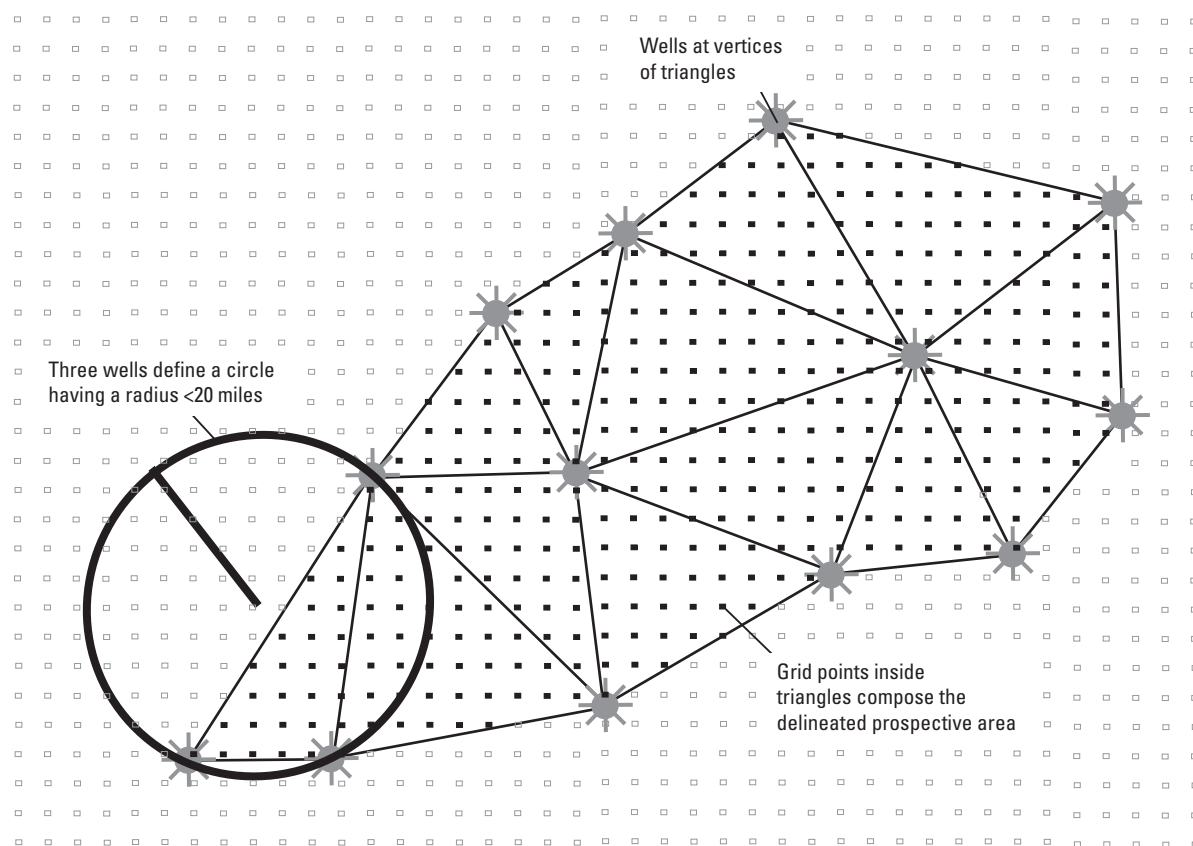
Figure 3.   Diagram for identifying and computing delineated prospective area. To facilitate comparisons with Circulars 1288 (Attanasi and others, 2007) and 1096 (Attanasi and Root, 1993), the delineated prospective area was calculated the same way for this Circular from grid points that were evenly spaced 2.83 miles apart. If three non-colinear wells define a triangle that can fit inside a circle having a radius less than 20 miles, then the triangle connecting the wells defines the delineated prospective area. Grid points that lie within such triangles appear as the delineated prospective area on the maps in figures 11–55. Because the grid point symbols in figures 11–55 are too large to be distinguished separately, the area covered by the grid points appears as a continuous area. From Attanasi and others (2007, fig. 5).

when a larger radius is used, there is a loss of resolution in defining the prospective area.

Data used in calculation of the delineated prospective areas included locations of all wildcat, exploratory, and development wells (both successful and dry), along with the locations of fields. The use of all petroleum well and field locations was intended to compensate for missing data for wildcat wells drilled prior to 1950. The producing wells, dry wells, and field locations may represent the only evidence of early exploration in some areas. Although the use of all the data added redundancy to the computations, it gave some assurance that no area that had been searched was excluded because of missing wildcat wells.

When exploration begins in an area, the delineated prospective area expands rapidly, and then the growth stabilizes to a much slower rate as drilling turns from exploration to development. If there are no discoveries, the area may be abandoned. If the area is not abandoned, wildcat drilling may continue, but this followup drilling may add little additional prospective area because the well locations may be within the existing delineated prospective area. Drilling aimed at extending discoveries or finding new pools near identified fields may increase the delineated prospective area at the margins, if at all.

The explored area is defined as the area in the delineated prospective area that is within 2 miles of a well. For example, if one well is exactly 2 miles from another well, then the explored area is the area covered by a circle between the wells. A circle with a diameter of 2 miles and radius of 1 mile has an area of 3.14 square miles. In this example, the largest field that could occur between the wells and remain undetected has a planar surface area of just less than 3.14 square miles. The recoverable oil expected from pools with a 3.14-square-mile planar surface area would vary with pay thickness and reservoir properties. In the United States, Permian basin (western Texas and eastern New Mexico) conventional fields with planar surface areas of 3.14 square miles averaged less than 12 MMBO (Attanasi and others, 1981). However, for offshore Gulf of Mexico pools, the average recoverable oil may be double that of a pool in the Permian basin with the same planar surface area (Attanasi and Haynes, 1984). According to these data, the largest potential undetected pool in areas designated as explored is estimated to range from 12 to 24 MMBO. For some countries, such pool sizes may be important at the local or perhaps national levels, but on a global scale they do not change the resource outlook.

In areas where the delineated prospective area is found to be unproductive and not worth additional evaluation, the size of the explored area will be minimal. A single well can potentially condemn a large area if the well indicates that commercial hydrocarbons were probably not generated or preserved because of a defective trap or seal or the lack of reservoir-quality rock.

The maps for individual countries or groups of countries in the study area show the location of the delineated prospective and explored areas (figs. 11–55). On these maps,

exploration maturity is conveyed qualitatively by visually comparing the extent of the delineated prospective and explored areas. The algorithm classifies a grid point as either inside or outside the delineated prospective area, and if the grid point is part of the delineated prospective area, whether it is part of the explored area. The algorithm also attaches years to each grid point in the delineated prospective and explored areas to denote when that location entered the delineated prospective category and when it became part of the explored area category. These data were used to construct the graphs that accompany the maps. In the graphs, a pattern of expanding delineated prospective area with no corresponding growth in explored area suggests unfavorable results to exploration in the new delineated prospective area. The graphs may also be used to represent quantitatively the production potential of discovered hydrocarbons within the delineated prospective areas.

Measuring Productivity of Delineated Prospective Areas

Discovery rates are commonly expressed in terms of the volume of oil and gas found divided by the number of exploration wells drilled during a specific time interval (yields per unit of exploration effort). For a single play with a fixed boundary, the discovery rate tends to decline as progressively smaller accumulations are discovered. Once a trend is established, it is common to extrapolate the discovery rate to estimate the remaining oil or gas in the play (Drew, 1997). If the petroleum province includes multiple plays in multiple sedimentary basins, discoveries within new areas may offset declining discoveries in old areas, and the discovery rate for the entire province may not decline. In such situations, the extrapolation of discovery rates is not useful for predicting the amounts of undiscovered oil and gas.

The procedure for separating the confounding effects of a declining discovery rate within an existing play or basin and a different, and perhaps increasing, discovery rate in an associated expanding area is to assign discoveries to the nearest grid points in the prospective area. Each grid point in the delineated prospective area was labeled with the year when that grid point became part of the prospective area. The prospective area date is never later than the discovery date of the accumulation. By associating volumes of oil and gas with the delineated prospective area points and prospective area dates, the hydrocarbon potential of the new prospective area can be compared with the hydrocarbon potential of the older areas. This scheme allows one to compare the hydrocarbon volumes yielded from drilling new areas with yields from old areas to decide whether future drilling should target sites already in the prospective area or sites that might open new delineated prospective areas (Attanasi and Root, 1988).

Tools for Analysis: Graphs

Two types of graphs are presented along with each of the map figures (figs. 11–55). Figure 4A is a generalized version of the first type of graph, which shows the growth of the cumulative delineated prospective area and the explored area, arranged by the year when the areas first became prospective or explored, plotted against the cumulative number of wildcat wells, which are ordered by drilling date. Increases in the slope of the growth profile of the delineated prospective area may indicate that a larger fraction of the wells were drilled outside the delineated prospective area, thus increasing the size of the area undergoing exploration. A rollover of this profile (decline in slope) suggests that a larger proportion of the newly drilled wildcat wells were sited within the existing prospective area, which is the case if the locations of most of the new wells were based on the results of previous drilling. The closer the 10-year markers at the top of the graph are to each other, the smaller the number of wildcat wells that were drilled in that decade.

The second type of graph (fig. 4B) shows cumulative recoverable oil and gas discoveries as functions of the cumulative delineated prospective area ordered by time. If all areas are equally productive (and if followup drilling is instantaneous), then the graph of recoverable cumulative oil or gas is a straight line (fig. 4B, profile A). If the earlier delineated prospective area is more richly endowed with oil and gas than the later delineated prospective area, then the shape of the graph is concave down (fig. 4B, profile B). Alternatively, if the later delineated prospective area is more richly endowed than the earlier delineated prospective area, then the graph is concave up (fig. 4B, profile C).

One complication in interpreting graphs such as figure 4B is that an apparent decline in the volume of discoveries per unit area for recently added areas could be exaggerated because of insufficient time for followup drilling required to develop the resources. However, if sufficient time has elapsed without significant resource additions or followup drilling, then the reduced hydrocarbon yields associated with that part of the delineated prospective area probably represent the hydrocarbon endowment accurately.

When technological advances open up entirely new areas, such as the North Sea and the highly productive deepwater areas offshore Brazil, West Africa, and Mozambique, the new areas immediately show high yields of hydrocarbons relative to the areas delineated earlier. In these situations, the graphs of oil and gas yields plotted as a function of the delineated prospective area are concave up (fig. 4B, profile C).
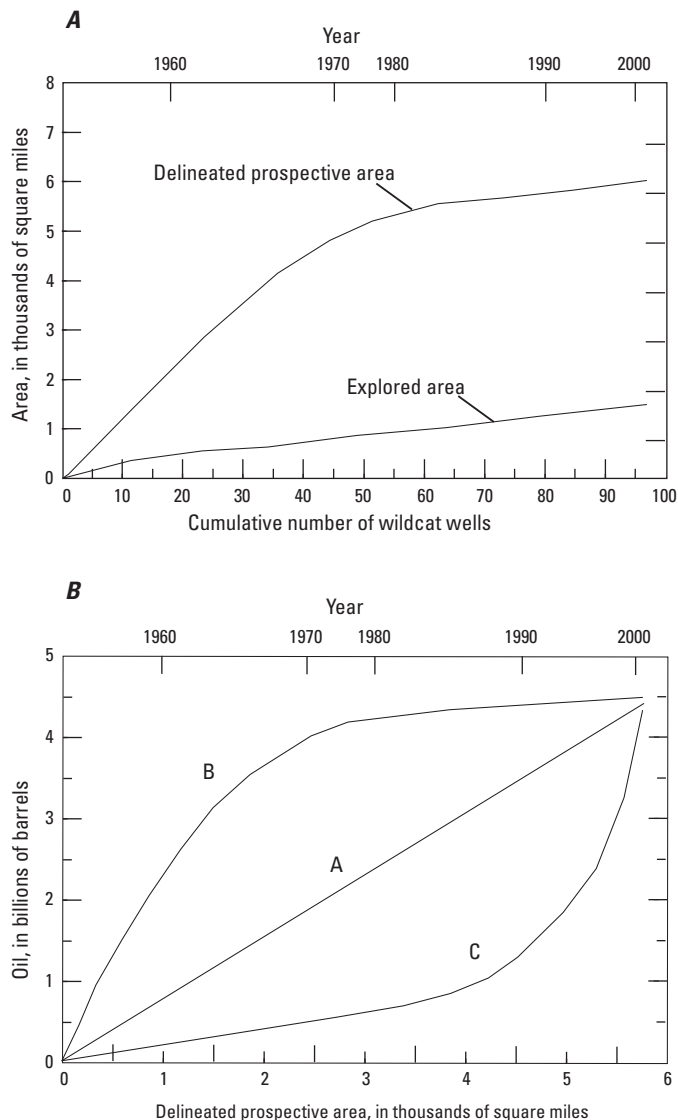
Figure 4.   Generalized graphs illustrating the possible profiles of the growth in the cumulative prospective area and the explored area. *A*, Profiles showing the growth in cumulative delineated prospective and explored areas plotted against the cumulative number of wildcat wells drilled, where both the areas and the wildcat wells are ordered by time. The top axis shows 10-year markers; the closer the markers are to each other, the fewer the wildcat wells that were drilled in that decade. *B*, Profiles A, B, and C of the cumulative oil discovered through 2001 and graphed by the year that the field location was classified as part of the delineated prospective area. Profile A is straight line and indicates that the delineated prospective areas identified by early exploration and late exploration are equally productive. Profile B indicates that the delineated prospective area identified by early exploration is more productive than the delineated prospective area identified by late exploration. Profile C indicates that the delineated prospective area identified by early exploration is less productive than the delineated prospective area identified by late exploration. From Attanasi and others (2007, fig. 6).

Exploration and Discovery Statistics

Exploration Effort

Measures of the quality and value of an exploration effort are not easily quantified. Ideally, the geologic and geographic context of an effort will determine the value, in terms of added information that may be realized by the expenditures on geophysical data or on the drilling of a wildcat well. For example, although some wildcat wells are drilled to test new plays, most wildcat wells are drilled to test for new pools or extensions of existing pools. Risks and costs vary with the characteristics of the geologic target and its geographic location. Consequently, the value and the costs of information generated by an exploration effort are highly dependent on local conditions, as well as on the economic conditions that determine the value of the hydrocarbons.

Table 3 shows the regional distribution of the cumulative number of wildcat wells, as classified by IHS Markit, and the cumulative recoverable volumes of oil and gas discoveries. Table 4 shows the annual totals of wildcat wells drilled in the study area by country and region from 1961 through 2015 (tables 4–7 follow the "References Cited"). The share of worldwide wildcat drilling accounted for by the United States and Canada declined from more than 90 percent in 1930 to less than 50 percent in 2015. For 2015, Europe and Asia (excluding Russia) account for about 24 and 23 percent of the study area's wildcat wells, respectively. South America accounts for 17 percent; Africa and Russia, about 11 percent each; the southwestern Pacific, 5 percent; and the Middle East, 4 percent of all study area wildcat wells.

For offshore wells (table 3), Europe and Asia (excluding Russia) each account for 28 percent of the study area's offshore wildcat wells; Africa, 17 percent; South America,

13 percent; and the southwestern Pacific, 8 percent. The Middle East and Russia account for 2 percent and less than 1 percent, respectively, of the offshore wildcat wells drilled in the study area. The fraction of each region's wildcat wells drilled offshore varies widely (table 3). Less than 1 percent of Russia's wildcat wells are offshore, whereas 29 percent of Asia's wildcat wells are offshore. Overall, offshore wildcat wells accounted for about 17 percent of the wildcat wells drilled in the study area to date. However, for the period from 2006 to 2015, about 26 percent of the wildcat wells drilled in the study area were offshore. During this same period, deepwater wildcat wells, that is, wells sited in waters deeper than 200 meters (m) (656 ft), accounted for 40 percent of the study area's offshore wildcat wells. The movement of exploration from onshore to offshore and then to the deep offshore suggests that operators were willing to incur the extra exploration costs because similar untested prospects were no longer available in less costly exploration areas.

About 29 percent of the wildcat wells in the study area were drilled to target formations at depths of at least 10,000 ft (table 7). However, there is great variability among the regions studied. In Africa, 39 percent of wildcat wells are at least 10,000 ft deep, and for Asia and the Middle East, 33 and 32 percent of the wildcat wells, respectively, were at depths of at least 10,000 feet. For Russia, South America, and Europe, deeper wildcat wells accounted for 29, 26, and 24 percent of the wildcat wells drilled in each region, respectively. Table 6 summarizes the regional average discovery sizes by decade, in terms of BOE, for fields at depths of less than 10,000 ft and for fields at depths of 10,000 ft or more. The six-decade timespan of data shows that average discovery sizes are declining in most regions and that discoveries associated with the deeper horizon are generally larger than shallower fields discovered during the same decade.

Table 3. Regional distribution in the study area of total and offshore wildcat wells drilled through 2015 and total and offshore estimated cumulative recoverable volumes of oil and gas discovered through 2015.

[Data are from IHS Markit (2016). BBO, billion barrels (bbl x 10^9) of oil; TCF, trillion cubic feet (ft^3 x 10^{12})]

Region	Total			Offshore		
	Wildcat wells	Oil (BBO)	Gas (TCF)	Wildcat wells	Oil (BBO)	Gas (TCF)
Caribbean	553	0.6	0.6	51	0.3	0.1
Central America	292	0.3	<0.1	68	<0.01	<0.01
Mexico	4,478	58.7	115.3	432	35.7	37.6
South America	21,916	238.3	660.2	2,884	89.3	249.2
Europe	30,861	96.3	794.0	6,318	72.7	403.2
Middle East	5,708	969.4	3,275.2	544	123.1	1,857.80
Africa	13,479	213.1	1,001.8	3,867	84.3	538.8
Asia	30,002	210.1	2,047.8	6,230	68.6	647.5
Southwestern Pacific	6,715	9.2	349.5	1,772	7.2	252.4
Russia	14,335	288	2,231.4	140	5.3	228.4
Total study area	**128,339**	**2,084.00**	**10,474.9**	**22,306**	**486.4**	**4,215.0**

Regional Exploration and Discovery Analysis

Regional exploration and discovery data are presented in tables 3–7 and figures 5–10. As discussed previously, table 3 shows the regional distribution of total and offshore wildcat wells and volumes of discovered oil and gas. Table 4 lists the annual totals of wildcat wells drilled by country for each region from 1961 through 2015. Table 5 shows the year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces within the study area by region. Table 6 shows the decadal average discovery sizes, in millions of barrels of oil equivalent (MMBOE), for fields at depths of less than 10,000 ft and fields at depths of at least 10,000 ft from 1956 through 2015. Table 7 summarizes the regional distribution in the study area of total land area, delineated prospective area, explored area, cumulative recoverable oil and gas discoveries, and wildcat wells and the percentages of total prospective area, explored area, cumulative recoverable oil and gas discoveries, and wildcat wells at depths of 10,000 ft and greater.

The annual discovery rates for oil and gas by 5-year intervals are shown by region in figures 5*A–G* and 6*A–G*, respectively, for the period from 1951 through 2015. The figures also show the onshore and offshore volumes of oil and gas discovered. Figure 7*A–G* shows the regional oil discovery rates calculated on the basis of oil per wildcat well for 5-year intervals from 1951 through 2015. For many areas, natural gas was not commercial before 2000, so reported volumes of discovered gas are likely to be incomplete and understated. Because wildcat well records do not have information on predrilling intent or target, there is no way to definitively distinguish wells targeting oil prospects and those targeting gas prospects.

The regional time profiles of the delineated prospective areas and explored areas are shown in figure 8*A–G*. Figure 9*A–G* shows regional cumulative recoverable oil and gas discoveries through 2015 plotted as a function of the cumulative delineated prospective area. Data for the Caribbean, Central America, and Mexico are included in the corresponding graphs for the entire study area, figures 8*H* and 9*H*. These figures show evidence regarding the quality or hydrocarbon yields of additions to the delineated prospective area. However, resource development policies, technology, and economics also influence the trends because these forces influence accessibility to and commercial value of the hydrocarbon resources.

Figure 10*A–G* shows the regional depth distributions of oil in oil fields and gas in gas fields. For the purposes of this study, a field is classified as either oil or gas on the basis of the gas:oil ratio of the field's estimated recoverable oil and gas. A field having at least 20,000 cubic feet of gas per barrel of crude oil is classified as a gas field; otherwise, the field is classified as an oil field. Although the natural gas found in oil accumulations is substantial, it is most often produced as a byproduct of the oil and will generally be reinjected into the

reservoir to maintain pressures. During the life of the oil field, production of associated gas will be constrained by the field's operator if oil production must be shut in for any reason.

The regional delineated prospective areas and explored areas shown in figures 8 and 9 are aggregated from data for individual countries or small groups of countries shown in figures 11–55. Maps and data are provided for the Caribbean (fig. 11) and Central America (fig. 12), but these areas are not discussed as a separate region because discovered petroleum is small. Mexico (fig. 13) is briefly discussed before the sections on the major regions. Data for each region are derived from figures as follows: South America, figures 14–22; Europe, figures 23–25; Middle East, figures 26–30; Africa, figures 31–42; Asia, figures 43–51; southwestern Pacific, figures 52–54; and Russia, figure 55.

In the discussions for each region, the delineated prospective area is described in terms of the early half and the late half. Recall from the previous section that the delineated prospective area is represented by grid points that have dates which signify when the area became prospective. Suppose that half of the delineated prospective area in a region was delineated by 1980. Then the early half is that part of the prospective area that became prospective before January 1980, and the late half is that part of the prospective area that became prospective during and after January 1980.

Mexico

In early editions of this Circular (Root and others, 1987; Attanasi and Root, 1993; Attanasi and others, 2007), drilling and discovery data available for Mexico were very incomplete. Consequently, maps of prospective and explored areas in Mexico were not presented. In the years between 2001 and 2016, IHS Markit made significant additions to both the drilling and discovery data available for Mexico. Mexico accounts for about 3 percent of the conventional oil and about 1 percent of conventional gas discovered in the study area through 2015. There are nine significant petroleum provinces in Mexico (table 5). Mexico shares the Yucatan Platform (fig. 13) with the Central American countries of Belize and Guatemala (fig. 12). The four most prolific provinces in terms of discovered oil, Villahermosa Uplift, Tampico-Misantla Basin, Saline-Comalcalco Basin, and Chicontepec Basin, account for 99 percent of the country's discovered oil. The four most prolific provinces in terms of discovered gas, Villahermosa Uplift, Tampico-Misantla Basin, Burgos Basin, and Veracruz Basin, account for 86 percent of the discovered gas.

Available data show that about 90 percent of the oil and gas in Mexico has been discovered since 1951. For the decade from 2006 through 2015, offshore discoveries accounted for about 71 percent of the oil discovered and 75 percent of the gas discovered. During the same period, the prospective area expanded at a rate of about 8,000 square miles per year, which is twice the rate of the previous decade (fig. 13). Half of the prospective area was delineated by 1965, and the early half

of the area accounts for 39 percent of the discovered oil and 65 percent of the discovered gas in Mexico. Mexico's later discoveries were primarily in newly explored offshore areas.

Mexico's delineated prospective area at a depth of 10,000 ft is about 68 percent of the delineated prospective area at the surface. Discoveries at 10,000 ft and deeper represent about 54 percent of the discovered oil and 53 percent of the discovered gas. From 2006 through 2015, on a BOE basis, the average size of new fields discovered in the deeper horizons was about nine times the average size of discoveries from horizons above depths of 10,000 ft (table 6).

South America

South America accounts for 11 percent of the oil and 6 percent of the gas discovered in the study area (table 3) with 32 significant provinces (table 5). The provinces with the largest volumes of oil are the Maracaibo Basin (figs. 18 and 20), Santos Basin (fig. 22), East Venezuela Basin (fig. 20), and Campos Basin (fig. 22). Each of these provinces has fields that total more than 20 BBO (table 5), and together they account for 76 percent of the oil discovered in this region. The provinces having the largest volumes of discovered gas are the East Venezuela Basin (fig. 20), Santos Basin (fig. 22), Maracaibo Basin (figs. 18 and 20), and Santa Cruz-Tarija Basin (figs. 16 and 21), which together account for 67 percent of the gas discovered in South America. In addition to the 38.5 BBO of conventional oil discoveries in the East Venezuela Basin (fig. 20), an estimated 270 BBO of extra-heavy oil associated with the Orinoco heavy oil belt was discovered in the province (IHS Markit, 2016).

Though many of South America's most prolific basins have discoveries made prior to 1951, discoveries made after 1951 account for 70 percent of the oil and 78 percent of the gas in conventional fields. These discoveries followed the development of the international oil industry after World War II, which provided export markets for previously developed and newly discovered oil fields. The giant deepwater discoveries in the Campos and Santos Basins (fig. 22) occurred because improved technology for the exploration, discovery, and production of deepwater accumulations had become available and economic since the latter 1980s. Figures 5*A* and 6*A* show that the highest 5-year annual average discovery rates for oil and gas occurred in the period from 2006 through 2010. For that period, the annual oil discovery rate was 8.2 BBO per year and the gas discovery rate was 21.5 TCF per year. During the period from 1996 through 2015, offshore discoveries accounted for 92 percent of the oil and 74 percent of the gas discovered. Figure 7*A* shows that the 5-year period from 2006 to 2010 had the highest rate of oil discovered per wildcat well, 28.3 MMBO per wildcat well.

South America accounts for 11 percent of the study area's total prospective area. By the end of 2015, the explored area of this region constituted about 26 percent of the delineated prospective area. The delineated prospective area for South

America doubled between 1977 and 2015 (fig. 8*A*). Despite the prolific offshore areas added since 1977, discoveries in the early half of the prospective area (before 1977) accounted for 62 percent of the oil and 61 percent of the natural gas discovered through 2015 (fig. 9*A*). Figure 9*A* shows that the prospective areas added between 1995 and 2010 are much more productive than the areas added between 1970 and 1985. The later prospective areas are in deep offshore waters where exploration targeted deeper formations.

For South America, the size of the delineated prospective area at a 10,000-ft drilling depth is about 45 percent of the delineated prospective area at the surface. About 49 percent of the oil in oil fields and 60 percent of the gas in gas fields are at depths of 10,000 ft or greater (fig. 10*A*). On a BOE basis, the average size of discoveries in the deep (10,000-ft depth and greater) drilling horizon from 2006 through 2015 was 25 times greater than the average size of discoveries in the shallow drilling horizon (depths less than 10,000 ft) (table 6). Brazil is the most prolific area for deepwater discoveries. Although Brazil's prospective area at a depth of 10,000 ft is about 56 percent of the prospective area measured at the surface, 87 percent of the oil discovered in oil fields and 69 percent of the gas discovered in gas fields are at depths of 10,000 ft and greater (fig. 22).

The maps in figures 14–22 show the 200- and 1,000-m (656- and 3,280-ft) bathymetric contours illustrating that the prospective areas along the coast of Brazil (fig. 22), Guyana, Suriname, and French Guiana (fig. 14) are deeper than prospective areas in other countries of South America.

Europe

In this study, Europe includes the British Isles, continental Europe, and several nearby islands (figs. 23–25) and excludes Greenland, Iceland, Russia, Cyprus, and Turkey. Greenland has 47 wells and Iceland has 22 wildcat wells, but their prospective areas were excluded from the European totals, and maps of these areas are not included herein. Although seven of Greenland's wells had oil or gas shows, no new discoveries were declared. All wells in Iceland were dry. Cyprus and Turkey are considered part of the Middle East, and Russia represents a single region.

Of the 31 significant provinces in Europe, 6 are shared with other regions (table 5). In table 5, the European oil and gas volume totals for these shared provinces do not include the oil and gas volumes within the other regions. For example, figure 25 shows the European parts of the Azov-Kuban Basin and Dnieper-Donets Basin, but the data for Europe exclude the parts of these provinces in Russia (fig. 55). Figure 23 shows the Central Barents Platform but does not include data for the part of the province in Russia (fig. 55). Similarly, the Pelagian Basin and Sicily provinces are shared with Africa (fig. 35), and the Aegean province is shared with Turkey and Cyprus in the Middle East (fig. 26).
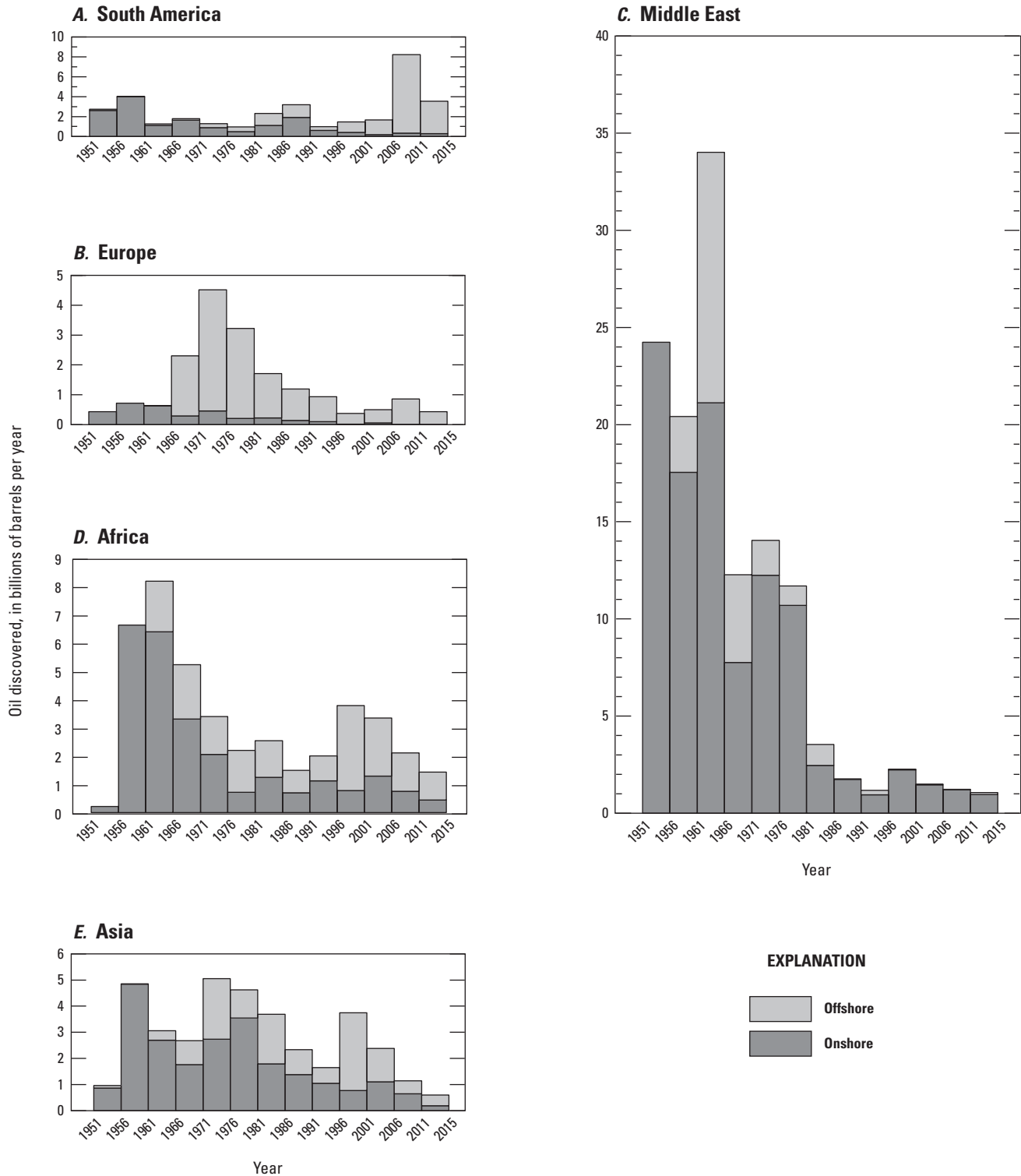
Figure 5.   Graphs showing average annual volume of oil discovered offshore and onshore for 5-year intervals from 1951 through 2015 for seven regions and the whole study area: *A*, South America; *B*, Europe; *C*, Middle East; *D*, Africa; *E*, Asia; *F*, Southwestern Pacific; *G*, Russia; and *H*, Study area. The study area graph (fig. 5*H*) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 5*A–G*. Discovery size estimates are from IHS Markit (2016). Note the change in vertical scale between graphs.

F. **Southwestern Pacific**

G. **Russia**

H. **Study area**

Oil discovered, in billions of barrels per year
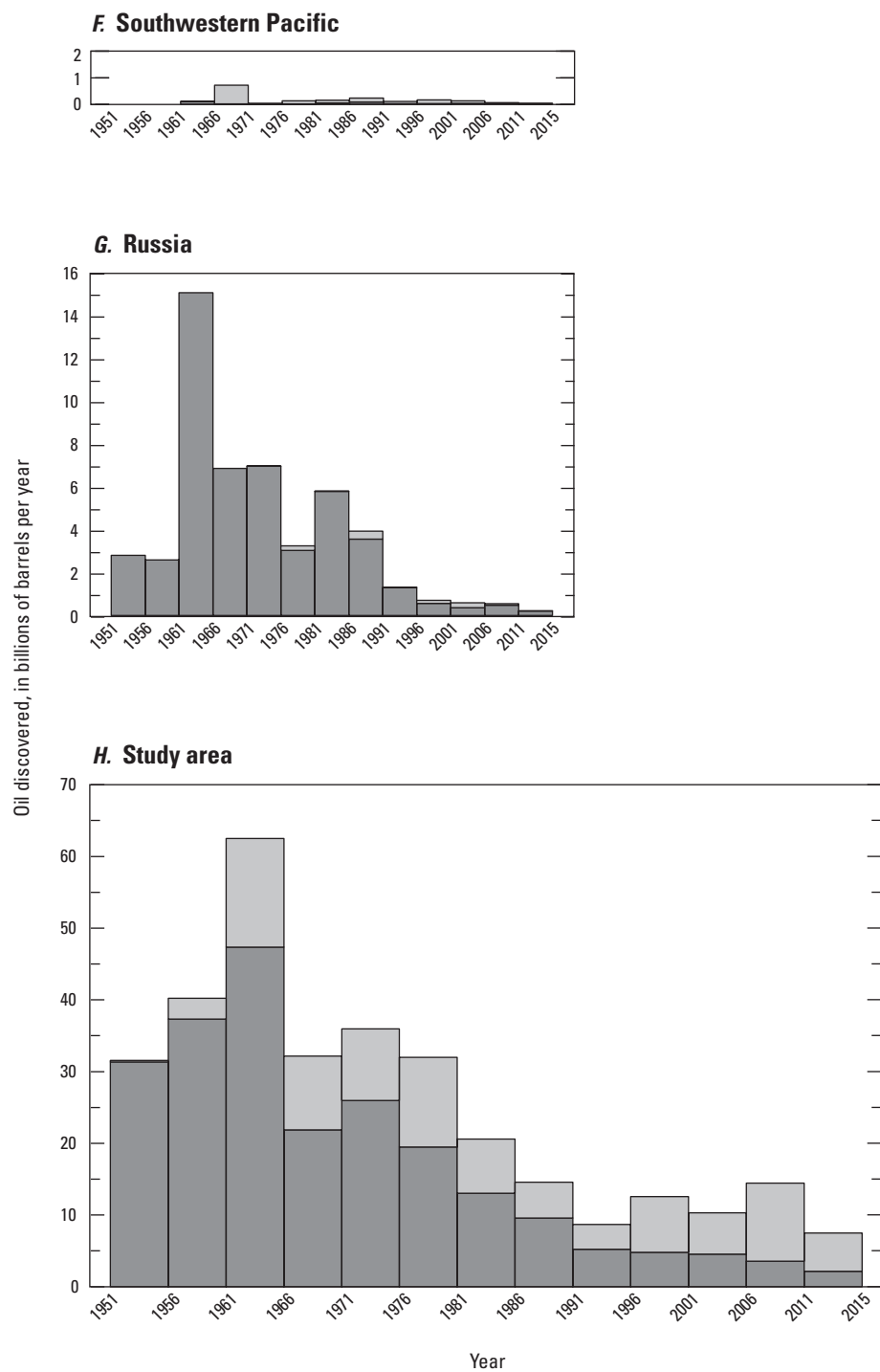
Year

Figure 5.   Continued.
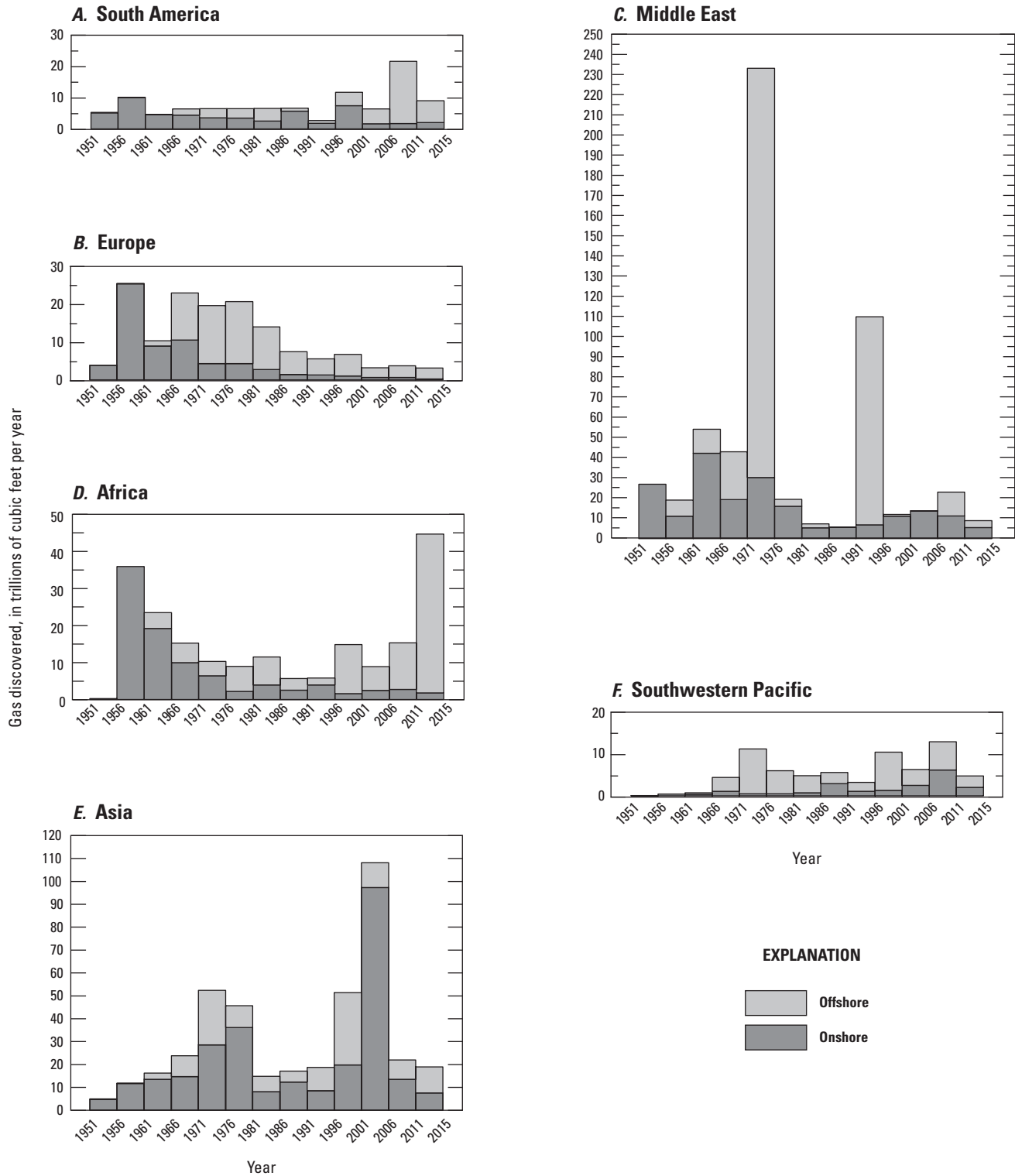
Figure 6.   Graphs showing average annual volume of gas discovered offshore and onshore for 5-year intervals from 1951 through 2015 for seven regions and the whole study area: *A*, South America; *B*, Europe; *C*, Middle East; *D*, Africa; *E*, Asia; *F*, Southwestern Pacific; *G*, Russia; and *H*, Study area. The study area graph (fig. 6*H*) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 6*A*–*G*. Discovery size estimates are from IHS Markit (2016). Note the change in vertical scale between graphs.

G. **Russia**
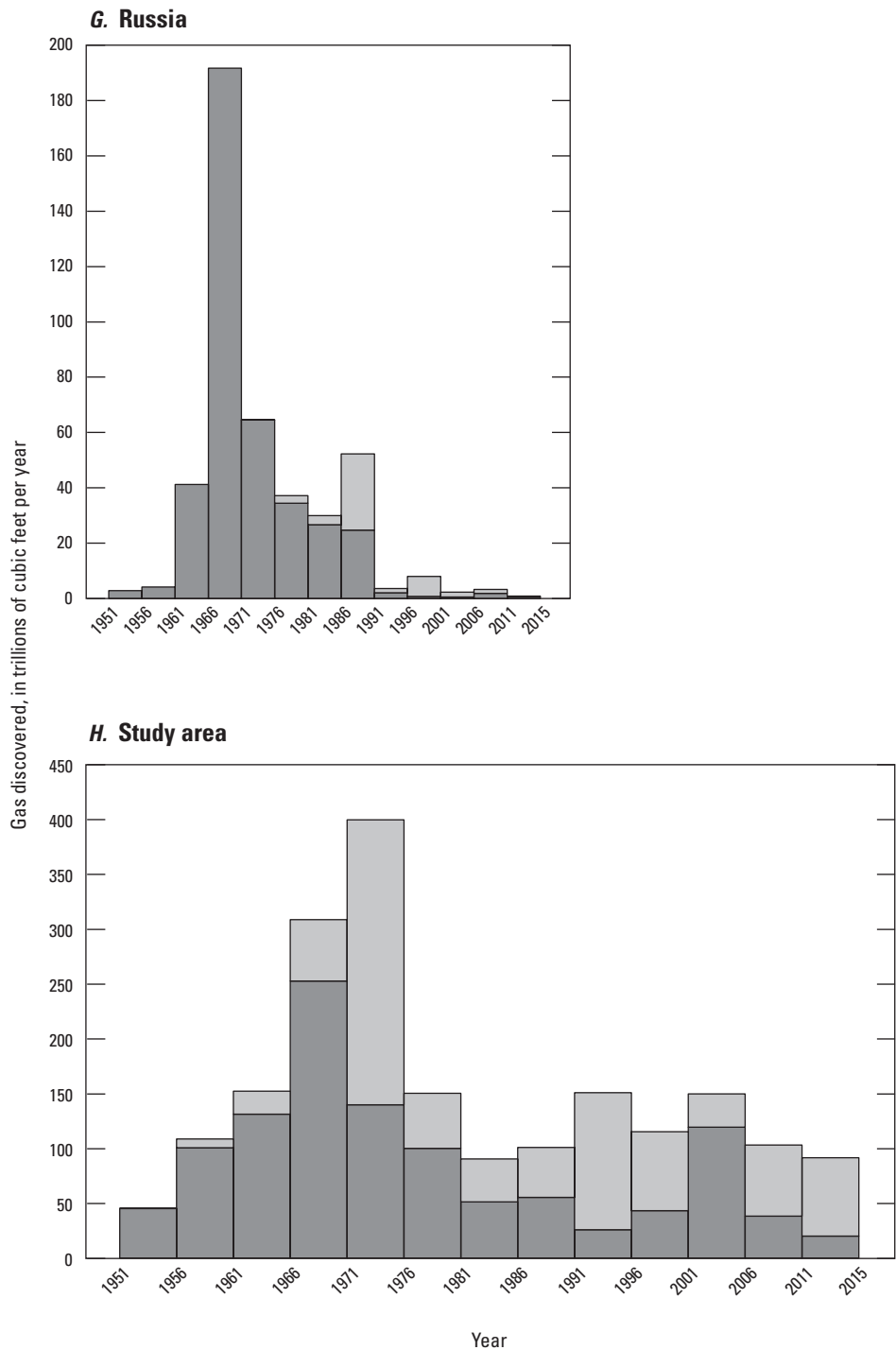
H. **Study area**

Year

Figure 6.   Continued.
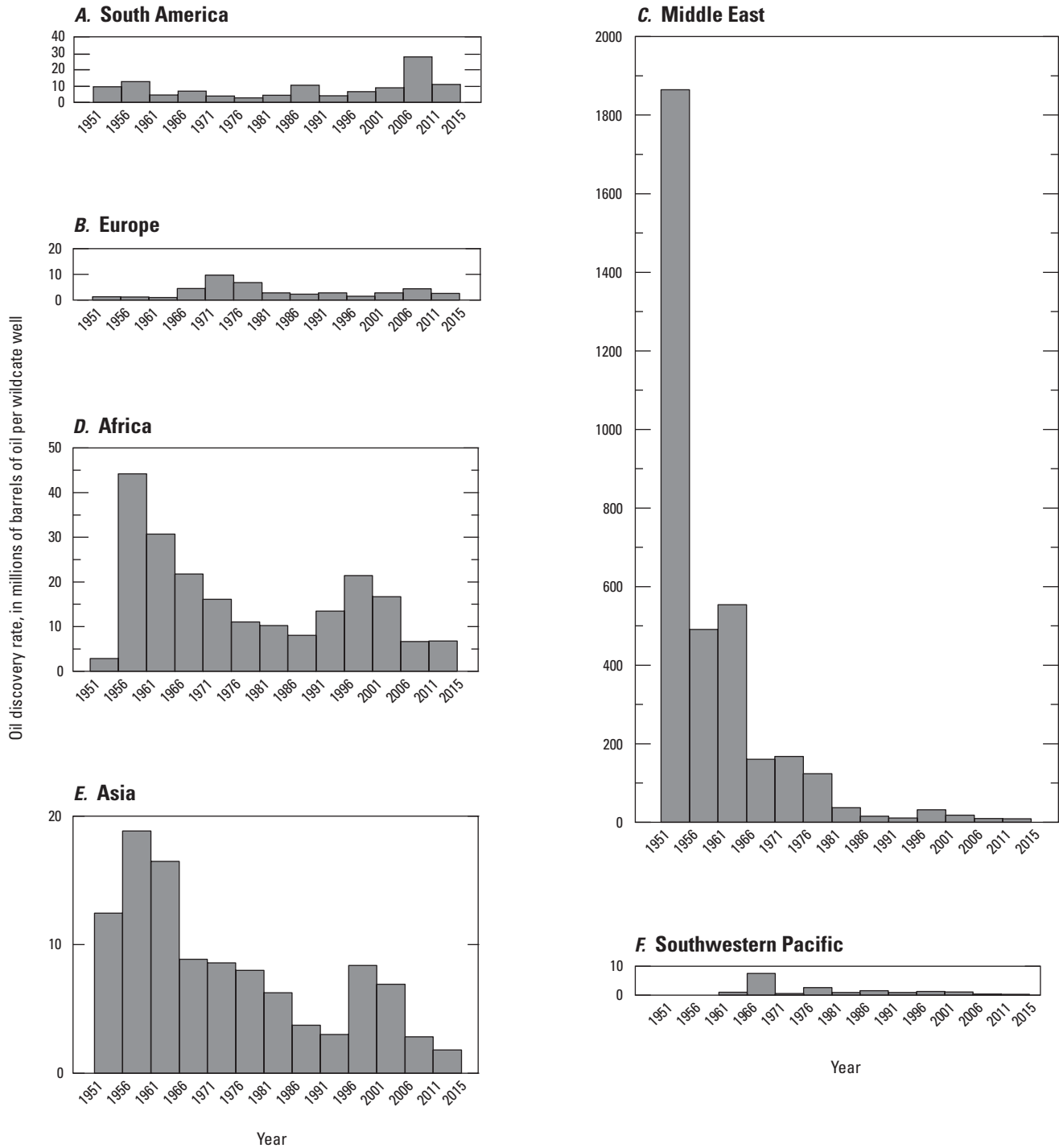
Figure 7.   Graphs showing oil discovery rate per wildcat well for 5-year intervals from 1951 through 2015 for seven regions and the whole study area: *A*, South America; *B*, Europe; *C*, Middle East; *D*, Africa; *E*, Asia; *F*, Southwestern Pacific; *G*, Russia; and *H*, Study area. The study area graph (fig. 7*H*) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 7*A–G*. Wildcat well data and discovery size estimates are from IHS Markit (2016). Discovery rates reflect data for all wildcat wells and discoveries both onshore and offshore. Note the change in vertical scale between the graphs.

G. **Russia**

H. **Study area**

Year

Figure 7.   Continued.

A. **South America**

B. **Europe**

C. **Middle East**

D. **Africa**

Area, in thousands of square miles

Cummulative number of wildcat wells
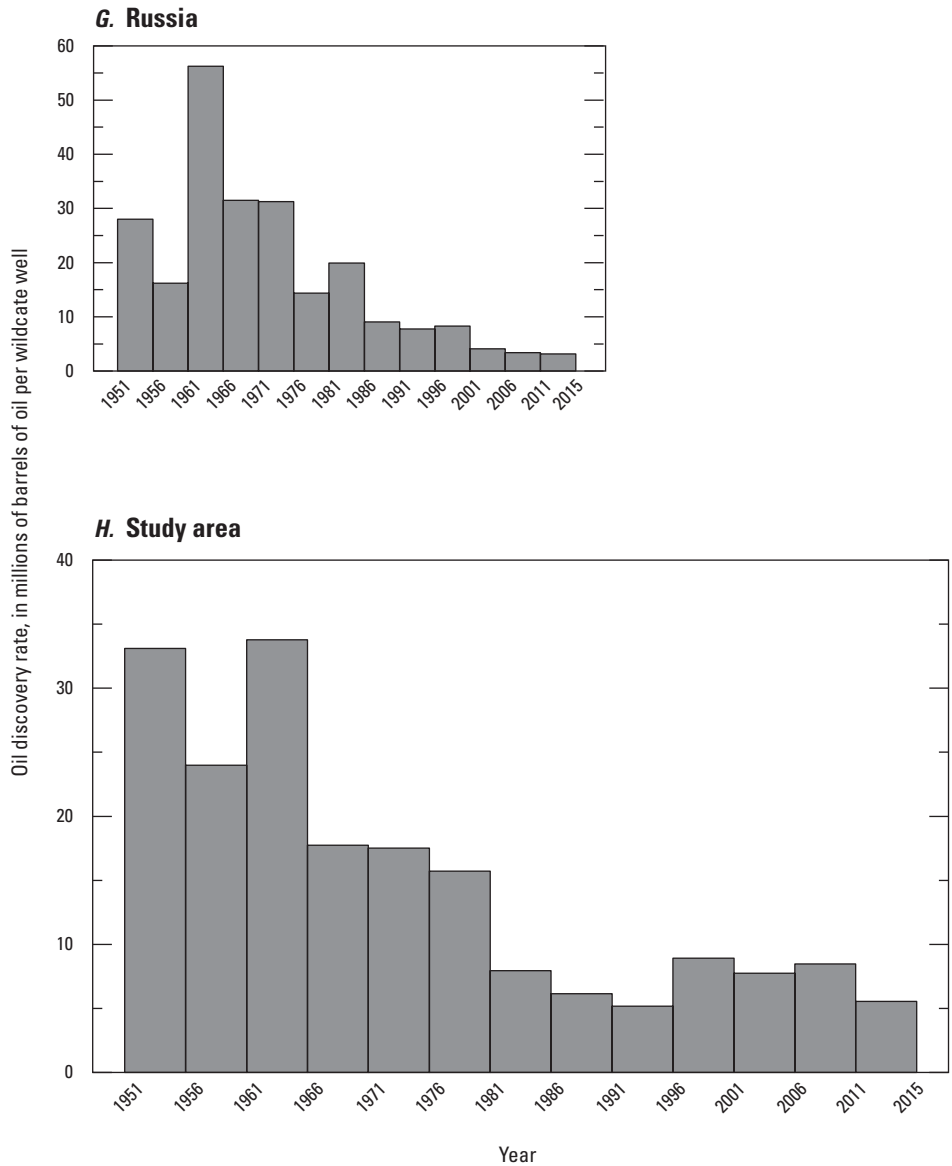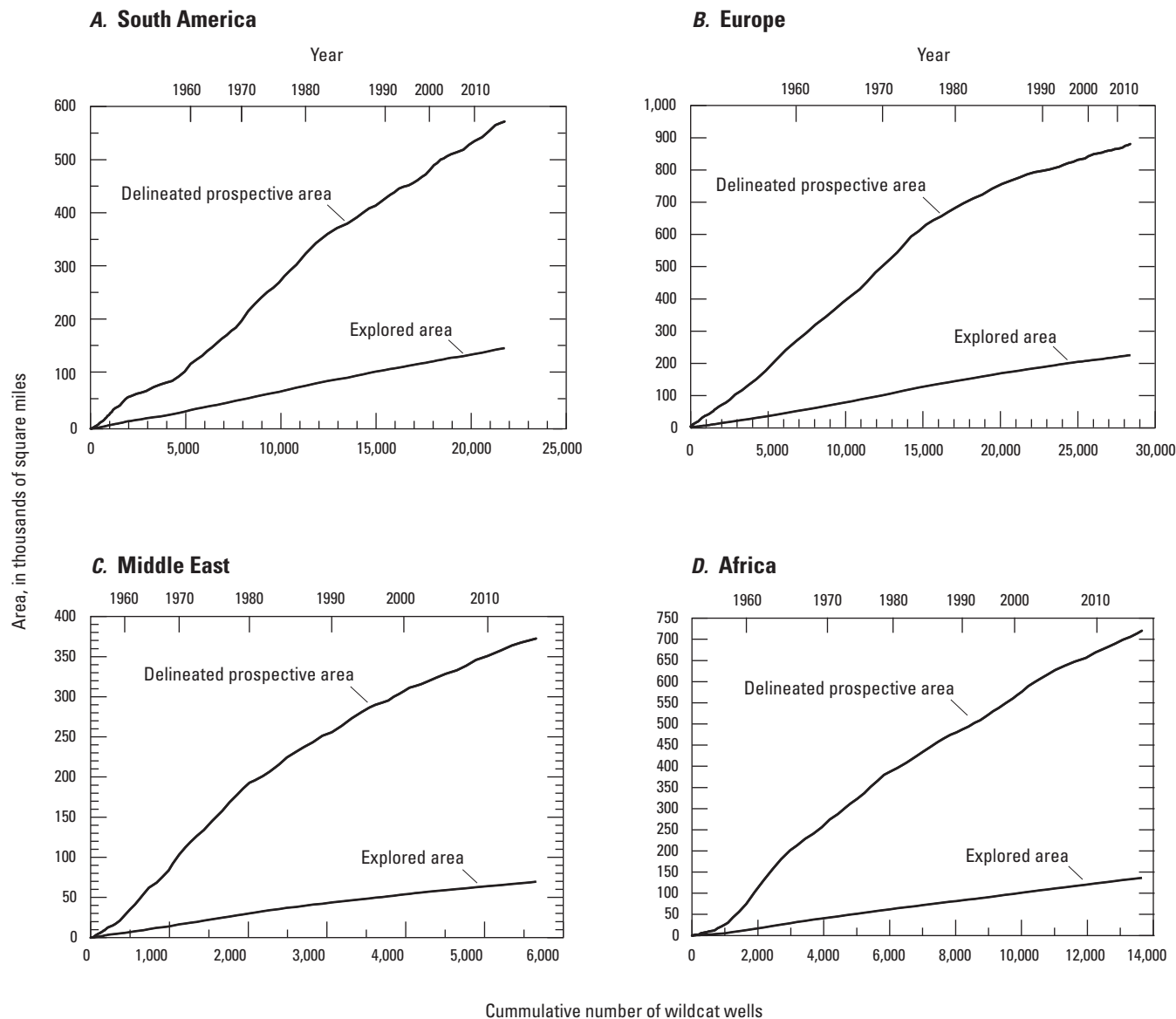
Figure 8.   Graphs showing growth in delineated prospective area and explored area delineated by wells drilled through 2015 for seven regions and the whole study area: *A*, South America; *B*, Europe; *C*, Middle East; *D*, Africa; *E*, Asia; *F*, Southwestern Pacific; *G*, Russia; and *H*, Study area. The study area graph (fig. 8*H*) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 8*A*–*G*. The regional graphs are at different scales and are derived from graphs in figures 14–55. The areas are arranged by the year they became prospective or explored, and the wells are also ordered by time. At the top axis of the graphs, the closer the 10-year markers are to each other, the smaller the number of the wildcat wells that were drilled in that decade. Calculations of delineated prospective and explored areas are explained in the text. Well data are from IHS Markit (2016). Only wildcat wells that have spud or completion dates and that have longitude and latitude coordinates are used in the growth calculations for this figure.

E. **Asia**

F. **Southwestern Pacific**

G. **Russia**

H. **Study area**

Area, in thousands of square miles

Cummulative number of wildcat wells
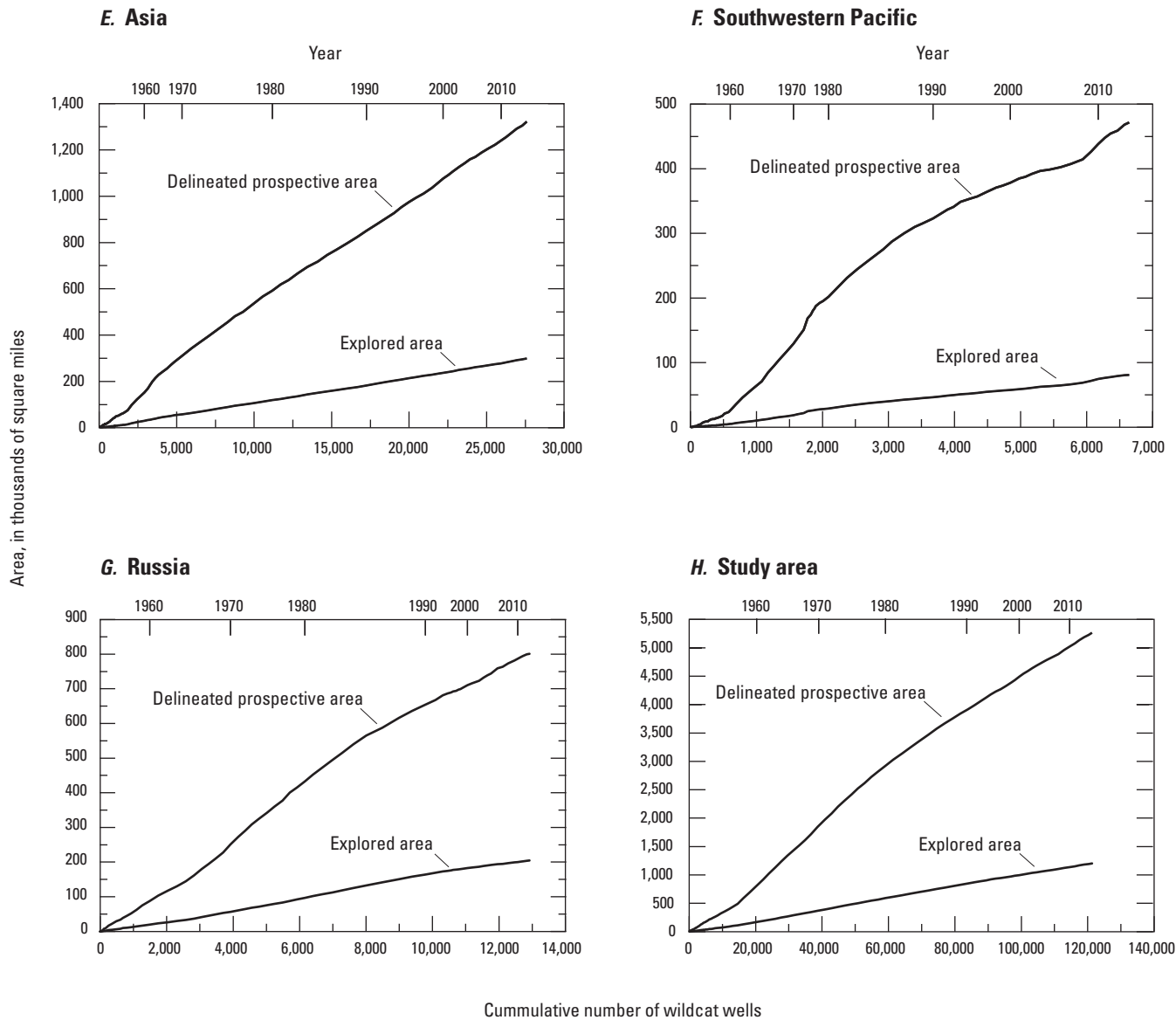
Figure 8. Continued.
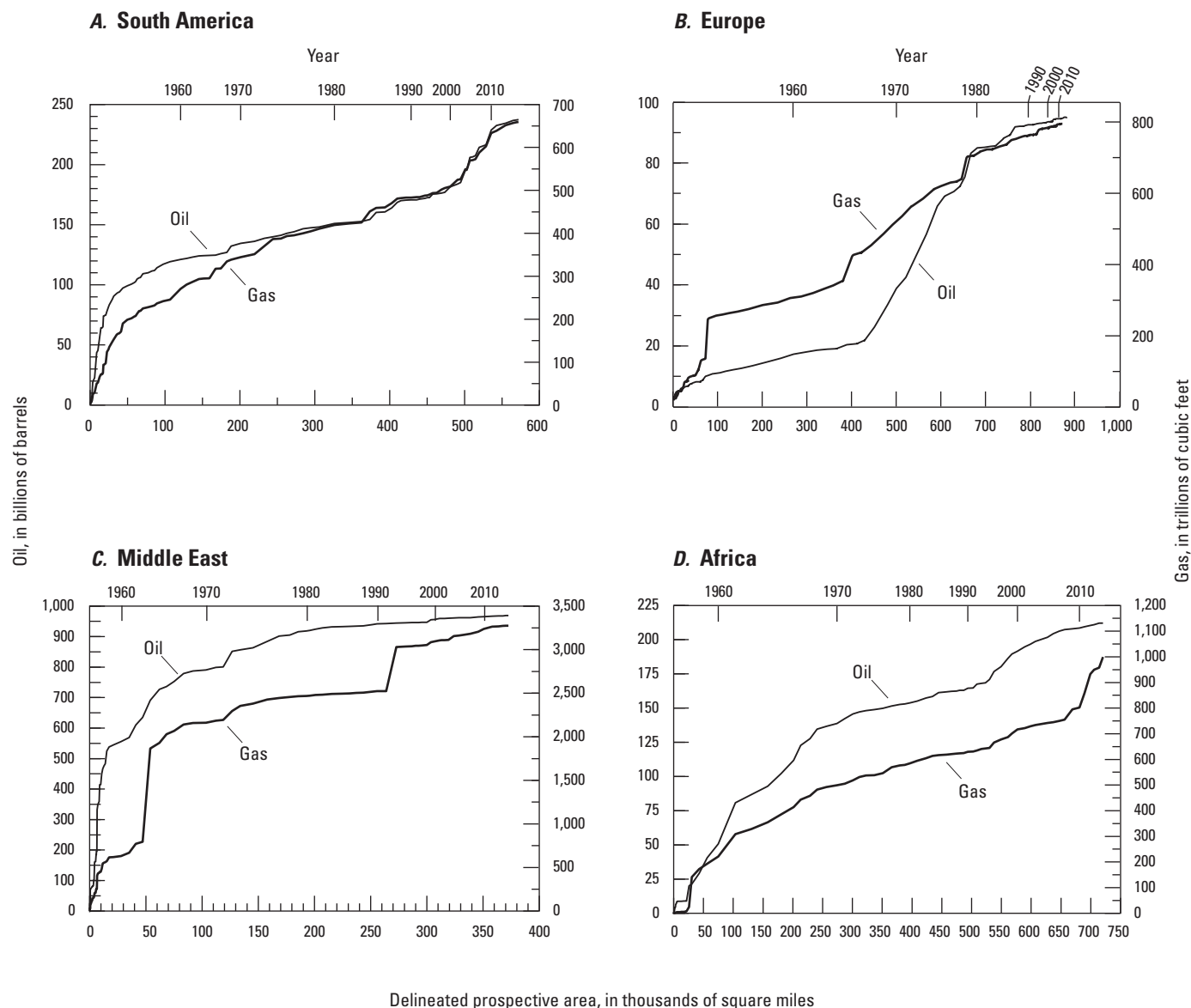
Figure 9. Graphs showing cumulative recoverable oil and gas discoveries through 2015 plotted as a function of cumulative delineated prospective area for seven regions and the whole study area: A, South America; B, Europe; C, Middle East; D, Africa; E, Asia; F, Southwestern Pacific; G, Russia; and H, Study area. The study area graph (fig. 9H) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 9A–G. The regional graphs are at different scales and are derived from graphs in figures 14–55. The oil and gas discoveries are graphed by the year that the field location was classified as part of the delineated prospective area, and the increments of prospective area are ordered by time. At the top axis of the graphs, the closer the 10-year markers are to each other, the lower the rate at which prospective area was added in that decade. Calculation of delineated prospective area is explained in the text. Discovery size estimates are from IHS Markit (2016).

E. **Asia**

F. **Southwestern Pacific**

G. **Russia**

H. **Study area**

Oil, in billions of barrels

Gas, in trillions of cubic feet

Delineated prospective area, in thousands of square miles
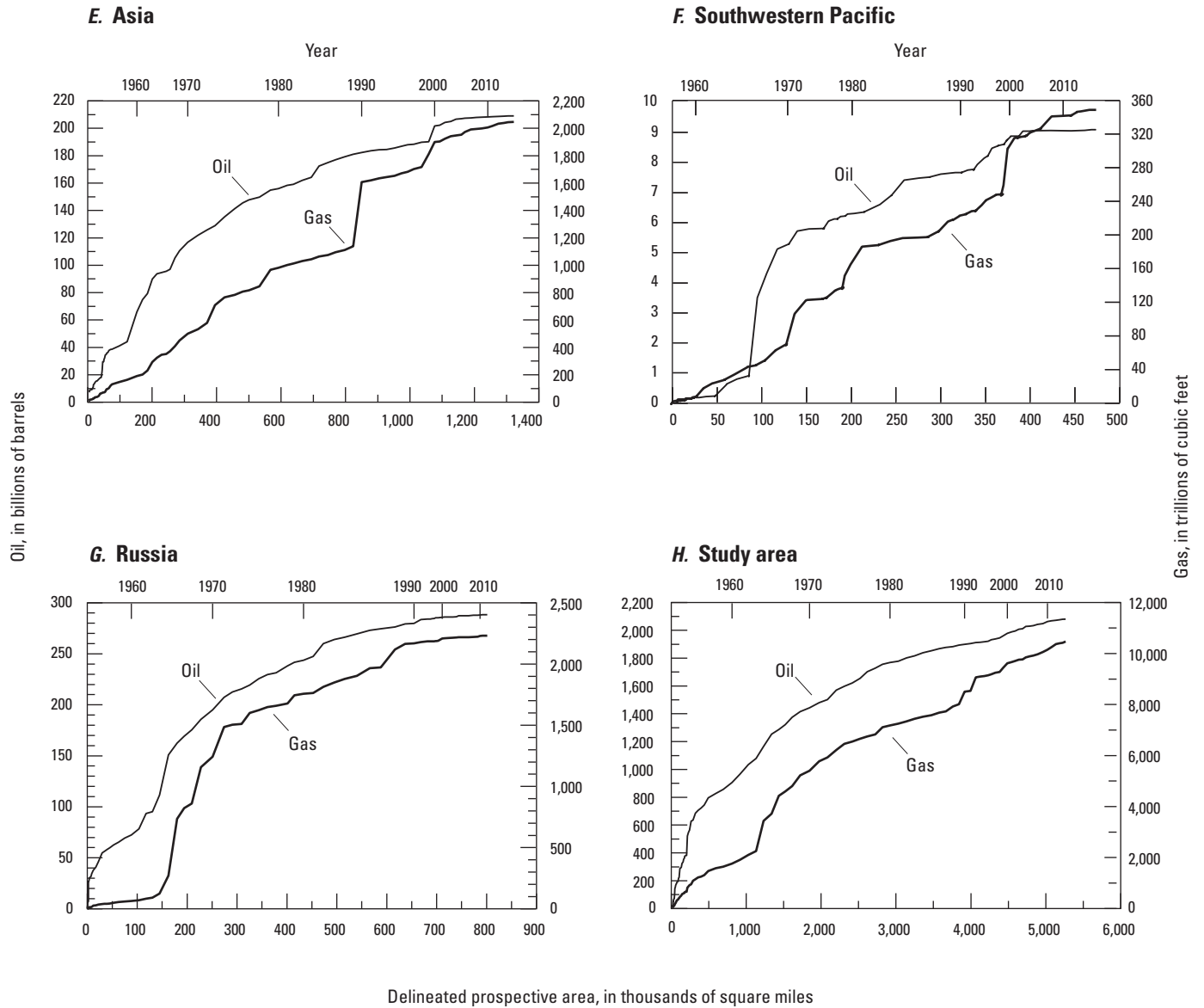
Figure 9.   Continued.
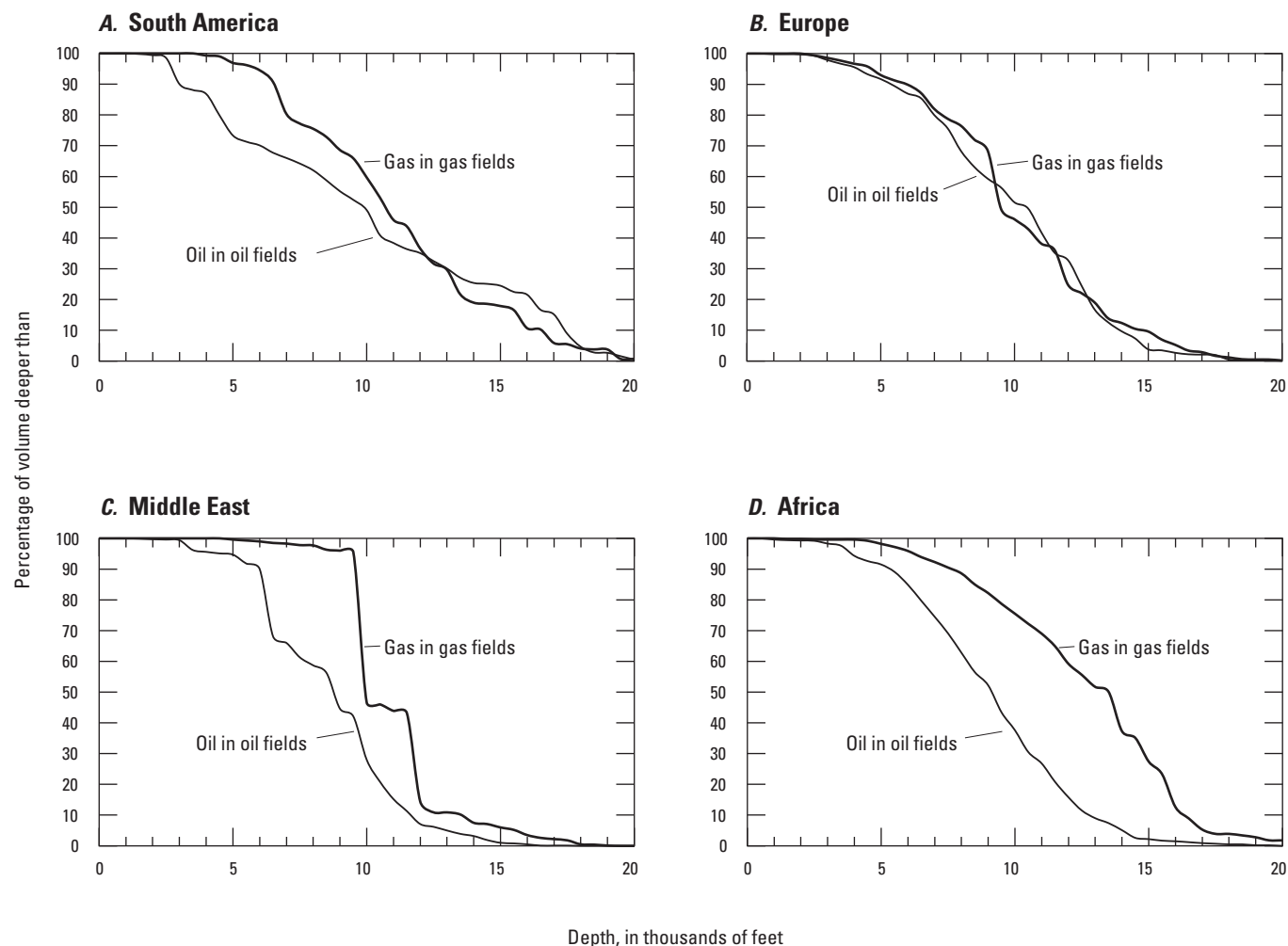
Figure 10. Graphs showing the depth distribution of cumulative recoverable oil in oil fields and natural gas in gas fields for seven regions and the whole study area: *A,* South America; *B,* Europe; *C,* Middle East; *D,* Africa; *E,* Asia; *F,* Southwestern Pacific; *G,* Russia; and *H,* Study area. The study area graph (fig. 10*H*) includes data for the Caribbean, Central America, and Mexico, as well as for the seven regions for which data are graphed in figure 10*A–G*. The graphs show the percentages of oil and gas volumes below (deeper than) each depth on the horizontal axis. Depths and discovery size estimates are from IHS Markit (2016).

E. **Asia**

F. **Southwestern Pacific**

G. **Russia**

H. **Study area**

Percentage of volume deeper than

Depth, in thousands of feet
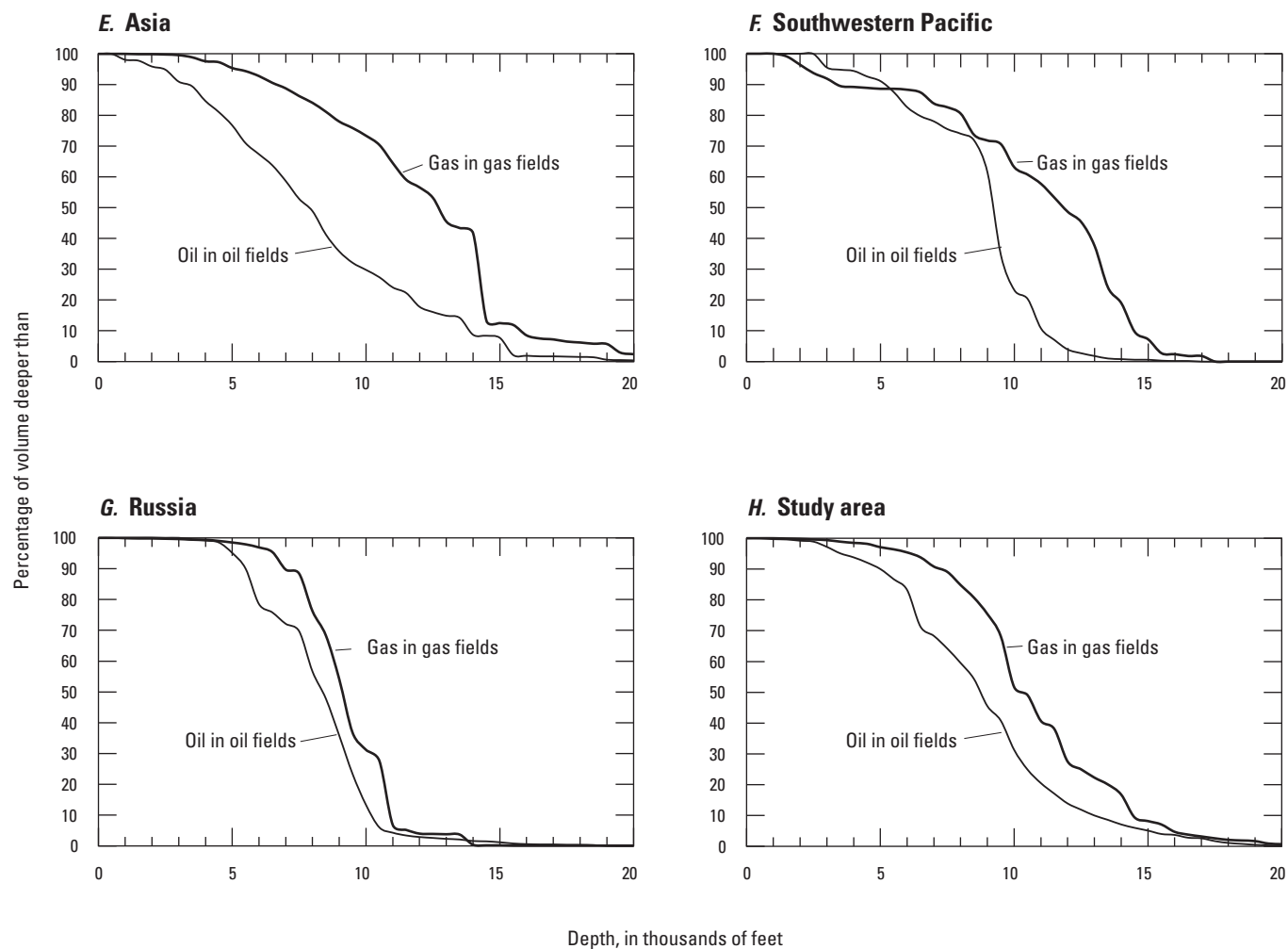
Figure 10.   Continued.

Europe accounts for about 5 percent of the oil and 8 percent of the natural gas discovered in the study area through 2015 (table 3). The North Sea Graben (fig. 23) accounts for 64 percent of the oil discovered in Europe through 2015 and 27 percent of the natural gas. The next most prolific provinces for oil are the Carpathian-Balkanian Basin (fig. 25), which accounts for only 6.9 percent of the oil, followed by Vestford-Helgeland (fig. 23) and Dnieper-Donets Basin (fig. 25). For natural gas, the Northwest German Basin (fig. 23) is the second most prolific province with 21 percent of the gas discovered in Europe, followed by the Dnieper-Donets Basin (fig. 25) and Anglo-Dutch Basin (fig. 23). The four most prolific oil provinces account for 78 percent of the discovered oil, and the four most prolific gas provinces account for 71 percent of the discovered gas.

About 92 percent of the oil discovered in Europe through 2015 has been discovered since 1951. The 5-year average annual oil discovery rate peaked at 4.5 BBO per year during the period from 1971 through 1975 (fig. 5*B*), and the 5-year average annual gas discovery rate peaked at 25.2 TCF per year during the period from 1956 to 1960 (fig. 6*B*). Figure 7*B* shows that the period from 1971 to 1975 had the highest discovery rate per wildcat well at 9.7 MMBO per wildcat well. During the decade from 2006 through 2015, offshore discoveries accounted for 92 percent of the discovered oil and 85 percent of the discovered natural gas.

Europe accounts for 17 percent of the study area's total prospective area. By the end of 2015, the explored area of Europe constituted about 26 percent of its delineated prospective area. The annual rate of expansion of the delineated prospective area declined by 25 percent between 2006 and 2015 (fig. 8*B*), primarily because of a slowdown in wildcat drilling. Figure 9*B* shows that the prospective area added during the period from 1967 through about 1978 yielded the greatest volumes of oil. This expansion was associated with the delineation of the North Sea Graben. Half of Europe's delineated prospective area was delineated by the end of 1966. The early half of the prospective area accounted for 23 percent of the oil and 55 percent of the natural gas discovered through 2015. According to the data that support figure 9*B*, the most productive part of the North Sea Graben was delineated after 1966.

For Europe, the delineated prospective area at a depth of 10,000 ft is about 42 percent of the delineated prospective area at the surface (table 7). Discoveries in deep horizons account for 52 percent of the oil in oil fields and 46 percent of the natural gas in gas fields (fig. 10*B*). For the period from 2006 to 2015, the average discovery sizes in shallow and deep horizons were about the same (table 6). During the previous ten-year period (1996–2005), deeper discoveries were more than twice the size of discoveries in the shallower horizons (table 6).

Figures 23, 24, and 25 show the northern part of Western Europe, the southern part of Western Europe, and Eastern Europe, respectively. For the southern part of Western Europe and Eastern Europe, the graphs tracking the productivity of additions to the prospective area show that the areas added

since 1970 have yielded relatively small oil and gas volumes. Although the prospective area added to the northern part of Western Europe since 1980 was not as productive as the area added between 1966 and 1979, the northern part of Western Europe probably accounted for most of the newly discovered oil in Europe (fig. 23), as is evidenced by the high proportion of offshore discoveries since 1980 (figs. 5*B* and 6*B*).

Middle East

In this study, the Middle East is defined as the Arabian Peninsula, Iran, Iraq, Turkey, Cyprus, Lebanon, Jordon, Syria, Israel, Gaza Strip, and the West Bank (figs. 26–30). The following significant provinces are shared with other regions: Aegean, Levantine Basin, Red Sea Basin, South Caspian Basin, Kura Basin, and Amu-Darya Basin. The tables and figures for the Middle East do not include data for the part of each province located outside the Middle East.

The Middle East accounts for 47 percent of the oil and 31 percent of the natural gas discovered through 2015 in the study area (table 3). Of the 25 significant provinces in the Middle East, 4 provinces, Mesopotamian Foredeep Basin (figs. 27, 29, and 30), Zagros Fold Belt (figs. 26, 28, 29, and 30), Greater Ghawar Uplift (fig. 27), and Rub Al Khali Basin (figs. 27 and 30), account for 93 percent of the oil discovered in the Middle East through 2015. The earliest discoveries in these oil provinces were reported before 1955 (table 5). The four leading provinces for natural gas are Qatar Arch (figs. 27 and 29), Zagros Fold Belt (figs. 26, 28, 29, and 30), Mesopotamian Foredeep Basin (figs. 27, 29, and 30), and Rub Al Khali Basin (figs. 27 and 30). These four provinces account for 87 percent of the discovered natural gas in this region. The most prolific oil and gas provinces in the Middle East are some of the most prolific oil and gas provinces in the entire study area (table 2).

In the Middle East, discoveries since 1951 represent 67 percent of the oil and 88 percent of the gas discovered through 2015. The annual oil discovery rate peaked at 34 BBO per year from 1961 through 1965 (fig. 5*C*), and the annual natural gas discovery rate was highest in the period from 1971 to 1975 at 233 TCF per year (fig. 6*C*). In both cases, the graphs show that the volumes of oil and gas discovered offshore constituted significant portions of the volumes of oil and gas reported. In terms of oil discovered per wildcat well, the peak period was from 1951 to 1955 (fig. 7*C*). The discovery of natural gas in Qatar's North Field in 1971 and the extension of the field into Iranian waters as the Pars South field in 1991 account for the spikes in the 5-year natural gas discovery rate (fig. 6*C*). The gas discovered during the period from 2006 to 2010 is from fields in the Levantine Basin offshore Israel (fig. 28). Although this volume of gas is dwarfed by the gas discovered in Iran and Qatar, gas in the Levantine Basin is extremely important to the smaller non-producing countries in the region. The maps (figs. 27, 28, and 30) show that the offshore discoveries are in close proximity to land.

Figure 8*C* shows that half of the prospective area was added after 1979; however, the late half of the prospective area accounts for 5 percent of the oil discovered and 25 percent of the natural gas discovered. The rollover of the oil yield curve indicates that the prospective area added after 1970 was much less productive than the earlier area. Although the 1,000-TCF North Field was discovered in 1971, the area became prospective in the early 1960s. By the end of 2015, the explored area of the Middle East represented about 19 percent of the prospective area. This low percentage may reflect the controlled nature of oil development by the primary members of OPEC that are in this region.

For the Middle East, the delineated prospective area at a depth of 10,000 ft is 53 percent of the delineated prospective area at the surface. Discoveries at depths of at least 10,000 ft represent about 28 percent of the oil discovered in oil fields and 47 percent of the gas discovered in gas fields (fig. 10*C*). During the period from 2006 to 2015, the average discovery size, on a BOE basis, at depths of 10,000 ft and below was about nine times larger than the average size of discoveries at shallower depths (table 6).

Africa

Africa accounts for about 10 percent of the discovered oil and gas in the study area (table 3). Africa has 31 significant provinces (table 5 and figs. 31–42). Although the Levantine Basin and Red Sea Basin are shared with the Middle East (figs. 26, 28, and 30) and Pelagian Basin and Sicily are shared with Europe (fig. 24), the tables and figures for Africa include only data for the part of each province in Africa. As shown in table 5, only two of the significant provinces of Africa had discoveries prior to 1951. The search for oil and gas in Africa began in earnest after World War II. The four most prolific provinces for oil, Niger Delta (figs. 34 and 40), Sirte Basin (fig. 35), West-Central Coastal (figs. 33, 39, and 40), and Trias/Ghadames Basin (figs. 35 and 36) account for 81 percent of Africa's discovered oil. The leading provinces for natural gas are Niger Delta (figs. 34 and 40), Tanzania Coastal (figs. 32 and 38), Grand Erg/Ahnet Basin (fig. 36), and Nile Delta Basin (fig. 37). These four provinces account for 66 percent of the natural gas discovered in Africa.

Figures 5*D* and 6*D* show that offshore discoveries have accounted for increasing fractions of annual oil and natural gas discoveries. The peak 5-year period for oil discoveries was from 1961 through 1965, and the peak 5-year period for natural gas discoveries was from 2011 to 2015. The very large natural gas discoveries associated with this peak were in offshore waters of Mozambique in the Tanzania Coastal province (fig. 38). The oil discovery rate per wildcat well peaked in the 5-year period from 1956 through 1960 (fig. 7*D*). Almost all oil and gas discovered in Africa has been discovered since the beginning of 1951. Over the last 20 years (1996–2015), offshore discoveries accounted for two-thirds of the oil and more than 90 percent of the natural gas discovered.

Africa accounts for 13 percent of the study area's prospective area. The explored area constitutes about 19 percent of Africa's prospective area. Half of the prospective area was added after 1976 (fig. 8*D*). Discoveries in the early half of the prospective area account for 71 percent of the oil and 55 percent of the natural gas discovered through 2015. The areas added after 1995, which improved the yields for oil discoveries (fig. 9*D*), were in the deep offshore waters of west Africa. The shape of the natural gas yield curve is similar to the oil yield curve but increases dramatically after 2010 because exploration in the newly prospective deepwater areas in the Tanzania Coastal province offshore east Africa resulted in the discovery of large nonassociated gas fields (figs. 9*D*, 37, and 38).

For Africa, the size of the delineated prospective area at a depth of 10,000 ft represents 48 percent of the delineated prospective area measured at the surface (table 7). Discoveries at depths of 10,000 ft and greater account for 38 percent of the oil in oil fields and 76 percent of the gas in gas fields (fig. 10*D*). During the period from 2006 to 2015, the average size of deep-horizon discoveries was almost four times the average size of shallow-horizon discoveries (table 6).

Asia

For this study, Asia includes countries of central Asia, China, Mongolia, Southeast Asia, the Indian subcontinent, and the Far East (figs. 43–51) but excludes Russia. Asia accounts for 10 percent of the oil and 20 percent of the natural gas discovered in the study area (table 3). The countries of central Asia account for 32 percent of the oil and 50 percent of the natural gas discovered in Asia (fig. 44), and China accounts for 35 percent of the oil and 15 percent of the natural gas (fig. 43).

There are 68 significant provinces in Asia (table 5). Although several significant provinces (Volga-Ural Region, North Caspian Basin, Middle Caspian Basin, South Caspian Basin, Kura Basin, Amu-Darya Basin, and Bonaparte Gulf Basin) have hydrocarbon resources both in Asia and in other regions, the tables and figures for Asia exclude the data for the part of each province outside Asia.

The four most prolific provinces for oil are the North Caspian Basin (fig. 44), Bohaiwan Basin (fig. 43), South Caspian Basin (fig. 44), and Songliao Basin (fig. 43). These four provinces account for 49 percent of the oil discovered in Asia. The four most prolific provinces for natural gas, Amu-Darya Basin (fig. 44), North Caspian Basin (fig. 44), Greater Sarawak Basin (figs. 47, 50, and 51), and South Caspian Basin (fig. 44), account for 56 percent of the natural gas discovered in Asia. Fifteen of the significant provinces had evidence of oil or gas before 1900 (table 5).

Discoveries prior to 1951 account for about 88 percent of the oil and nearly all the natural gas discovered in this region. Figure 5*E* shows that annual oil discoveries have been sustained by the increasing share of offshore discoveries. Although the average annual volume of oil discovered was near the maximum during several 5-year periods, the peak

period was from 1971 through 1975. The average annual rate of discovery of natural gas peaked during the period from 2001 through 2005 (fig. 6E). Figure 7E shows that the oil discovery rate per wildcat well peaked during the period from 1956 through 1960. Offshore discoveries represent about two-thirds of the oil and one-third of the gas discovered in Asia since 1996. The large natural gas discoveries of central Asia were in onshore fields.

Asia accounts for about one-fourth of the delineated prospective area in the study area (table 7). The region's explored area is 23 percent of its prospective area. Half of the prospective area was added after 1983 (fig. 8E). The early half of the prospective area has yielded about 75 percent of the oil and 50 percent of the gas discovered through 2015. Figure 9E shows the oil yields in the prospective areas added after 2000 declining dramatically as the plot rolls over. However, these areas were still productive in terms of additional natural gas discoveries (fig. 9E).

For Asia, the prospective area at a depth of 10,000 ft represents about 45 percent of the prospective area at the surface. Discoveries at depths of at least 10,000 ft account for about 30 percent of the oil in oil fields and 73 percent of the gas in gas fields (fig. 10E). Since 2006, on a BOE basis, the average size of fields discovered in the deeper horizons was about three times the average size of discoveries at depths of less than 10,000 ft (table 6).

Southwestern Pacific

For this study, the southwestern Pacific region includes Australia, New Zealand, Timor-Leste, and Papua New Guinea, along with several South Pacific island nations (figs. 52–54). Of the 12 significant provinces in this region, only the Bonaparte Gulf Basin is shared with another region. The southwestern Pacific accounts for less than 1 percent of the oil and about 3 percent of natural gas discovered in the study area through 2015 (table 3). The amount of oil discovered is small, and the Gippsland Basin (fig. 53), the region's most prolific oil province, accounts for 46 percent of the discovered oil. The Northwest Shelf province (fig. 53) accounts for 42 percent of the natural gas discovered in the region.

Nearly all the oil and gas discoveries were reported after 1951. Discoveries in offshore fields represent about 79 percent of the oil and 72 percent of the discovered gas. The peak 5-year interval for average annual oil discoveries and average annual oil discovered per wildcat well was from 1966 through 1970 (figs. 5F and 7F). The peak 5-year period for annual natural gas discoveries was from 2006 through 2010 (fig. 6F). From 2006 through 2015, offshore discoveries accounted for half of the oil and gas discovered.

Figure 8F shows the growth in the prospective area, and figure 9F shows the oil and gas yields by prospective area. The explored area accounts for 17 percent of the prospective area. Figure 9F shows that prospective areas added after 2000 have resulted in additional natural gas discoveries but have yielded virtually no additional crude oil discoveries. Half of

the prospective area was added after 1982. The early half of the prospective area accounts for 72 percent of the discovered oil and 54 percent of the discovered natural gas.

The prospective area at a depth of 10,000 ft is only 16 percent of the prospective area at the surface (table 7). Though the prospective area at 10,000 ft is small, the deeper horizons account for 24 percent of the oil in oil fields and 63 percent of natural gas in gas fields (fig. 10F). From 2006 through 2015, on a BOE basis, the average size of new fields discovered in the deeper horizons was about four times the average size of discoveries at depths of less than 10,000 ft (table 6).

Russia

Russia accounts for 14 percent of the oil and 21 percent of the gas discovered in the study area (table 3). Russia extends from Europe eastward to the tip of Alaska in North America. The part of Russia in Europe and the part of Russia in Asia are shown on separate maps (fig. 55). Of its 18 significant provinces, Russia shares 6 provinces with other regions (table 5). The Azov-Kuban Basin, Dnieper-Donets Basin, and Central Barents Platform are shared with Europe (figs. 23 and 25). The Middle Caspian Basin, Volga-Ural Region, and North Caspian Basin are shared with Asia (fig. 44).

The most prolific oil and gas province, the West Siberian Basin, accounts for 60 percent of the oil and 74 percent of the natural gas discovered in Russia (table 5). The next most prolific oil provinces are Volga-Ural Region, Timan-Pechora Basin, and Middle Caspian Basin. Together with the West Siberian Basin, these provinces account for about 96 percent of Russia's discovered oil. The next most prolific gas provinces are the South Barents Basin, Volga-Ural Region, and North Caspian Basin. The four most prolific gas provinces account for about 87 percent of Russia's discovered natural gas.

About 88 percent of Russia's oil and 99 percent of its natural gas were discovered after the beginning of 1951. Figures 5G and 7G show that the 5-year period from 1961 through 1965 had the highest average annual oil discovery rate and the highest rate of oil discovered per wildcat well. The average annual natural gas discovery rate was highest during the period from 1966 to 1970 (fig. 6G). Offshore discoveries account for less than 2 percent of Russia's discovered oil and about 10 percent of its discovered gas. Very few offshore areas are part of the delineated prospective area. Russia's vast coastal areas are commonly at high latitudes, implying a hostile environment for exploration and development of oil and gas resources.

Russia's prospective area represents 15 percent of the prospective area of the study area (table 7). Russia's explored area is 26 percent of its prospective area. Growth in the prospective area slowed after the beginning of the 1990s (fig. 8G). The rollover of the oil and gas yield curves suggests that the areas added after 1990 are much less productive than the areas that became prospective earlier (fig. 9G). Half of Russia's

prospective area was added after 1978. The prospective area delineated before 1978 (the early half of the area) accounts for 83 percent of Russia's discovered oil and 75 percent of the discovered natural gas. The percentages of oil and gas in the early half of the prospective area are the highest of any region in the study area.

The prospective area at a depth of 10,000 ft is about 47 percent of Russia's prospective area at the surface (table 7). However, only 13 percent of the oil in oil fields and 31 percent of the gas in gas fields are at depths of 10,000 ft and greater (fig. 10*G*). From 2006 through 2015, on a BOE basis, the average size of new fields discovered in the deeper horizons was only slightly larger than the average size of discoveries in horizons less than 10,000 ft deep (table 6).

Study Area

Table 3 shows cumulative wildcat wells, total oil and gas discoveries, offshore wells, and offshore oil and gas discoveries for the study area. Overall, offshore discoveries account for 23 percent of the oil and 40 percent of the natural gas discovered in the study area. For the study area, the four most prolific oil provinces are Mesopotamian Foredeep Basin, Zagros Fold Belt, West Siberian Basin, and Greater Ghawar Uplift (table 2). These four provinces account for 46 percent of the oil discovered in the study area. The four most prolific natural gas provinces, West Siberian Basin, Qatar Arch, Amu-Darya Basin, and Zagros Fold Belt, account for 43 percent of the gas discovered in the study area.

For the entire study area, discoveries after 1951 account for about 78 percent of the oil and 94 percent of the natural gas discovered through 2015. The highest 5-year average annual rates of oil discovered and oil discovered per wildcat well occurred in the period from 1961 through 1965 (figs. 5*H* and 7*H*), which reflects the high rates of oil discovery in the Middle East (fig. 5*C*) and Russia (fig. 5*G*) during that period. The natural gas discovery rate peaked during the period from 1971 through 1975 (fig. 6*H*). Large gas discoveries in the Middle East (fig. 6*C*), Asia (fig. 6*E*), and Russia (fig. 6*G*) contributed to the peak. From 2006 through 2015, offshore discoveries accounted for 71 percent of the oil discovered and 78 percent of the gas discovered. During that decade, the offshore oil and gas discoveries amounted to 81 BBO and 680 TCF of gas, of which the offshore discoveries of Africa and South America accounted for 67 BBO and 421 TCF of gas (IHS Markit, 2016).

The estimates of the delineated prospective area, explored area, and cumulative oil and gas were summed across the 10 regions shown in table 3 to obtain the area and yield graphs for the study area (figs. 8*H* and 9*H*). The rate of additions to the prospective area has slowed since the early 1990s (fig. 8*H*). The slight rollover in the oil and gas yield curves in the 1980s (fig. 9*H*) indicates that the newly delineated prospective areas are slightly less productive than the earlier delineated prospective areas. It should be kept in mind that the oil and gas yields of the recently delineated prospective areas

will likely increase as these areas become more intensively explored. For the entire study area, half of the delineated prospective area was added after 1977. The prospective area delineated through 1977, or the early half of the area, accounts for 82 percent of the oil discovered and 64 percent of the natural gas discovered in the study area.

Table 7 summarizes the data for the total land area, prospective area, explored area, cumulative recoverable oil and gas discoveries, and wildcat wells. The table also lists the percentages of prospective and explored areas, oil and gas discoveries, and wildcat wells at depths of at least 10,000 ft. For the study area, 31 percent of the oil in oil fields and 52 percent of the gas in gas fields are at depths of 10,000 ft and greater (fig. 10*H*). From 2006 through 2015, on a BOE basis, the average size of new fields discovered in deep horizons was about five times the average size of discoveries at depths of less than 10,000 ft (table 6).

Summary and Conclusions

This Circular summarizes available data pertaining to oil and gas exploration for the world outside the United States and Canada, that is, the study area. The exploration data are principally for wildcat wells that have targeted conventional discrete oil and gas accumulations. The goal of the compilation, presentation, and analysis is to identify, at a reconnaissance level, the areas explored for oil and gas and to characterize their degree of exploration maturity. The maps show the delineated prospective areas, which are the industry-defined areas of interest in the search for undiscovered conventional oil and gas accumulations. The maps also show the explored areas, which are the areas where sufficient exploration and development drilling have occurred to virtually preclude the possibility of new large discoveries. The maps show all the significant onshore and offshore areas of interest for exploration. The bathymetric contours at 200 and 1,000 m (656 and 3,280 ft) below sea level show the extent of offshore drilling.

The delineated prospective area is generally only a small part of a country's land area. Over the entire study area, the explored area is only 23 percent of the prospective area (table 7). Although the exploration effort is measured in terms of wildcat wells, the measure of exploration maturity used in this Circular takes into account all oil and gas wells that penetrated the depth interval of interest, as well as known field locations. This procedure augments information for areas where records for wells drilled early in the industry's history are missing. In order not to overstate the degree of exploration maturity of the deeper formations, the analysis was repeated using only wells and fields at least as deep as 10,000 ft. In the study area, 29 percent of the wildcat wells were drilled to depths of at least 10,000 ft.

Table 7 shows the regional variation in the percentage of deep prospective area at a depth of 10,000 ft. With the exception of the Caribbean, Central America, and the southwestern

Pacific, the proportion ranges from 42 to 68 percent and the percentage of deep explored area ranges from 34 to 55 percent. On a map, the prospective and explored areas at 10,000 ft would be overlain by the prospective and explored areas at the surface. The calculations show that substantially less than half of the delineated and explored areas can be considered delineated or explored at depths of 10,000 ft and greater.

There may be several reasons for the disparity between the total and deep prospective and explored areas. In certain areas, the depths of conventional discrete accumulations may be constrained by shallow basement rocks. Alternatively, if deep formations are perceived to be prone to gas accumulations rather than oil, and if gas markets are nonexistent or immature, there is an economic incentive to avoid drilling wildcat wells to deep formations. For the study area, 31 percent of the discovered gas is at depths of at least 10,000 ft (table 7) and 52 percent of the gas in gas fields is at least as deep as 10,000 ft. Table 7 shows that 32 percent of the oil in both oil and gas fields and 42 percent of the gas in both oil and gas fields are at least as deep at 10,000 ft. In order to properly interpret the intensity of exploration at various depths by using the prospective and explored area concepts, the calculations should be prepared with multiple depth cutoffs at the level of the petroleum basin or subbasin areas.

The maps show a static state of hydrocarbon exploration. The dynamic measures of exploration progress are shown in the graphs that depict the growth in delineated prospective and explored areas as a function of the number of wildcat wells. The relation between the expansion of the delineated prospective area and the associated rate of wildcat drilling is determined by the nature of the wildcat wells. Successful wildcat drilling that finds accumulations in new plays (extensive margin and higher risk) will likely lead to followup wildcat wells and produce a larger incremental expansion in the prospective area than wildcat wells drilled to verify new pools within an operating field (intensive margin and lower risk). Economic factors tend to drive the rate of wildcat drilling, as well as the risk-taking behavior of exploration firms, which in turn affects the siting of new wildcat wells and other petroleum wells that result in reserve additions. By risk classification, these wells range from new pool wildcat wells to infill development wells. The rate of drilling and mix of wells determines the rate of increase in the size of the delineated prospective area.

Another aspect of the dynamic measures of exploration progress is the assignment of discoveries to specific additions to the prospective area. Discoveries are organized spatially and assigned dates that indicate when the area became prospective. The graphs of oil and gas discoveries as functions of delineated prospective area provide a way to evaluate an area's petroleum potential in terms of the amount of oil and gas discovered. Several basin- and play-level empirical studies confirmed that on average, large accumulations are discovered early in the exploration and discovery process (Drew, 1997; Attanasi and others, 2007). Although a prospective area may be only partially explored, the early discoveries

provide valuable information about its ultimate yields from a global perspective.

Empirical data show that relatively few of the most prolific provinces contain an overwhelming percentage of the oil and gas discovered to date. More than 400 provinces are in the study area (U.S. Geological Survey World Energy Assessment Team, 2000). According to the data presented in table 2, the 21 provinces with at least 20 BBO discovered through 2015 account for 85 percent of all oil discovered in the study area. Similarly, the 17 provinces having at least 120 TCF of gas discovered through 2015 account for 69 percent of all gas discovered in the study area. The data in table 3 show the regional distribution of discovered oil and gas.

Not only are the discoveries concentrated in a few provinces, they are also concentrated regionally and among political entities. Table 1 shows that the world's oil and gas reserves are also concentrated by geographical areas. The Middle East alone accounts for about 47 percent of the world's oil reserves and 43 percent of the natural gas reserves.

At various times since the 1970s, OPEC members have restricted oil production to manipulate crude oil prices with varying degrees of success. The conventional wisdom of prices reflecting resource scarcity may not hold. In order to predict the potential magnitude of oil production, some analysts have used exploration and discovery data in place of the unreliable price and economic signals with some success (Hubbert, 1967). However, for such analysis to be reliable, exploration and discovery data must be sufficiently complete and the exploration process far enough along that the analyst can correctly interpret the trends.

One effect of global, short-term, high crude oil prices was to make it profitable to develop oil in offshore fields, deep offshore waters, and environments with extreme climates. During the period from 2006 to 2015, offshore wildcat wells accounted for 26 percent of the wildcat wells drilled in the study area. Of these offshore wells, 40 percent were sited in waters deeper than 200 m. During the same period, offshore discoveries accounted for 71 percent of the oil and 78 percent of the gas discovered in the study area.

Inflated prices also made it profitable to develop the unconventional resources of extra-heavy oil and tar sands. In these accumulations, extraction costs are higher than those of comparable conventional accumulations and the produced oil generally requires some upgrading to be used as feedstock in conventional oil refineries. Finally, higher prices permitted the commercial development of technology to extract oil (tight oil) and gas (shale gas) in reservoirs with very low permeability. The application of hydraulic fracturing in combination with horizontal wells resulted in the ability to produce the oil in such reservoirs at commercial rates. As the oil industry has improved its techniques, unit extraction costs have fallen to levels comparable to the extraction costs of conventional accumulations. According to the U.S. Energy Information Administration (EIA, 2016a), tight oil accounted for 35 percent of the oil produced in the United States in 2015 and gas from shales accounted for 62 percent of 2015 gas production. Currently,

production of tight oil and shale gas outside the United States and Canada is very limited, although favorable geologic conditions have been identified in several countries (EIA, 2013). In the future, worldwide oil and gas supply streams are expected to increasingly include unconventional resources.

The limitations of this study relate to the data and methods used for appraising the productivity of newly added prospective areas. Although for a given area, on average, the largest accumulations are discovered early in the discovery process, newly prospective areas that have not undergone a threshold level of exploration may be undervalued. Field-size data provided by IHS Markit are periodically verified, although some of the data undoubtedly come from secondary sources. Without internationally accepted standards for reserve estimation, there may be some ambiguity in the interpretations of the data.

The magnitudes of the prospective and explored areas at a depth of 10,000 ft are much smaller than the prospective and explored areas at the surface. However, the interpretation of these disparities should be within the context of the geology of petroleum basins and subbasins rather than at a broad regional scale. The data and methods presented are useful to identify the industry's search area for undiscovered oil and gas and to assess the degree of exploration maturity of an area with respect to discovery of discrete conventional oil and gas accumulations. Although the development and production of large continuous-type oil and gas accumulations in the study area are still in their infancy, the technology to develop those resources is available. Such accumulations will likely make significant contributions to the future oil and gas supply stream from the study area.

References Cited

Adelman, M.A., 1970, Economics of exploration for petroleum and other minerals: Geoexploration, v. 8, nos. 3–4, p. 131–150. [Also available at https://doi.org/10.1016/0016-7142(70)90030-X.]

Adelman, M.A., 1992, Finding and developing costs in the United States 1945–1986, in Moroney, J.R., ed., Advances in the economics of energy and resources: Greenwich, Conn., JAI Press, v. 7, p. 11–58.

Attanasi, E.D., and Freeman, P.A., 2013, Role of stranded gas in increasing global gas supplies: U.S. Geological Survey Open-File Report 2013–1044, 57 p., accessed September 2016, at http://pubs.usgs.gov/of/2013/1044.

Attanasi, E.D., Freeman, P.A., and Glovier, J.A., 2007, Statistics of petroleum exploration in the world outside the United States and Canada: U.S. Geological Survey Circular 1288, 167 p. [Also available at https://doi.org/10.3133/cir1288.]

Attanasi, E.D., Garland, T.M., Wood, J.H., Dietzman, W.D., and Hicks, J.N., 1981, Economics and resource appraisal—The case of the Permian basin: Journal of Petroleum Technology, v. 33, no. 4, p. 603–616. [Also available at https://doi.org/10.2118/7738-PA.]

Attanasi, E.D., and Haynes, J.L., 1984, Economics and appraisal of conventional oil and gas in the western Gulf of Mexico: Journal of Petroleum Technology, v. 36, no. 12, p. 1271–1280. [Also available at https://doi.org/10.2118/11297-PA.]

Attanasi, E.D., and Root, D.H., 1988, Forecasting petroleum discoveries in sparsely drilled areas—Nigeria and the North Sea: Mathematical Geology, v. 20, no. 7, p. 763–776. [Also available at https://doi.org/10.1007/BF00890190.]

Attanasi, E.D., and Root, D.H., 1993, Statistics of petroleum exploration in the Caribbean, Latin America, Western Europe, the Middle East, Africa, non-Communist Asia, and the southwestern Pacific: U.S. Geological Survey Circular 1096, 129 p. [Also available at https://doi.org/10.3133/cir1096.]

Baker, R.A., Gehman, H.M., James, W.R., and White, D.A., 1984, Geologic field number and size assessments of oil and gas plays: American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 426–432. [Also available at http://archives.datapages.com/data/bulletns/1984-85/data/pg/0068/0004/0400/0426.htm.]

BP, 2003, BP statistical review of world energy, June 2003: London, BP, 40 p., accessed June 2003, at http://bp.com/subsection.do?categoryId=95&contentId=2006480.

BP, 2016, BP statistical review of world energy, June 2016 [dataset]: London, BP, accessed June 8, 2016, at http://www.bp.com/content/dam/bp/excel/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-workbook.xlsx.

Drew, L.J., 1997, Undiscovered petroleum and mineral resources—Assessment and controversy: New York, Plenum Press, 210 p.

Environmental Systems Research Institute, Inc. [ESRI], 1992, Rivers and water bodies [coverage], in ArcWorld 1:3M [database]: Redlands, Calif., ESRI, on CD-ROM.

Environmental Systems Research Institute, Inc. [ESRI], 1998, Cntry98/Country [shape file for country and land mass boundaries], in World, Mexico, Canada, and European countries, and general U.S. data, CD 1 of ESRI data & maps 1998: Redlands, Calif., ESRI, on CD-ROM.

Gautier, D.L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., eds., 1996, 1995 National assessment of United States oil and gas resources—Results, methodology, and supporting data (ver. 2): U.S. Geological Survey Digital Data Series 30, 1 CD-ROM.

Hayes, M.H., 2006, Flexible LNG supply and gas market integration—Simulation approach for valuing the market arbitrage option, *in* World Gas Conference, 23d, Amsterdam, 2006, Proceedings: Hoersholm, Denmark, International Gas Union, v. 4, p. 2130–2147, accessed October 17, 2009, at http://www.igu.org/html/wgc2006/.

Hubbert, M.K., 1967, Degree of advancement of petroleum exploration in United States: American Association of Petroleum Geologists Bulletin, v. 51, no. 11, p. 2207–2227. [Also available at http://archives.datapages.com/data/bulletns/1965-67/data/pg/0051/0011/2200/2207.htm.]

IHS Markit, 2016, International petroleum exploration and production database: London, IHS Markit.

National Geophysical Data Center, 1988, ETOPO5 5-minute gridded elevation data [release publicized by Data Announcement 88–MGG–02, Digital relief of the surface of the Earth]: Boulder, Colo., National Geophysical Data Center, accessed August 11, 2000, at http://www.ngdc.noaa.gov/mgg/global/etopo5.HTML.

Natural Earth, 2016, ne_10m_admin_0_countries (ver. 3.1.0) [shape file for country boundaries]: Natural Earth, accessed October 18, 2016, at http://www.naturalearthdata.com/downloads/10m-cultural-vectors/.

Root, D.H., Attanasi, E.D., and Turner, R.L., 1987, Statistics of petroleum exploration in the non-Communist world outside the United States and Canada: U.S. Geological Survey Circular 981, 132 p. [Also available at https://doi.org/10.3133/cir981.]

Root, D.H., and Schuenemeyer, J.H., 1980, Petroleum-resource appraisal and discovery rate forecasting in partially explored regions—Mathematical foundations: U.S. Geological Survey Professional Paper 1138–B, p. B1–B9. [Also available at https://doi.org/10.3133/pp1138AC.]

Schanz, J.J., Jr., 1978, Oil and gas resources—Welcome to uncertainty: Resources, v. 58, p. 1–16.

U.S. Central Intelligence Agency [CIA], 2001, The world factbook 2001: Washington, D.C., U.S. Central Intelligence Agency, 670 p. [Also available at https://www.cia.gov/library/publications/download/download-2001/index.html.]

U.S. Central Intelligence Agency [CIA], 2016, The world factbook 2016: Washington, D.C., U.S. Central Intelligence Agency, accessed December 28, 2016, at https://www.cia.gov/library/publications/the-world-factbook/index.html.

U.S. Energy Information Administration [EIA], 2000, U.S. crude oil, natural gas, and natural gas liquids reserves—1999 annual report: U.S. Energy Information Administration [Report] DOE/EIA–0216(99), 156 p. [Also available at https://www.eia.gov/naturalgas/crudeoilreserves/archive/1999/full.pdf.]

U.S. Energy Information Administration [EIA], 2013, Technically recoverable shale oil and shale gas resources—An assessment of 137 shale formations in 41 countries outside the United States: Washington, D.C., U.S. Energy Information Administration, [variously paged], accessed December 22, 2016, at http://www.eia.gov/analysis/studies/worldshalegas/archive/2013/pdf/fullreport_2013.pdf.

U.S. Energy Information Administration [EIA], 2016a, U.S. crude oil, and natural gas proved reserves, year-end 2015: Washington, D.C., U.S. Energy Information Administration, 46 p., accessed December 20, 2016, at https://www.eia.gov/naturalgas/crudeoilreserves/.

U.S. Energy Information Administration [EIA], 2016b, Who are the major players supplying the world oil market?: Washington, D.C., U.S. Energy Information Administration, accessed September 20, 2016, at http://www.eia.gov/energy_in_brief/article/world_oil_market.cfm.]

U.S. Geological Survey National Oil and Gas Resource Assessment Team, 1995, 1995 national assessment of United States oil and gas resources: U.S. Geological Survey Circular 1118, 20 p. [Also available at https://doi.org/10.3133/cir1118.]

U.S. Geological Survey World Energy Assessment Team, 2000, U.S. Geological Survey world petroleum assessment 2000—Description and results: U.S. Geological Survey Digital Data Series DDS–60, 4 CD-ROMs. [Also available at https://doi.org/10.3133/ds60.]

White, D.A., 1980, Assessing oil and gas plays in facies-cycles wedges: American Association of Petroleum Geologists Bulletin, v. 64, no. 8, p. 1158–1178. [Also available at http://archives.datapages.com/data/bulletns/1980-81/data/pg/0064/0008/1150/1158.htm.]

Tables 4–7

[Figures 11–55 follow table 7]

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.

[Data are from IHS Markit (2016). Some entries in this table differ from entries in table 2 of Circular 1096 (Attanasi and Root, 1993) and table 5 of Circular 1288 (Attanasi and others, 2007) because (1) the well classification system changed in 1996 and (2) historical wildcat well data were added to the database by IHS Markit. The column denoted "Unkn" means year unknown; these wells are not plotted on graphs in figures 11–55. The computation of the delineated prospective and explored areas mapped in figures 11–55 used all wildcat, exploration, and development wells, both successful and dry, except for wells with a missing or obviously incorrect location]

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Caribbean[1]													
Cuba	212	6	1	0	4	1	0	0	1	0	0	3	2	1	1	1	7	5	0	1
Bahamas	4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Barbados	7	0	0	0	0	0	8	2	0	0	1	2	0	0	0	0	0	0	1	0
Haiti	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Dominican Republic	21	3	0	0	0	0	0	2	0	6	1	0	0	0	0	0	0	0	0	3
Jamaica	4	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
Puerto Rico	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bonaire, Sint Eustatius, and Saba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aruba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**260**	**9**	**1**	**0**	**4**	**1**	**8**	**4**	**1**	**6**	**4**	**7**	**2**	**2**	**1**	**1**	**7**	**9**	**1**	**4**
							Central America[2]													
Guatemala	9	2	1	0	0	0	0	0	0	0	4	2	2	0	1	2	3	4	0	0
Belize	11	1	1	1	0	0	0	2	0	0	0	0	5	2	1	4	0	2	0	2
Costa Rica	18	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Honduras	6	0	0	1	0	2	4	1	0	1	0	1	3	3	0	1	0	0	2	0
Nicaragua	7	0	0	0	0	0	0	1	2	4	8	3	0	0	3	2	0	2	3	0
Panama	18	1	4	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	1	1
Total	**69**	**4**	**7**	**4**	**0**	**2**	**4**	**4**	**2**	**5**	**12**	**7**	**10**	**5**	**7**	**10**	**3**	**8**	**6**	**3**
							Mexico													
Mexico	852	93	87	72	66	111	117	86	121	100	92	87	107	83	73	53	66	65	83	67

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
Caribbean[1]—Continued																				
Cuba	7	0	0	0	0	2	3	1	0	3	1	1	2	0	4	1	3	3	7	3
Bahamas	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Barbados	0	0	0	0	8	5	1	0	0	2	3	1	0	0	0	0	0	0	0	0
Haiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dominican Republic	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0
Jamaica	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bonaire, Sint Eustatius, and Saba	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Virgin Islands	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aruba	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0
Total	7	3	6	0	8	7	5	1	0	7	8	2	2	0	4	2	5	3	7	3
Central America[2]—Continued																				
Guatemala	4	5	9	3	3	1	0	0	4	2	0	0	0	0	1	1	0	1	4	1
Belize	0	3	2	1	1	2	0	0	0	0	2	1	0	0	1	0	0	2	0	0
Costa Rica	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Honduras	2	0	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Nicaragua	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Panama	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Total	6	9	11	7	4	3	1	0	4	5	2	1	1	1	2	1	0	3	4	1
Mexico—Continued																				
Mexico	59	47	45	49	38	57	40	31	24	31	23	34	35	16	8	12	6	4	20	18

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
Caribbean[1]—Continued																		
Cuba	1	3	4	0	2	0	2	3	2	0	2	0	3	0	0	1	70	380
Bahamas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Barbados	0	1	2	0	0	0	0	0	0	0	0	0	1	0	0	0	30	75
Haiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Dominican Republic	1	3	1	6	0	1	0	0	0	0	0	0	0	0	0	0	2	56
Jamaica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Bonaire, Sint Eustatius, and Saba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Aruba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Total	**2**	**7**	**7**	**6**	**2**	**1**	**2**	**3**	**2**	**0**	**2**	**0**	**4**	**0**	**0**	**1**	**102**	**553**
Central America[2]—Continued																		
Guatemala	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	73
Belize	0	0	0	0	0	1	1	7	11	4	9	2	3	6	0	1	0	92
Costa Rica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
Nicaragua	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1	40
Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
Total	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**8**	**12**	**4**	**11**	**2**	**3**	**7**	**1**	**1**	**1**	**292**
Mexico—Continued																		
Mexico	44	56	49	96	101	75	52	64	53	73	36	29	35	44	25	32	536	4,478

[1]No wildcat wells were reported for Bermuda, Cayman Islands, Navassa Island, and Turks and Caicos Islands. Bonaire, Sint Eustatius, and Saba belong to the Netherlands and are part of the Lesser Antilles. No wildcat wells were reported for other parts of the Lesser Antilles.

[2]No wildcat wells were reported for El Salvador.

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
South America																				
Guyana	1	0	0	0	0	0	0	2	0	0	0	1	0	0	2	3	1	0	0	0
Suriname	2	0	0	0	1	1	10	1	6	2	5	1	0	0	0	1	0	0	1	0
French Guiana[3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Chile	140	10	16	15	17	14	18	15	18	20	18	20	32	16	24	19	19	6	14	9
Argentina	706	78	94	56	45	73	71	81	67	61	100	118	92	121	92	64	73	93	59	56
Paraguay	9	0	0	0	0	0	1	2	0	0	0	11	5	0	0	1	2	2	3	1
Uruguay	18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0
Falkland Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ecuador	73	2	0	1	1	2	1	3	6	6	12	10	18	8	6	1	1	3	4	8
Colombia	414	27	18	23	23	18	21	16	20	27	19	18	20	19	17	11	14	17	26	24
Peru	547	14	13	15	4	24	15	21	15	17	21	20	17	18	17	39	13	8	10	1
Venezuela	2,956	112	97	73	60	64	50	30	32	47	48	67	83	79	107	69	70	68	70	107
Trinidad and Tobago	111	7	5	14	11	14	3	3	8	6	8	23	20	9	9	5	12	4	5	6
Bolivia	59	13	18	10	9	9	13	17	12	3	6	3	7	4	6	7	14	9	9	11
Brazil	243	49	52	59	46	53	55	69	61	53	50	57	57	59	59	71	85	73	97	114
Total	**5,279**	**312**	**313**	**266**	**217**	**272**	**259**	**260**	**245**	**242**	**287**	**349**	**351**	**333**	**339**	**292**	**306**	**283**	**300**	**337**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
						South America—Continued														
Guyana	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Suriname	0	0	3	6	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
French Guiana[3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chile	13	26	14	5	8	2	10	13	8	14	10	5	8	8	2	10	6	1	5	0
Argentina	71	81	71	115	119	134	76	72	78	74	77	73	45	59	100	122	88	89	66	66
Paraguay	0	1	1	0	0	0	1	1	1	1	0	0	0	1	2	1	0	0	0	0
Uruguay	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Falkland Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Ecuador	5	1	4	9	3	1	4	6	13	8	3	17	5	7	4	4	4	5	8	7
Colombia	29	52	64	28	35	50	45	57	81	51	43	35	30	37	28	17	10	17	29	15
Peru	10	10	8	19	20	4	1	7	2	4	0	0	3	2	2	5	4	9	10	6
Venezuela	200	186	169	107	154	156	100	16	41	32	20	38	34	33	28	38	50	42	32	25
Trinidad and Tobago	2	6	13	2	0	3	1	4	3	7	4	5	2	1	7	8	7	3	9	9
Bolivia	3	14	13	6	8	6	2	3	6	8	6	20	12	10	11	7	9	5	14	20
Brazil	139	182	237	202	199	130	112	114	103	80	74	74	70	77	56	50	71	53	59	52
Total	**472**	**559**	**599**	**499**	**546**	**488**	**356**	**295**	**336**	**279**	**237**	**268**	**209**	**236**	**240**	**262**	**249**	**224**	**238**	**200**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
						South America—Continued												
Guyana	1	0	0	0	0	3	0	0	0	0	0	0	2	0	0	1	1	22
Suriname	0	1	1	1	0	0	1	5	12	4	0	3	5	2	3	2	7	90
French Guiana[3]	0	0	0	0	0	0	0	0	0	0	0	5	0	3	0	0	0	10
Chile	2	0	0	0	0	0	1	6	10	8	23	19	17	22	36	14	15	801
Argentina	64	72	47	38	54	49	47	54	91	58	40	73	65	85	65	62	55	4,895
Paraguay	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	50
Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	30
Falkland Islands	0	0	0	0	0	0	0	0	0	0	7	3	4	0	0	3	0	23
Ecuador	11	4	10	7	4	7	4	1	5	3	3	2	10	12	24	1	3	395
Colombia	22	17	15	33	22	35	54	71	96	63	91	115	113	82	91	33	23	2,521
Peru	3	3	5	3	6	4	4	7	6	7	6	11	9	6	17	2	9	1,083
Venezuela	27	12	17	9	6	9	9	13	3	7	6	2	3	7	6	15	5	5,946
Trinidad and Tobago	5	7	8	10	5	7	11	9	8	1	1	3	7	4	2	4	11	482
Bolivia	18	11	5	9	8	4	2	2	1	5	3	5	3	2	11	6	0	517
Brazil	47	113	54	73	53	53	80	116	144	127	115	155	142	94	51	38	0	5,051
Total	**200**	**240**	**162**	**183**	**159**	**171**	**213**	**284**	**376**	**283**	**295**	**396**	**380**	**319**	**308**	**181**	**132**	**21,916**

[3]French Guiana is listed separately although it is an overseas department of France.

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
								Europe[4]												
United Kingdom	254	9	6	7	9	28	31	42	43	55	30	31	35	69	81	87	76	84	45	50
Norway	0	0	0	0	0	0	1	5	10	12	8	12	14	14	16	15	20	11	14	14
Germany	2,466	153	122	123	129	104	119	81	68	80	70	73	53	42	50	34	57	55	66	50
Denmark	29	0	0	0	0	0	3	2	7	2	4	2	0	4	3	3	7	5	3	1
Netherlands	168	3	5	2	38	37	11	2	18	41	36	33	28	23	24	29	24	35	21	25
Ireland	0	0	2	3	0	0	0	0	0	0	0	3	2	3	3	7	5	7	18	11
Sweden	1	0	0	0	0	0	0	1	2	0	0	4	10	13	14	27	6	6	32	11
Belgium	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faroe Islands[5]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Svalbard and Jan Mayen[6]	0	0	0	0	0	0	1	1	0	0	0	1	2	2	2	1	0	1	0	0
Isle of Man	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	754	83	105	95	78	51	55	28	31	46	34	41	46	28	22	25	29	26	62	41
Austria	249	13	17	13	19	17	20	10	13	18	16	25	16	16	20	35	22	27	20	25
France	808	106	94	101	78	62	31	21	12	25	12	7	11	10	9	11	13	13	16	22
Spain	109	14	17	23	11	15	18	13	16	10	8	13	5	18	7	17	20	15	18	15
Portugal	40	1	1	4	0	0	0	0	0	0	0	0	0	0	3	7	9	1	0	2
Switzerland	11	2	1	2	2	3	0	0	0	0	0	0	0	1	0	0	0	1	1	0
Malta	1	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0
San Marino	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Romania	163	23	13	19	17	21	28	17	23	34	16	21	10	13	13	15	16	15	10	12
Ukraine	68	11	12	14	9	13	12	20	8	14	9	6	9	5	8	10	17	14	10	14
Belarus	0	0	0	1	2	1	1	4	3	1	2	2	13	4	9	4	6	4	4	3
Hungary	522	46	53	55	58	32	34	15	12	22	20	21	20	17	16	23	37	19	34	23
Albania	36	11	11	8	8	6	3	5	4	3	14	12	10	11	12	14	11	12	4	8
Serbia	81	17	9	11	6	8	6	3	7	5	8	15	17	12	10	22	9	28	25	13
Montenegro	7	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Poland	473	67	63	59	61	117	172	150	140	150	143	131	124	90	71	56	47	49	43	46

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Europe[4]—Continued													
Czech Republic	22	3	4	2	5	10	6	4	8	6	4	3	3	13	6	5	8	15	7	7
Greece	23	6	11	6	3	2	0	8	0	0	2	1	1	3	3	0	2	5	2	5
Bulgaria	337	61	53	54	10	22	14	17	9	14	10	16	15	12	22	17	11	13	18	11
Lithuania	1	0	0	1	2	1	3	2	1	1	5	5	5	4	4	7	5	3	4	4
Slovakia	22	1	4	6	6	10	3	7	2	8	5	5	5	1	0	1	1	0	2	1
Slovenia	41	2	2	0	0	0	0	2	1	1	0	0	0	0	0	0	2	1	4	3
Latvia	0	0	0	0	1	1	0	6	5	4	2	2	0	1	0	0	0	0	0	0
Moldova	11	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bosnia and Herzegovina	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Croatia	125	4	14	20	10	5	18	14	13	10	3	7	9	18	11	10	14	13	17	17
Macedonia	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Total	**6,825**	**637**	**622**	**635**	**565**	**567**	**590**	**480**	**456**	**563**	**461**	**492**	**466**	**448**	**439**	**482**	**475**	**478**	**500**	**434**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Europe[4]—Continued													
United Kingdom	45	71	95	95	149	133	148	90	108	118	169	148	114	61	79	70	81	76	53	38
Norway	24	22	32	26	28	28	30	21	17	16	28	32	32	24	21	21	21	38	21	13
Germany	42	66	81	59	60	54	46	37	25	20	30	19	16	9	9	17	20	11	11	6
Denmark	4	2	4	10	5	14	3	5	3	4	1	4	6	1	0	0	1	6	3	2
Netherlands	37	39	52	43	44	55	41	36	35	39	44	49	32	27	17	26	35	35	35	18
Ireland	3	14	4	6	7	6	7	3	5	3	3	1	2	3	3	4	2	4	0	2
Sweden	12	14	14	12	11	15	0	4	10	1	7	5	0	1	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faroe Islands[5]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Svalbard and Jan Mayen[6]	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0
Isle of Man	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Italy	55	75	77	55	63	52	87	75	71	34	33	47	36	26	21	28	31	28	28	14
Austria	16	24	23	20	31	26	12	13	15	6	12	5	7	4	6	6	7	13	9	4
France	25	38	46	32	41	55	73	26	34	36	25	30	10	5	8	7	7	0	5	0
Spain	21	23	10	20	10	24	17	12	9	10	4	7	0	4	2	3	1	5	3	5
Portugal	0	1	2	3	0	1	0	0	3	0	2	0	2	4	0	1	0	0	1	1
Switzerland	1	1	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Malta	1	0	2	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1
San Marino	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Romania	13	7	9	14	13	7	10	8	11	12	10	6	11	16	27	26	15	30	22	17
Ukraine	9	10	7	12	20	11	3	11	8	6	9	8	10	7	2	6	0	4	7	17
Belarus	4	1	3	4	5	2	1	4	0	3	1	2	2	3	3	5	1	0	0	3
Hungary	29	25	31	28	13	25	30	20	20	34	24	10	19	15	4	14	16	13	13	12
Albania	18	11	12	10	6	8	11	12	5	14	9	2	0	3	2	3	1	3	0	0
Serbia	13	11	9	12	7	12	12	9	9	13	4	7	5	6	7	8	6	7	11	2
Montenegro	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Poland	50	41	67	55	52	55	54	47	63	73	57	37	36	23	36	55	39	38	25	35

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Europe[4]—Continued													
Czech Republic	9	7	7	10	11	6	5	4	5	5	2	4	4	2	3	2	3	2	5	5
Greece	5	8	11	7	7	5	6	7	4	3	1	0	1	0	1	0	0	0	2	0
Bulgaria	10	6	9	18	13	16	24	18	16	9	6	1	4	7	10	4	5	0	3	1
Lithuania	4	5	6	5	5	5	4	5	6	1	4	2	1	2	2	0	1	1	0	2
Slovakia	1	0	0	1	2	0	0	0	0	0	1	4	6	0	2	3	4	0	1	2
Slovenia	2	0	2	0	0	1	2	1	2	0	1	4	0	1	0	0	0	0	0	0
Latvia	0	0	0	0	1	0	0	0	1	1	0	1	0	2	1	0	0	0	0	0
Moldova	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bosnia and Herzegovina	0	0	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Croatia	15	18	13	11	20	29	20	17	15	23	21	8	4	7	10	4	3	6	4	0
Macedonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**469**	**540**	**633**	**568**	**626**	**648**	**647**	**487**	**502**	**486**	**508**	**444**	**362**	**264**	**276**	**313**	**302**	**321**	**262**	**200**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

50

Statistics of Petroleum Exploration in the World Outside the United States and Canada Through 2015

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Europe[4]—Continued											
United Kingdom	37	41	30	25	35	40	43	51	62	46	37	26	35	31	31	20	12	3,615
Norway	19	23	21	17	8	13	16	21	36	49	33	39	28	40	44	40	0	1,108
Germany	3	5	10	6	6	8	6	8	6	10	4	10	9	1	10	10	39	4,784
Denmark	6	6	3	5	3	1	3	1	1	3	1	5	2	3	4	2	0	202
Netherlands	6	18	23	9	16	10	15	16	14	11	11	20	18	8	22	19	0	1,578
Ireland	0	5	1	2	2	0	2	1	2	1	1	0	0	1	0	1	0	165
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1	11	249
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7
Faroe Islands[5]	0	4	0	1	0	0	1	0	2	0	1	0	0	0	2	0	0	11
Svalbard and Jan Mayen[6]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
Isle of Man	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Italy	17	12	6	5	6	6	7	8	7	4	2	0	2	3	1	2	43	2,747
Austria	10	4	8	5	14	16	17	9	8	8	3	4	8	5	0	6	31	1,026
France	2	0	0	2	3	3	3	4	4	2	3	5	8	5	5	2	11	2,027
Spain	6	3	2	2	1	2	0	3	0	1	1	0	0	0	0	2	4	599
Portugal	0	0	0	0	0	11	0	0	0	0	0	1	2	0	0	0	0	103
Switzerland	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	33
Malta	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	14
San Marino	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Romania	9	10	15	17	12	19	17	30	27	22	22	16	8	7	8	11	1,117	2,150
Ukraine	19	6	5	6	9	8	8	6	2	2	1	2	4	2	2	0	984	1,516
Belarus	3	1	1	1	2	2	2	3	3	0	0	3	0	1	1	1	3	138
Hungary	8	11	6	11	6	10	11	16	18	18	11	11	14	9	7	6	16	1,663
Albania	0	2	0	2	1	0	1	0	0	0	0	0	2	1	1	0	13	356
Serbia	4	5	5	7	5	5	2	7	4	7	6	2	3	2	0	0	2	548
Montenegro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	23
Poland	31	41	31	24	27	25	15	19	20	12	9	17	12	22	32	19	97	3,643

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Europe[4]—Continued											
Czech Republic	4	8	4	5	2	0	0	5	2	1	0	2	5	15	3	3	9	310
Greece	4	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	159
Bulgaria	0	1	2	2	2	2	4	5	3	0	3	3	0	2	0	2	26	973
Lithuania	1	0	0	2	2	3	1	1	0	1	1	0	3	0	1	2	0	137
Slovakia	4	0	2	2	2	1	1	2	0	2	2	2	1	4	4	0	0	146
Slovenia	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	0	15	94
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	38
Moldova	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	21
Bosnia and Herzegovina	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	10
Croatia	4	3	3	0	2	0	4	0	2	1	1	0	1	0	1	5	17	644
Macedonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Total	**197**	**212**	**180**	**158**	**168**	**185**	**182**	**216**	**223**	**201**	**156**	**168**	**169**	**164**	**181**	**154**	**2,474**	**30,861**

[4]No wildcat wells were reported for Andorra, Estonia, Finland, Gibraltar, Kosovo, Liechtenstein, Luxembourg, or Monaco. Greenland (which is part of part of Denmark) has 15 wildcat wells, and Iceland has 7 stratigraphic test wells.

[5]Faroe Islands are part of Denmark.

[6]Svalbard is a group of islands in the Artic Ocean north of and belonging to Norway. Jan Mayen is an island in the Artic Ocean north of and belonging to Norway.

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Middle East													
Turkey	97	35	18	11	13	31	30	19	27	12	33	20	24	28	36	43	42	21	20	10
Cyprus	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Saudi Arabia	22	0	0	4	1	2	5	8	7	3	6	9	5	4	5	11	7	5	7	6
Kuwait	11	1	2	10	3	2	5	2	0	0	2	1	2	0	0	0	1	1	2	1
Abu Dhabi[7]	3	0	3	0	4	1	3	3	8	8	11	9	1	8	10	5	7	1	6	6
'Ajman[7]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dubai[7]	1	0	0	0	2	1	1	0	1	0	0	1	1	0	0	0	3	1	0	3
Al Fujayrah[7]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Umm al Qaywayn[7]	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2	1	0	0
Ra's al Khaymah[7]	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	1	0	0	0
Sharjah[7]	1	0	0	1	1	1	0	1	0	0	0	1	0	1	1	1	0	0	2	0
Former Neutral Zone[8]	12	3	7	4	3	1	3	2	0	0	0	0	0	1	0	0	1	0	0	0
Oman	26	1	3	3	5	2	8	2	3	6	2	11	11	11	4	10	10	9	8	13
Qatar	10	1	5	3	3	1	1	4	3	2	1	2	2	0	0	0	3	1	0	4
Yemen	0	0	3	0	1	1	0	0	0	0	0	0	0	0	1	0	4	2	1	2
Bahrain	4	1	1	0	0	1	1	0	0	0	0	0	1	1	0	1	0	0	2	1
Syria	17	0	3	5	1	0	1	0	3	0	0	0	0	2	5	5	9	11	15	9
Lebanon	3	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Israel[9]	62	5	4	4	12	11	14	8	8	5	8	7	3	3	1	9	9	12	4	5
Jordan	4	0	0	1	0	0	0	0	0	0	2	5	1	0	0	0	0	0	1	0
Iraq	88	6	2	0	0	0	0	0	0	0	1	2	1	2	4	2	9	10	14	9
Iran	74	13	9	6	9	12	23	22	21	15	13	9	11	20	21	20	21	18	16	3
Total	**435**	**67**	**60**	**54**	**58**	**68**	**96**	**72**	**81**	**54**	**80**	**79**	**64**	**81**	**88**	**107**	**129**	**94**	**98**	**72**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Middle East—Continued													
Turkey	24	21	30	25	19	23	24	27	35	34	30	28	22	24	21	13	14	11	14	14
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saudi Arabia	5	2	3	5	2	0	0	1	0	2	5	2	5	7	3	2	3	5	4	3
Kuwait	0	1	1	1	3	3	0	1	2	1	2	0	0	0	0	1	0	0	0	0
Abu Dhabi[7]	1	5	10	13	12	9	7	2	1	7	2	1	3	4	3	1	2	0	0	0
'Ajman[7]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dubai[7]	3	1	1	0	6	5	0	1	2	1	1	2	1	2	0	0	1	0	0	0
Al Fujayrah[7]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Umm al Qaywayn[7]	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ra's al Khaymah[7]	1	0	2	0	2	2	1	0	1	0	0	0	0	1	0	0	0	0	1	0
Sharjah[7]	2	1	1	2	2	4	0	1	0	0	0	0	1	0	3	0	1	0	2	0
Former Neutral Zone[8]	0	1	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	2	0
Oman	14	15	20	19	37	24	37	24	23	22	30	40	16	18	18	18	28	29	17	23
Qatar	0	0	2	1	0	0	0	1	6	2	5	4	2	0	0	0	3	3	4	0
Yemen	3	4	3	1	3	12	18	21	15	15	11	20	35	34	22	19	13	10	9	7
Bahrain	1	0	0	0	0	0	3	0	0	0	0	0	2	1	0	0	0	0	0	0
Syria	5	8	5	2	6	16	20	10	22	21	27	24	32	26	15	11	13	13	7	10
Lebanon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Israel[9]	8	5	14	9	11	3	3	1	2	3	3	1	2	6	8	5	3	3	3	7
Jordan	1	0	3	4	5	1	1	3	7	7	4	3	1	2	5	0	0	1	2	1
Iraq	7	3	3	4	6	2	0	2	1	0	0	0	0	0	1	1	0	0	1	1
Iran	3	1	1	1	1	0	0	0	3	2	1	2	4	2	0	2	3	3	2	5
Total	**79**	**69**	**102**	**89**	**115**	**104**	**115**	**95**	**120**	**117**	**121**	**127**	**126**	**127**	**101**	**73**	**84**	**79**	**68**	**71**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

[Data are from IHS Markit (2016). Some entries in this table differ from entries in table 2 of Circular 1096 (Attanasi and Root, 1993) and table 5 of Circular 1288 (Attanasi and others, 2007) because (1) the well classification system changed in 1996 and (2) historical wildcat well data were added to the database by IHS Markit. The column denoted "Unkn" means year unknown; these wells are not plotted on graphs in figures 11–55. The computation of the delineated prospective and explored areas mapped in figures 11–55 used all wildcat, exploration, and development wells, both successful and dry, except for wells with a missing or obviously incorrect location]

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Middle East—Continued											
Turkey	14	21	14	23	19	23	40	51	46	50	76	78	71	55	44	24	0	1,672
Cyprus	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	6
Saudi Arabia	5	1	2	4	6	5	5	8	11	6	7	3	3	9	13	0	35	299
Kuwait	0	1	5	1	5	2	5	1	0	0	0	0	2	1	4	1	3	93
Abu Dhabi[7]	2	0	0	0	1	0	1	0	1	0	3	3	1	0	0	0	0	192
'Ajman[7]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dubai[7]	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	46
Al Fujayrah[7]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
Umm al Qaywayn[7]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
Ra's al Khaymah[7]	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	18
Sharjah[7]	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	35
Former Neutral Zone[8]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	46
Oman	9	17	17	15	17	27	10	18	19	17	15	28	18	21	26	30	1	925
Qatar	1	4	2	2	0	1	4	0	2	3	0	2	0	3	0	2	0	105
Yemen	12	15	20	15	24	23	32	33	19	15	18	9	0	4	1	1	1	532
Bahrain	0	0	1	2	2	1	0	0	0	0	0	1	4	0	1	1	1	35
Syria	3	4	5	8	5	15	10	15	12	15	17	20	3	0	0	3	2	516
Lebanon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Israel[9]	7	2	3	1	2	1	1	3	0	2	1	2	8	4	4	3	1	339
Jordan	0	0	1	0	0	3	0	0	0	2	0	0	0	0	0	0	0	71
Iraq	0	0	1	1	0	0	0	3	2	3	4	12	14	16	17	8	6	269
Iran	4	6	2	2	10	6	5	8	6	11	10	7	10	4	1	4	0	488
Total	**58**	**71**	**73**	**74**	**91**	**109**	**114**	**140**	**118**	**126**	**152**	**168**	**136**	**117**	**114**	**78**	**50**	**5,708**

[7]One of the seven United Arab Emirates.

[8]The former Neutral Zone was located between Kuwait and SaudiAarabia.

[9]No wildcat wells were reported for Gaza Strip or West Bank by IHS Markit (2016), although wells may have been included with the data for Israel.

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Africa[10]													
Cote d'Ivoire	8	1	0	0	0	0	0	0	0	0	0	0	2	1	1	2	1	8	5	3
Ghana	4	0	0	0	0	0	0	3	0	0	9	1	1	1	1	5	0	1	1	2
Benin	0	0	0	0	0	0	0	0	1	1	4	0	0	2	0	0	0	0	0	0
Guinea-Bissau	1	3	0	0	0	0	0	0	2	3	0	0	0	1	0	0	0	0	0	0
Guinea-Bissau/Senegal JEZ[11]	0	0	0	0	0	0	0	1	0	0	3	2	0	0	0	0	0	0	0	0
Togo	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Senegal	24	9	3	0	0	1	2	2	2	3	1	1	1	0	0	1	2	1	0	0
The Gambia	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Guinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liberia	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Ethiopia	18	0	0	1	0	1	0	0	0	0	0	0	1	3	3	0	0	0	0	0
Somalia	21	3	2	3	1	3	1	1	2	2	0	0	0	1	1	1	1	1	0	0
Eritrea	11	0	0	0	0	0	2	0	0	2	1	0	0	2	0	0	0	1	0	0
Kenya	2	1	1	1	1	0	0	1	1	0	0	2	0	0	0	1	2	0	1	0
Angola	78	12	4	11	4	19	10	15	43	23	12	27	11	6	28	9	0	3	3	2
Angola/Congo Unitized Area[12]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nigeria	96	16	7	19	31	58	62	77	35	21	22	52	54	41	49	33	18	29	27	34
Nigeria/Sao Tome and Principe JDZ[13]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libya	142	96	112	150	136	118	64	42	83	76	52	43	31	24	28	45	30	35	36	24
Libya/Tunisia JEZ[14]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	
Tunisia	77	1	7	4	5	7	6	12	6	4	4	11	13	8	16	6	8	7	7	12
Algeria	333	59	55	56	43	18	10	19	16	30	36	27	12	9	15	21	26	22	23	17
Morocco	243	16	10	2	8	6	12	11	6	13	1	6	4	3	3	5	5	3	4	7
Egypt	156	10	7	11	9	8	17	10	23	29	38	24	22	15	15	21	38	44	29	32
Mozambique	5	1	3	0	0	5	1	14	0	0	11	6	2	0	0	0	0	0	0	0

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Africa[10]—Continued													
Tanzania	3	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	1
Burundi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Africa	2	0	0	0	0	5	3	5	4	11	13	18	11	19	4	21	17	13	10	5
Namibia	1	0	0	0	0	0	0	0	0	0	4	1	0	0	1	0	0	0	0	0
Botswana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lesotho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Zambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zimbabwe	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gabon	102	9	14	5	1	8	9	10	11	21	12	11	17	13	15	16	16	17	12	16
Congo (Brazzaville)	11	1	3	2	0	0	0	0	0	1	2	2	6	6	6	4	0	0	5	6
Cameroon	21	0	0	0	0	1	0	4	0	1	6	2	3	2	3	6	4	24	16	16
Equatorial Guinea	0	0	0	0	0	0	0	1	5	0	0	1	0	0	0	0	0	0	0	0
Central African Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Congo (Kinshasa)	2	0	0	0	1	1	0	0	0	0	0	1	6	4	0	3	2	1	2	1
Sudan	0	1	3	3	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2	5
South Sudan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Chad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	4	3	5	1
Mauritania	0	0	1	1	0	0	0	0	0	2	2	0	1	1	3	0	0	0	0	0
Niger	0	0	6	1	2	0	0	0	0	0	0	0	0	0	0	7	0	0	0	3
Mali	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Uganda	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Sahara	0	8	15	7	4	3	4	6	0	1	1	0	1	1	0	0	0	0	0	0
Madagascar	49	0	0	1	1	1	0	0	0	0	1	8	1	2	5	1	0	0	0	0
Mauritius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,412**	**248**	**254**	**278**	**247**	**263**	**203**	**234**	**240**	**244**	**237**	**250**	**200**	**165**	**203**	**215**	**178**	**216**	**190**	**189**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Africa[10]—Continued													
Cote d'Ivoire	1	7	9	2	6	2	0	0	0	0	0	0	0	0	0	0	5	4	4	2
Ghana	1	0	1	0	0	2	0	1	0	3	1	0	0	0	0	0	0	1	1	0
Benin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Guinea-Bissau	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Guinea-Bissau/Senegal JEZ[11]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Togo	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Senegal	0	0	1	0	1	0	0	0	1	2	0	0	0	4	0	0	0	0	1	0
The Gambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Guinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sierra Leone	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liberia	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethiopia	0	0	0	1	1	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0
Somalia	1	0	3	0	2	2	0	1	2	0	3	0	0	0	0	0	0	0	0	0
Eritrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Kenya	0	2	1	0	0	1	1	0	3	4	1	0	1	1	0	0	0	0	0	0
Angola	4	9	21	23	11	18	14	15	19	9	20	20	12	12	12	7	16	16	23	14
Angola/Congo Unitized Area[12]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nigeria	30	29	27	25	16	15	18	16	26	28	36	24	28	29	15	21	29	28	24	9
Nigeria/Sao Tome and Principe JDZ[13]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libya	17	34	37	37	41	38	21	17	14	15	12	8	20	28	24	13	10	19	15	7
Libya/Tunisia JEZ[14]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tunisia	13	28	18	10	12	14	5	12	7	8	6	9	12	9	7	13	9	11	11	6
Algeria	25	19	20	21	11	25	18	26	9	14	11	18	17	18	21	18	19	23	30	14
Morocco	9	11	8	5	4	5	4	8	2	0	1	2	2	3	0	0	0	0	2	0
Egypt	37	57	62	42	37	67	60	47	47	37	38	43	36	25	25	27	51	69	65	31
Mozambique	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	0	0

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Africa[10]—Continued													
Tanzania	0	0	1	2	2	2	1	2	0	0	2	1	0	0	0	0	1	1	0	0
Burundi	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
South Africa	7	9	15	8	11	13	15	15	17	19	21	8	5	3	5	3	0	1	4	0
Namibia	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	1	0	1	1
Botswana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lesotho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zambia	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Zimbabwe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gabon	16	23	19	15	16	15	7	6	17	28	25	32	13	2	5	9	9	17	7	2
Congo (Brazzaville)	8	10	11	4	3	9	3	8	4	3	7	10	19	2	1	2	1	4	6	4
Cameroon	19	19	8	2	5	2	3	0	3	1	0	0	2	1	0	2	2	3	3	2
Equatorial Guinea	0	0	2	0	1	1	1	0	1	0	0	1	1	0	2	2	8	9	6	1
Central African Republic	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Congo (Kinshasa)	0	3	4	4	4	1	1	0	3	1	1	0	0	0	1	0	1	0	0	0
Sudan	1	7	6	7	3	7	2	1	0	4	0	0	0	0	0	0	1	6	4	4
South Sudan	0	3	5	3	0	0	0	0	0	0	0	0	0	0	1	1	3	5	5	9
Chad	0	0	0	0	0	3	3	0	0	0	2	1	0	0	2	0	0	0	0	0
Mauritania	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Niger	2	0	2	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	3	0
Mali	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uganda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Sahara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Madagascar	0	0	0	0	0	4	3	2	0	0	1	1	2	1	0	0	0	0	0	0
Mauritius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seychelles	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Total	**193**	**272**	**283**	**211**	**189**	**253**	**183**	**182**	**177**	**177**	**193**	**179**	**171**	**138**	**125**	**123**	**167**	**220**	**217**	**108**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Africa[10]—Continued											
Cote d'Ivoire	1	1	2	1	0	3	0	2	0	2	3	3	4	2	5	2	0	105
Ghana	2	4	0	1	0	0	0	0	4	2	6	6	10	4	2	0	0	81
Benin	0	0	0	2	0	1	0	1	0	0	0	0	0	0	3	0	0	16
Guinea-Bissau	0	0	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0	18
Guinea-Bissau/Senegal JEZ[11]	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	8
Togo	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	7
Senegal	2	0	0	0	0	1	0	0	0	0	0	0	2	0	2	0	12	82
The Gambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Guinea	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Sierra Leone	0	0	0	0	0	0	0	0	0	1	1	0	2	1	0	0	0	7
Liberia	0	0	0	0	0	0	0	0	0	0	0	2	3	1	3	0	0	16
Ethiopia	0	0	0	0	0	0	1	1	0	0	1	0	0	3	2	0	0	41
Somalia	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	60
Eritrea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	23
Kenya	0	0	0	0	0	0	0	1	0	0	1	0	1	5	12	5	0	54
Angola	21	10	16	18	9	14	14	26	15	18	16	9	9	11	21	9	5	856
Angola/Congo Unitized Area[12]	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	3
Nigeria	13	16	17	16	19	13	20	15	12	13	6	11	13	11	10	9	1	1,469
Nigeria/Sao Tome and Principe JDZ[13]	0	0	0	0	0	0	1	0	0	4	1	0	1	0	0	0	0	7
Libya	14	19	10	11	19	22	33	50	48	44	57	15	4	24	18	2	77	2,261
Libya/Tunisia JEZ[14]	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Tunisia	6	4	5	10	6	6	7	17	18	6	13	8	11	9	4	5	6	582
Algeria	15	28	22	22	37	37	34	39	39	35	22	8	30	18	4	2	36	1,652
Morocco	3	1	0	1	5	1	3	2	3	3	8	6	0	3	7	12	57	549
Egypt	49	45	50	50	49	61	91	87	118	101	111	99	92	72	64	49	4	2,653
Mozambique	2	0	0	1	4	0	0	5	6	3	7	5	7	8	6	1	0	107

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

60

Statistics of Petroleum Exploration in the World Outside the United States and Canada Through 2015

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Africa[10]—Continued											
Tanzania	0	1	0	0	0	0	0	1	3	2	5	4	8	6	9	4	0	67
Burundi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
South Africa	2	3	0	6	1	0	0	0	1	2	0	0	0	1	1	0	97	454
Namibia	0	0	2	0	0	0	0	0	1	0	0	0	2	3	2	0	0	25
Botswana	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
Lesotho	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zambia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Zimbabwe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gabon	6	12	9	10	8	15	13	4	13	16	14	10	6	12	12	2	9	789
Congo (Brazzaville)	5	4	1	1	2	7	6	7	1	6	5	4	3	5	3	2	0	236
Cameroon	1	0	2	3	2	2	2	4	5	2	1	7	3	3	4	6	0	233
Equatorial Guinea	4	10	12	8	9	6	1	6	5	1	4	1	2	2	2	2	0	118
Central African Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Congo (Kinshasa)	1	1	0	0	1	0	0	0	0	0	3	1	0	1	0	0	0	56
Sudan	8	12	12	3	13	12	8	5	0	4	4	7	1	1	1	1	0	163
South Sudan	7	11	16	7	15	17	25	26	17	12	13	4	0	0	0	0	0	207
Chad	0	0	5	0	3	5	8	5	0	5	25	4	1	3	4	3	0	101
Mauritania	0	3	2	2	7	6	5	2	1	0	0	3	0	1	3	2	0	52
Niger	3	0	0	0	1	2	0	2	0	6	10	11	15	4	1	11	0	97
Mali	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Uganda	0	0	0	1	2	0	3	1	5	8	4	4	5	4	0	0	0	38
Western Sahara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	52
Madagascar	1	0	0	0	0	0	0	0	17	1	0	3	0	0	0	0	0	106
Mauritius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Total	166	185	186	176	214	232	275	312	332	297	341	237	239	220	205	129	306	13,479

[10]No wildcat wells were reported for Burkina Faso, Cabo Verde, Comoros, Djibouti, Malawi, Reunion, Rwanda, Sao Tome and Principe, or Swaziland.

[11]Guinea-Bissau and Senegal share the Guinea-Bissau/Senegal Joint Economic Zone (JEZ).

[12]Angola and Congo (Brazzaville) share the Angola/Congo Unitized Area.

[13]Nigeria and Sao Tome and Principe share the Nigeria/Sao Tome and Principe Joint Development Zone (JDZ).

[14]Libya and Tunisia share the Libya/Tunisia Joint Exploration Zone (JEZ).

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
							Asia[15]													
China	982	132	48	39	46	73	146	125	66	62	230	334	299	218	245	274	181	272	343	324
Mongolia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kazakhstan	217	5	10	10	17	23	18	14	36	25	15	20	10	15	20	47	19	20	28	30
Azerbaijan	233	6	8	7	15	10	19	14	8	11	13	12	12	8	6	7	10	9	9	13
Turkmenistan	78	18	10	13	20	42	23	18	30	19	25	17	19	22	21	13	18	27	22	25
Uzbekistan	54	11	6	11	8	9	12	12	11	7	14	9	2	13	17	17	9	10	12	11
Georgia	116	4	16	18	19	13	20	18	19	20	20	25	17	25	34	25	15	24	12	15
Kyrgyzstan	16	1	3	2	2	2	2	1	3	3	1	0	1	2	1	2	3	0	3	0
Tajikistan	5	3	2	0	1	0	1	1	1	3	2	0	0	1	1	0	1	3	1	2
Armenia	12	10	11	5	4	3	5	7	2	3	6	1	6	1	2	0	0	0	0	0
Pakistan	86	2	2	1	3	2	2	2	2	3	1	4	2	4	4	4	2	3	2	3
Afghanistan	5	3	4	6	6	4	2	3	3	0	4	1	1	5	2	10	5	2	6	5
India	25	2	13	4	8	13	9	7	10	8	15	10	11	5	7	11	19	15	23	13
Bangladesh	16	0	2	1	0	1	0	1	0	2	1	0	0	0	0	0	6	3	1	0
Maldives	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Nepal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sri Lanka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	0	0
Vietnam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	2	0	0	8
Burma	107	4	6	0	2	1	0	0	1	1	1	2	6	5	8	10	14	5	5	2
Thailand	1	0	0	1	0	0	0	0	0	3	2	2	5	6	15	6	15	0	1	1
Cambodia	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0
Laos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Japan	33	5	3	5	4	3	4	4	8	3	0	5	8	12	19	23	16	21	25	14
Japan/South Korea JDZ[16]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Korea	0	0	0	0	0	0	0	6	1	0	0	0	1	4	0	2	0	0	0	0
North Korea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Philippines	80	8	6	3	12	0	0	0	0	0	1	13	7	10	8	12	8	12	12	18

Area	Pre-1961	1961	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Asia[15]—Continued																				
Taiwan	18	1	2	1	4	3	8	7	5	10	6	7	3	15	11	16	8	7	8	7
Indonesia	1,062	5	1	10	16	10	7	10	24	28	78	134	114	145	143	131	106	81	98	113
Malaysia	68	7	5	3	1	0	2	11	16	25	44	21	26	20	10	23	2	10	17	34
Malaysia/Thailand JDA[17]	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Brunei	11	1	1	1	0	0	0	0	2	4	2	1	6	4	1	7	4	2	4	3
Total	**3,226**	**228**	**159**	**141**	**188**	**212**	**280**	**261**	**248**	**240**	**481**	**619**	**557**	**540**	**580**	**645**	**468**	**526**	**632**	**642**
Southwestern Pacific[18]																				
Papua New Guinea	56	0	1	1	1	1	0	3	8	3	2	2	1	5	1	4	2	1	1	0
Fiji	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Caledonia[19]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Australia	481	16	64	96	132	139	92	79	74	91	92	54	72	54	44	23	14	15	52	49
Timor-Leste	3	2	0	0	0	0	0	0	0	2	3	4	3	0	0	1	0	0	0	0
Timor Sea JPDA[20]	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
New Zealand	91	3	3	3	12	5	3	4	4	9	9	10	10	2	1	5	6	3	9	1
Total	**631**	**21**	**68**	**100**	**145**	**145**	**95**	**86**	**86**	**105**	**106**	**71**	**86**	**61**	**46**	**33**	**22**	**19**	**65**	**50**
Russia																				
Russia	1,488	264	283	273	272	246	230	196	207	245	212	248	200	193	219	253	217	245	218	209
Grand total for study area																				
Grand total	**20,477**	**1,883**	**1,854**	**1,823**	**1,762**	**1,887**	**1,882**	**1,683**	**1,687**	**1,804**	**1,972**	**2,209**	**2,043**	**1,911**	**1,995**	**2,091**	**1,871**	**1,943**	**2,093**	**2,007**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Asia[15]—Continued													
China	301	184	172	228	313	343	299	344	339	308	231	234	227	236	201	248	229	272	274	215
Mongolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	1	0
Kazakhstan	31	31	40	39	23	34	49	50	72	41	48	68	54	52	18	10	11	3	10	16
Azerbaijan	9	8	11	7	3	5	9	4	7	8	2	0	3	5	2	3	7	2	3	6
Turkmenistan	27	24	25	24	21	25	27	36	23	33	27	24	19	16	9	6	1	8	7	7
Uzbekistan	12	17	9	8	9	4	5	11	10	10	9	18	13	11	9	14	2	1	13	14
Georgia	21	17	26	33	35	30	29	20	27	24	14	10	7	2	0	2	0	0	0	1
Kyrgyzstan	0	1	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Tajikistan	3	3	1	2	3	4	7	5	1	1	0	0	0	0	0	0	0	0	0	0
Armenia	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	12	0
Pakistan	2	8	4	10	16	15	12	7	18	18	15	11	16	25	17	26	26	21	27	14
Afghanistan	0	0	2	2	1	0	0	0	0	1	0	0	5	0	0	0	0	0	0	0
India	25	23	11	25	32	36	44	47	47	75	95	93	93	50	53	53	55	36	54	38
Bangladesh	0	5	2	0	0	1	1	0	4	2	1	0	0	0	1	0	0	1	3	2
Maldives	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Nepal	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Sri Lanka	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vietnam	5	0	0	0	0	1	1	0	1	3	6	11	3	17	21	18	20	11	3	1
Burma	2	11	8	7	15	10	8	4	3	4	4	9	10	5	6	8	7	4	4	2
Thailand	3	11	15	26	17	12	2	15	13	2	10	8	11	11	10	4	7	15	10	9
Cambodia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	4	0	1	0
Laos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Japan	10	13	9	7	8	9	10	7	7	5	6	8	5	6	3	1	5	3	5	4
Japan/South Korea JDZ[16]	2	1	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
South Korea	0	0	0	1	0	0	0	1	0	3	2	4	0	2	0	0	0	0	1	0
North Korea	1	1	4	0	3	1	0	1	1	1	1	1	0	0	0	0	0	0	0	1
Philippines	22	12	15	3	0	0	0	3	7	5	3	6	3	3	5	3	4	2	4	2

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

64

Area	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	1999
							Asia[15]—Continued													
Taiwan	10	8	6	7	2	3	3	1	1	0	0	3	1	6	2	2	6	2	5	0
Indonesia	116	126	130	145	117	120	72	56	91	70	81	104	91	77	60	62	73	92	81	64
Malaysia	19	29	12	3	7	12	4	8	7	19	33	42	29	21	25	15	3	5	9	9
Malaysia/Thailand JDA[17]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	9	2	0
Brunei	1	6	5	3	12	3	1	2	4	4	7	3	2	2	3	0	1	6	4	2
Total	**622**	**541**	**508**	**581**	**638**	**670**	**584**	**624**	**684**	**639**	**597**	**658**	**592**	**547**	**450**	**478**	**468**	**495**	**534**	**407**
							Southwestern Pacific[18]—Continued													
Papua New Guinea	1	0	1	1	7	3	2	2	5	11	19	7	3	2	5	6	5	2	1	3
Fiji	2	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Caledonia[19]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Australia	81	104	166	147	152	191	114	173	144	103	130	109	89	80	84	106	116	118	136	88
Timor-Leste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Timor Sea JPDA[20]	0	0	0	0	0	0	0	0	0	0	0	0	0	4	13	5	5	7	4	2
New Zealand	4	5	2	8	17	20	15	10	14	5	6	6	5	8	4	4	8	7	8	5
Total	**88**	**110**	**173**	**156**	**176**	**214**	**131**	**185**	**163**	**119**	**155**	**122**	**97**	**94**	**106**	**121**	**134**	**134**	**149**	**98**
							Russia—Continued													
Russia	244	238	284	311	290	333	391	485	500	396	396	307	219	136	111	67	85	79	54	51
							Grand total for study area—Continued													
Grand total	**2,239**	**2,388**	**2,644**	**2,471**	**2,630**	**2,777**	**2,453**	**2,385**	**2,510**	**2,256**	**2,240**	**2,142**	**1,814**	**1,559**	**1,423**	**1,452**	**1,500**	**1,562**	**1,553**	**1,157**

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
							Asia[15]—Continued											
China	82	83	88	166	88	79	77	99	138	115	96	85	87	75	71	55	445	11,566
Mongolia	2	0	2	3	0	2	0	0	0	0	2	1	2	0	0	0	53	74
Kazakhstan	9	9	18	14	8	15	28	23	26	8	20	21	21	16	10	12	470	2,027
Azerbaijan	4	7	5	2	9	2	0	0	2	1	1	2	1	2	1	1	192	766
Turkmenistan	7	7	4	9	16	12	6	10	7	14	1	5	1	2	3	1	393	1,367
Uzbekistan	16	12	22	17	17	20	20	18	31	49	21	2	4	1	0	0	95	799
Georgia	2	1	1	0	1	0	1	2	3	0	0	1	0	2	0	0	69	856
Kyrgyzstan	1	3	0	0	1	1	0	0	0	3	0	1	0	0	0	0	1	64
Tajikistan	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	37	99
Armenia	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	100
Pakistan	17	14	19	31	25	24	31	31	28	27	25	15	27	33	45	61	0	895
Afghanistan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	90
India	45	54	57	41	77	61	67	87	96	100	98	69	53	59	66	79	74	2,396
Bangladesh	3	0	0	0	2	1	0	1	1	0	0	4	5	2	2	1	0	79
Maldives	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nepal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sri Lanka	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	10
Vietnam	9	5	8	11	14	8	7	15	18	14	9	12	9	12	13	4	50	356
Burma	8	8	3	3	4	11	11	11	18	9	3	9	6	3	7	9	36	470
Thailand	14	14	5	4	13	8	7	7	7	27	25	21	17	32	21	21	0	512
Cambodia	0	0	0	1	3	2	0	0	1	0	1	0	2	0	0	0	0	23
Laos	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Japan	3	5	1	1	1	1	0	0	1	0	0	0	1	1	0	0	20	381
Japan/South Korea JDZ[16]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
South Korea	0	0	0	0	1	2	2	0	0	0	0	0	1	0	0	2	0	36
North Korea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Philippines	2	0	0	1	2	0	0	1	6	0	6	2	2	3	1	2	4	344

Table 4. Wildcat wells by year, 1961–2015, for the Caribbean, Central America, Mexico, South America, Europe, the Middle East, Africa, Asia, the southwestern Pacific, and Russia.—Continued

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Unkn	Total
						Asia[15]—Continued												
Taiwan	2	0	0	0	2	1	1	1	0	1	2	0	0	2	0	1	45	273
Indonesia	77	75	53	48	52	46	63	52	40	42	54	46	73	55	56	29	84	5,089
Malaysia	23	26	22	23	33	35	29	24	20	24	24	24	30	28	38	26	8	1,093
Malaysia/Thailand JDA[17]	0	0	4	0	0	0	0	3	2	2	0	1	1	0	0	0	0	32
Brunei	4	6	1	3	1	1	2	1	1	1	4	5	4	7	1	1	7	175
Total	**330**	**330**	**313**	**378**	**370**	**332**	**353**	**386**	**447**	**437**	**393**	**331**	**347**	**335**	**336**	**305**	**2,089**	**30,002**
						Southwestern Pacific[18]—Continued												
Papua New Guinea	3	0	3	2	2	3	5	5	7	0	3	6	4	6	3	6	4	241
Fiji	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
New Caledonia[19]	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Tonga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Australia	97	123	72	88	112	104	136	126	157	116	83	87	77	90	81	64	27	5,804
Timor-Leste	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	20
Timor Sea JPDA[20]	2	1	0	0	0	1	0	0	1	2	4	0	0	0	0	0	0	52
New Zealand	14	10	17	11	12	35	24	24	14	9	16	6	5	11	22	1	0	585
Total	**119**	**134**	**92**	**101**	**126**	**143**	**165**	**155**	**179**	**127**	**106**	**101**	**86**	**107**	**106**	**71**	**31**	**6,715**
						Russia—Continued												
Russia	154	138	214	137	116	112	191	159	164	188	100	102	57	60	54	80	1,414	14,335
						Grand total for study area—Continued												
Grand total	**1,271**	**1,373**	**1,276**	**1,309**	**1,348**	**1,361**	**1,548**	**1,727**	**1,906**	**1,736**	**1,592**	**1,534**	**1,456**	**1,373**	**1,330**	**1,032**	**7,135**	**128,339**

[15]No wildcat wells were reported for Bhutan or Singapore.

[16]Japan and South Korea share the Japan/South Korea Joint Development Zone (JDZ).

[17]Malaysia and Thailand share the Malaysia/Thailand Joint Development Area (JDA).

[18]No wildcat wells were reported for French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia, Nauru, Northern Mariana Islands, Samoa, Solomon Islands, Tuvalu, or Vanuatu.

[19]New Caledonia is listed separately although it is an overseas territory of France.

[20]Australia and Timor-Leste share the Timor Sea Joint Petroleum Development Area (JPDA).

Table 5.   Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Caribbean (fig. 11)			
Greater Antilles Deformed Belt, 6117 (Cuba and Dominican Republic)	1881	603	561
Central America (fig. 12)			
Yucatan Platform,* 5308 (Belize and Guatemala)	1982	184	3
Mexico (fig. 13)			
Tampico-Misantla Basin, 5301	1904	9,762	18,222
Macuspana Basin, 5306	1905	14	6,474
Saline-Comalcalco Basin, 5304	1910	4,358	4,827
Burgos Basin, 5300	1927	99	16,051
Veracruz Basin, 5302	1953	193	7,639
Villahermosa Uplift, 5305	1954	43,731	55,488
Chicontepec Basin, 5317	1957	383	980
Yucatan Platform,* 5308	1966	0	3
Gulf Cenozoic OCS, 5097	2012	129	277
Total		**58,668**	**109,961**
South America (figs. 14–22)			
Progreso Basin, 6083 (Ecuador and Peru)	1863	299	888
East Venezuela Basin, 6098 (Venezuela and Trinidad and Tobago)	1867	38,473	192,486
Talara Basin, 6081 (Peru)	1869	2,472	6,465
San Jorge Basin, 6058 (Argentina)	1907	6,722	7,495
Maracaibo Basin, 6099 (Colombia and Venezuela)	1914	64,359	70,208
Middle Magdelena, 6090 (Colombia)	1918	3,215	3,855
Neuquen Basin, 6055 (Argentina)	1922	6,343	39,983
Santa Cruz-Tarija Basin, 6045 (Argentina, Bolivia, and Paraguay)	1924	424	62,274
Cuyo Basin, 6051 (Argentina)	1933	1,622	386
Reconcavo Basin, 6032 (Brazil)	1939	2,040	4,388
Ucayali Basin, 6040 (Peru)	1939	68	9,233
Magallanes Basin, 6059 (Argentina and Chile)	1945	1,152	30,143
Llanos Basin, 6096 (Colombia and Venezuela)	1948	7,381	10,809
Barinas-Apure Basin, 6097 (Venezuela)	1948	2,342	750
Upper Magdelena, 6089 (Colombia)	1949	1,041	862
Sergipe-Alagoas Basin, 6029 (Brazil)	1957	2,574	5,282
Putumayo-Oriente-Maranon Basin, 6041 (Colombia, Ecuador, and Peru)	1963	11,792	3,224
Guyana-Suriname Basin, 6021 (French Guiana, Guyana, and Suriname)	1965	515	164
Espirito Santo Basin, 6034 (Brazil)	1969	2,837	5,058
Caera Basin, 6026 (Brazil)	1971	294	311

Table 5. Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
South America (figs. 14–22)—Continued			
Tobago Trough, 6103 (Venezuela and Trinidad and Tobago)	1971	0	10,608
Campos Basin, 6035 (Brazil)	1972	28,623	19,409
Potigar Basin, 6027 (Brazil)	1973	2,004	3,689
Guajira Basin, 6095 (Colombia)	1973	0	6,015
Foz do Amazonas Basin, 6022 (Brazil)	1976	1	1,111
Solimoes Basin, 6011 (Brazil)	1978	367	5,083
Santos Basin, 6036 (Brazil)	1979	49,935	113,395
South Caribbean Deformed Belt, 6104 (Colombia and Venezuela)	1979	95	11,445
Madre dos Dios Basin, 6043 (Bolivia and Peru)	1984	1	15,598
Eastern Cordillera Basin, 6092 (Colombia)	1994	145	716
Falklands Plateau, 6060 (Falkland Islands)	1998	453	2,771
Malvinas Plateau, 6062 (Falkland Islands)	2012	0	6,000
Total		**237,591**	**650,103**
Europe (figs. 23–25)			
Carpathian-Balkanian Basin, 4061 (Bulgaria, Moldova, and Romania)	1835	6,603	14,281
North Carpathian Basin, 4047 (Austria, Czech Republic, Poland, Romania, Slovakia, and Ukraine)	1850	1,839	20,299
Pannonian Basin, 4048 (Austria, Bosnia and Herzegovina, Croatia, Hungary, Romania, Serbia, Slovakia, Slovenia, and Ukraine)	1856	2,586	16,903
Northwest German Basin, 4035 (Denmark, Germany, and Netherlands)	1856	2,726	159,837
Alps, 4051 (Croatia, Italy, Macedonia, Romania, and Serbia)	1860	1,300	6,873
Azov-Kuban Basin,* 1108 (Ukraine)	1864	43	752
Ireland-Scotland Platform, 4026 (Ireland and United Kingdom)	1876	432	4,920
Transylvanian Basin, 4057 (Romania and Ukraine)	1880	1	32,703
Po Basin, 4060 (Croatia, Italy, and San Marino)	1890	317	25,336
Anglo-Paris Basin, 4040 (France and United Kingdom)	1896	952	420
Bohemia, 4046 (Austria, Czech Republic, Germany, and Slovakia)	1914	998	5,539
Tuscany-Latium-Paola, 4062 (Italy)	1915	1	2,580
Adriatic Basin, 4058 (Albania, Croatia, and Italy)	1918	923	2,863
Anglo-Dutch Basin, 4036 (Netherlands and United Kingdom)	1919	764	90,586
German-Polish Basin, 4033 (Germany and Poland)	1925	238	12,616
Dnieper-Donets Basin,* 1009 (Ukraine)	1936	2,994	92,936
Irish Sea, 4030 (United Kingdom)	1939	246	10,189
Pyrenean Foothills-Ebro Basin, 4044 (France and Spain)	1939	132	12,255
Sicily,* 4066 (Italy and Malta)	1940	565	1,471
Aquitaine Basin, 4045 (France)	1954	403	34

Table 5. Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Europe (figs. 23–25)—Continued			
Pripyat Basin, 1010 (Belarus)	1963	1,241	669
North Sea Graben, 4025 (Denmark, Germany, Netherlands, Norway, and United Kingdom)	1966	60,829	205,732
Iberic Cordillera, 4083 (Spain)	1967	293	241
Aegean,* 4075 (Greece)	1971	173	156
Horda-Norwegian-Danish Basin, 4023 (Denmark and Norway)	1972	360	291
Faeroes-Shetland-Orkney Basin, 4019 (Faroe Islands and United Kingdom)	1977	2,961	6,618
Hammerfest-Varanger Basin, 4015 (Norway)	1981	264	11,420
Vestford-Helgeland, 4017 (Norway)	1981	4,546	35,589
Pelagian Basin,* 2048 (Italy)	1988	15	2
Central Barents Platform,* 4012 (Norway)	2008	976	2,698
Black Sea Continental Slope, 1107 (Romania)	2012	0	3,200
Total		**95,554**	**780,985**
Middle East (figs. 26–30)			
Zagros Fold Belt, 2030 (Iran, Iraq, Syria, and Turkey)	1905	175,325	585,247
Greater Ghawar Uplift, 2021 (Bahrain, Qatar, and Saudi Arabia)	1932	168,940	229,070
Mesopotamian Foredeep Basin, 2024 (Iran, Iraq, Kuwait, former Kuwait-Saudi Arabia Neutral Zone, and Saudi Arabia)	1938	441,861	445,175
Widyan Basin-Interior Platform, 2023 (Iraq, Kuwait, and Saudi Arabia)	1939	31,762	20,510
Euphrates/Mardin, 2075 (Syria and Turkey)	1940	1,350	3,893
Rub Al Khali Basin, 2019 (Iran, Oman, Qatar, Saudi Arabia, and United Arab Emirates)	1954	116,743	289,766
Levantine Basin,* 2032 (Cyprus, Gaza Strip, and Israel)	1955	161	40,571
South Oman Salt Basin, 2011 (Oman)	1956	3,532	4,139
South Caspian Basin,* 1112 (Iran)	1960	492	1,200
Fahud Salt Basin, 2016 (Oman)	1962	5,353	13,863
Ghaba Salt Basin, 2014 (Oman)	1964	2,025	28,857
Central Oman Platform, 2015 (Oman)	1966	344	15,839
Kura Basin,* 1113 (Iran)	1967	3	1
Qatar Arch, 2022 (Iran and Qatar)	1967	4,850	1,522,941
Kopet-Dag Foldbelt, 1155 (Iran)	1967	0	2,000
Amu-Darya Basin,* 1154 (Iran)	1968	0	17,305
Palmyra Zone, 2077 (Syria)	1968	241	6,147
Red Sea Basin,* 2071 (Saudi Arabia)	1969	99	4,090
East Flank Oman Sub-basin, 2012 (Oman)	1973	3,232	187
Anah Graben, 2089 (Syria)	1982	440	280

Table 5.   Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Middle East (figs. 26–30)—Continued			
Ma'Rib-Al Jawf/Masila Basin, 2004 (Yemen)	1984	1,634	14,597
Khleisha Uplift, 2074 (Syria)	1986	1,887	1,847
Aegean,* 4075 (Turkey)	1988	0	338
Interior Homocline-Central Arch, 2020 (Saudi Arabia)	1989	6,635	23,580
Masila-Jeza Basin, 2009 (Yemen)	1991	2,003	621
Total		**968,910**	**3,272,061**
Africa (figs. 31–42)			
Red Sea Basin,* 2071 (Egypt, Eritrea, and Sudan)	1907	11,280	9,047
Pelagian Basin,* 2048 (Libya and Tunisia)	1949	2,825	28,143
West-Central Coastal, 7203 (Angola, Cameroon, Congo [Brazzaville], Congo [Kinshasa], Equatorial Guinea, and Gabon)	1951	37,326	65,696
Benue, 7136 (Nigeria)	1953	10	1,270
Mozambique Coastal, 7343 (Mozambique)	1953	50	9,636
Grand Erg/Ahnet Basin, 2058 (Algeria)	1954	605	125,545
Niger Delta, 7192 (Cameroon, Equatorial Guinea, and Nigeria)	1954	65,648	259,668
Morondava, 7373 (Madagascar)	1955	678	154
Trias/Ghadames Basin, 2054 (Algeria, Libya, and Tunisia)	1956	21,458	47,020
Illizi Basin, 2056 (Algeria and Libya)	1956	4,655	50,204
Hamra Basin, 2047 (Libya)	1957	1,303	4,253
Sirte Basin, 2043 (Libya)	1958	46,398	55,009
Senegal, 7013 (Guinea-Bissau, Mauritania, and Senegal)	1959	830	4,476
Somali, 7255 (Ethiopia, Kenya, and Somalia)	1959	155	4,577
Fezzan Uplift, 2046 (Libya)	1961	309	158
Taoudeni Basin, 7035 (Algeria, Mali, and Mauritania)	1963	0	1,711
Nile Delta Basin, 2035 (Egypt)	1966	32	89,099
North Egypt Basin, 2039 (Egypt)	1966	1,514	13,914
Levantine Basin,* 2032 (Egypt)	1967	19	3,969
Abu Gharadiq Basin, 2038 (Egypt)	1968	1,190	5,437
Gulf of Guinea, 7183 (Benin, Cote d'Ivoire, Ghana, Nigeria, and Togo)	1968	2,850	10,541
Karoo, 7355 (South Africa)	1969	0	1,483
South African Coastal, 7363 (South Africa)	1969	136	3,680
Tanzania Coastal, 7273 (Kenya, Mozambique, and Tanzania)	1974	10	145,420
Orange River Coastal, 7303 (Namibia and South Africa)	1974	37	2,503
Sud, 7146 (Cameroon, Chad, South Sudan, and Sudan)	1975	5,723	701
Murzuk Basin, 2045 (Libya)	1978	3,886	724

Table 5. Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Africa (figs. 31–42)—Continued			
Sicily,* 4066 (Tunisia)	1982	0	150
Mediterranean Basin, 2070 (Egypt)	2003	0	1,222
East African Rift, 7246 (Uganda)	2006	1,392	252
Total		211,003	945,762
Asia (figs. 43–51)			
Irrawaddy, 8048 (Burma and India)	1864	673	15,933
Assam, 8034 (Bangladesh and India)	1867	2,852	7,820
Niigata Basin, 3308 (Japan)	1867	128	3,751
South Caspian Basin,* 1112 (Azerbaijan and Turkmenistan)	1869	24,871	108,150
Kura Basin,* 1113 (Azerbaijan and Georgia)	1869	539	308
Taiwan Thrust and Fold Belt, 3151 (Taiwan)	1876	1	2,104
Sulaiman-Kirthar, 8025 (Pakistan)	1883	5	20,683
North Sumatra Basin, 3822 (Indonesia, Malaysia, and Thailand)	1885	734	23,990
East Java Basin, 3809 (Indonesia)	1888	1,485	13,019
North Caspian Basin,* 1016 (Kazakhstan)	1892	28,217	134,258
South Sumatra Basin, 3828 (Indonesia)	1896	3,111	27,724
Kutei Basin, 3817 (Indonesia)	1897	3,664	56,737
Northwest Java Basin, 3824 (Indonesia)	1897	3,878	14,112
Banda Arc,* 3803 (Indonesia)	1897	54	2,048
Ganges-Brahmaputra Delta, 8047 (Bangladesh, Burma, and India)	1900	48	35,811
Pamusian Tarakan Basin, 3606 (Indonesia)	1900	795	4,265
Fergana Basin, 1159 (Kyrgyzstan, Tajikistan, and Uzbekistan)	1901	899	1,709
Japan Volcanic Arc/Accreted Terrane, 3304 (Japan and South Korea)	1903	100	1,282
Ordos Basin, 3128 (China)	1907	8,110	69,695
Baram Delta/Brunei-Sabah Basin, 3701 (Brunei and Malaysia)	1910	9,487	57,412
Afghan-Tajik Basin, 1156 (Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan)	1934	180	8,777
Bintuni/Sulawati Province, 3805 (Indonesia)	1936	592	25,648
Junggar Basin, 3115 (China)	1937	5,570	8,448
Barito Basin, 3804 (Indonesia)	1938	186	306
Middle Caspian Basin,* 1109 (Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan)	1939	5,519	10,100
Central Sumatra Basin, 3808 (Indonesia)	1939	15,117	3,675
Qilianshan Fold Belt, 3134 (China)	1939	379	176
Amu-Darya Basin,* 1154 (Afghanistan, Turkmenistan, and Uzbekistan)	1953	1,223	757,114
Greater Sarawak Basin, 3702 (Indonesia, Malaysia, Vietnam)	1953	1,403	123,310

Table 5.   Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Asia (figs. 43–51)—Continued			
Qaidam Basin, 3131 (China)	1955	1,021	9,635
Indus, 8042 (India and Pakistan)	1957	474	32,711
Tarim Basin, 3154 (China)	1958	3,487	63,948
Bombay, 8043 (India)	1958	8,676	38,176
Turpan Basin, 3156 (China)	1958	751	2,349
Northern Irian Jaya Waropen Basin, 3823 (Indonesia)	1958	0	1,100
Songliao Basin, 3144 (China)	1959	22,456	13,753
Bohaiwan Basin, 3127 (China)	1961	24,915	19,572
Temtsag Hailar Basin, 3207 (China and Mongolia)	1961	666	177
Indian Shield, 8003 (India)	1963	1,060	2,147
North Ustyurt Basin, 1150 (Kazakhstan and Uzbekistan)	1964	2,708	9,916
Jianghan Basin, 3112 (China)	1965	397	64
Malay Basin, 3703 (Cambodia, Indonesia, Malaysia, Thailand, and Vietnam)	1969	5,318	66,063
East China Sea Basin, 3109 (China and Taiwan)	1969	102	8,196
Cauvery, 8044 (India and Sri Lanka)	1969	131	4,614
Nanyang Basin, 3126 (China)	1971	608	66
Penyu/West Natuna Basin, 3825 (Indonesia and Malaysia)	1972	984	6,378
Thai Basin, 3507 (Thailand)	1973	971	21,417
Luxi Jiaoliao Uplift, 3124 (China)	1973	1,659	357
Saigon Basin, 3505 (Vietnam)	1974	356	7,771
Yinggehai Basin, 3159 (China and Vietnam)	1975	21	13,581
Mekong/Cuulong/Vung Tau Basin, 3503 (Vietnam)	1975	3,941	5,709
Palawan Shelf, 3605 (Philippines)	1976	168	3,649
Reed Bank Basin, 3609 (Philippines)	1976	0	1,822
Krishna-Godavari, 8045 (India)	1979	788	25,763
Pearl River Mouth Basin, 3130 (China)	1979	2,350	3,656
Volga-Ural Region,* 1015 (Kazakhstan)	1979	202	2,615
Qiongdongnan Basin, 3136 (China and Vietnam)	1979	2	1,961
Thailand Mesozoic Basin Belt, 3508 (Thailand)	1981	374	775
Shanxi Plateau, 3140 (China)	1982	0	7,771
Khorat Platform, 3502 (Thailand)	1982	0	2,322
South China Continental Shelf Slope, 3181 (China and Vietnam)	1984	409	7,700
South Turgay Basin, 1167 (Kazakhstan)	1984	1,936	1,443
Sulawesi Accretionary Prism, 3829 (Indonesia)	1986	21	2,680
Altay-Sayan Folded Region, 1219 (China)	1992	148	2,097

Table 5. Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10^6) of oil; BCF, billion cubic feet (ft^3 x 10^9); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Asia (figs. 43–51)—Continued			
Bonaparte Gulf Basin,* 3910 (Indonesia)	2000	0	18,470
Central Kazakhstan Folded Region, 1168 (Kazakhstan)	2003	150	121
Mahanadi, 8046 (India)	2006	0	2,697
Total		**207,045**	**2,027,924**
Southwestern Pacific (figs. 52–54)			
Taranaki Basin, 3031 (New Zealand)	1867	267	9,052
Surat Basin, 3958 (Australia)	1900	39	26,201
Gippsland Basin, 3930 (Australia)	1924	4,181	14,337
New Guinea Foreland Basin-Fold Belt, 3966 (Papua New Guinea)	1949	829	24,965
Northwest Shelf, 3948 (Australia)	1954	2,462	146,818
Bowen Basin, 3911 (Australia)	1955	0	7,570
Papuan Basin-Shelf Platform, 3969 (Papua New Guinea)	1958	<1	4,928
Bonaparte Gulf Basin,* 3910 (Australia)	1964	588	32,811
Eromanga Basin, 3924 (Australia)	1964	497	21,129
Perth Basin, 3952 (Australia)	1964	49	4,333
Clarence-Moreton Basin, 3919 (Australia)	1968	0	2,675
Browse Basin, 3913 (Australia)	1971	169	49,092
Total		**9,081**	**343,910**
Russia (fig. 55)			
Azov-Kuban Basin,* 1108	1864	2,222	20,217
Middle Caspian Basin,* 1109	1893	7,410	34,582
Timan-Pechora Basin, 1008	1916	15,757	39,967
North Sakhalin Basin, 1322	1923	3,721	41,958
Volga-Ural Region,* 1015	1929	80,354	99,238
West Siberian Basin, 1174	1953	172,142	1,647,065
Angara-Lena Terrace, 1209	1954	2	50,681
Lena-Vilyuy Basin, 1214	1956	0	15,528
Nepa-Botuoba Arch, 1210	1962	3,754	47,140
Dnieper-Donets Basin,* 1009	1963	6	796
North Caspian Basin,* 1016	1963	143	65,618
Yenisey-Khatanga Basin, 1175	1965	38	18,549
Baykit Arch, 1207	1974	1,820	12,613
South Barents Basin, 1050	1983	0	126,034
Central Barents Platform,* 4012	1984	0	156
Ludlov Saddle, 1059	1990	0	2,470

Table 5.   Year of first discovery and cumulative recoverable oil and gas discovered through 2015 in the 212 significant provinces in the study area.—Continued

[Each significant province has at least one field containing 100 million barrels of recoverable oil or 600 billion cubic feet of recoverable gas. Some provinces (marked by an asterisk) have resources in more than one region, and the petroleum in each part of the province is apportioned to the correct region. Data are from IHS Markit (2016). Province names and code numbers are from U.S. Geological Survey World Energy Assessment Team (2000). The provinces in this table are listed within each region by year of first discovery. Province boundaries are mapped and data on oil and gas discoveries in significant provinces are given in figures 11–55 for all regions. MMBO, million barrels (bbl x 10⁶) of oil; BCF, billion cubic feet (ft³ x 10⁹); OCS, Outer Continental Shelf]

Petroleum province name and code (country)	Year of first discovery	Cumulative recoverable oil discovered though 2015 (MMBO)	Cumulative recoverable gas discovered though 2015 (BCF)
Russia (fig. 55)—Continued			
Deryugin Basin, 1321	2006	133	5,593
Kempendiay Region, 1212	2009	0	700
Total		**287,501**	**2,228,904**

Table 6.   Decadal average discovery size by region of fields discovered at drilling depths of less than 10,000 feet and fields discovered at drilling depths of at least 10,000 feet.

[Data are from IHS Markit (2016). The "Study area" column includes data for the Caribbean and Central America, as well as for the eight regions listed in the table. On the basis of calorific heating values, it is assumed that 1 barrel of oil is equivalent to 6,000 cubic feet of natural gas; that is, 1 BOE = 1 barrel of crude oil or 6,000 cubic feet of natural gas or 1.5 barrels of natural gas liquids]

Average discovery size in millions of barrels of oil equivalent (MMBOE)									
Decade	Mexico	South America	Europe	Middle East	Africa	Asia	Southwestern Pacific	Russia	Study area
Fields at depths of less than 10,000 feet									
1956–1965	46	70	44	2,787	288	193	12	266	240
1966–1975	22	47	44	2,344	134	103	100	547	248
1976–1985	262	32	19	129	53	42	39	191	62
1986–1995	4	16	13	51	36	32	14	106	37
1996–2005	6	14	11	20	52	35	24	30	28
2006–2015	4	10	23	22	31	15	14	19	18
Fields at depths of at least 10,000 feet									
1956–1965	140	161	69	3,991	640	174	30	184	603
1966–1975	64	108	148	1,250	131	282	160	541	333
1976–1985	303	51	98	563	62	175	270	301	159
1986–1995	127	104	33	793	68	54	86	72	114
1996–2005	17	122	27	409	115	316	80	28	158
2006–2015	37	251	21	196	117	41	58	21	94

Table 7. Regional distribution in the study area of land area, delineated prospective area, explored area, cumulative recoverable oil and gas discoveries, and wildcat wells drilled through 2015 and percentages of total delineated prospective area, explored area, cumulative recoverable oil and gas discoveries, and wildcat wells at depths of at least 10,000 feet.

[Data are from IHS Markit (2016). Land areas in square miles (mi²) are converted from areas in square kilometers in "The World Factbook 2001" (U.S. Central Intelligence Agency, 2001) and "The World Factbook 2016" (U.S. Central Intelligence Agency, 2016). ft, foot; BBO, billion barrels (bbl x 10⁹) of oil; TCF, trillion cubic feet (ft³ x 10¹²)]

Region	Land area (mi²)	Delineated prospective area		Explored area		Oil		Natural gas		Wildcat wells	
		At surface (mi²)	At depth of 10,000 ft (percent)	At surface (mi²)	At depth of 10,000 ft (percent)	Total (BBO)	At depth of ≥10,000 ft (percent)	Total (TCF)	At depth of ≥10,000 ft (percent)	Total	At depth of ≥10,000 ft (percent)
Caribbean	86,524	20,863	32	3,736	25	1	49	1	74	553	14
Central America	196,127	17,025	21	2,292	22	<1	0	<1	0	292	22
Mexico	750,561	103,090	68	32,295	55	59	54	115	53	4,478	38
South America	6,769,307	572,056	45	150,269	36	238	49	660	56	21,916	26
Europe	2,186,167	878,761	42	224,990	34	96	52	794	46	30,861	24
Middle East	2,377,520	372,542	53	69,660	41	969	28	3,275	44	5,708	32
Africa	11,495,615	720,482	48	136,329	45	213	42	1,000	57	13,479	39
Asia	9,537,566	1,322,373	45	299,181	37	210	30	2,048	70	30,002	33
Southwestern Pacific	3,282,520	471,586	16	80,964	16	9	24	350	61	6,715	17
Russia	6,323,482	801,354	47	204,997	34	288	13	2,231	31	14,335	29
Total study area	**43,003,681**	**5,280,132**	**43**	**1,204,713**	**36**	**2,084**	**32**	**10,475**	**42**	**128,339**	**29**

Figures 11–55

Introduction.— Figures 11–55 show delineated prospective area, explored area, and known petroleum provinces of the study area regions—the Caribbean (fig. 11), Central America (fig. 12), Mexico (fig. 13), South America (figs. 14–22), Europe (figs. 23–25), the Middle East (figs. 26–30), Africa (figs. 31–42), Asia (figs. 43–51), the southwestern Pacific (figs. 52–54), and Russia (fig. 55). Each figure includes a map, two graphs, and a summary of the exploration data. If significant provinces occur in the mapped area, then a table provides information on each significant province. Definitions of terms are provided below.

Maps.—All maps in Circular 1288 (Attanasi and others, 2007) were drawn by using ArcView software (version 3.2, created by Environmental Systems Research Institute, Inc. [ESRI]) and were edited in Adobe Illustrator (version 10). If possible, only the delineated prospective areas and explored areas were revised for use in this Circular; otherwise, new maps with new map extents were drawn by using ArcGIS software (version 10.3.1, created by ESRI) and were edited in Adobe Illustrator (version CS6). Each map is shown in unprojected geographic coordinates, except for the northern part of Western Europe (fig. 23) and Russia (two maps in fig. 55). These three maps are shown in equidistant conic projection to minimize distortion of distance over the near-polar areas. Scales are not provided, as the scale varies on unprojected maps.

Methods for computing and identifying delineated prospective areas and explored areas are explained in the text and are the same methods as those used in Attanasi and Root (1993). Recall that the delineated prospective area is described as the set of all (grid) points that are reasonably close to wells (producing or dry) and that are also inside the area drilled. Also recall that the explored area is defined as the area consisting of the points in the delineated prospective area that are within 2 miles of a well. The computation of delineated prospective area and explored area used locations of all wildcat, exploration, and development wells, both successful and dry, along with the locations of fields. All data except data for wells with a missing or obviously incorrect location were used because, for some areas, most of the wildcat well history, particularly prior to 1950, is missing. The dry and producing well locations and field locations may represent the only evidence of prior exploration. Use of all the data added some redundancy to the computations but assured that no area that had been searched was excluded because of missing wildcat or exploration wells.

Landmass outlines and country boundaries are from the "Data & Maps Series Cntry98 File" (ESRI, 1998). The countries of Kosovo and South Sudan have been recognized since the publication of Circular 1288 (Attanasi and others, 2007), so country boundaries separating South Sudan from Sudan and Kosovo from Serbia are from the "ne_10m_admin_0_countries"

file (Natural Earth, 2016). Exclusive economic zones are shared by multiple countries. In such situations, neighboring countries have agreed to joint economic zones (JEZs), joint development zones (JDZs), or joint development areas (JDAs). These areas are not delineated on the maps because standard boundaries were not available. However, the general location of an exclusive economic zone may be labeled where IHS Markit (2016) assigned discoveries to that zone. Country names are from the "The World Factbook 2016" (U.S. Central Intelligence Agency [CIA], 2016). If only part of the country is shown, then no delineated prospective area was identified in the rest of the country. Selected major rivers and lakes are from the "ArcWorld 1:3M Rivers and Water Bodies Coverage" (ESRI, 1992).

Generalized bathymetric contour lines are shown at 200 and 1,000 meters (656 and 3,280 feet) below sea level. Contour lines were generated from the "ETOPO5 5-Minute-Gridded Elevation Data" (National Geophysical Data Center, 1988) by using ESRI's Arc/Info software (version 8.2). ETOPO5 is a raster dataset of worldwide land and sea-floor elevations at 5-minute spacing. Contour lines were then generalized in Arc/Info to smooth the lines and to reduce jagged features.

Petroleum province names, boundaries, and code numbers are from the "U.S. Geological Survey World Petroleum Assessment 2000" (U.S. Geological Survey World Energy Assessment Team, 2000). Of all the known petroleum provinces shown in figures 11–55, 212 are classified as significant because, by the end of 2015, they had at least one field containing 100 million barrels of crude oil or 600 billion cubic feet of gas (table 5).

Tables of significant petroleum provinces through 2015.—In figures 11–55, tables facing the maps provide information on the part of each significant province in a country, if there are reported discoveries for that significant province in that country. (Table 5 gives the total cumulative recoverable oil and gas volumes in each significant province in all the countries it occupies.) Data are from the "International Petroleum Exploration and Production Database" (IHS Markit, 2016), and the country order in the significant province tables follows the order in that database. Within each country, provinces are listed alphabetically. The tables show year of first discovery, oil in large oil fields (containing at least 100 million barrels), oil in all oil fields, gas in oil fields, gas in gas fields, and gas in all fields. A field is classified as either oil or gas on the basis of its gas:oil ratio. A field having at least 20,000 cubic feet of gas per barrel of crude oil is classified as a gas field; otherwise, the field is classified as an oil field.

Graphs.—Two graphs are shown with each map in figures 11–55; the two types of graphs are described in the text section "Tools for Analysis: Graphs," and generalized graphs are shown in figure 4. The first graph shows the growth

of cumulative delineated prospective area and explored area, arranged by the year when the areas became prospective or explored, plotted against the cumulative number of wildcat wells drilled in the country or country group through 2015, where the wells are also ordered by time. The second graph shows cumulative recoverable oil and gas discoveries as functions of cumulative delineated prospective area, where the increments of prospective area are ordered by time. Dates are shown at the top of each graph. Data plotted are from IHS Markit (2016).

Only wildcat wells that have spud or completion dates and complete data indicating a location within the country or country group were used to construct graphs. Thus, cumulative wildcat well counts in the graphs are typically less than those in table 4, which includes wells without dates or coordinates.

For many wildcat wells drilled before 1950, data were not available, and, therefore, the delineated prospective areas and explored areas as of 1950 are underestimated in the graphs. Records of followup drilling after 1950 probably result in an overestimate of the rate of increase in the delineated prospective area. Nonetheless, the growth in delineated prospective area after 1970 is probably real and not an artifact of missing data.

Summaries of exploration data.—Land areas for the overseas departments of France (Reunion, Guadeloupe, Martinique, and French Guiana) are from "The World Factbook 2001" (CIA, 2001), and all other land areas are from "The World Factbook 2016" (CIA, 2016). Land areas from the CIA (2001, 2016) in square kilometers were converted to square miles for ease in comparing this Circular with Circular 1288 (Attanasi and others, 2007). The conversion factor was 2.589988110336 square kilometers per square mile. Land areas for country groups may not add to the totals shown because of rounding. Computation of the delineated prospective area and the explored area is explained in the text. Wildcat wells and cumulative recoverable oil and gas discoveries through 2015 are from IHS Markit (2016).

Field depths were calculated from the average vertical depths of a field's production wells, and the field's oil and gas volumes were assigned that depth. Reported discoveries of oil and gas in conventional fields are provided for each country or country group. The percentages of oil and gas assigned to fields at depths of at least 10,000 feet are also provided, along with the percentages of oil in oil fields and gas in gas fields assigned to fields at 10,000 feet or deeper.

EXPLANATION FOR MAPS IN FIGURES 11–55

- Delineated prospective area
- Explored area
- Petroleum province boundary; province names, codes, and boundaries are from U.S. Geological Survey World Energy Assessment Team (2000)
- Country boundary from Environmental Systems Research Institute (ESRI, 1998), except for South Sudan and Kosovo (Natural Earth, 2016); country names are from U.S. Central Intelligence Agency (2016)
- River from ESRI (1992)
- Bathymetry contour at 200 meters (656 feet) from National Geophysical Data Center (1988)
- Bathymetry contour at 1,000 meters (3,280 feet) from National Geophysical Data Center (1988)

UNITS USED IN FIGURES 11–55

BBO	billion barrels of oil (bbl $\times 10^9$)
BCF	billion cubic feet (ft$^3 \times 10^9$)
ft	foot
mi^2	square mile
MMBO	million barrels of oil (bbl $\times 10^6$)
TCF	trillion cubic feet (ft$^3 \times 10^{12}$)
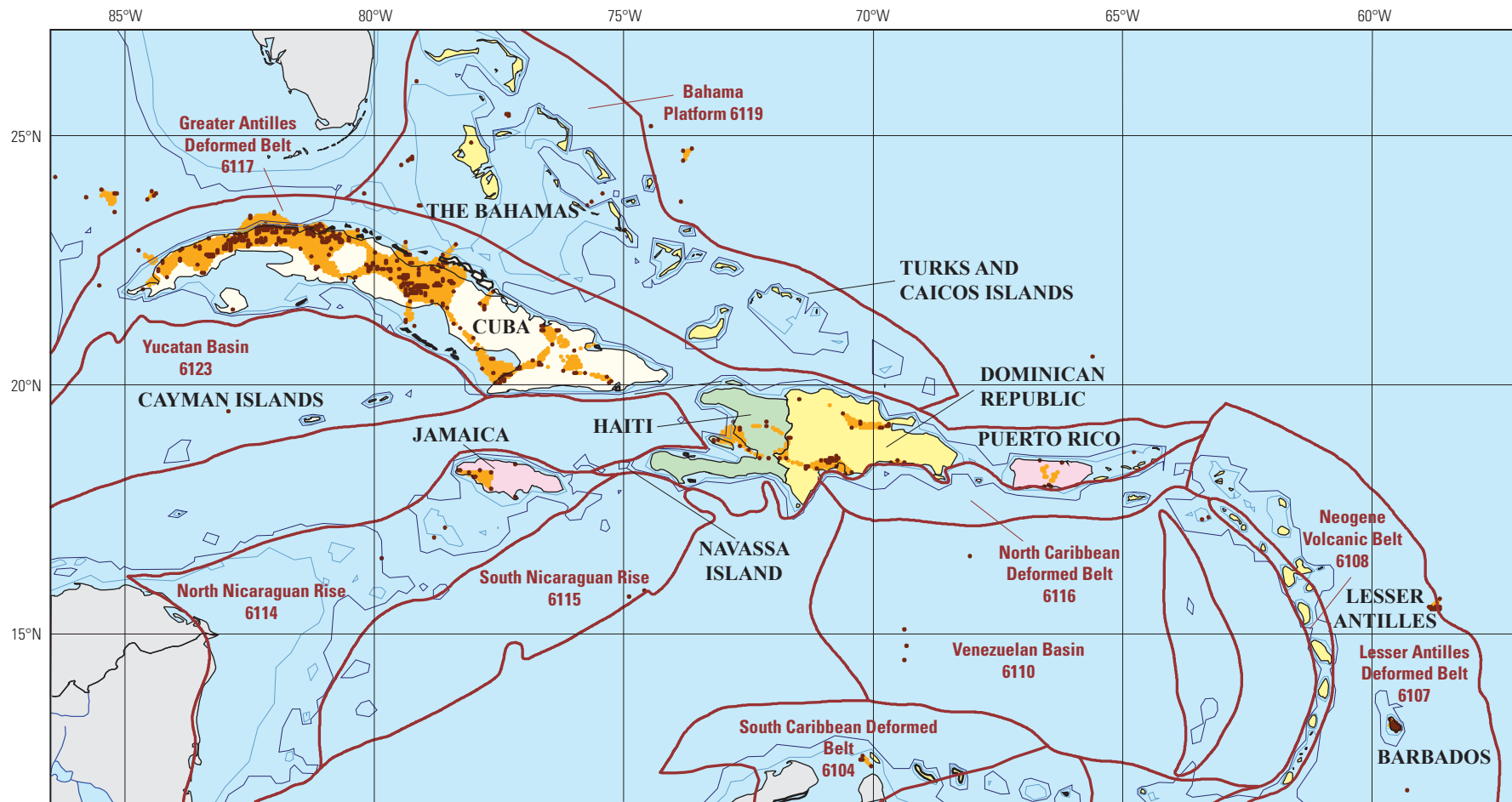
Figure 11. Map, graphs, and tables of data for oil and gas exploration through 2015 in the Caribbean. Parts of the Caribbean are Cuba, Barbados, The Bahamas, Turks and Caicos Islands, Navassa Island, Bermuda, Cayman Islands, Dominican Republic, Haiti, Jamaica, Puerto Rico, and the Lesser Antilles. Bermuda is not shown on the map; it lacks delineated prospective area. For this study, the Lesser Antilles are considered to include the former Netherlands Antilles, British Virgin Islands, Martinique (an overseas department of France), Dominica, Grenada, Virgin Islands, Saint Kitts and Nevis, Antigua and Barbuda, Anguilla, Montserrat, Guadeloupe (an overseas department of France), Saint Lucia, Saint Vincent and the Grenadines, and Aruba.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Cuba						
Greater Antilles Deformed Belt, 6117	1881	185	603	561	0	561
Dominican Republic						
Greater Antilles Deformed Belt, 6117	1905	0	<1	0	0	0

Exploration data

Country	Land area (mi²)
Cuba	42,402
Barbados	166
Bahamas	3,865
Turks and Caicos Islands	369
Navassa Island	2
Bermuda (not shown on map)	21
Cayman Islands	102
Dominican Republic	18,656
Haiti	10,641
Jamaica	4,182
Puerto Rico	3,425
Lesser Antilles	2,696
Total	**86,524**

Delineated prospective area through 2015:
    At the surface .... 20,863 mi²
    Percentage at depth of 10,000 ft... 32 percent

Explored area through 2015:
    At the surface .... 3,736 mi²
    Percentage at depth of 10,000 ft... 25 percent

Wildcat wells through 2015:
    Total.. 553 wells
    Percentage at depths of ≥10,000 ft...................................... 14 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil.. 622 MMBO
    Gas.. 599 BCF
    Percentage of oil at depths of ≥10,000 ft .... 49 percent
    Percentage of gas at depths of ≥10,000 ft .... 74 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft .... 48 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft .... 0 percent

Figure 11. Continued.

Figure 11. Caribbean

79

Figure 12.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Central America. Countries of Central America are Guatemala, Belize, Costa Rica, Honduras, Nicaragua, Panama, and El Salvador.

Figure 12. Central America **81**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Belize						
Yucatan Platform, 5308	2005	0	22	1	0	1
Guatemala						
Yucatan Platform, 5308	1981	151	163	2	0	2

Exploration data

Country	Land area (mi²)
Guatemala	41,374
Belize	8,805
Costa Rica	19,714
Honduras	43,201
Nicaragua	46,328
Panama	28,703
El Salvador	8,000
Total	**196,127**

Delineated prospective area through 2015:
At the surface .... 17,025 mi²
Percentage at depth of 10,000 ft ....21 percent

Explored area through 2015:
At the surface .... 2,292 mi²
Percentage at depth of 10,000 ft ....22 percent

Wildcat wells through 2015:
Total ....292 wells
Percentage at depths of ≥10,000 ft ....22 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
Oil ....259 MMBO
Gas ....41 BCF
Percentage of oil at depths of ≥10,000 ft ....0 percent
Percentage of gas at depths of ≥10,000 ft ....0 percent
Percentage of oil in oil fields at depths of ≥10,000 ft ....0 percent
Percentage of gas in gas fields at depths of ≥10,000 ft ....0 percent

Figure 12. Continued.

Figure 13. Map, graphs, and tables of data for oil and gas exploration through 2015 in Mexico. OCS, Outer Continental Shelf.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
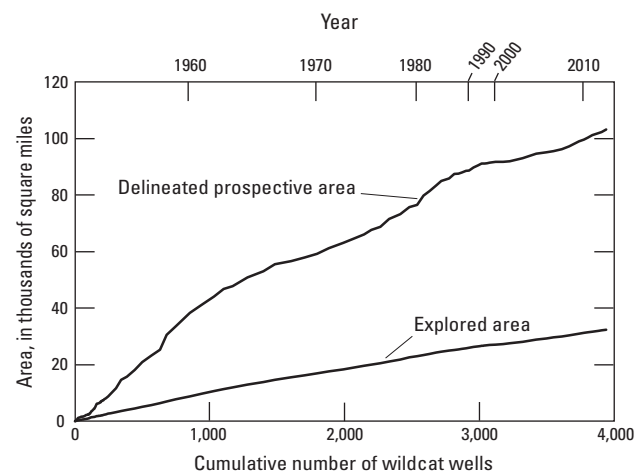
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 13. Continued.

Figure 13. Mexico

83

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
		Mexico				
Burgos Basin, 5300	1927	0	99	151	15,900	16,051
Chicontepec Basin, 5317	1957	133	383	978	2	980
Gulf Cenozoic OCS, 5097	2012	115	129	277	0	277
Macuspana Basin, 5306	1905	0	14	47	6,427	6,474
Saline-Comalcalco Basin, 5304	1910	2,777	4,358	4,729	98	4,827
Tampico-Misantla Basin, 5301	1904	8,064	9,762	17,801	421	18,222
Veracruz Basin, 5302	1953	0	193	449	7,191	7,639
Villahermosa Uplift, 5305	1954	41,410	43,731	53,285	2,203	55,488
Yucatan Platform, 5308	1966	0	0	0	3	3
Undesignated offshore area		0	8	0	3,613	3,613
Total		**52,498**	**58,677**	**77,717**	**35,857**	**113,573**

Figure 13. Continued.

Exploration data

Country	Land area (mi²)
Mexico	750,561

Delineated prospective area through 2015:
    At the surface .... 103,090 mi²
    Percentage at depth of 10,000 ft... 68 percent

Explored area through 2015:
    At the surface .... 32,295 mi²
    Percentage at depth of 10,000 ft... 55 percent

Wildcat wells through 2015:
    Total... 4,478 wells
    Percentage at depths of ≥10,000 ft....................................... 38 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...58.734 BBO
    Gas...115.267 TCF
    Percentage of oil at depths of ≥10,000 ft .... 54 percent
    Percentage of gas at depths of ≥10,000 ft .... 53 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft .... 54 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft .... 35 percent

Figure 13. Continued.

Figure 13. Mexico

85
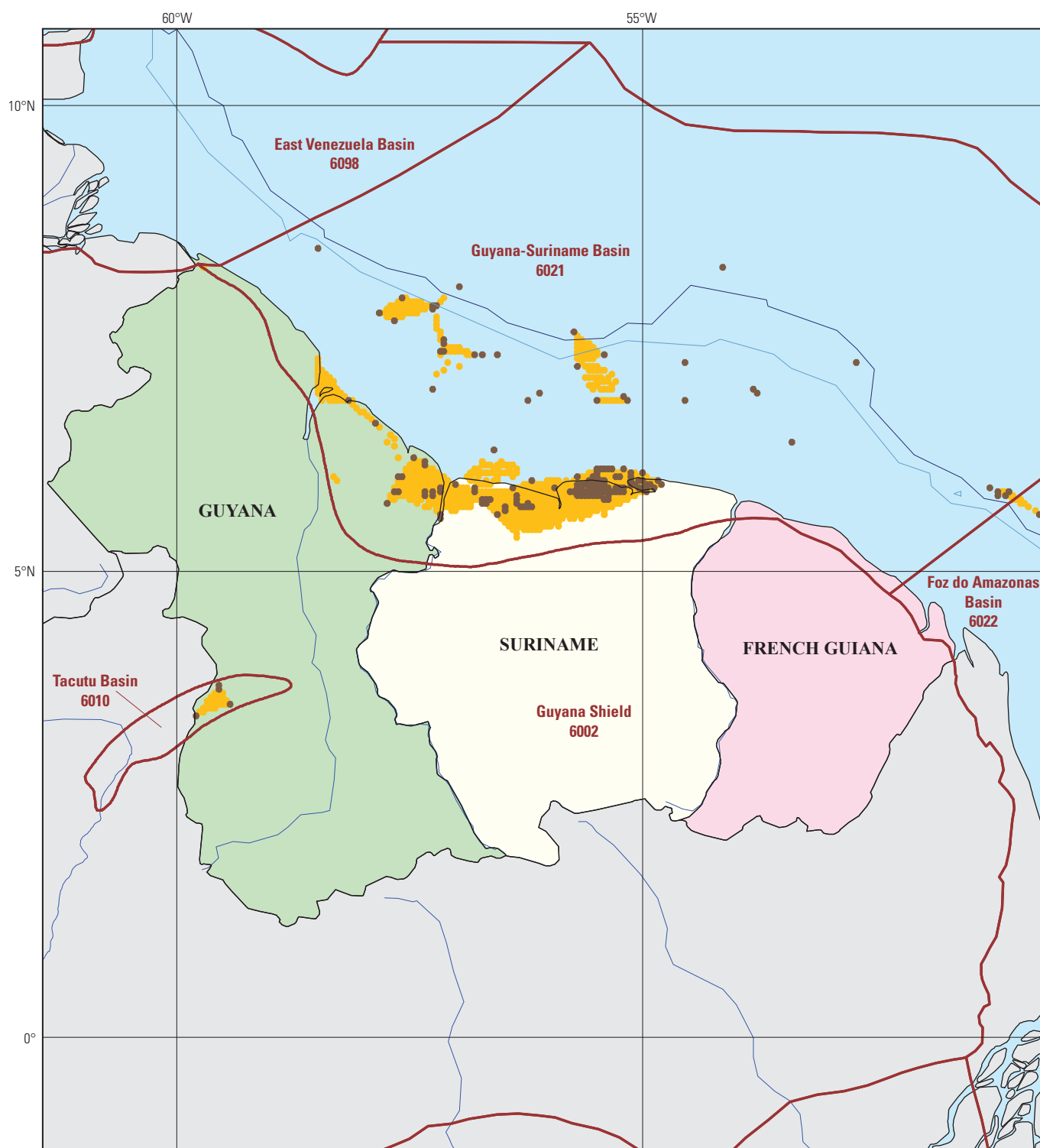
Figure 14.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Suriname, Guyana, and French Guiana (an overseas department of France).

Figure 14. Suriname, Guyana, French Guiana   87

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 14.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
French Guiana						
Guyana-Suriname Basin, 6021	2011	150	150	40	0	40
Guyana						
Guyana-Suriname Basin, 6021	2015	240	240	120	0	120
Suriname						
Guyana-Suriname Basin, 6021	1965	0	125	4	0	4

Figure 14. Continued.

Figure 14. Suriname, Guyana, French Guiana   89

Exploration data

Country	Land area (mi²)
Guyana	76,004
Suriname	60,232
French Guiana	34,421
Total	**170,657**

Delineated prospective area through 2015:

At the surface .... 5,693 mi²

Percentage at depth of 10,000 ft...4 percent

Explored area through 2015:

At the surface .... 1,162 mi²

Percentage at depth of 10,000 ft...7 percent

Wildcat wells through 2015:

Total... 122 wells

Percentage at depths of ≥10,000 ft..22 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil...15 MMBO

Gas.. 164 BCF

Percentage of oil at depths of ≥10,000 ft ....76 percent

Percentage of gas at depths of ≥10,000 ft ....98 percent

Percentage of oil in oil fields at depths of ≥10,000 ft ....77 percent

Percentage of gas in gas fields at depths of ≥10,000 ft ....0 percent

Figure 14.   Continued.

Figure 15.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Chile.

Figure 15. Chile   **91**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Significant petroleum province—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Chile						
Magallanes Basin, 6059	1945	0	469	1,890	9,601	11,491

Exploration data

Country	Land area (mi²)
Chile	287,187

Delineated prospective area through 2015:
    At the surface .... 15,067 mi²
    Percentage at depth of 10,000 ft...48 percent

Explored area through 2015:
    At the surface .... 5,355 mi²
    Percentage at depth of 10,000 ft...25 percent

Wildcat wells through 2015:
    Total... 801 wells
    Percentage at depths of ≥10,000 ft...16 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil..469 MMBO
    Gas.. 11.532 BCF
    Percentage of oil at depths of ≥10,000 ft ....4 percent
    Percentage of gas at depths of ≥10,000 ft ....5 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft ....7 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft ....10 percent

Figure 15. Continued.

Figure 16. Map, graphs, and tables of data for oil and gas exploration through 2015 in Argentina, Paraguay, Uruguay, and the Falkland Islands.

Figure 16. Argentina, Paraguay, Uraguay, and the Falkland Islands   93

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
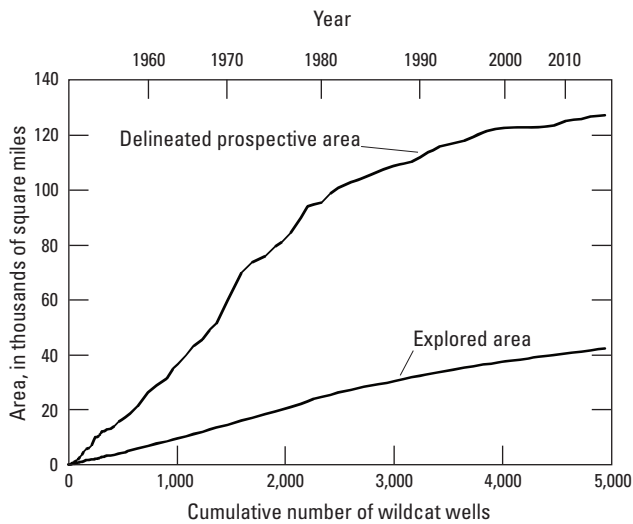
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 16.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Argentina						
Cuyo Basin, 6051	1933	1,089	1,622	384	2	386
Magallanes Basin, 6059	1949	0	683	2,319	16,333	18,652
Neuquen Basin, 6055	1922	4,079	6,343	22,840	17,143	39,983
San Jorge Basin, 6058	1907	4,853	6,722	7,178	317	7,495
Santa Cruz-Tarija Basin, 6045	1926	0	44	18	8,215	8,233
Total		**10,021**	**15,415**	**32,738**	**42,010**	**74,749**
Paraguay						
Santa Cruz-Tarija Basin, 6045	1959	0	0	0	26	26
Falkland Islands						
Falklands Plateau, 6060	1998	353	453	445	2,326	2,771
Malvinas Plateau, 6062	2012	0	0	0	6,000	6,000
Total		**353**	**453**	**445**	**8,326**	**8,771**

Figure 16. Continued.

Figure 16. Argentina, Paraguay, Uraguay, and the Falkland Islands   95

Exploration data

Country	Land area (mi²)
Argentina	1,056,642
Paraguay	153,399
Uruguay	67,574
Falkland Islands	4,700
Total	**1,282,315**

Delineated prospective area through 2015:

    At the surface .... 127,293 mi²

    Percentage at depth of 10,000 ft...38 percent

Explored area through 2015:

    At the surface .... 42,356 mi²

    Percentage at depth of 10,000 ft...26 percent

Wildcat wells through 2015:

    Total..4,998 wells

    Percentage at depths of ≥10,000 ft...19 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

    Oil.. 16.055 BBO

    Gas.. 84.324 TCF

    Percentage of oil at depths of ≥10,000 ft ....9 percent

    Percentage of gas at depths of ≥10,000 ft ....37 percent

    Percentage of oil in oil fields at depths of ≥10,000 ft ....9 percent

    Percentage of gas in gas fields at depths of ≥10,000 ft ....37 percent

Figure 16. Continued.
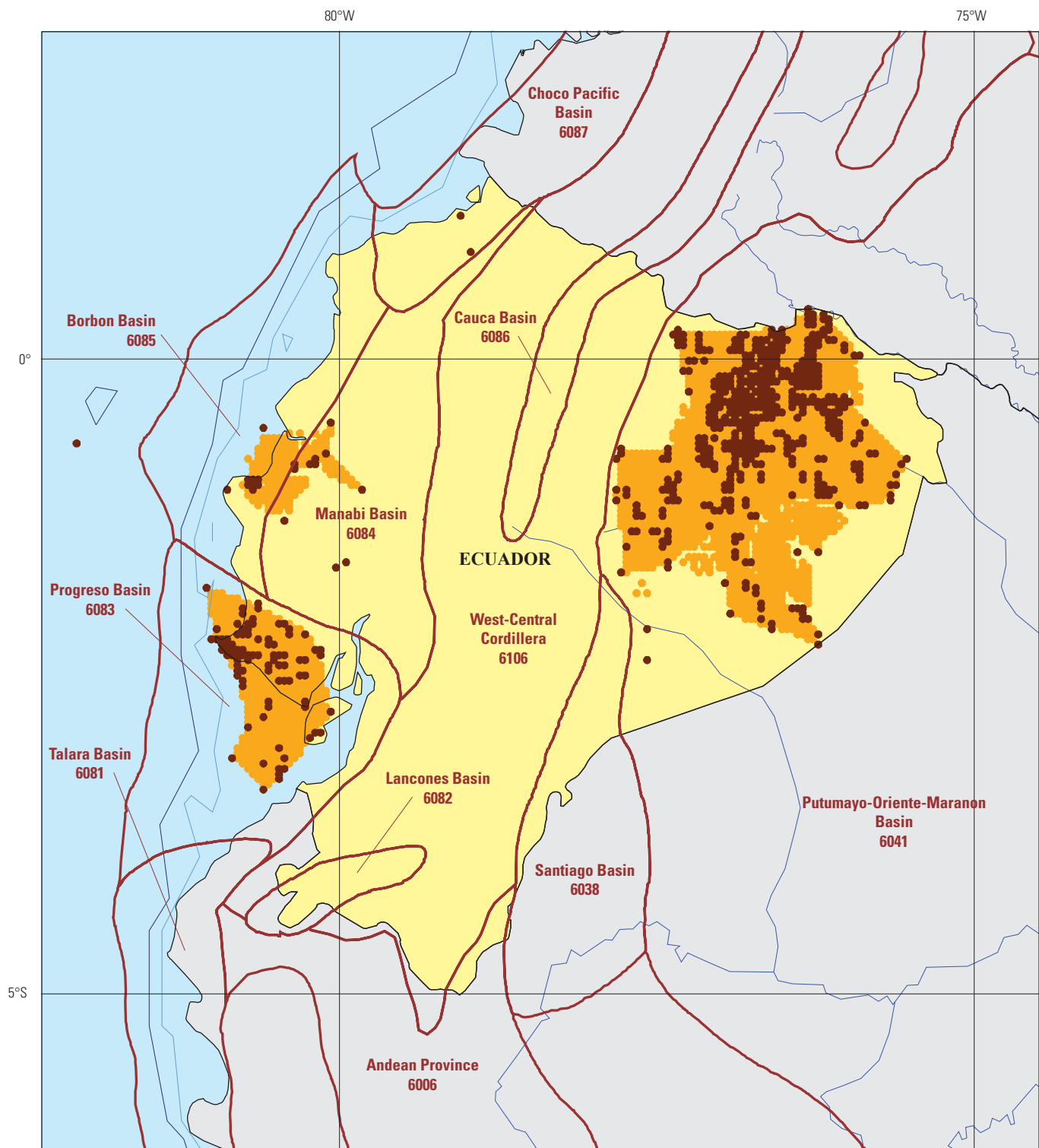
Figure 17.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Ecuador.

Figure 17. Ecuador 97

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
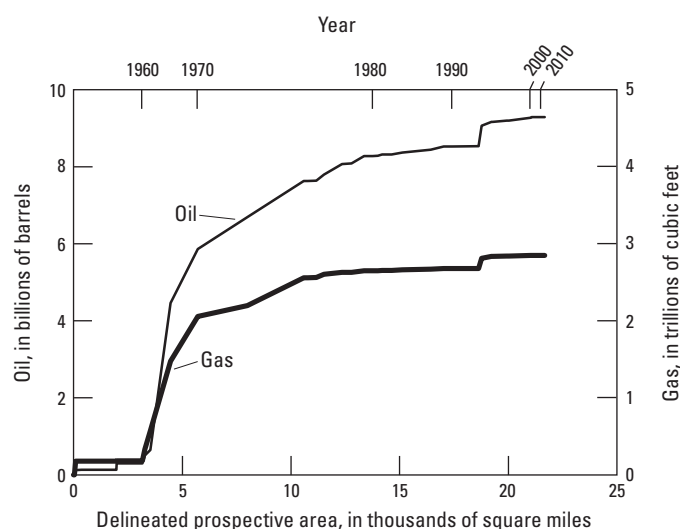
Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Ecuador						
Progreso Basin, 6083	1918	120	134	181	364	545
Putumayo-Oriente-Maranon Basin, 6041	1967	6,617	9,207	2,348	0	2,348
Total		**6,737**	**9,341**	**2,529**	**364**	**2,893**

Exploration data

Country	Land area (mi²)
Ecuador	106,889

Delineated prospective area through 2015:
- At the surface ....21,685 mi²
- Percentage at depth of 10,000 ft..55 percent

Explored area through 2015:
- At the surface ....4,809 mi²
- Percentage at depth of 10,000 ft..55 percent

Wildcat wells through 2015:
- Total...395 wells
- Percentage at depths of ≥10,000 ft.....................................41 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
- Oil...9.341 BBO
- Gas..2.893 TCF
- Percentage of oil at depths of ≥10,000 ft ....42 percent
- Percentage of gas at depths of ≥10,000 ft ....35 percent
- Percentage of oil in oil fields at depths of ≥10,000 ft ....42 percent
- Percentage of gas in gas fields at depths of ≥10,000 ft ....0 percent

Figure 17. Continued.
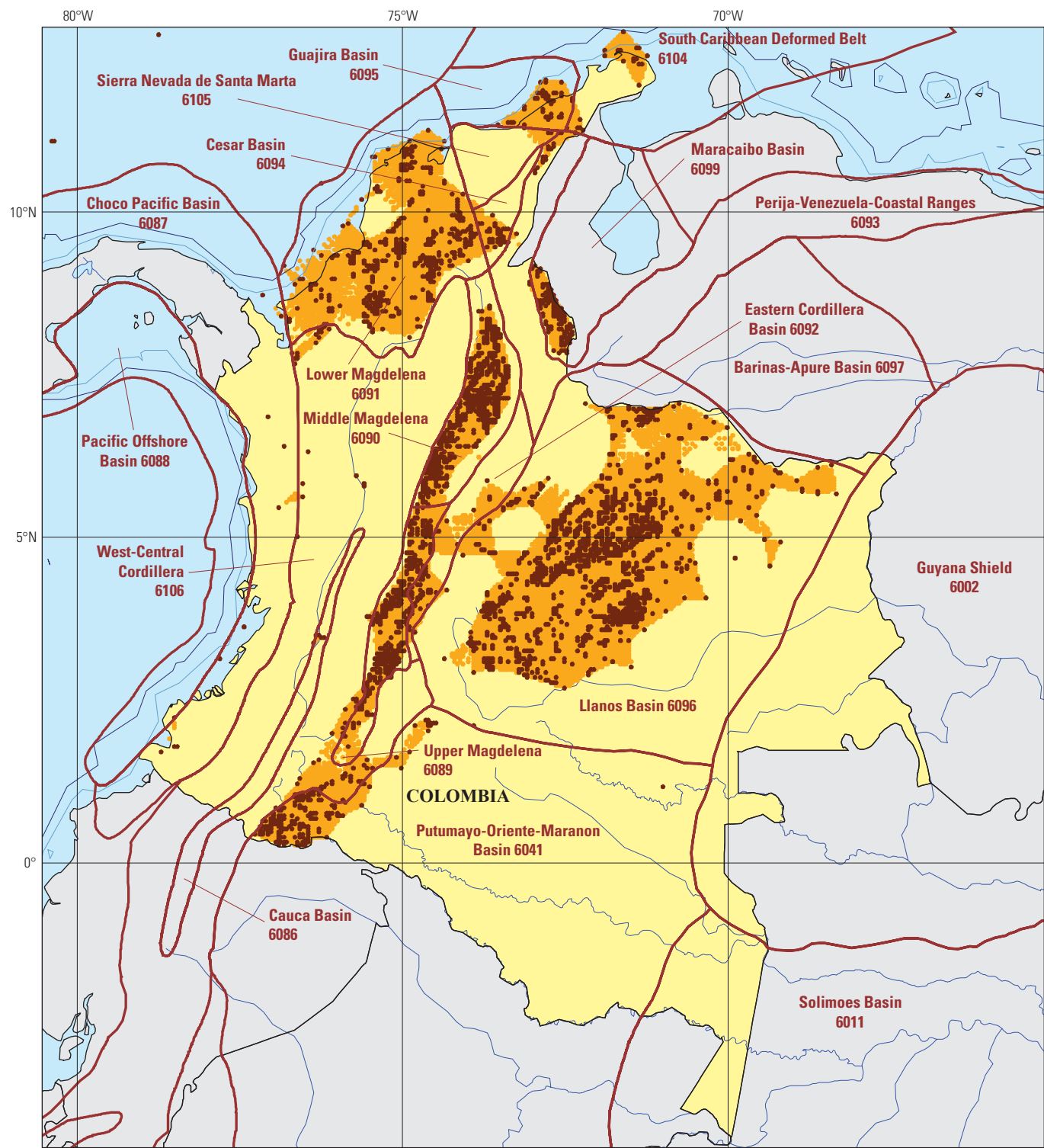
Figure 18.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Colombia.

Figure 18. Colombia 99

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
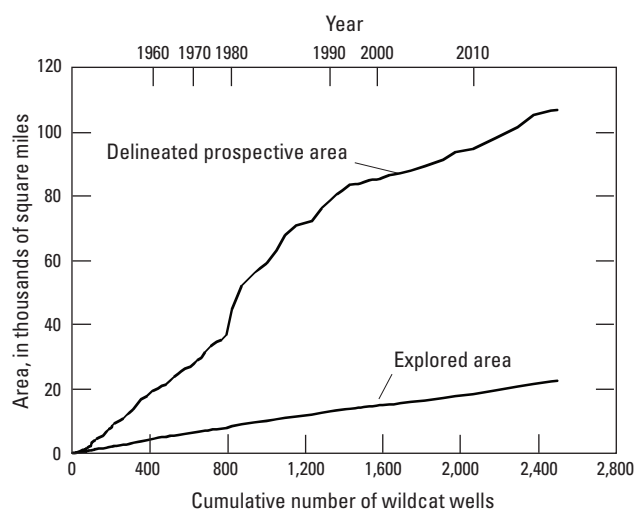
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
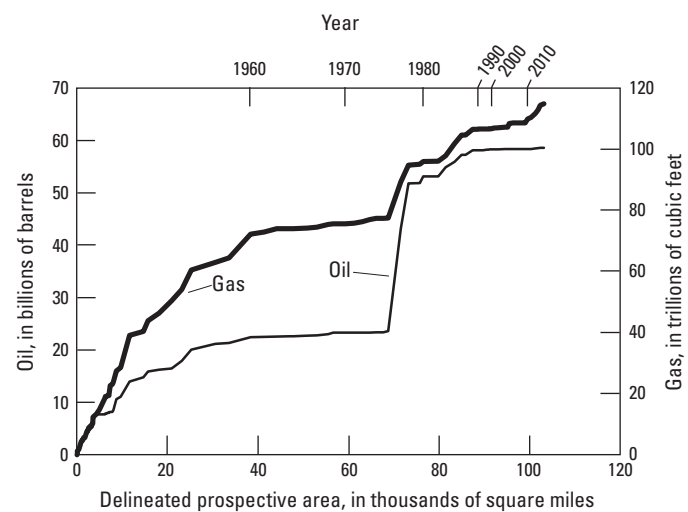

Figure 18. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Colombia						
Eastern Cordillera Basin, 6092	1994	130	145	711	5	716
Guajira Basin, 6095	1973	0	0	0	6,015	6,015
Llanos Basin, 6096	1948	4,498	6,427	3,808	6,962	10,770
Maracaibo Basin, 6099	1920	410	490	567	332	898
Middle Magdelena, 6090	1918	2,583	3,215	3,646	210	3,855
Putumayo-Oriente-Maranon Basin, 6041	1963	292	634	638	0	638
South Caribbean Deformed Belt, 6104	1979	0	0	0	825	825
Upper Magdelena, 6089	1949	323	1,041	822	40	862
Total		**8,235**	**11,952**	**10,192**	**14,388**	**24,580**

Figure 18.   Continued.

Figure 18. Colombia 101

Exploration data

Country	Land area (mi²)
Colombia	401,044

Delineated prospective area through 2015:
    At the surface .... 106,997 mi²
    Percentage at depth of 10,000 ft...27 percent

Explored area through 2015:
    At the surface ....22,502 mi²
    Percentage at depth of 10,000 ft...27 percent

Wildcat wells through 2015:
    Total..2,521 wells
    Percentage at depths of ≥10,000 ft...27 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil.. 12.034 BBO
    Gas...27.792 TCF
    Percentage of oil at depths of ≥10,000 ft ....19 percent
    Percentage of gas at depths of ≥10,000 ft ....45 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft ....20 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft ....53 percent

Figure 18. Continued.
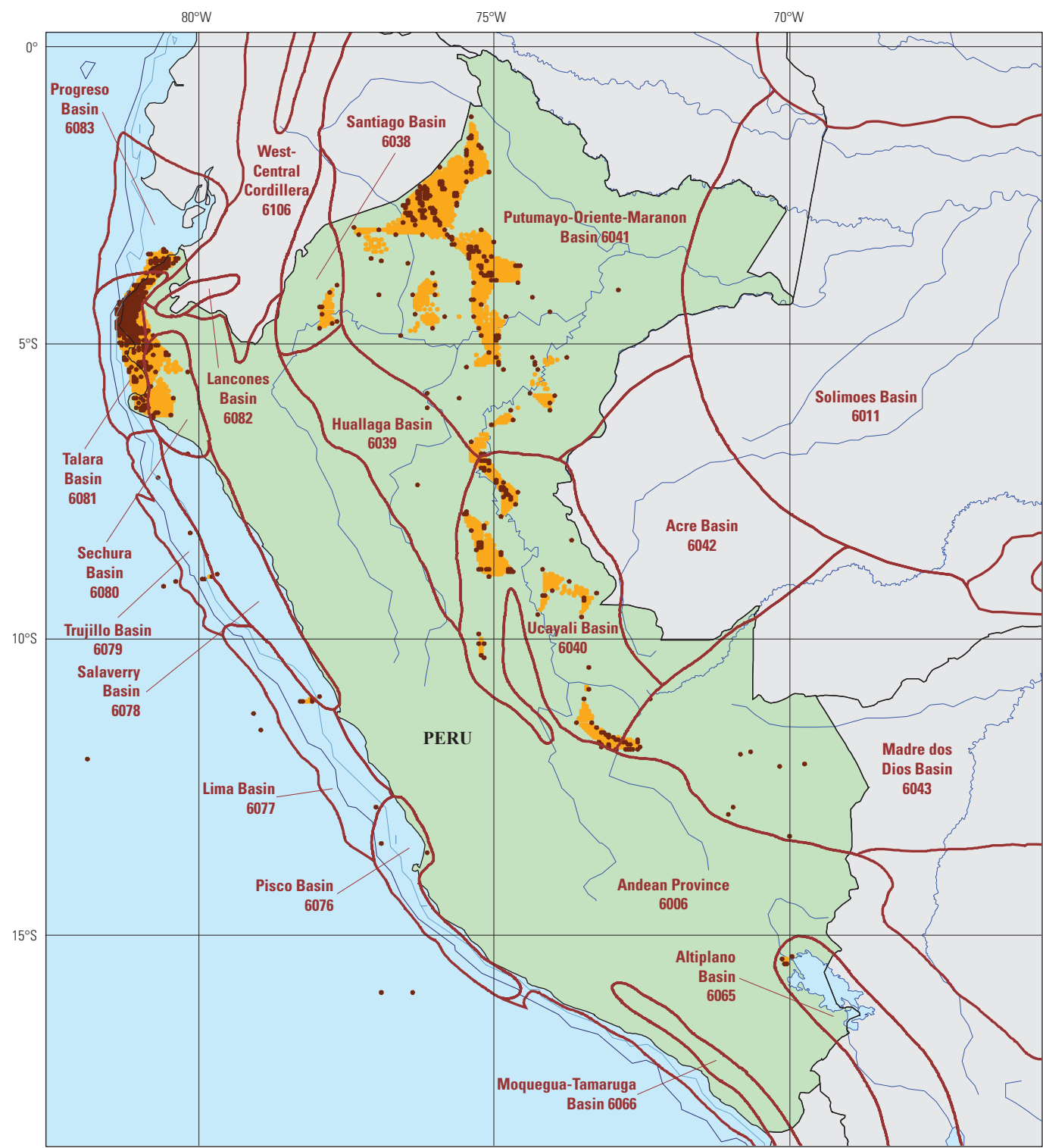
Figure 19.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Peru.

Figure 19. Peru   103

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
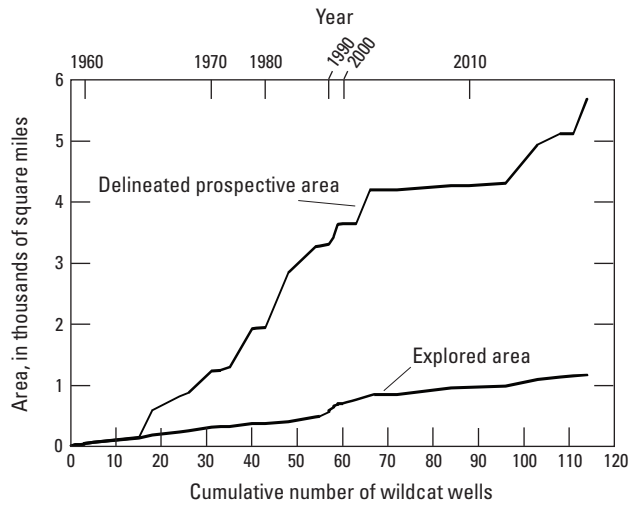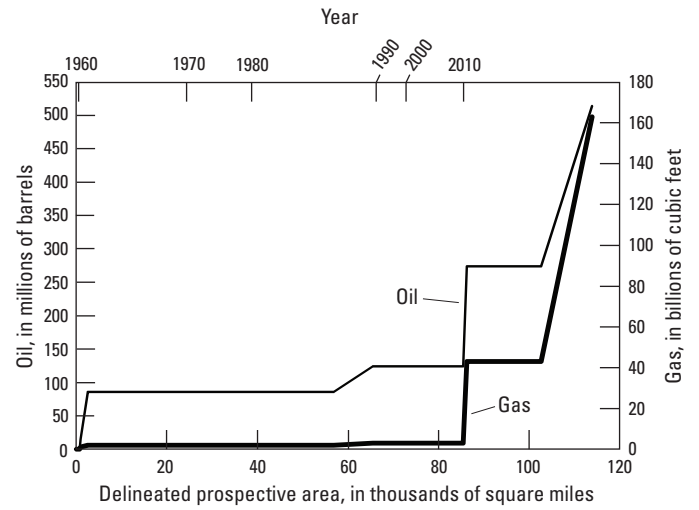
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 19.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Peru						
Madre dos Dios Basin, 6043	1984	0	0	0	15,598	15,598
Progreso Basin, 6083	1863	0	165	292	51	343
Putumayo-Oriente-Maranon Basin, 6041	1971	706	1,951	238	0	238
Talara Basin, 6081	1869	2,066	2,472	5,047	1,418	6,465
Ucayali Basin, 6040	1939	0	68	19	9,213	9,233
Total		**2,772**	**4,656**	**5,596**	**26,280**	**31,876**

Figure 19.   Continued.

Figure 19. Peru   105

Exploration data

Country	Land area (mi²)
Peru	494,209

Delineated prospective area through 2015:
    At the surface ....23,362 mi²
    Percentage at depth of 10,000 ft...48 percent

Explored area through 2015:
    At the surface ....4,763 mi²
    Percentage at depth of 10,000 ft...41 percent

Wildcat wells through 2015:
    Total...1,083 wells
    Percentage at depths of ≥10,000 ft...15 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...4.657 BBO
    Gas..32.217 TCF
    Percentage of oil at depths of ≥10,000 ft ....29 percent
    Percentage of gas at depths of ≥10,000 ft ....60 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft ....29 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft ....70 percent

Figure 19.   Continued.

Figure 20.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Venezuela and Trinidad and Tobago.

Figure 20. Venezuela and Trinidad and Tobago   107

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
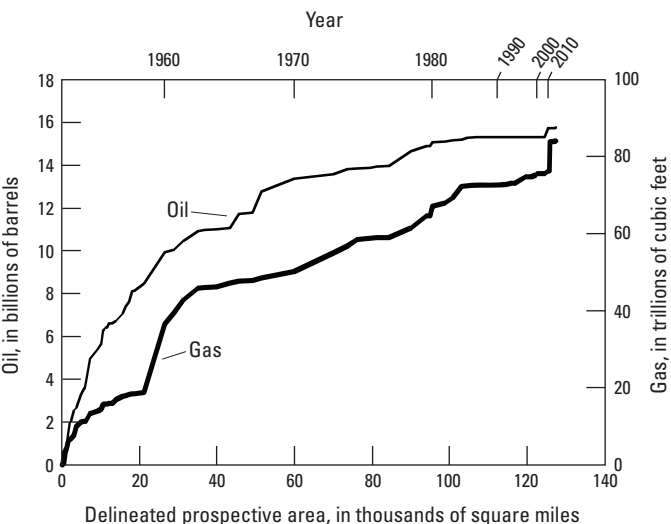

Figure 20.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Venezuela						
Barinas-Apure Basin, 6097	1948	1,877	2,342	157	593	750
East Venezuela Basin, 6098	1913	28,725	34,237	104,099	43,032	147,132
Llanos Basin, 6096	1983	954	954	39	0	39
Maracaibo Basin, 6099	1914	63,165	63,869	68,858	451	69,309
South Caribbean Deformed Belt, 6104	1993	0	95	120	10,500	10,620
Tobago Trough, 6103	1979	0	0	0	6,945	6,945
Total		**94,720**	**101,497**	**173,274**	**61,521**	**234,795**
Trinidad and Tobago						
East Venezuela Basin, 6098	1867	3,233	4,236	8,055	37,300	45,355
Tobago Trough, 6103	1971	0	0	0	3,663	3,663
Total		**3,233**	**4,236**	**8,055**	**40,963**	**49,018**

Figure 20.   Continued.

Figure 20. Venezuela and Trinidad and Tobago **109**

Exploration data

Country	Land area (mi²)
Venezuela	340,561
Trinidad and Tobago	1,980
Total	**342,541**

Delineated prospective area through 2015:
  At the surface ....95,136 mi²
  Percentage at depth of 10,000 ft...47 percent

Explored area through 2015:
  At the surface ....31,757 mi²
  Percentage at depth of 10,000 ft...38 percent

Wildcat wells through 2015:
  Total...6,428 wells
  Percentage at depths of ≥10,000 ft..26 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil.. 106.080 BBO
  Gas..285.434 TCF
  Percentage of oil at depths of ≥10,000 ft ....27 percent
  Percentage of gas at depths of ≥10,000 ft ....41 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....28 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....58 percent

Figure 20. Continued.
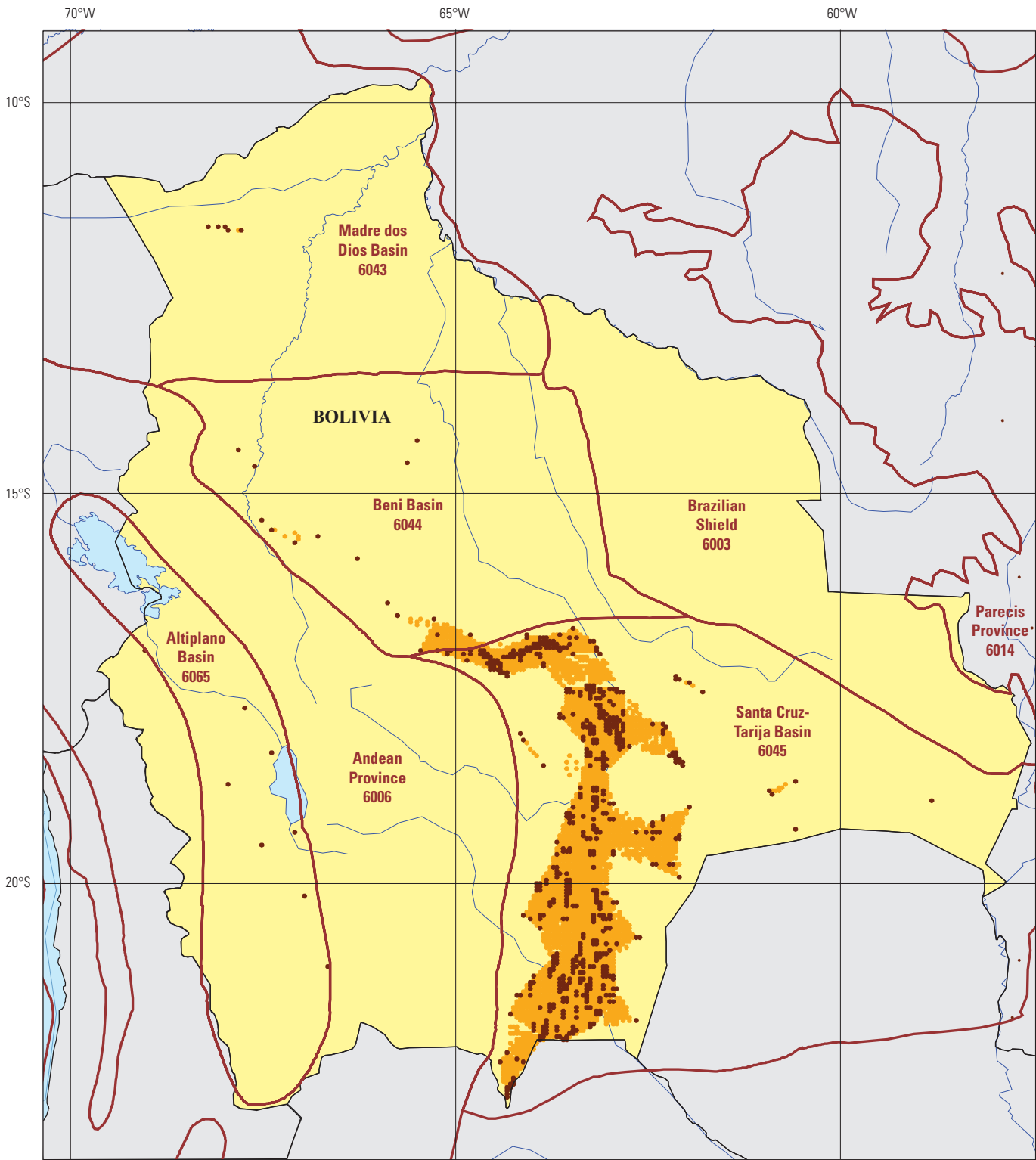
Figure 21.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Bolivia.

Figure 21. Bolivia   111

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
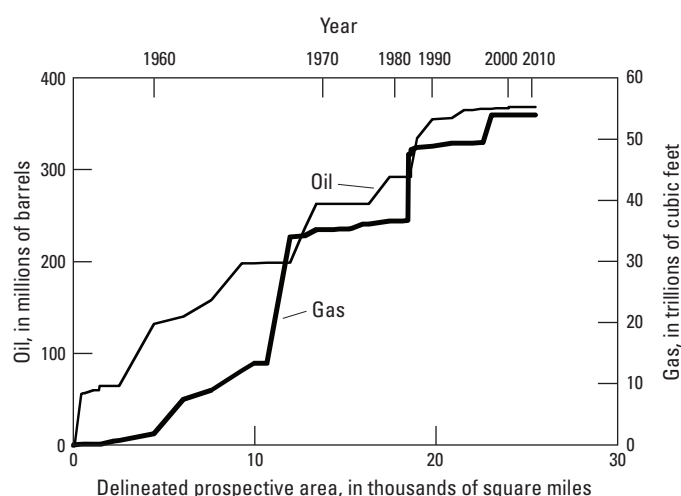
Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Bolivia						
Madre dos Dios Basin, 6043	1991	0	1	<1	0	<1
Santa Cruz-Tarija Basin, 6045	1924	0	380	1,668	52,347	54,015
Total		**0**	**381**	**1,668**	**52,347**	**54,015**

Exploration data

Country	Land area (mi²)
Bolivia	418,265

Delineated prospective area through 2015:
   At the surface ....25,483 mi²
   Percentage at depth of 10,000 ft...58 percent

Explored area through 2015:
   At the surface ....4,471 mi²
   Percentage at depth of 10,000 ft...52 percent

Wildcat wells through 2015:
   Total...517 wells
   Percentage at depths of ≥10,000 ft..49 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
   Oil...382 MMBO
   Gas...54.016 TCF
   Percentage of oil at depths of ≥10,000 ft ....20 percent
   Percentage of gas at depths of ≥10,000 ft ....82 percent
   Percentage of oil in oil fields at depths of ≥10,000 ft ....21 percent
   Percentage of gas in gas fields at depths of ≥10,000 ft ....85 percent

Figure 21. Continued.

Figure 22.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Brazil.

Figure 22. Brazil   113

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
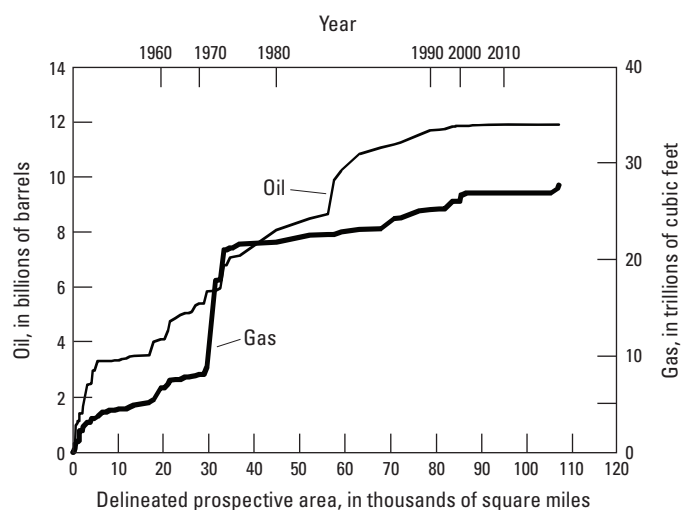

Figure 22. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
			Brazil			
Caera Basin, 6026	1971	100	294	204	107	311
Campos Basin, 6035	1972	25,017	28,623	16,960	2,449	19,409
Espirito Santo Basin, 6034	1969	1,953	2,837	2,101	2,957	5,058
Foz do Amazonas Basin, 6022	1976	0	1	0	1,111	1,111
Potigar Basin, 6027	1973	1,181	2,004	2,373	1,316	3,689
Reconcavo Basin, 6032	1939	1,311	2,040	2,678	1,710	4,388
Santos Basin, 6036	1979	48,170	49,935	98,365	15,030	113,395
Sergipe-Alagoas Basin, 6029	1957	1,761	2,574	4,377	905	5,282
Solimoes Basin, 6011	1978	328	367	2,755	2,328	5,083
Total		**79,821**	**88,675**	**129,812**	**27,914**	**157,726**

Figure 22.   Continued.

Figure 22. Brazil 115

Exploration data

Country	Land area (mi²)
Brazil	3,266,199

Delineated prospective area through 2015:
    At the surface...151,340 mi²
    Percentage at depth of 10,000 ft.. 59 percent

Explored area through 2015:
    At the surface...33,094 mi²
    Percentage at depth of 10,000 ft.. 50 percent

Wildcat wells through 2015:
    Total...5,051 wells
    Percentage at depths of ≥10,000 ft .... 31 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...88.806 BBO
    Gas..161.850 TCF
    Percentage of oil at depths of ≥10,000 ft... 88 percent
    Percentage of gas at depths of ≥10,000 ft.. 87 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft.................................... 87 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft.................................. 69 percent

Figure 22. Continued.

Figure 23. Maps, graphs, and tables of data for oil and gas exploration through 2015 in the northern part of Western Europe. For this figure, the parts mapped are the United Kingdom, Norway, Germany, Denmark, Netherlands, Ireland, Sweden, Belgium, Faroe Islands, Finland, Luxembourg, Svalbard, Jan Mayen, and the Isle of Man. The Faroe Islands are a self-governing overseas administrative division of Denmark. Svalbard (a territory of Norway) is a group of islands in the Arctic Ocean; see the separate small map. Data for Greenland and Iceland are not mapped and are not included in the exploration data; they had no discoveries through 2015.

Figure 23. Northern Part of Western Europe **117**
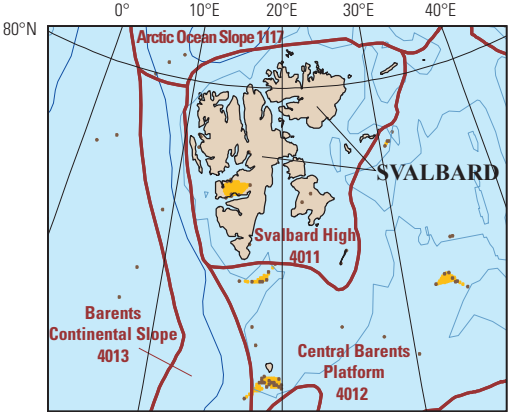
Map of oil and gas exploration through 2015 in Svalbard.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
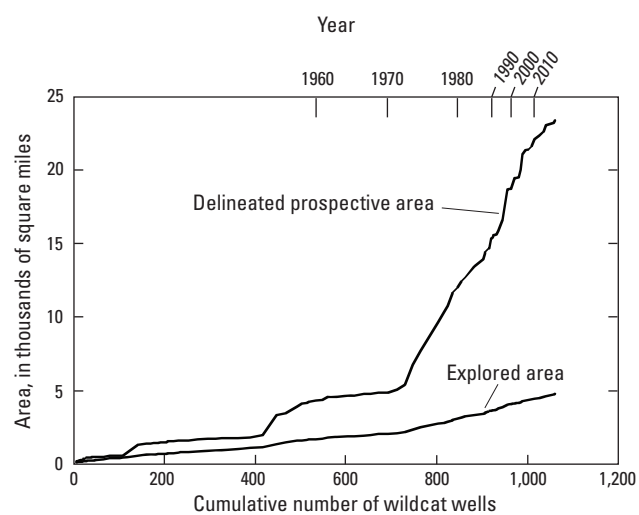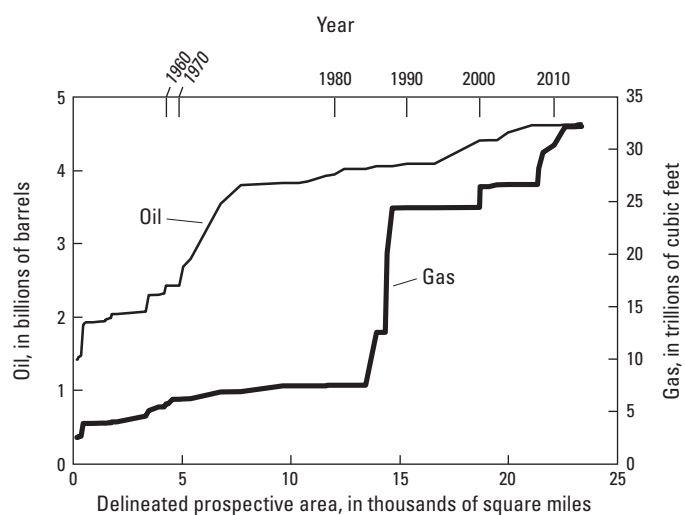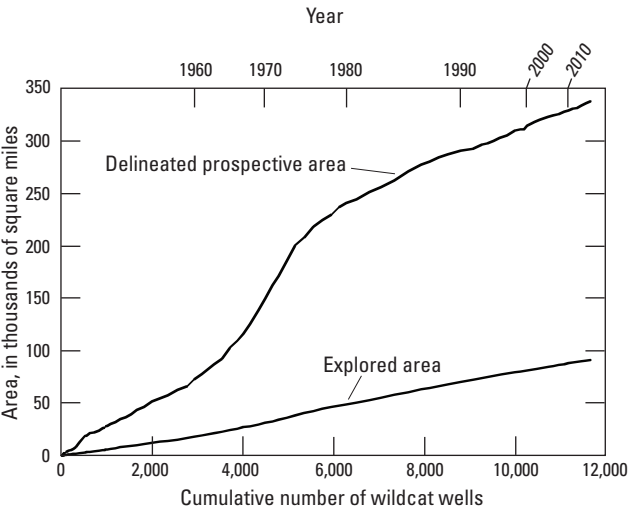

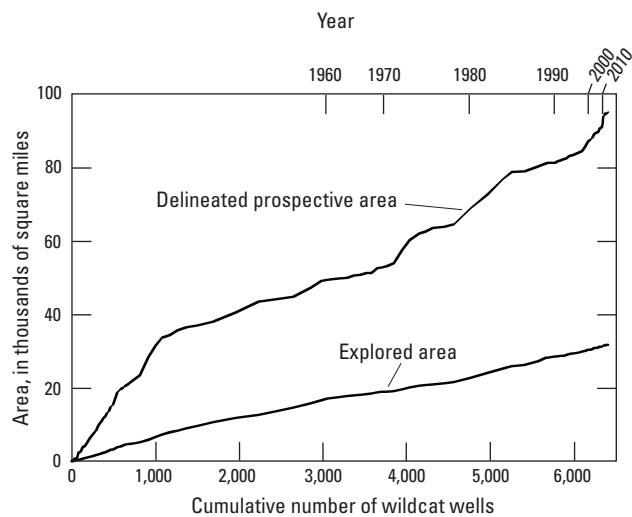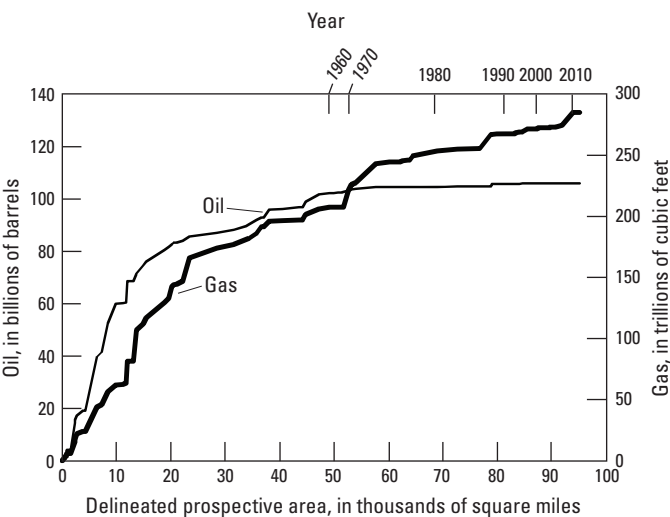**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**

Figure 23. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
United Kingdom						
Anglo-Dutch Basin, 4036	1919	0	88	35	61,577	61,612
Anglo-Paris Basin, 4040	1896	515	613	219	93	313
Faeroes-Shetland-Orkney Basin, 4019	1977	2,497	2,941	2,412	4,200	6,612
Ireland-Scotland Platform, 4026	1876	0	0	0	478	478
Irish Sea, 4030	1939	115	246	425	9,764	10,189
North Sea Graben, 4025	1969	22,703	28,965	35,086	31,772	66,858
Total		**25,830**	**32,852**	**38,177**	**107,884**	**146,061**
Norway						
Central Barents Platform, 4012	2008	760	976	1,381	1,317	2,698
Hammerfest-Varanger Basin, 4015	1981	179	264	508	10,912	11,420
Horda-Norwegian-Danish Basin, 4023	1972	116	171	57	70	127
North Sea Graben, 4025	1967	23,649	28,791	42,132	80,368	122,500
Vestford-Helgeland, 4017	1981	3,819	4,546	11,086	24,503	35,589
Undesignated offshore area		0	1	0	4,721	4,721
Total		**28,523**	**34,750**	**55,164**	**121,890**	**177,054**
Germany						
Bohemia, 4046	1930	0	1	<1	330	331
German-Polish Basin, 4033	1925	0	29	49	3,698	3,746
North Sea Graben, 4025	1974	0	0	0	450	450
Northwest German Basin, 4035	1856	1,090	2,313	1,245	32,373	33,618
Total		**1,090**	**2,343**	**1,294**	**36,851**	**38,145**
Denmark						
Horda-Norwegian-Danish Basin, 4023	1973	0	189	62	102	164
North Sea Graben, 4025	1966	2,477	2,887	4,804	4,735	9,540
Northwest German Basin, 4035	1943	0	0	0	1	1
Total		**2,477**	**3,076**	**4,867**	**4,838**	**9,705**
Netherlands						
Anglo-Dutch Basin, 4036	1952	0	675	361	28,613	28,974
North Sea Graben, 4025	1968	0	186	792	5,592	6,384
Northwest German Basin, 4035	1943	411	413	369	125,850	126,219
Total		**411**	**1,274**	**1,522**	**160,055**	**161,577**
Ireland						
Ireland-Scotland Platform, 4026	1963	327	432	267	4,175	4,442
Undesignated offshore area		0	0	0	325	325
Total		**327**	**432**	**267**	**4,500**	**4,767**
Faroe Islands						
Faeroes-Shetland-Orkney Basin, 4019	2001	0	20	6	0	6

Figure 23.   Continued.

Figure 23. Northern Part of Western Europe 119

Exploration data

Country	Land area (mi²)
United Kingdom	93,410
Norway	117,484
Germany	134,623
Denmark	16,384
Netherlands	13,086
Ireland	26,596
Sweden	158,431
Belgium	11,690
Faroe Islands	538
Finland	117,304
Luxembourg	998
Svalbard	23,956
Jan Mayen	146
Isle of Man	221
Total	**714,867**

Delineated prospective area through 2015:
  At the surface ....337,933 mi²
  Percentage at depth of 10,000 ft .... 45 percent

Explored area through 2015:
  At the surface ....91,404 mi²
  Percentage at depth of 10,000 ft .... 44 percent

Wildcat wells through 2015:
  Total ....11,738 wells
  Percentage at depths of ≥10,000 ft .... 33 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil ....74.919 BBO
  Gas ....540.328 TCF
  Percentage of oil at depths of ≥10,000 ft .... 59 percent
  Percentage of gas at depths of ≥10,000 ft .... 54 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft .... 58 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft .... 50 percent

Figure 23. Continued.

Figure 24.   Map, graphs, and tables of data for oil and gas exploration through 2015 in the southern part of Western Europe. For this figure, the parts mapped are Italy, Austria, France, Spain, Portugal, Switzerland, Andorra, Liechtenstein, Malta, Monaco, San Marino, and Gibraltar (an overseas territory of the United Kingdom).

Figure 24. Southern Part of Western Europe **121**

London-Brabant
Platform
4037

Rhine Graben
4055

North Carpathian
Basin
4047

Southwest
German Basin
4039

Bohemia
4046

Transgraben
4053

Molasse Basin
4049

Jura
4052

AUSTRIA

SWITZERLAND

Pannonian Basin
4048

LIECHTENSTEIN

Po Basin
4060

ITALY

Alps
4051

Bresse
Depression
4054

MONACO

Lion-Camargue
4056

SAN
MARINO

Provence Basin
4068

Adriatic Basin
4058

Tuscany-
Latium-
Paola
4062

Corsican-
Sardinian Basins
4067

Apulia Platform
4059

Tyrrhenian Basin
4069

Sicily
4066

MALTA

Pelagian Basin
2048

5°E
10°E
15°E
20°E
50°N
45°N
40°N
35°N

Figure 24. Continued.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

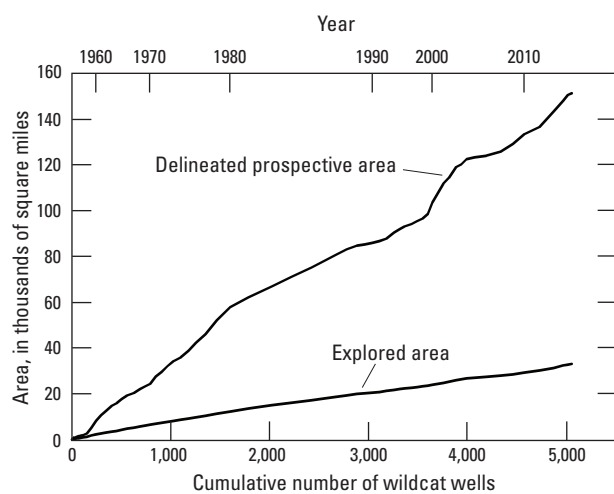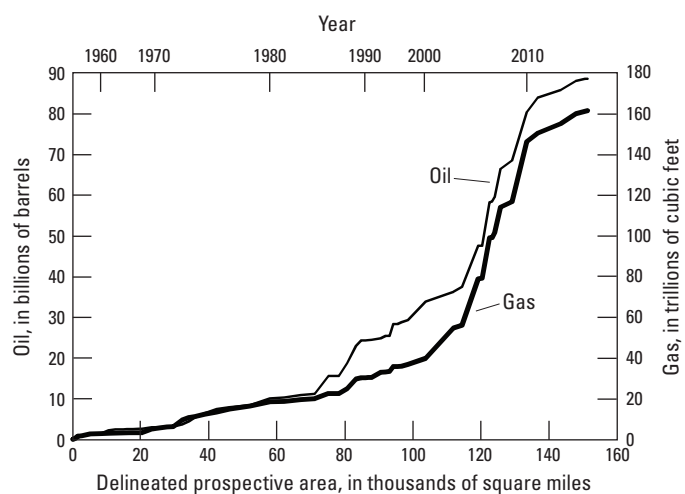**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Italy						
Adriatic Basin, 4058	1978	0	82	34	200	234
Alps, 4051	1860	740	1,090	1,067	5,793	6,859
Pelagian Basin, 2048	1988	0	15	2	0	2
Po Basin, 4060	1890	265	317	177	23,768	23,946
Sicily, 4066	1940	348	565	110	1,361	1,471
Tuscany-Latium-Paola, 4062	1915	0	1	1	2,579	2,580
Total		1,353	2,070	1,390	33,701	35,091
Austria						
Bohemia, 4046	1929	590	872	2,218	1,447	3,665
North Carpathian Basin, 4047	1960	0	<1	0	469	469
Pannonian Basin, 4048	1982	0	0	0	1	1
Total		590	873	2,218	1,917	4,136
France						
Anglo-Paris Basin, 4040	1954	0	339	24	83	107
Aquitaine Basin, 4045	1954	237	403	34	0	34
Pyrenean Foothills-Ebro Basin, 4044	1939	0	132	138	11,818	11,956
Total		237	874	197	11,901	12,098

Figure 24.   Continued.

Figure 24. Southern Part of Western Europe   123

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015—Continued

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Spain						
Iberic Cordillera, 4083	1967	160	293	115	126	241
Pyrenean Foothills-Ebro Basin, 4044	1980	0	0	0	299	299
Total		**160**	**293**	**115**	**425**	**540**
Malta						
Sicily, 4066	1999	0	0	0	<1	<1
San Marino						
Po Basin, 4060	1960	0	0	0	1	1

Exploration data

Country	Land area (mi²)
Italy	113,568
Austria	31,832
France	212,345
Spain	192,657
Portugal	35,317
Switzerland	15,443
Andorra	181
Liechtenstein	62
Malta	122
Monaco	1
San Marino	24
Gibraltar	3
Total	**601,553**

Delineated prospective area through 2015:
At the surface ....223,962 mi²
Percentage at depth of 10,000 ft..34 percent

Explored area through 2015:
At the surface ....46,818 mi²
Percentage at depth of 10,000 ft..26 percent

Wildcat wells through 2015:
Total...6,550 wells
Percentage at depths of ≥10,000 ft...20 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
Oil...4.243 BBO
Gas..53.389 TCF
Percentage of oil at depths of ≥10,000 ft ....42 percent
Percentage of gas at depths of ≥10,000 ft ....27 percent
Percentage of oil in oil fields at depths of ≥10,000 ft ....42 percent
Percentage of gas in gas fields at depths of ≥10,000 ft ....29 percent

Figure 24.   Continued.

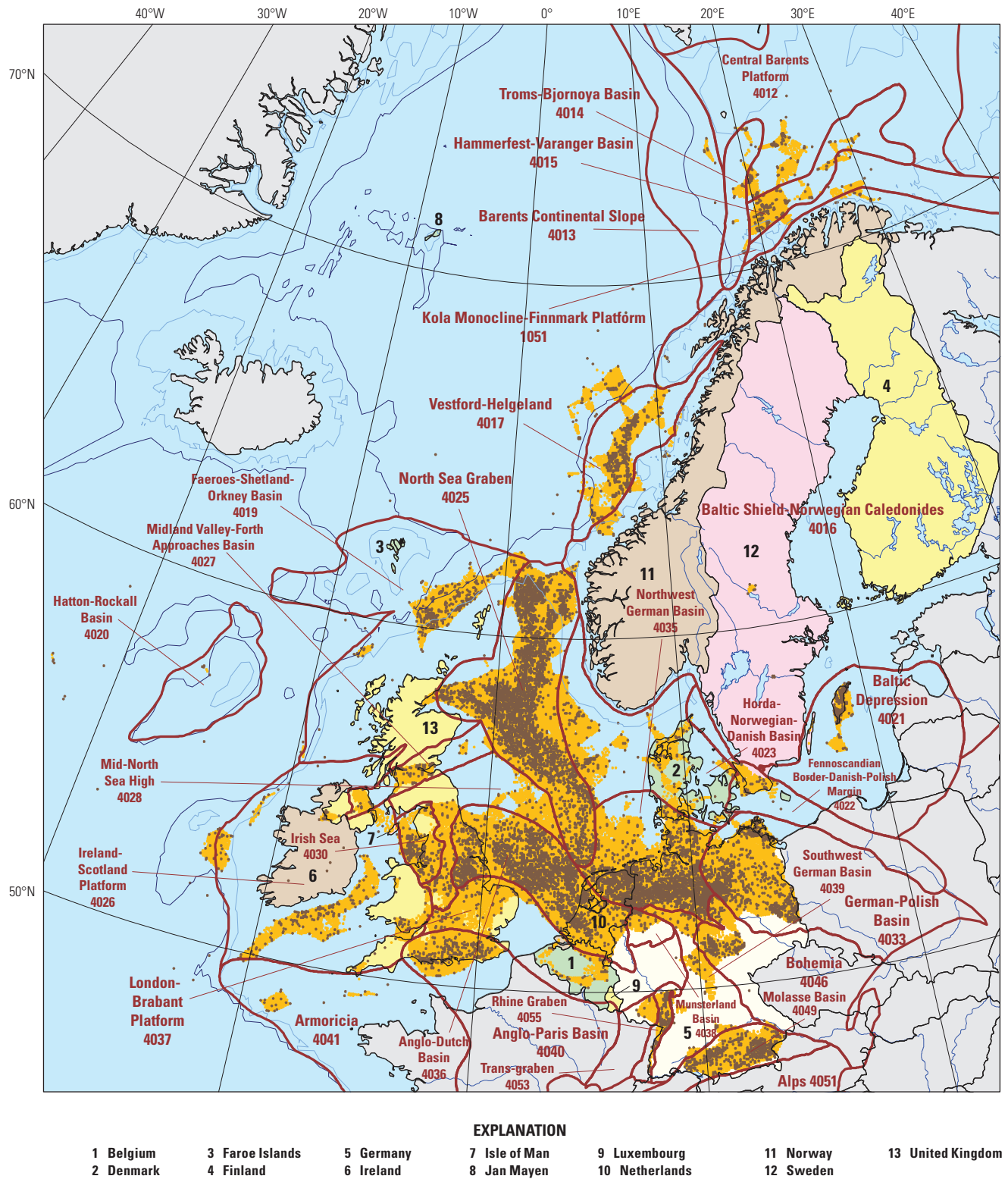**Figure 25.** Map, graphs, and tables of data for oil and gas exploration through 2015 in Eastern Europe. For this figure, the parts mapped are Romania, Ukraine, Belarus, Hungary, Albania, Serbia, Montenegro, Kosovo, Croatia, Poland, Czech Republic, Greece, Bulgaria, Slovakia, Slovenia, Moldova, Lithuania, Latvia, Bosnia and Herzegovina, Estonia, and Macedonia.

Figure 25. Eastern Europe **125**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
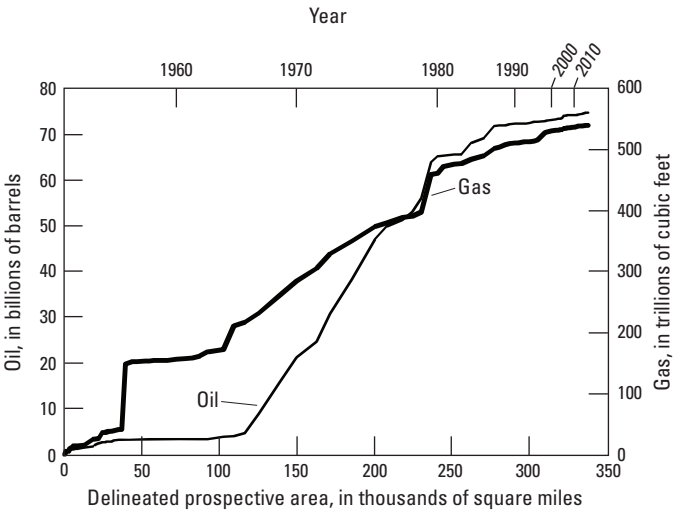

Figure 25. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Romania						
Alps, 4051	1965	0	0	0	4	4
Black Sea Continental Slope, 1107	2012	0	0	0	3,200	3,200
Carpathian-Balkanian Basin, 4061	1835	2,807	6,554	6,020	7,700	13,720
North Carpathian Basin, 4047	2009	0	0	0	86	86
Pannonian Basin, 4048	1900	160	479	304	467	771
Transylvanian Basin, 4057	1880	0	1	4	32,691	32,695
Total		**2,967**	**7,033**	**6,328**	**44,147**	**50,475**
Ukraine						
Azov-Kuban Basin, 1108	1936	0	43	12	740	752
Dnieper-Donets Basin, 1009	1936	1,701	2,994	8,212	84,724	92,936
North Carpathian Basin, 4047	1860	1,085	1,693	3,861	9,732	13,593
Pannonian Basin, 4048	1960	0	0	0	52	52
Transylvanian Basin, 4057	1982	0	0	0	8	8
Total		**2,786**	**4,729**	**12,084**	**95,256**	**107,340**
Belarus						
Pripyat Basin, 1010	1963	480	1,241	669	0	669
Hungary						
Pannonian Basin, 4048	1936	443	859	4,274	6,572	10,846
Albania						
Adriatic Basin, 4058	1918	500	839	2,488	137	2,626
Serbia						
Alps, 4051	1976	209	210	5	0	5
Pannonian Basin, 4048	1951	102	433	768	676	1,444
Total		**311**	**642**	**773**	**676**	**1,449**
Croatia						
Adriatic Basin, 4058	1983	0	2	4	0	4
Alps, 4051	1979	0	0	0	5	5
Pannonian Basin, 4048	1856	372	809	829	2,334	3,163
Po Basin, 4060	1977	0	0	0	1,389	1,389
Total		**372**	**811**	**832**	**3,728**	**4,560**
Poland						
German-Polish Basin, 4033	1961	0	209	478	8,392	8,870
North Carpathian Basin, 4047	1853	0	144	150	5,735	5,885
Total		**0**	**352**	**628**	**14,127**	**14,755**
Czech Republic						
Bohemia, 4046	1920	0	80	282	82	364
North Carpathian Basin, 4047	1908	0	3	11	252	263
Total		**0**	**83**	**294**	**334**	**628**
Greece						
Aegean, 4075	1971	121	173	102	54	156

Figure 25.   Continued.

Figure 25. Eastern Europe   **127**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015—Continued

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Bulgaria						
Carpathian-Balkanian Basin, 4061	1949	0	47	52	509	561
Slovakia						
Bohemia, 4046	1914	0	44	42	1,137	1,179
North Carpathian Basin, 4047	1850	0	0	0	2	2
Pannonian Basin, 4048	1958	0	<1	1	527	528
Total		**0**	**45**	**44**	**1,666**	**1,709**
Slovenia						
Pannonian Basin, 4048	1943	0	6	23	74	97
Moldova						
Carpathian-Balkanian Basin, 4061	1957	0	3	<1	0	<1
Bosnia and Herzegovina						
Pannonian Basin, 4048	1934	0	<1	0	0	0
Macedonia						
Alps, 4051	1969	0	<1	<1	0	<1

Exploration data

Country	Land area (mi²)
Romania	88,761
Ukraine	223,681
Belarus	78,340
Hungary	34,598
Albania	10,578
Serbia	29,913
Montenegro	5,194
Kosovo	4,203
Poland	117,474
Czech Republic	29,825
Greece	50,443
Bulgaria	41,888
Lithuania	24,201
Slovakia	18,573
Slovenia	7,780
Latvia	24,034
Moldova	12,699
Bosnia and Herzegovina	19,763
Croatia	21,612
Estonia	16,366
Macedonia	9,820
Total	**869,748**

Delineated prospective area through 2015:

At the surface ....316,866 mi²

Percentage at depth of 10,000 ft .... 45 percent

Explored area through 2015:

At the surface ....86,768 mi²

Percentage at depth of 10,000 ft .... 28 percent

Wildcat wells through 2015:

Total ....12,573 wells

Percentage at depths of ≥10,000 ft .... 18 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil ....17.273 BBO

Gas ....200.829 TCF

Percentage of oil at depths of ≥10,000 ft .... 22 percent

Percentage of gas at depths of ≥10,000 ft .... 39 percent

Percentage of oil in oil fields at depths of ≥10,000 ft .... 24 percent

Percentage of gas in gas fields at depths of ≥10,000 ft .... 42 percent

Figure 25.   Continued.

Figure 26. Map, graphs, and tables of data for oil and gas exploration through 2015 in Turkey and Cyprus.
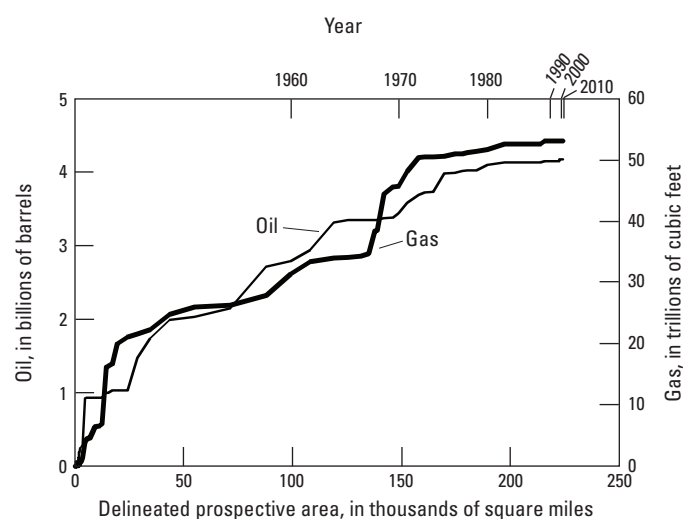
Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
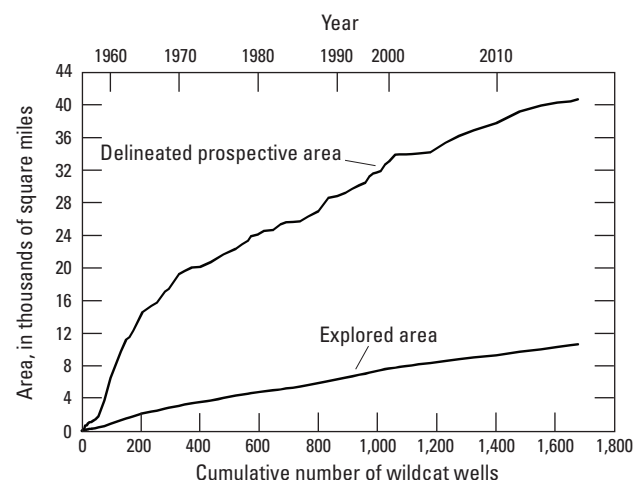
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 26. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Turkey						
Aegean, 4075	1988	0	0	0	338	338
Euphrates/Mardin, 2075	1958	0	75	43	14	57
Zagros Fold Belt, 2030	1945	310	966	44	267	311
Total		**310**	**1,041**	**87**	**618**	**705**
Cyprus						
Levantine Basin, 2032	2011	0	0	0	1,786	1,786

Exploration data

Country	Land area (mi²)
Turkey	297,157
Cyprus	3,568
Total	**300,725**

Delineated prospective area through 2015:
    At the surface .... 40,639 mi^2
    Percentage at depth of 10,000 ft... 33 percent

Explored area through 2015:
    At the surface .... 10,619 mi^2
    Percentage at depth of 10,000 ft... 22 percent

Wildcat wells through 2015:
    Total.. 1,678 wells
    Percentage at depths of ≥10,000 ft...................................... 18 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...1.270 BBO
    Gas...3.342 TCF
    Percentage of oil at depths of ≥10,000 ft .... 3 percent
    Percentage of gas at depths of ≥10,000 ft .... 55 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft .... 3 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft .... 67 percent

Figure 26. Turkey and Cyprus

129

Figure 27. Map, graphs, and tables of data for oil and gas exploration through 2015 in the Arabian Peninsula. For this figure, the parts mapped are Saudi Arabia, Kuwait, United Arab Emirates, Oman, Qatar, Yemen, and Bahrain. Outlines of the seven individual emirates of the United Arab Emirates (UAE) are not shown on the map, but significant provinces are listed for six of them; the seven are Abu Dhabi, Dubai, Sharjah, Ra's al Khaymah, Umm al Qaywayn, 'Ajman, and Al Fujayrah. The former Kuwait-Saudi Arabia Neutral Zone contains resources according to the IHS Markit (2016), and so it is listed in the significant provinces table, but it is not mapped because it is not mentioned in "The World Factbook 2016" (CIA, 2016).

Figure 27. Arabian Peninsula   131

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
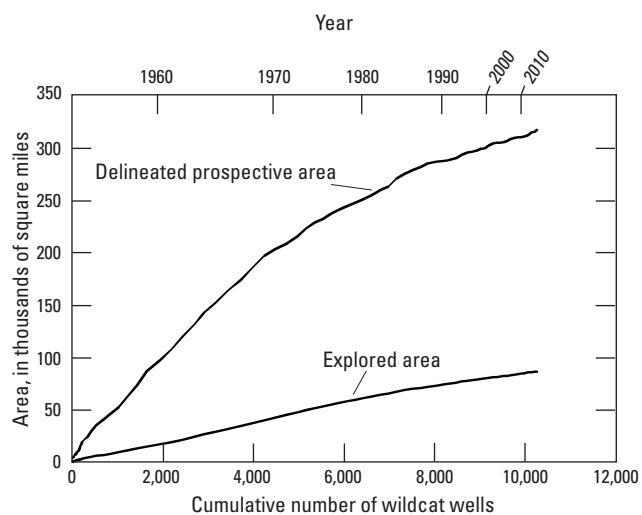
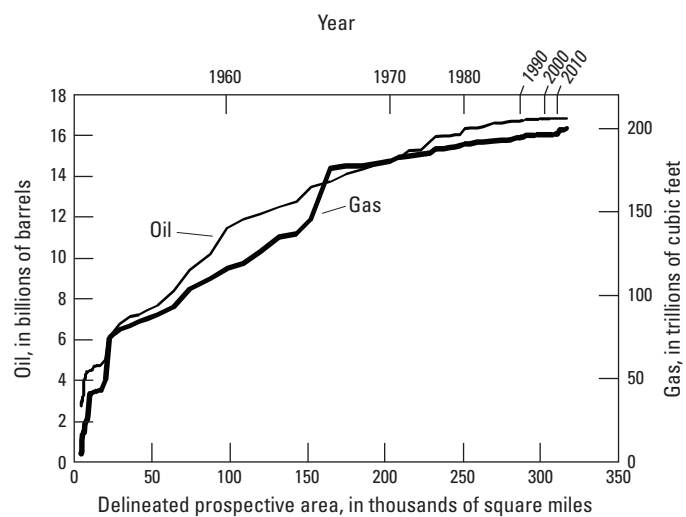**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**

Figure 27.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Saudi Arabia						
Greater Ghawar Uplift, 2021	1938	161,552	161,637	192,560	4,950	197,510
Interior Homocline-Central Arch, 2020	1989	6,210	6,635	17,450	6,130	23,580
Mesopotamian Foredeep Basin, 2024	1940	161,545	161,756	100,672	8,625	109,297
Red Sea Basin, 2071	1969	0	99	15	4,075	4,090
Rub Al Khali Basin, 2019	1967	22,950	23,287	45,106	11,340	56,446
Widyan Basin-Interior Platform, 2023	1957	30,734	31,049	10,471	3,400	13,871
Total		**382,991**	**384,463**	**366,274**	**38,520**	**404,794**
Kuwait						
Mesopotamian Foredeep Basin, 2024	1938	92,325	92,564	75,189	10,462	85,651
Widyan Basin-Interior Platform, 2023	1972	0	<1	1	0	1
Total		**92,325**	**92,565**	**75,190**	**10,462**	**85,652**
UAE - Abu Dhabi						
Rub Al Khali Basin, 2019	1954	75,738	77,250	178,268	5,831	184,099
UAE - Dubai						
Rub Al Khali Basin, 2019	1966	4,124	4,253	3,248	4,000	7,248
UAE - Sharjah						
Rub Al Khali Basin, 2019	1972	110	110	900	5,492	6,392
UAE - Ra's al Khaymah						
Rub Al Khali Basin, 2019	1972	0	6	115	200	315
UAE - Umm al Qaywayn						
Rub Al Khali Basin, 2019	1976	0	0	0	300	300
UAE - 'Ajman						
Rub Al Khali Basin, 2019	1983	0	0	0	95	95
Former Kuwait-Saudi Arabia Neutral Zone						
Mesopotamian Foredeep Basin, 2024	1953	13,725	13,910	12,184	0	12,184
Oman						
Central Oman Platform, 2015	1966	239	344	216	15,623	15,839
East Flank Oman Sub-basin, 2012	1973	2,448	3,232	187	0	187
Fahud Salt Basin, 2016	1962	5,121	5,353	8,468	5,395	13,863
Ghaba Salt Basin, 2014	1964	675	2,025	220	28,636	28,857
Rub Al Khali Basin, 2019	1969	975	1,528	2,201	1,184	3,384
South Oman Salt Basin, 2011	1956	2,398	3,532	1,889	2,250	4,139
Total		**11,856**	**16,013**	**13,180**	**53,088**	**66,268**
Qatar						
Greater Ghawar Uplift, 2021	1940	5,800	5,803	10,800	0	10,800
Qatar Arch, 2022	1971	3,920	3,944	3,756	1,002,775	1,006,531
Rub Al Khali Basin, 2019	1960	5,015	5,109	12,494	0	12,494
Total		**14,735**	**14,856**	**27,050**	**1,002,775**	**1,029,825**

Figure 27.   Continued.

Figure 27. Arabian Peninsula **133**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015—Continued

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Yemen						
Ma'Rib-Al Jawf/Masila Basin, 2004	1984	1,285	1,634	8,549	6,048	14,597
Masila-Jeza Basin, 2009	1991	1,330	2,003	521	100	621
Total		**2,615**	**3,637**	**9,070**	**6,148**	**15,218**
Bahrain						
Greater Ghawar Uplift, 2021	1932	1,500	1,500	20,760	0	20,760

Exploration data

Country	Land area (mi²)
Saudi Arabia	830,000
Kuwait	6,880
United Arab Emirates	32,278
Oman	119,499
Qatar	4,473
Yemen	203,850
Bahrain	293
Total	1,197,273

Delineated prospective area through 2015:
    At the surface..184,236 mi^2
    Percentage at depth of 10,000 ft .... 53 percent

Explored area through 2015:
    At the surface..35,303 mi^2
    Percentage at depth of 10,000 ft .... 42 percent

Wildcat wells through 2015:
    Total ....2,340 wells
    Percentage at depths of ≥10,000 ft .... 35 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil ....608.747 BBO
    Gas ....1,834.783 TCF
    Percentage of oil at depths of ≥10,000 ft.. 19 percent
    Percentage of gas at depths of ≥10,000 ft... 19 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft................................... 19 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft................................. 10 percent

Figure 27. Continued.
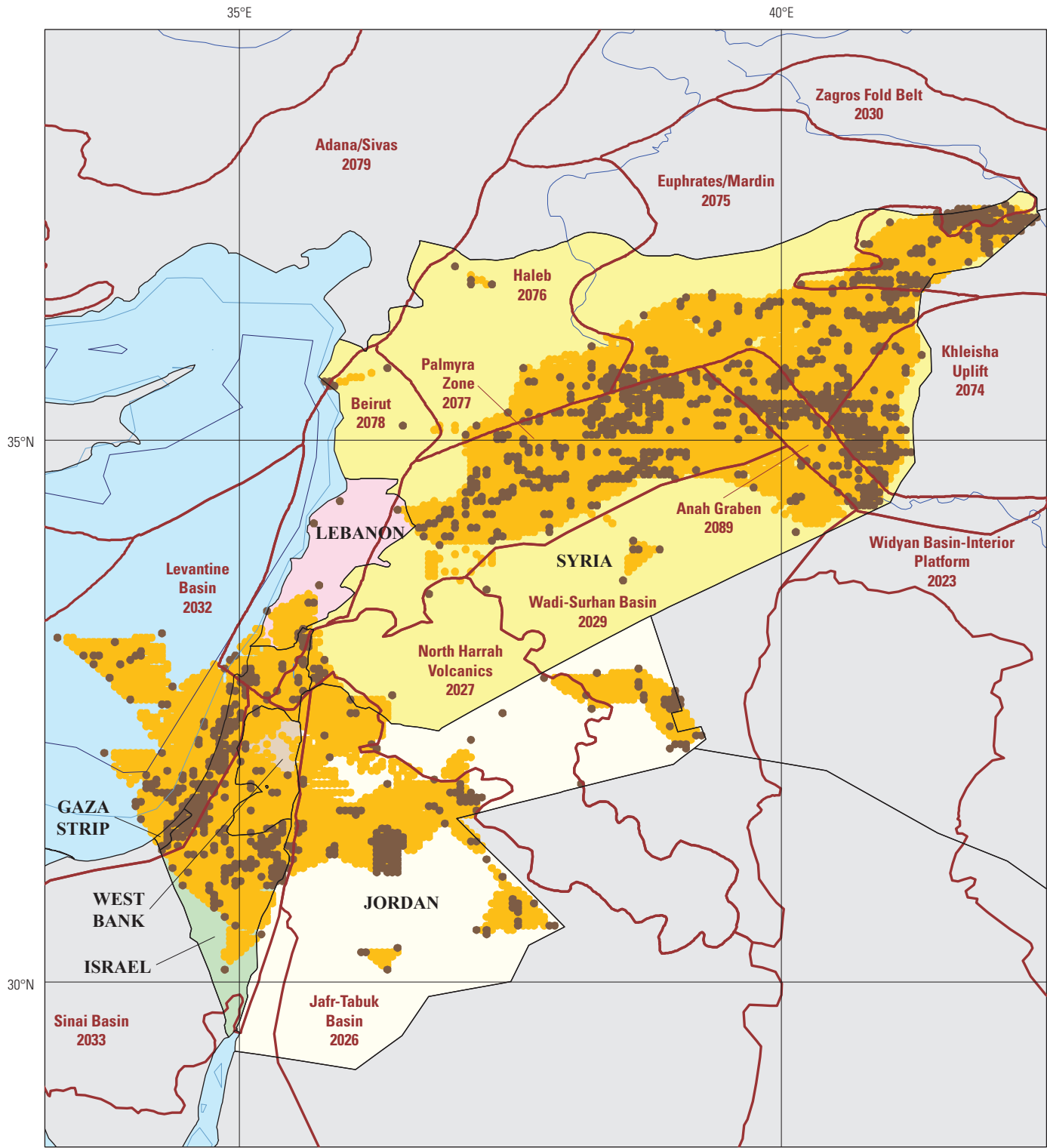
Figure 28.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Syria, Israel, Jordan, Lebanon, Gaza Strip, and the West Bank.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
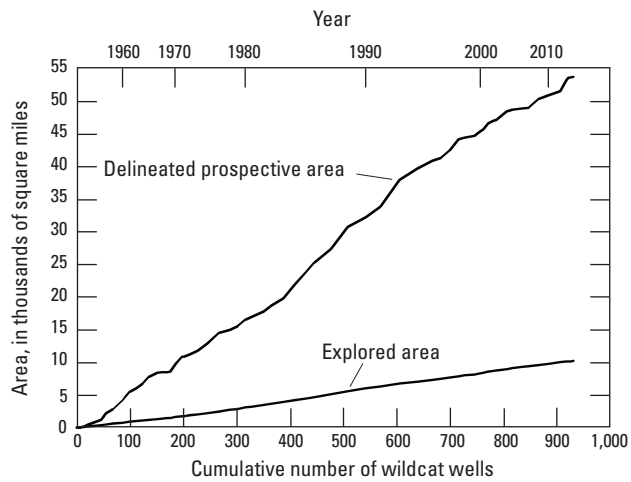
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
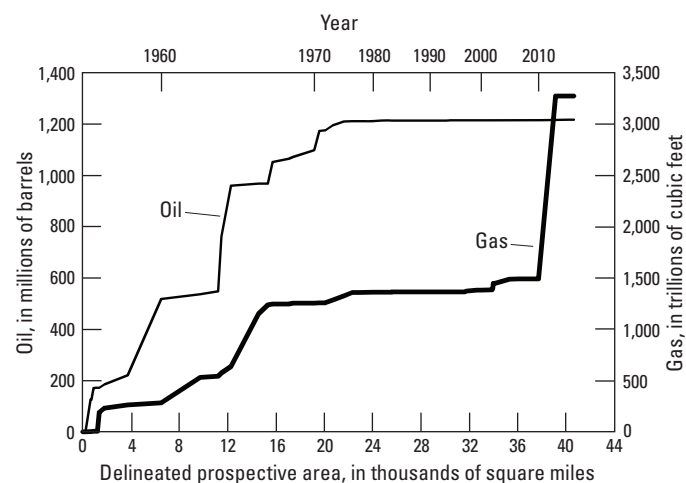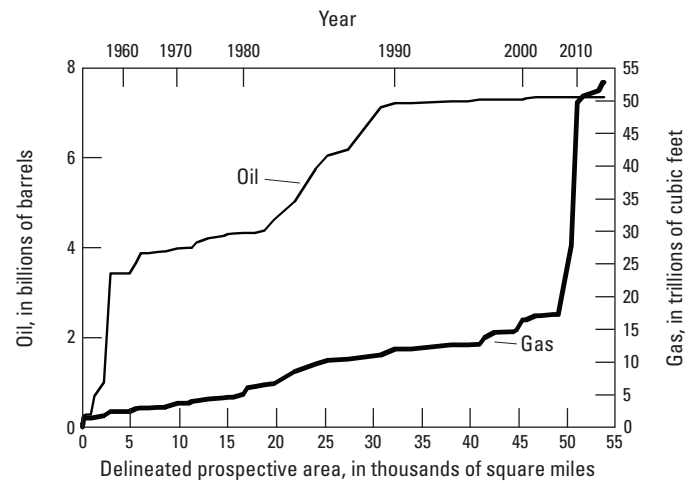

Figure 28.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Syria						
Anah Graben, 2089	1982	218	440	255	25	280
Euphrates/Mardin, 2075	1940	872	1,274	2,656	1,180	3,836
Khleisha Uplift, 2074	1986	1,043	1,887	1,826	21	1,847
Palmyra Zone, 2077	1968	0	241	414	5,733	6,147
Zagros Fold Belt, 2030	1956	3,098	3,364	1,518	36	1,554
Total		**5,230**	**7,207**	**6,668**	**6,994**	**13,663**
Israel						
Levantine Basin, 2032	1955	110	161	173	38,612	38,785

Figure 28.   Continued.

Exploration data

Country	Land area (mi²)
Syria	70,900
Israel	7,849
Jordan	34,287
Lebanon	3,950
Gaza Strip	139
West Bank	2,178
Total	**119,302**

Delineated prospective area through 2015:
   At the surface...53,714 mi²
   Percentage at depth of 10,000 ft.. 54 percent

Explored area through 2015:
   At the surface...10,235 mi²
   Percentage at depth of 10,000 ft.. 39 percent

Wildcat wells through 2015:
   Total...933 wells
   Percentage at depths of ≥10,000 ft... 34 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
   Oil...7.405 BBO
   Gas..52.900 TCF
   Percentage of oil at depths of ≥10,000 ft... 29 percent
   Percentage of gas at depths of ≥10,000 ft.. 75 percent
   Percentage of oil in oil fields at depths of ≥10,000 ft.................................... 29 percent
   Percentage of gas in gas fields at depths of ≥10,000 ft.................................. 83 percent

Figure 28.   Continued.
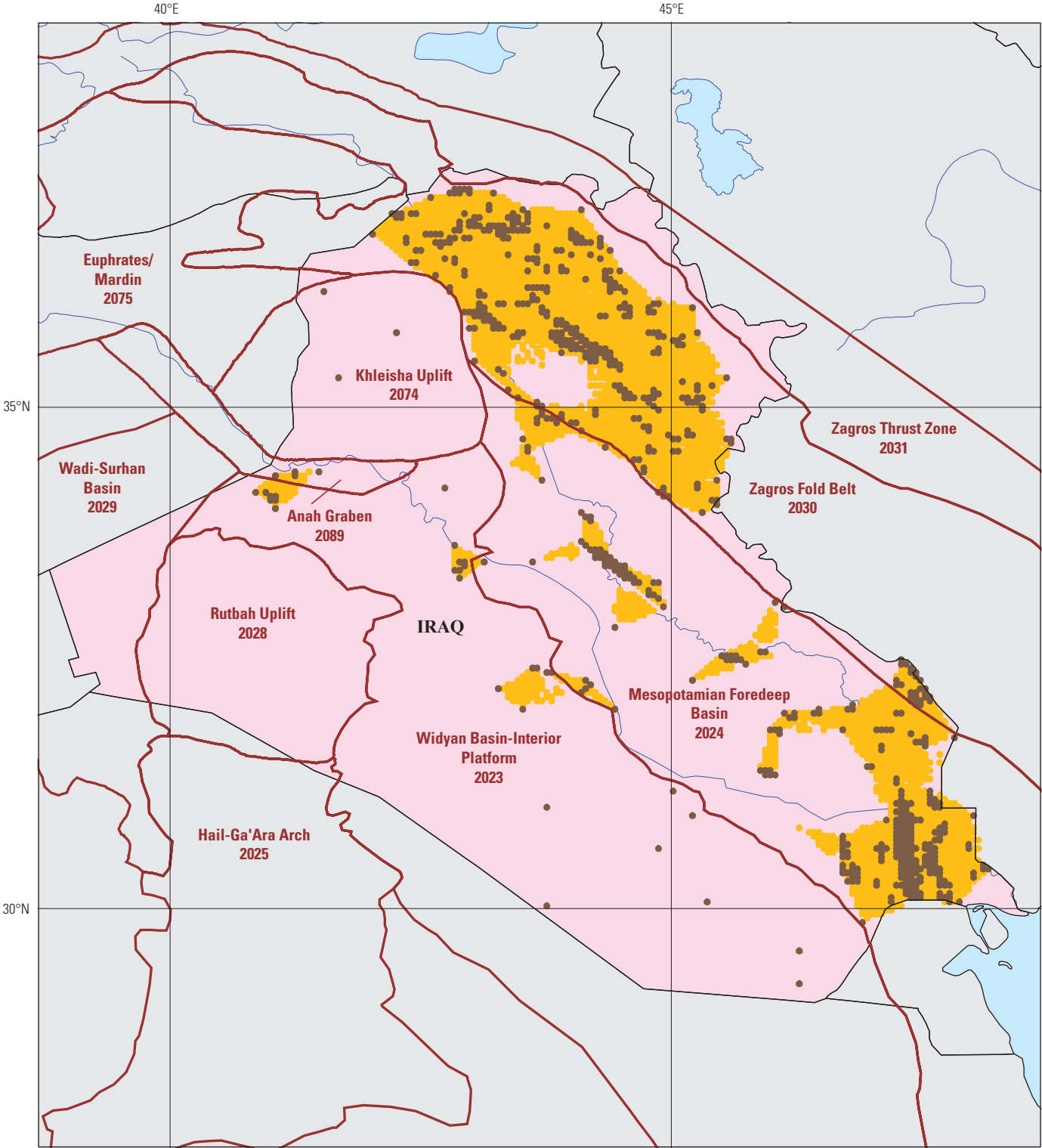
Figure 29.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Iraq.

Figure 29. Iraq **139**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

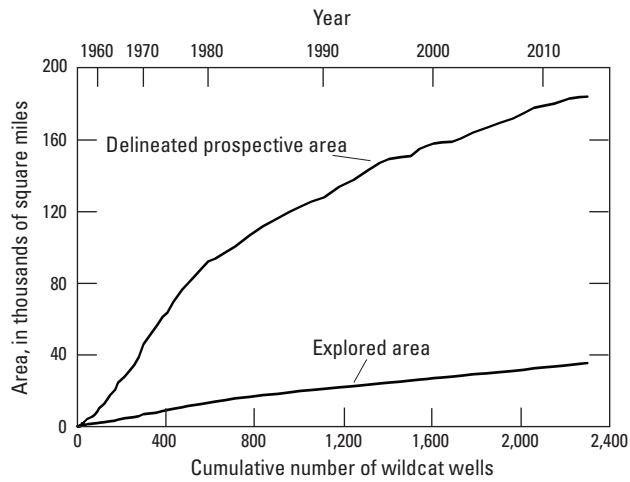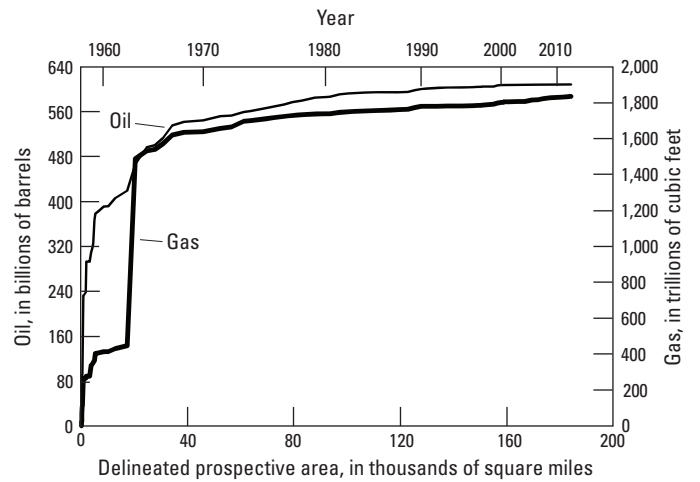**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Iraq						
Mesopotamian Foredeep Basin, 2024	1938	142,181	142,697	132,694	38	132,732
Widyan Basin-Interior Platform, 2023	1939	526	713	328	6,310	6,638
Zagros Fold Belt, 2030	1905	44,495	46,233	40,351	29,098	69,449
Total		**187,202**	**189,643**	**173,373**	**35,446**	**208,819**

Exploration data

Country	Land area (mi²)
Iraq	168,868

Delineated prospective area through 2015:
At the surface ....32,405 mi²
Percentage at depth of 10,000 ft...60 percent

Explored area through 2015:
At the surface ....5,578 mi²
Percentage at depth of 10,000 ft...58 percent

Wildcat wells through 2015:
Total...269 wells
Percentage at depths of ≥10,000 ft..52 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
Oil.. 189.643 BBO
Gas.. 208.819 TCF
Percentage of oil at depths of ≥10,000 ft ....34 percent
Percentage of gas at depths of ≥10,000 ft ....37 percent
Percentage of oil in oil fields at depths of ≥10,000 ft ....34 percent
Percentage of gas in gas fields at depths of ≥10,000 ft ....37 percent

Figure 29. Continued.
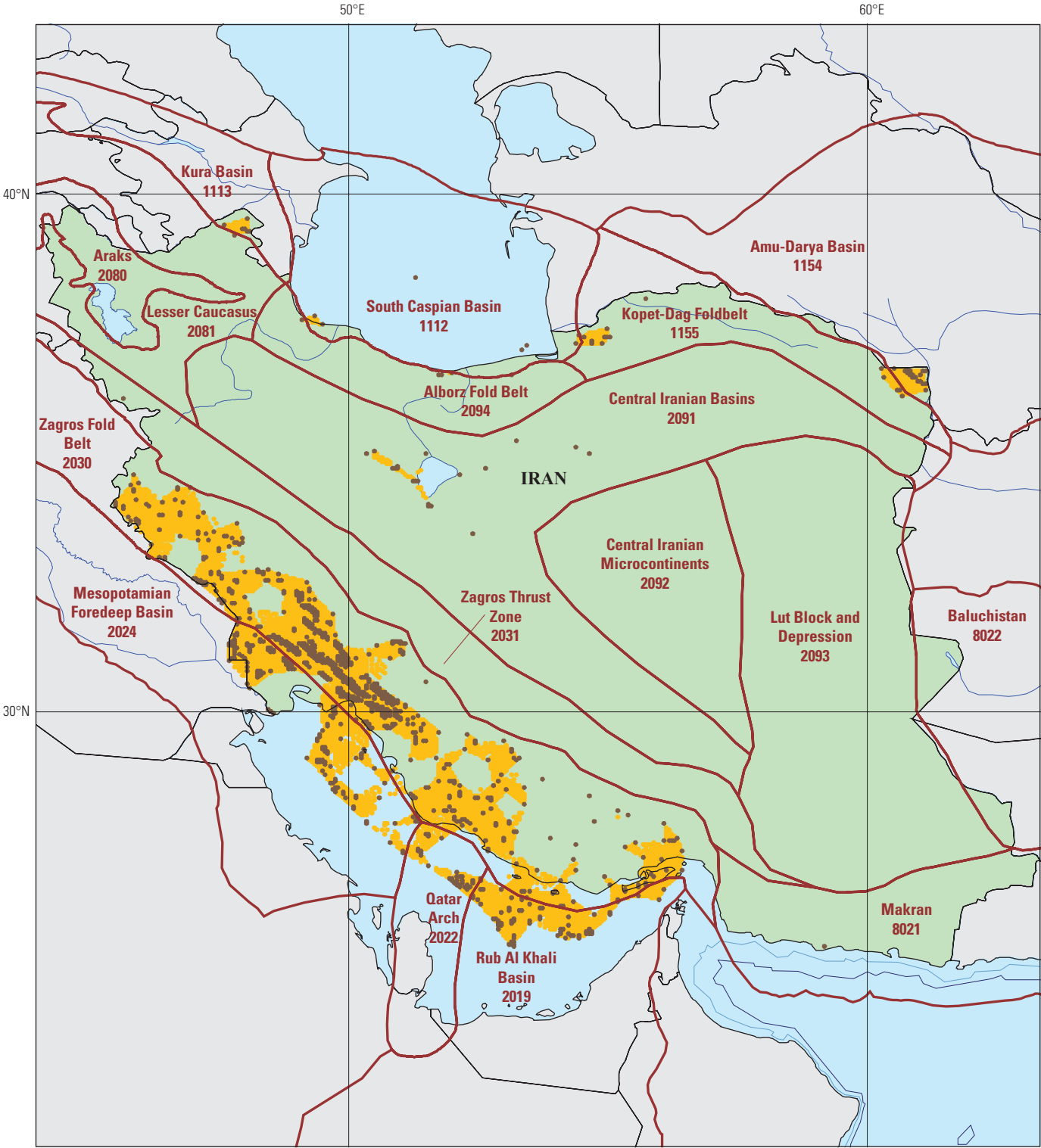
Figure 30.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Iran.

Figure 30. Iran   141

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
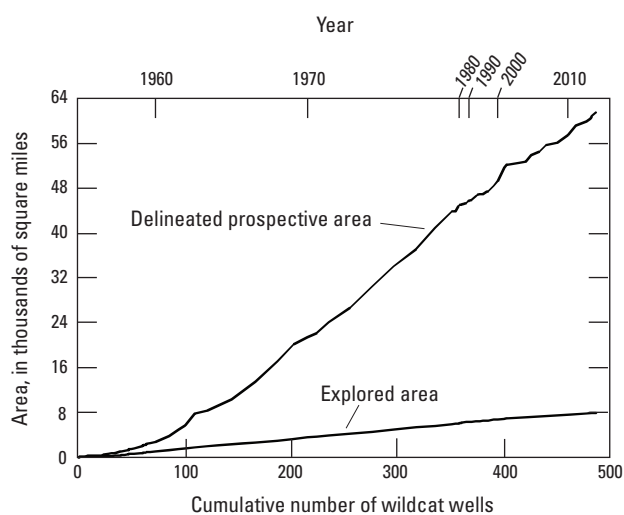
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 30.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
			Iran			
Amu-Darya Basin, 1154	1968	0	0	0	17,305	17,305
Kopet-Dag Foldbelt, 1155	1967	0	0	0	2,000	2,000
Kura Basin, 1113	1967	0	3	1	0	1
Mesopotamian Foredeep Basin, 2024	1960	30,563	30,933	39,308	66,003	105,311
Qatar Arch, 2022	1967	0	906	0	516,409	516,409
Rub Al Khali Basin, 2019	1965	4,798	5,200	13,552	5,441	18,993
South Caspian Basin, 1112	1960	492	492	500	700	1,200
Zagros Fold Belt, 2030	1908	123,003	124,761	272,129	241,804	513,933
Total		**158,855**	**162,295**	**325,490**	**849,662**	**1,175,153**

Figure 30. Continued.

Figure 30. Iran   143

Exploration data

Country	Land area (mi²)
Iran	591,352

Delineated prospective area through 2015:
    At the surface...61,548 mi²
    Percentage at depth of 10,000 ft.. 65 percent

Explored area through 2015:
    At the surface...7,925 mi²
    Percentage at depth of 10,000 ft.. 54 percent

Wildcat wells through 2015:
    Total..488 wells
    Percentage at depths of ≥10,000 ft .... 54 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil ....162.344 BBO
    Gas ....1,175.408 TCF
    Percentage of oil at depths of ≥10,000 ft... 55 percent
    Percentage of gas at depths of ≥10,000 ft.. 82 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft.................................... 55 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft................................... 94 percent

Figure 30. Continued.

Figure 31.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Cote d'Ivoire, Ghana, Benin, Guinea-Bissau, Togo, Senegal, The Gambia, Guinea, Sierra Leone, Liberia, and Cabo Verde (not mapped). The Guinea-Bissau/Senegal Joint Economic Zone (JEZ) is not delineated on the map because a standard boundary was not available.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
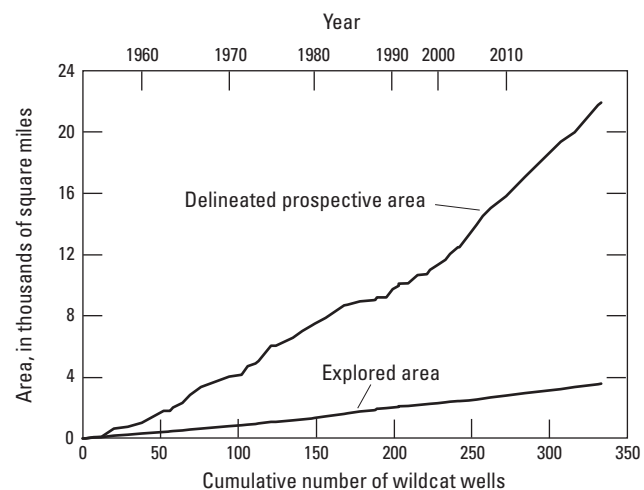
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 31. Continued.

Figure 31. Cote d'Ivoire, Ghana, Benin, and Neighboring Countries   **145**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Cote d'Ivoire						
Gulf of Guinea, 7183	1972	477	781	1,343	2,311	3,654
Undesignated offshore area		180	185	123	30	153
Total		**657**	**966**	**1,465**	**2,341**	**3,806**
Ghana						
Gulf of Guinea, 7183	1970	990	1,722	4,498	837	5,335
Undesignated offshore area		0	165	180	0	180
Total		**990**	**1,887**	**4,678**	**837**	**5,515**
Benin						
Gulf of Guinea, 7183	1968	0	91	161	0	161
Undesignated offshore area		0	30	15	0	15
Total		**0**	**121**	**176**	**0**	**176**
Guinea-Bissau						
Senegal, 7013	2004	0	13	4	0	4
Togo						
Gulf of Guinea, 7183	1970	0	7	2	0	2
Senegal						
Senegal, 7013	1959	658	658	861	94	955
Guinea-Bissau/Senegal JEZ						
Senegal, 7013	1967	0	10	1	0	1

Figure 31. Continued.

Exploration data

Country	Land area (mi²)
Cote d'Ivoire	122,782
Ghana	87,851
Benin	42,711
Guinea-Bissau	10,857
Togo	20,998
Senegal	74,336
The Gambia	3,861
Guinea	94,872
Sierra Leone	27,653
Liberia	37,189
Cabo Verde (not shown on map)	1,557
Total	**524,668**

Delineated prospective area through 2015:

    At the surface .... 21,722 mi²

    Percentage at depth of 10,000 ft... 52 percent

Explored area through 2015:

    At the surface .... 3,414 mi²

    Percentage at depth of 10,000 ft... 48 percent

Wildcat wells through 2015:

    Total.. 345 wells

    Percentage at depths of ≥10,000 ft..................................... 100 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

    Oil...3.957 BBO

    Gas...15.667 TCF

    Percentage of oil at depths of ≥10,000 ft .... 79 percent

    Percentage of gas at depths of ≥10,000 ft .... 55 percent

    Percentage of oil in oil fields at depths of ≥10,000 ft .... 80 percent

    Percentage of gas in gas fields at depths of ≥10,000 ft .... 67 percent

Figure 31. Continued.

Figure 31. Coted'Ivoire, Ghana, Benin, and Neighboring Countries   147
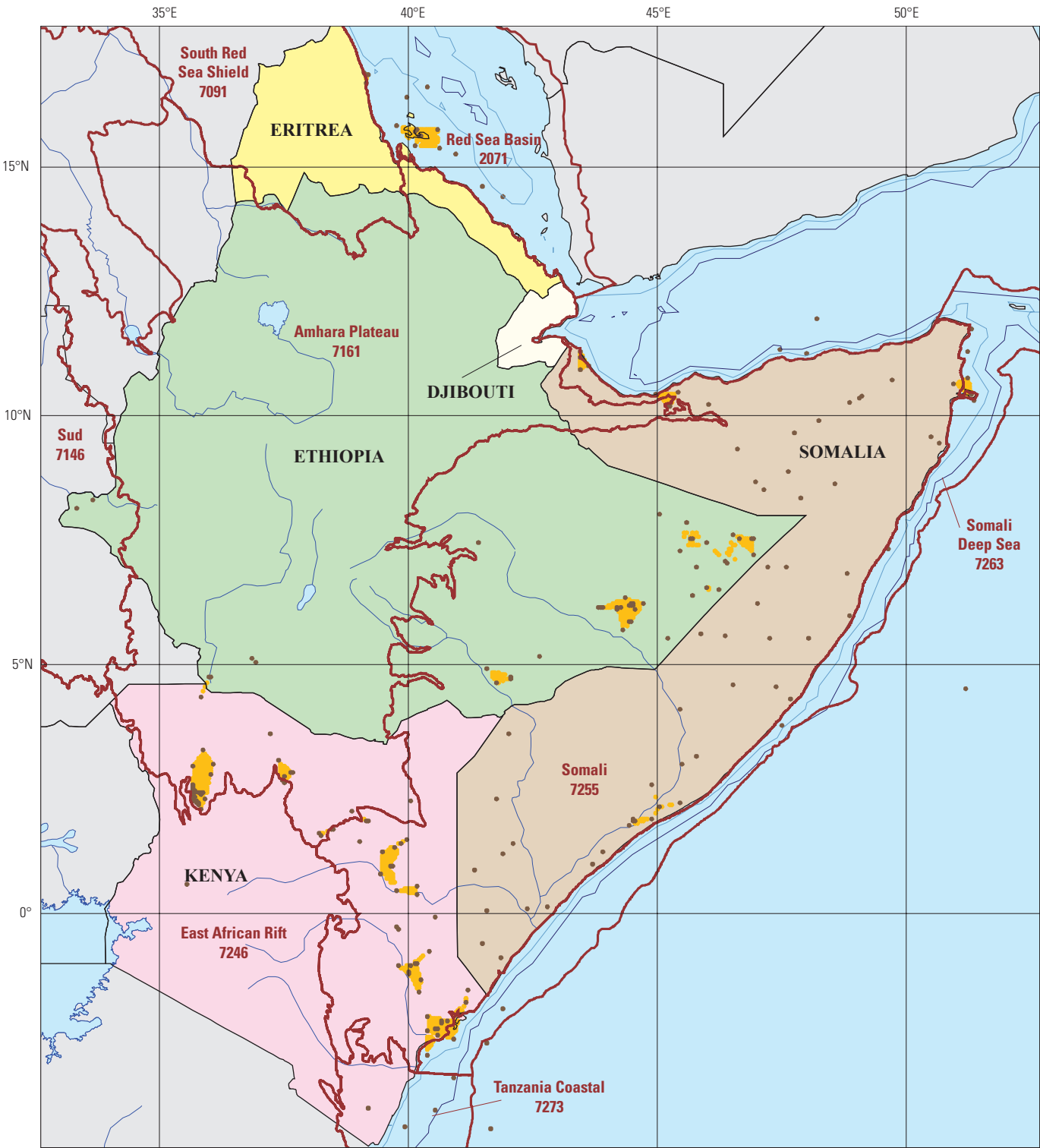
Figure 32.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Ethiopia, Somalia, Eritrea, Kenya, and Djibouti.

Figure 32. Ethiopia, Somalia, Eritrea, Kenya, and Djibouti   149

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 32.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

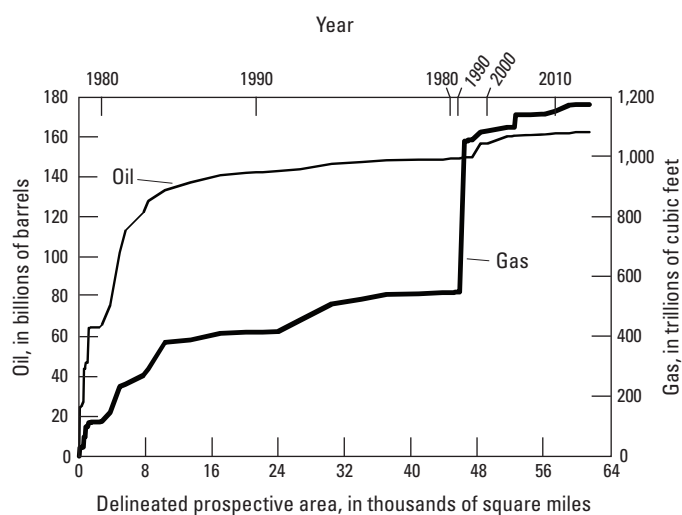| Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Ethiopia						
Somali, 7255	1972	155	155	106	3,685	3,791
Somalia						
Somali, 7255	1959	0	0	0	200	200
Eritrea						
Red Sea Basin, 2071	1970	0	0	0	5	5
Kenya						
Amhara Plateau, 7161	1993	458	686	101	0	101
Somali, 7255	1960	0	0	0	585	585
Tanzania Coastal, 7273	1974	0	10	95	260	355
Total		**458**	**696**	**196**	**845**	**1,041**

Figure 32.   Continued.

Figure 32. Ethiopia, Somalia, Eritrea, Kenya, and Djibouti   **151**

Exploration data

Country	Land area (mi²)
Ethiopia	386,102
Somalia	242,216
Eritrea	38,996
Kenya	219,746
Djibouti	8,950
Total	**896,011**

Delineated prospective area through 2015:
    At the surface .... 7,928 mi²
    Percentage at depth of 10,000 ft..21 percent

Explored area through 2015:
    At the surface .... 1,021 mi²
    Percentage at depth of 10,000 ft..29 percent

Wildcat wells through 2015:
    Total.. 178 wells
    Percentage at depths of ≥10,000 ft..42 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...851 MMBO
    Gas..5.038 BCF
    Percentage of oil at depths of ≥10,000 ft ....2 percent
    Percentage of gas at depths of ≥10,000 ft ....75 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft ....2 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft ....80 percent

Figure 32. Continued.
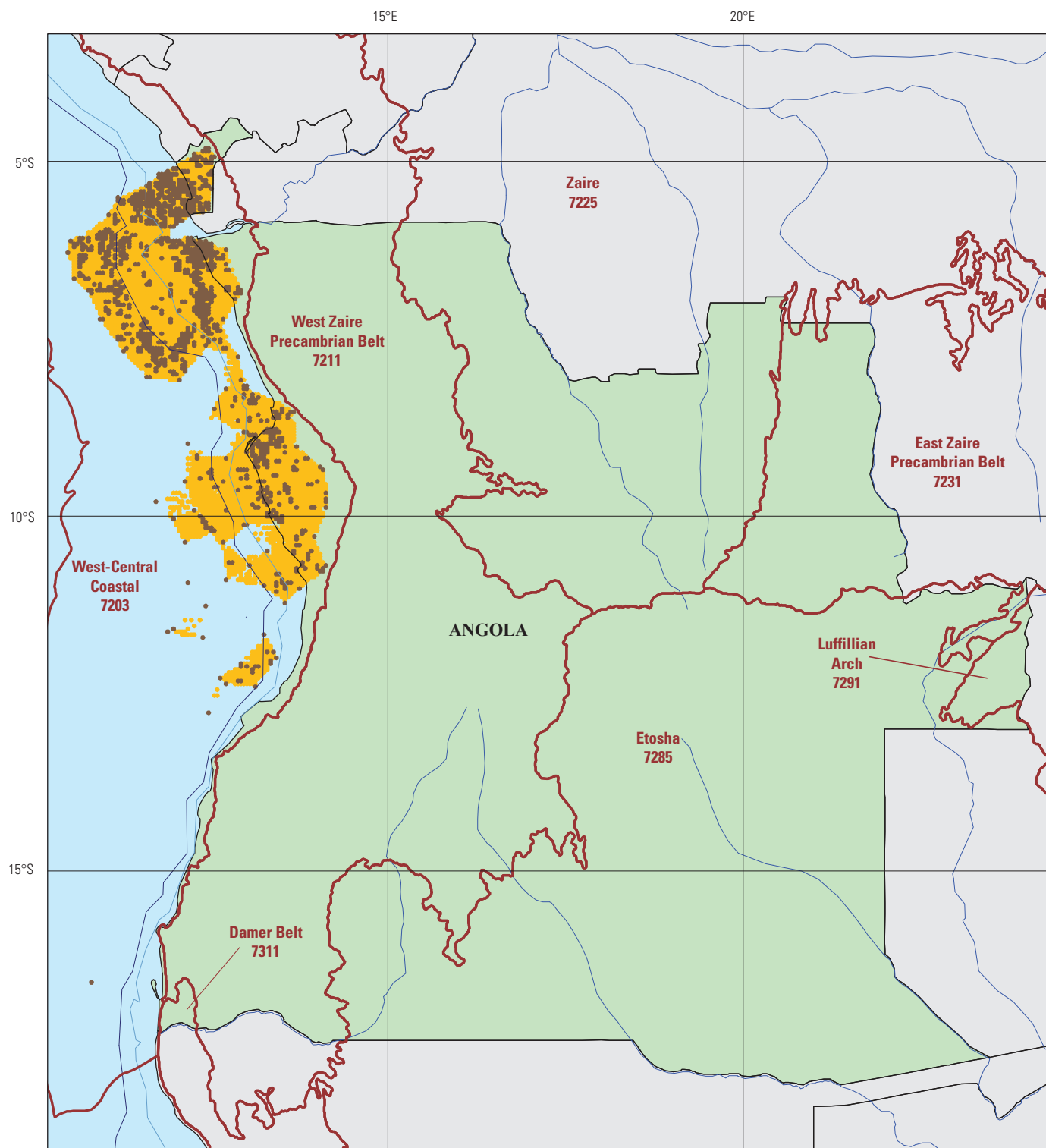
Figure 33.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Angola. The Angola/Congo Unitized Area is not delineated on the map because a standard boundary was not available.

Figure 33. Angola **153**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
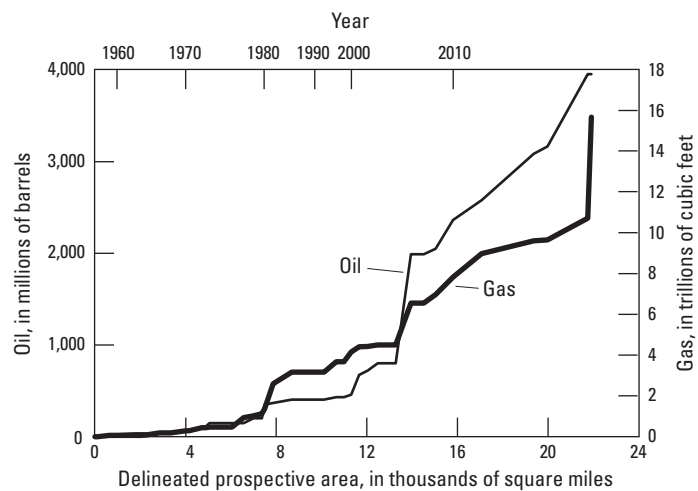

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Angola						
West-Central Coastal, 7203	1955	19,056	24,926	26,672	13,981	40,653
Angola/Congo Unitized Area						
West-Central Coastal, 7203	2003	0	90	90	0	90

Exploration data

Country	Land area (mi²)
Angola	481,354

Delineated prospective area through 2015:
At the surface ....40,584 mi²
Percentage at depth of 10,000 ft..60 percent

Explored area through 2015:
At the surface ....9,196 mi²
Percentage at depth of 10,000 ft..56 percent

Wildcat wells through 2015:
Total..859 wells
Percentage at depths of ≥10,000 ft..42 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
Oil...25.016 BBO
Gas... 40.743 TCF
Percentage of oil at depths of ≥10,000 ft ....68 percent
Percentage of gas at depths of ≥10,000 ft ....80 percent
Percentage of oil in oil fields at depths of ≥10,000 ft ....68 percent
Percentage of gas in gas fields at depths of ≥10,000 ft ....93 percent

Figure 33. Continued.
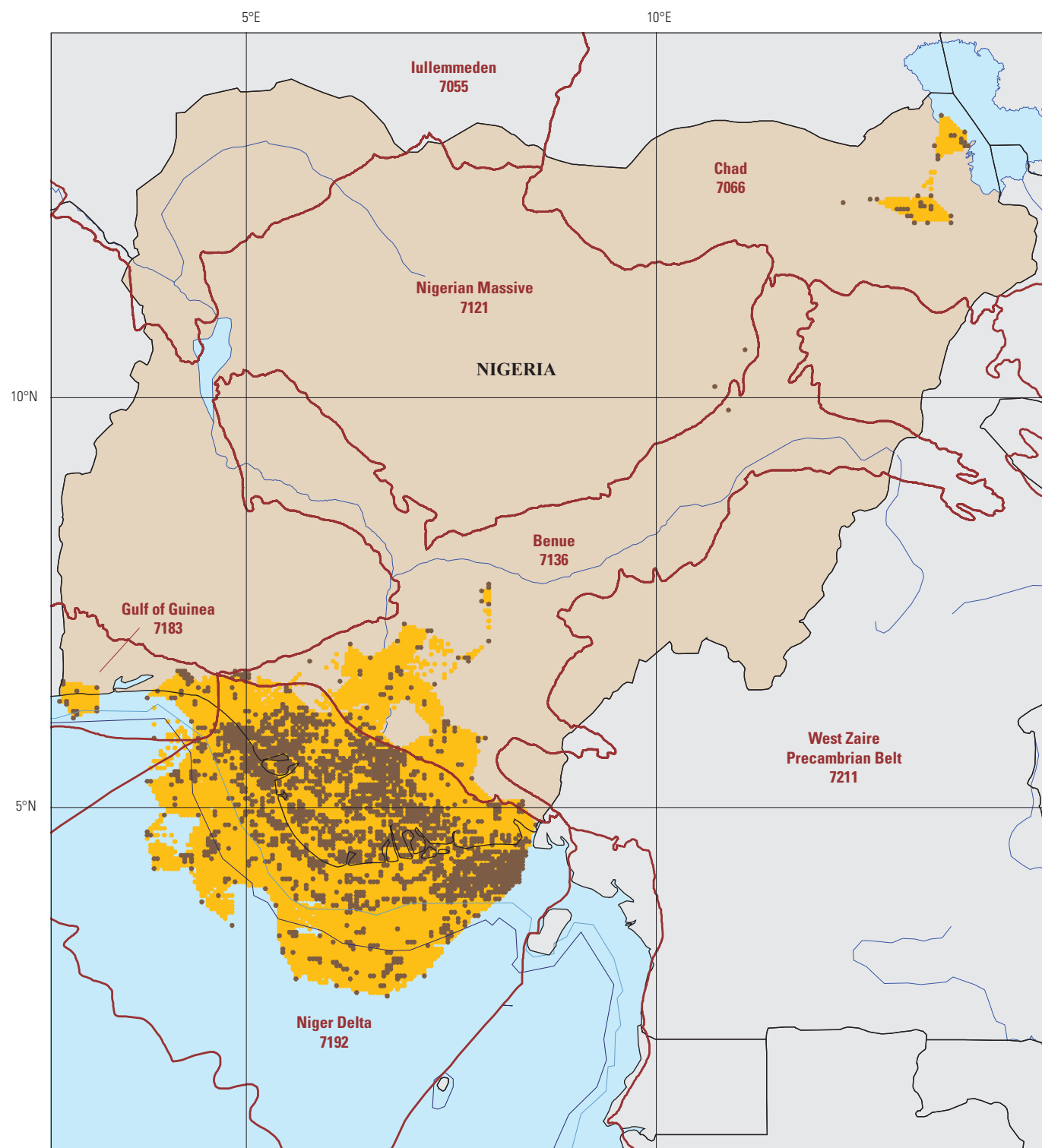
Figure 34. Map, graphs, and tables of data for oil and gas exploration through 2015 in Nigeria. The Nigeria/Sao Tome and Principe Joint Development Zone (JDZ) is not delineated on the map because a standard boundary was not available.

Figure 34. Nigeria 155

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
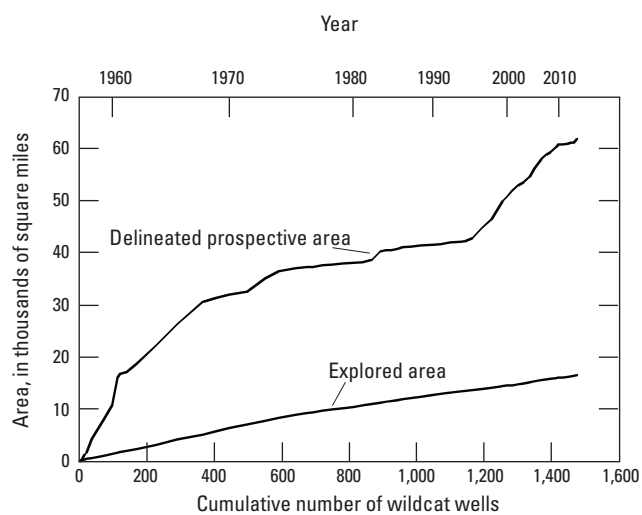
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 34. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

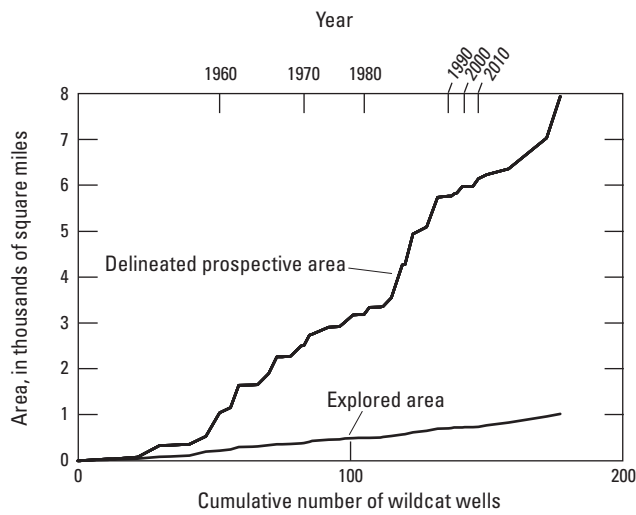| Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Nigeria						
Benue, 7136	1953	0	10	40	1,230	1,270
Gulf of Guinea, 7183	1981	190	249	1,390	0	1,390
Niger Delta, 7192	1954	49,741	62,338	172,001	69,851	241,852
Total		**49,931**	**62,596**	**173,431**	**71,081**	**244,512**
Nigeria/Sao Tome and Principe JDZ						
Niger Delta, 7192	2006	0	110	205	1,200	1,405

Figure 34.   Continued.

Figure 34. Nigeria 157

Exploration data

Country	Land area (mi²)
Nigeria	351,649

Delineated prospective area through 2015:
　At the surface ....61,807 mi²
　Percentage at depth of 10,000 ft..72 percent

Explored area through 2015:
　At the surface .... 16,440 mi²
　Percentage at depth of 10,000 ft..73 percent

Wildcat wells through 2015:
　Total.. 1,476 wells
　Percentage at depths of ≥10,000 ft..65 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
　Oil... 62.706 BBO
　Gas..245.950 TCF
　Percentage of oil at depths of ≥10,000 ft ....44 percent
　Percentage of gas at depths of ≥10,000 ft ....61 percent
　Percentage of oil in oil fields at depths of ≥10,000 ft ....44 percent
　Percentage of gas in gas fields at depths of ≥10,000 ft ....74 percent

Figure 34. Continued.
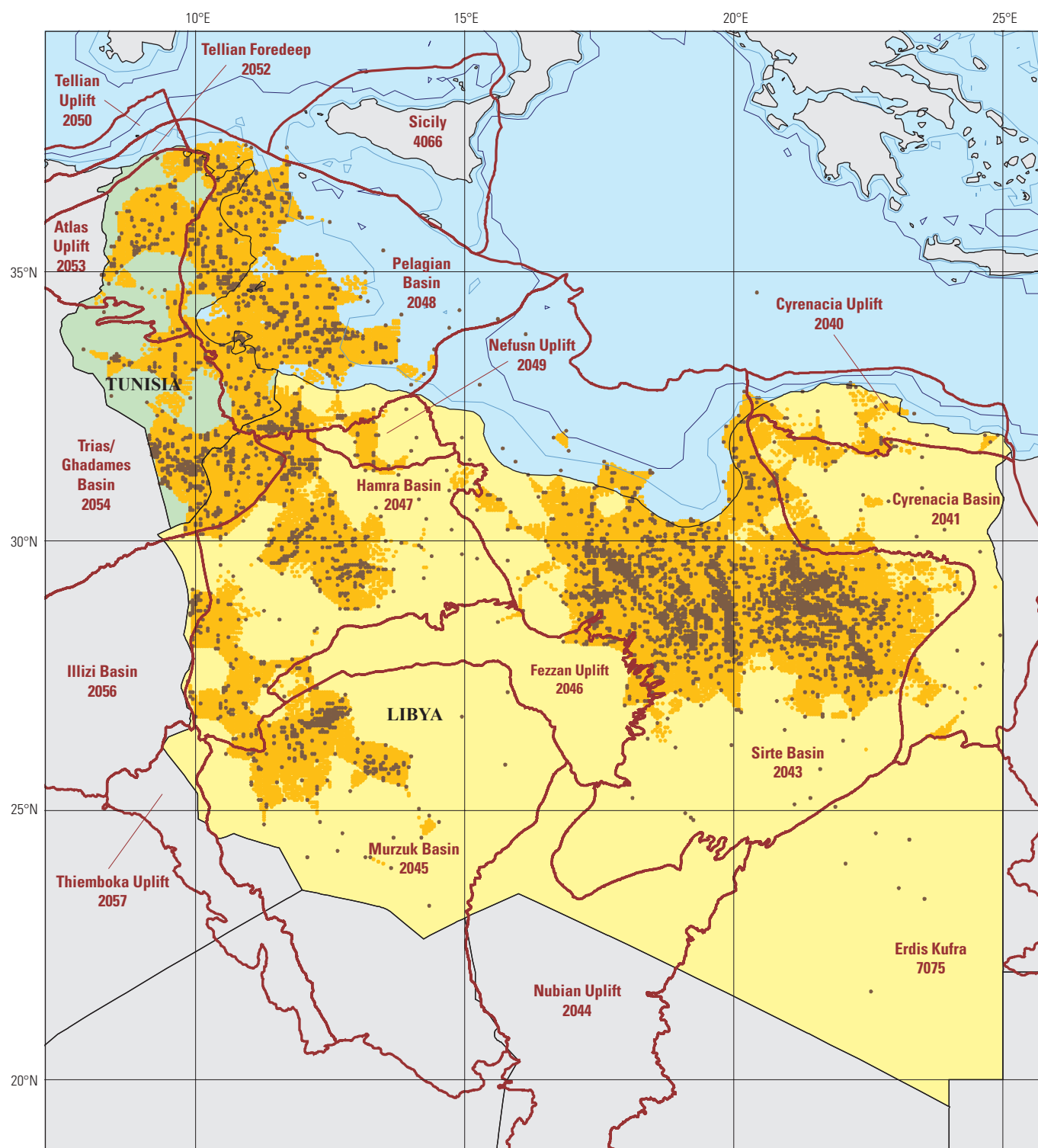
Figure 35.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Libya and Tunisia. The Libya/Tunisia Joint Economic Zone (JEZ) is not delineated on the map because a standard boundary was not available.

Figure 35. Libya and Tunisia **159**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
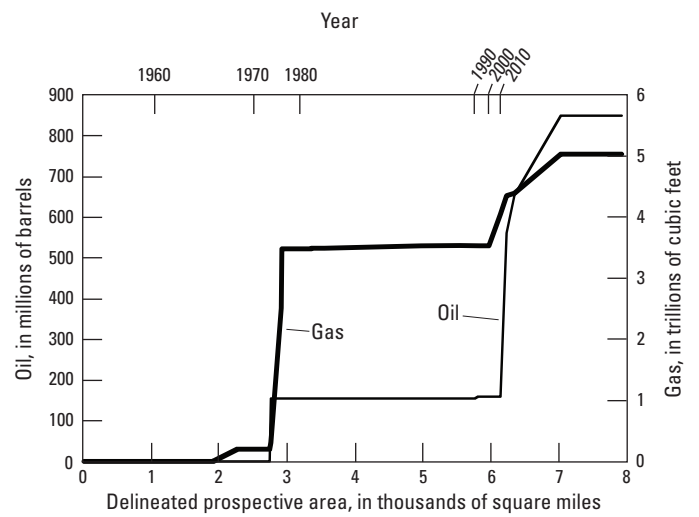
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 35. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Libya						
Fezzan Uplift, 2046	1961	224	309	158	0	158
Hamra Basin, 2047	1957	730	1,303	1,720	2,534	4,253
Illizi Basin, 2056	1964	0	40	0	2,721	2,721
Murzuk Basin, 2045	1978	3,003	3,886	689	35	724
Pelagian Basin, 2048	1959	1,335	1,918	4,564	19,399	23,963
Sirte Basin, 2043	1958	42,417	46,398	32,235	22,775	55,009
Trias/Ghadames Basin, 2054	1961	0	268	334	96	430
Total		**47,709**	**54,121**	**39,699**	**47,558**	**87,257**
Tunisia						
Pelagian Basin, 2048	1949	330	901	656	3,454	4,110
Sicily, 4066	1982	0	0	0	150	150
Trias/Ghadames Basin, 2054	1964	750	1,017	1,514	1,123	2,636
Total		**1,080**	**1,918**	**2,170**	**4,726**	**6,896**
Libya/Tunisia JEZ						
Pelagian Basin, 2048	1992	0	7	71	0	71

Figure 35.   Continued.

Figure 35. Libya and Tunisia   **161**

Exploration data

Country	Land area (mi²)
Libya	679,362
Tunisia	59,985
Total	**739,347**

Delineated prospective area through 2015:
  At the surface ....212,627 mi²
  Percentage at depth of 10,000 ft...41 percent

Explored area through 2015:
  At the surface ....33,265 mi²
  Percentage at depth of 10,000 ft...36 percent

Wildcat wells through 2015:
  Total...2,848 wells
  Percentage at depths of ≥10,000 ft...26 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil... 56.097 BBO
  Gas... 94.293 TCF
  Percentage of oil at depths of ≥10,000 ft ....27 percent
  Percentage of gas at depths of ≥10,000 ft ....51 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....27 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....52 percent

Figure 35.   Continued.
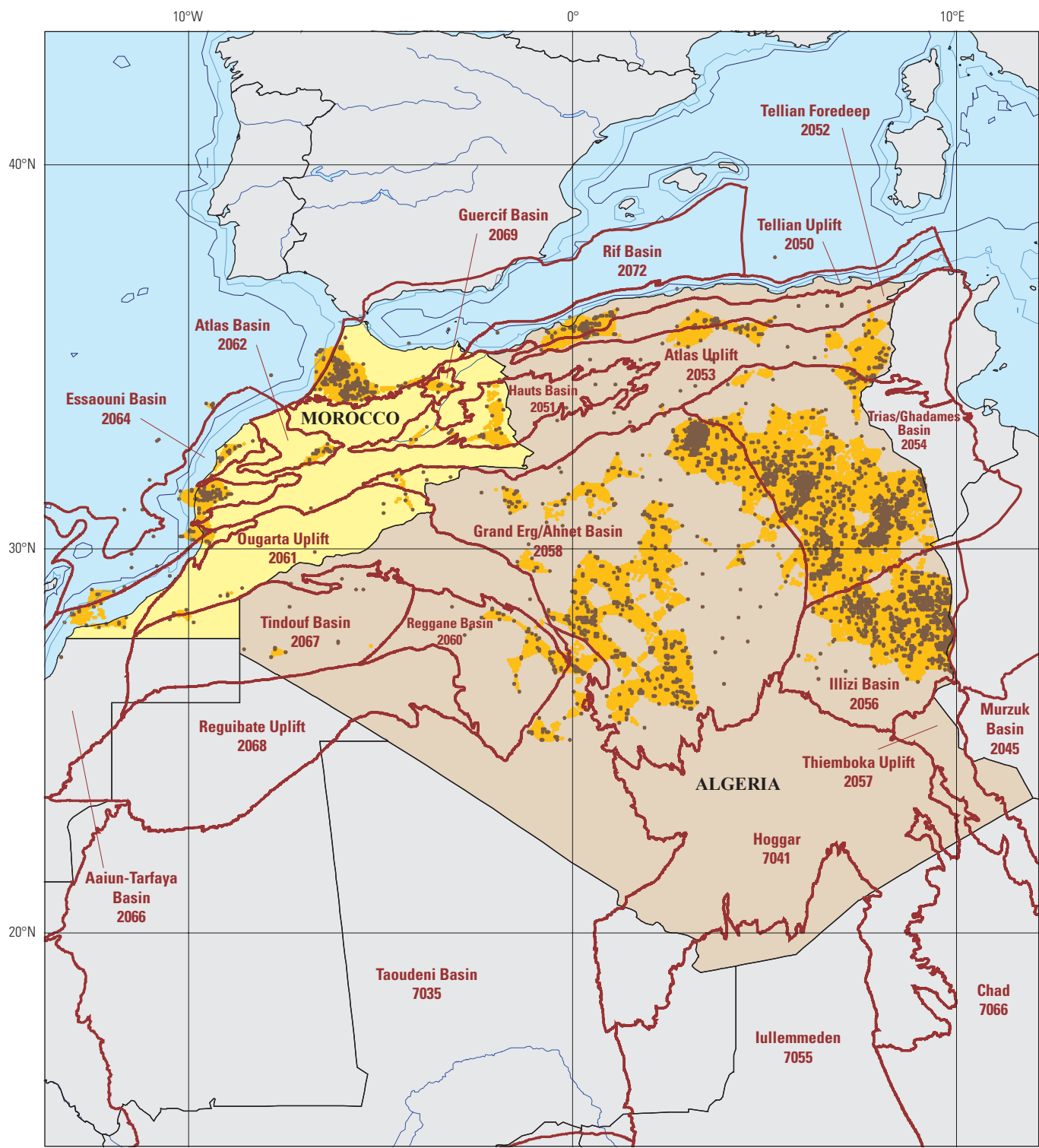
Figure 36.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Algeria and Morocco.

Figure 36. Algeria and Morocco **163**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
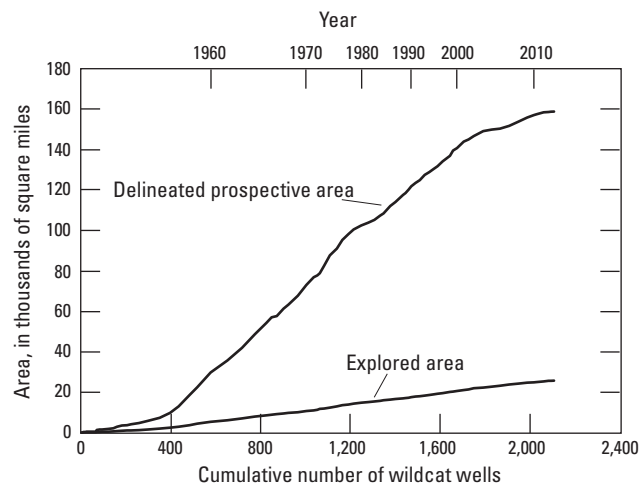
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
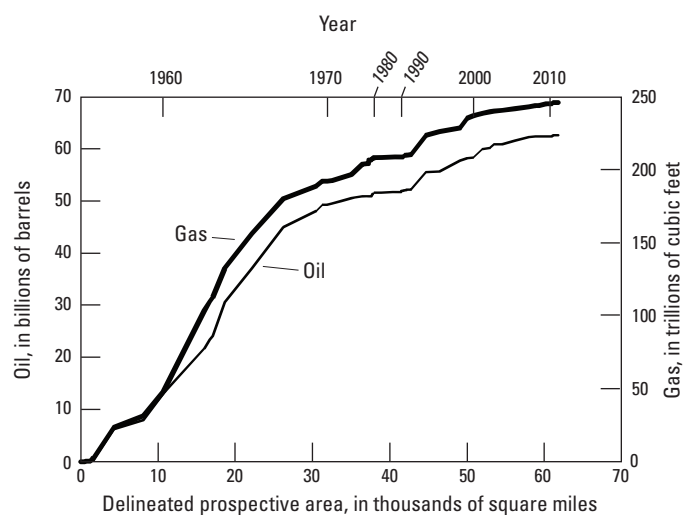

Figure 36. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Algeria						
Grand Erg/Ahnet Basin, 2058	1954	200	605	947	124,598	125,545
Illizi Basin, 2056	1956	3,494	4,615	16,209	31,275	47,483
Taoudeni Basin, 7035	1963	0	0	0	1,550	1,550
Trias/Ghadames Basin, 2054	1956	17,850	20,172	21,939	22,015	43,954
Total		**21,544**	**25,392**	**39,095**	**179,438**	**218,533**
Morocco						
Undesignated offshore area		0	0	0	50	50

Figure 36. Continued.

Figure 36. Algeria and Morocco   **165**

Exploration data

Country	Land area (mi²)
Algeria	919,595
Morocco	172,317
Total	**1,091,913**

Delineated prospective area through 2015:

At the surface .... 158,866 mi²

Percentage at depth of 10,000 ft..39 percent

Explored area through 2015:

At the surface .... 25,706 mi²

Percentage at depth of 10,000 ft..40 percent

Wildcat wells through 2015:

Total...2,201 wells

Percentage at depths of ≥10,000 ft..31 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil.. 25.480 BBO

Gas... 220.580 TCF

Percentage of oil at depths of ≥10,000 ft ....71 percent

Percentage of gas at depths of ≥10,000 ft ....19 percent

Percentage of oil in oil fields at depths of ≥10,000 ft ....74 percent

Percentage of gas in gas fields at depths of ≥10,000 ft ....14 percent

Figure 36.   Continued.
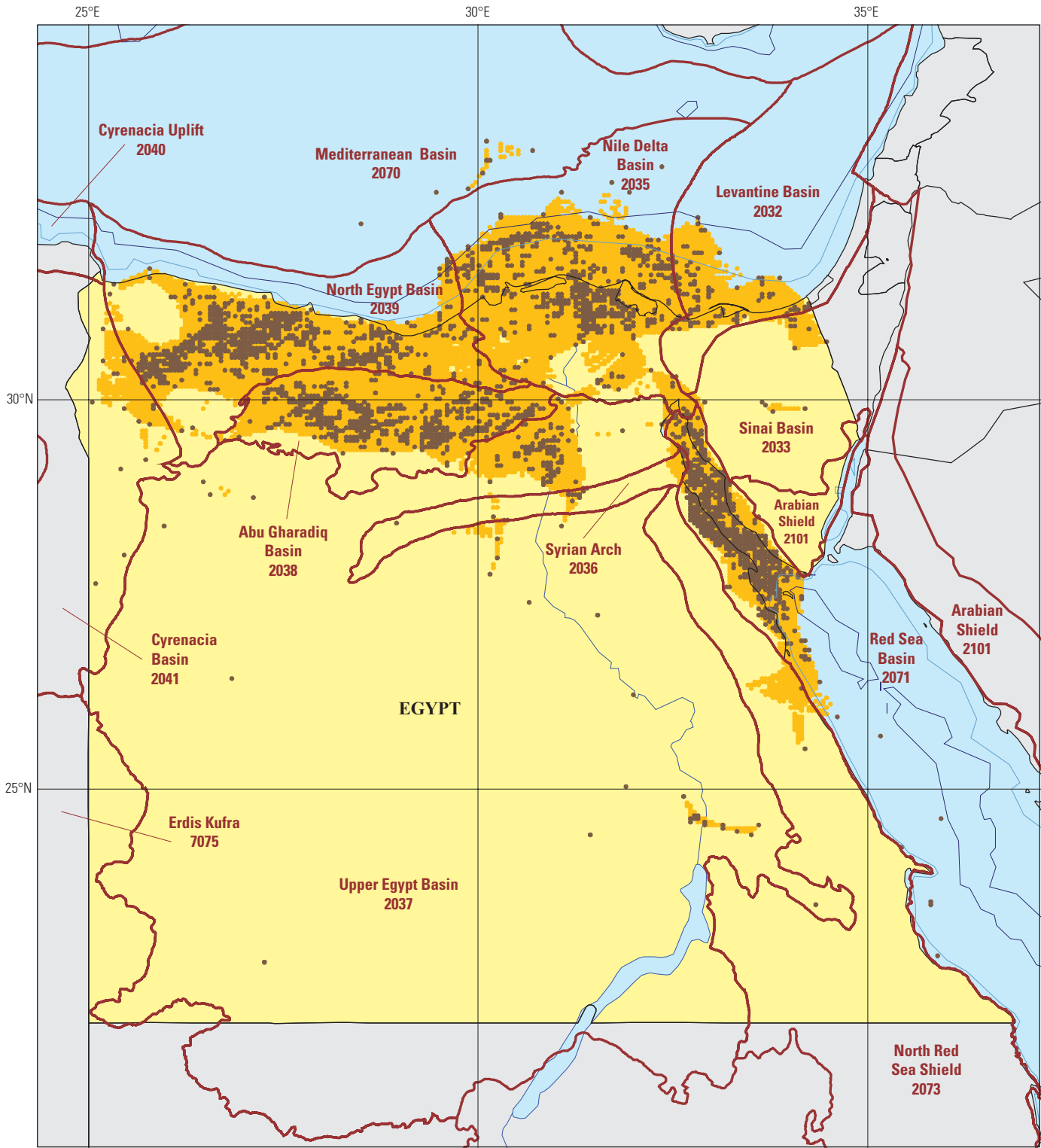
Figure 37.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Egypt.

Figure 37.   Egypt   167

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
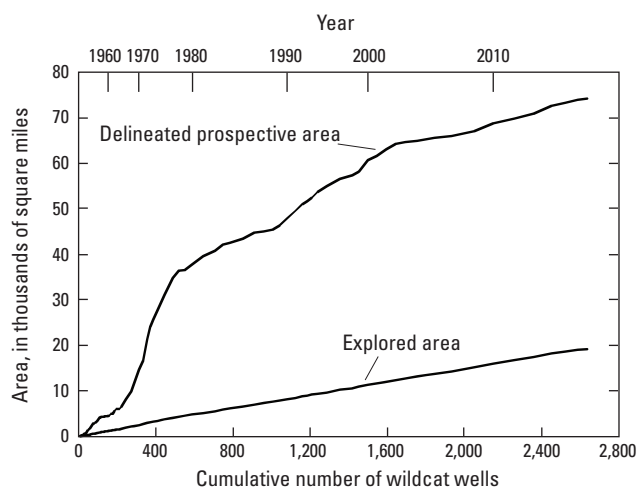
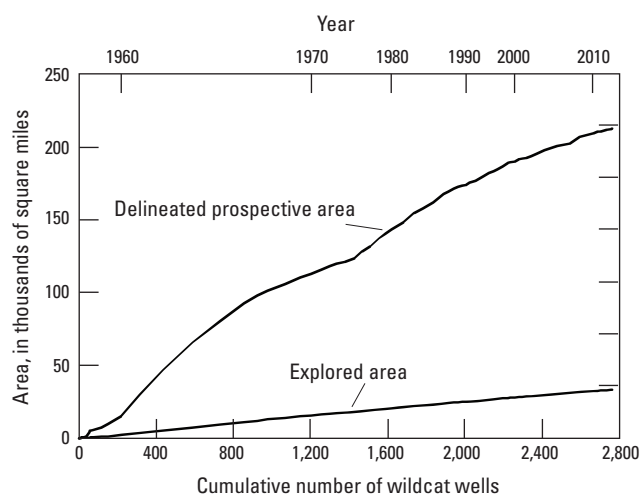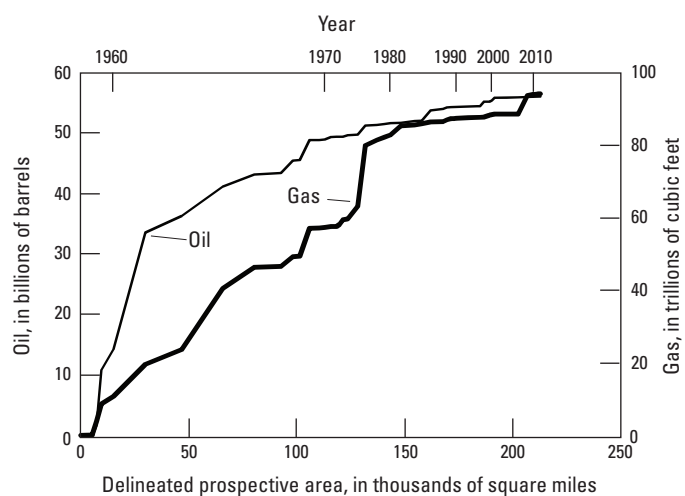**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**
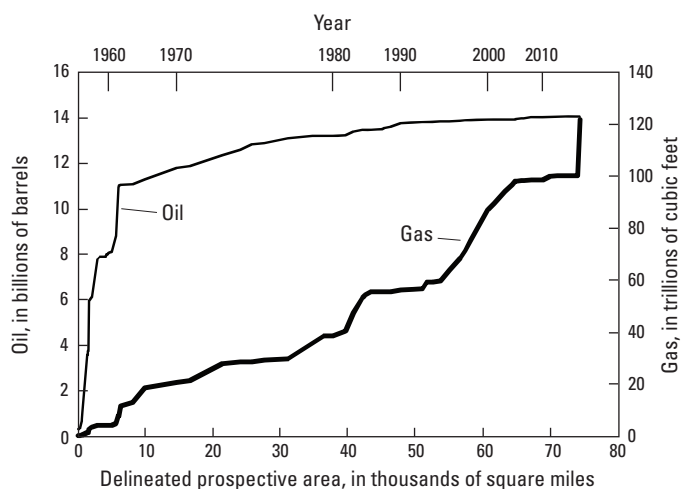
Figure 37.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Egypt						
Abu Gharadiq Basin, 2038	1968	222	1,190	1,831	3,606	5,437
Levantine Basin, 2032	1967	0	19	13	3,956	3,969
Mediterranean Basin, 2070	2003	0	0	0	1,222	1,222
Nile Delta Basin, 2035	1966	0	32	241	88,858	89,099
North Egypt Basin, 2039	1966	0	1,514	2,134	11,780	13,914
Red Sea Basin, 2071	1907	8,931	11,280	7,059	1,133	8,192
Total		**9,153**	**14,035**	**11,278**	**110,555**	**121,833**

Figure 37. Continued.

Figure 37. Egypt   169

Exploration data

Country	Land area (mi²)
Egypt	384,345

Delineated prospective area through 2015:
  At the surface ....74,252 mi²
  Percentage at depth of 10,000 ft...74 percent

Explored area through 2015:
  At the surface .... 19,157 mi²
  Percentage at depth of 10,000 ft...58 percent

Wildcat wells through 2015:
  Total..2,653 wells
  Percentage at depths of ≥10,000 ft..48 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil... 14.149 BBO
  Gas.. 121.857 TCF
  Percentage of oil at depths of ≥10,000 ft ....34 percent
  Percentage of gas at depths of ≥10,000 ft ....57 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....34 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....60 percent

Figure 37.   Continued.
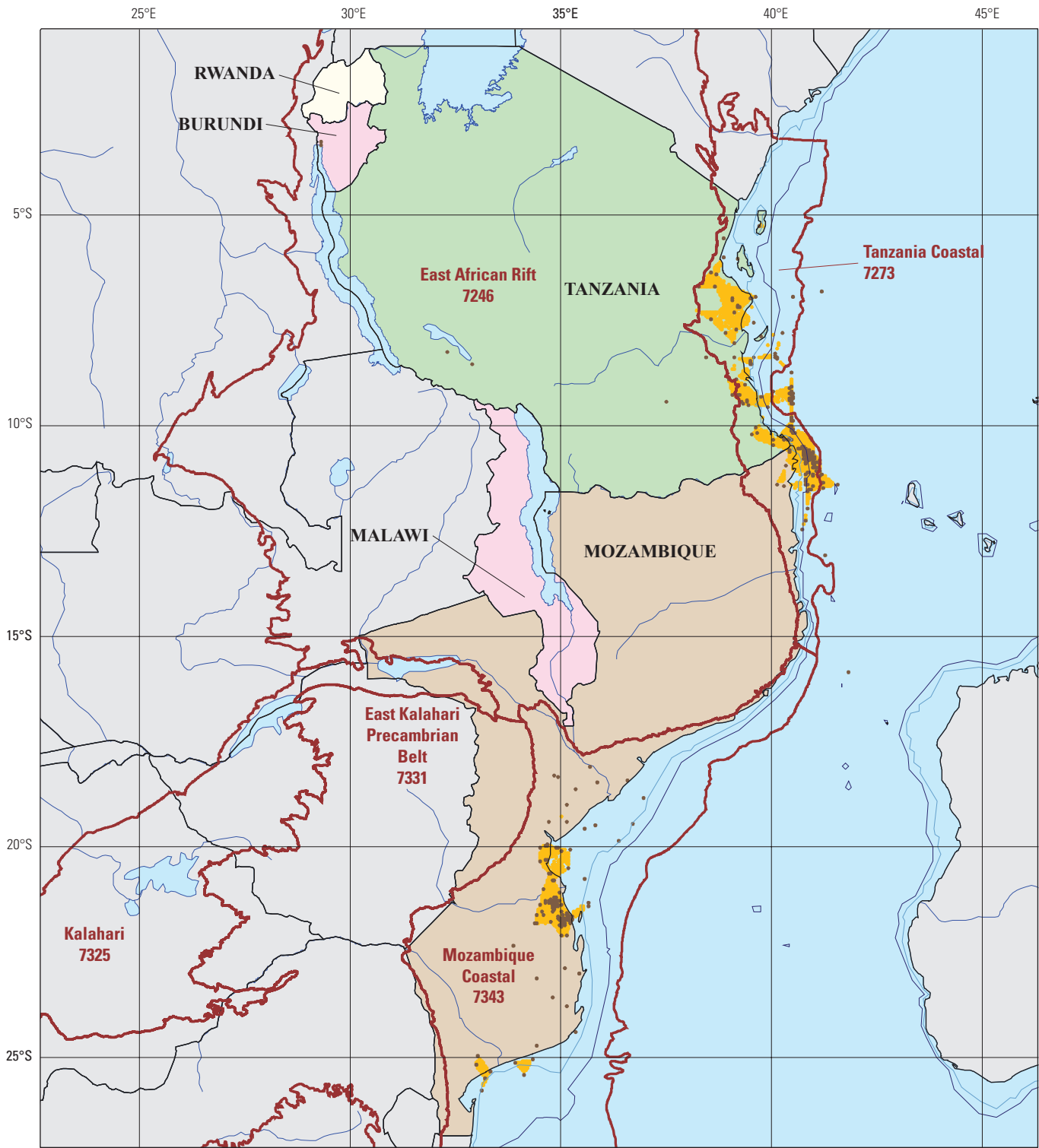
Figure 38.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Mozambique, Tanzania, Burundi, Malawi, and Rwanda.

Figure 38. Mozambique, Tanzania, Burundi, Malawi, and Rwanda   171

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
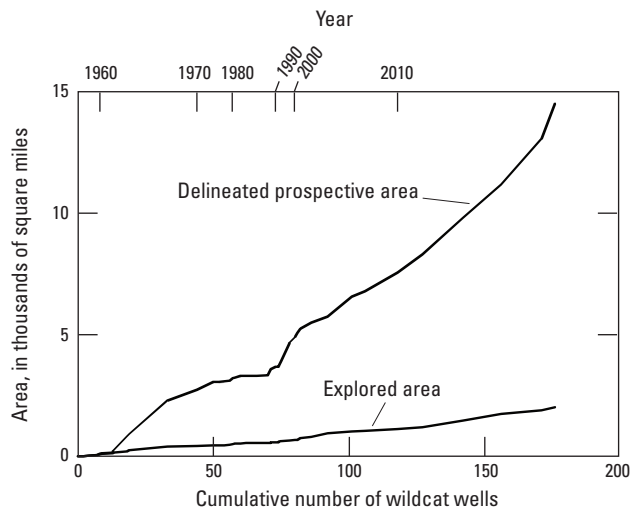
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
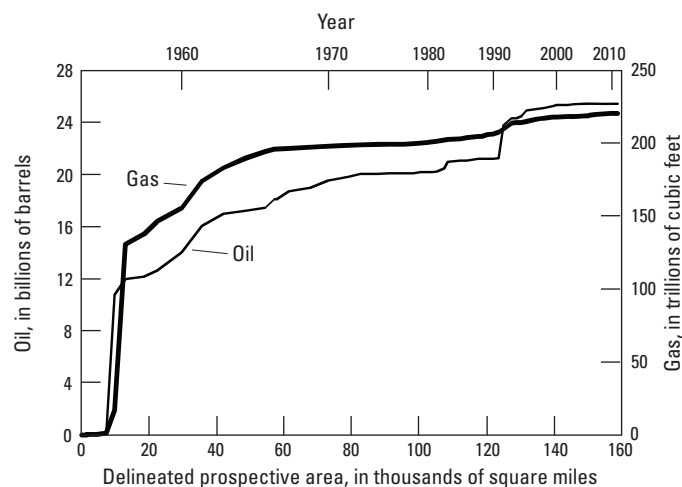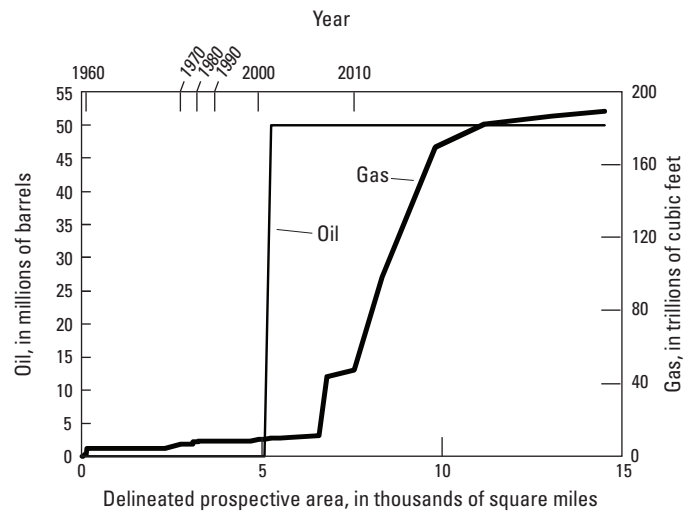

Figure 38.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Mozambique						
Mozambique Coastal, 7343	1953	0	50	625	9,011	9,636
Tanzania Coastal, 7273	2010	0	0	0	125,130	125,130
Undesignated offshore area		0	0	0	16,500	16,500
Total		**0**	**50**	**625**	**150,641**	**151,266**
Tanzania						
Tanzania Coastal, 7273	1974	0	0	0	19,935	19,935
Undesignated offshore area		0	0	0	18,100	18,100
Total		**0**	**0**	**0**	**38,035**	**38,035**

Figure 38.   Continued.

Figure 38. Mozambique, Tanzania, Burundi, Malawi, and Rwanda   **173**

Exploration data

Country	Land area (mi²)
Mozambique	303,623
Tanzania	342,009
Burundi	9,915
Malawi	36,324
Rwanda	9,524
Total	**701,396**

Delineated prospective area through 2015:
   At the surface .... 14,515 mi²
   Percentage at depth of 10,000 ft..47 percent

Explored area through 2015:
   At the surface .... 2,031 mi²
   Percentage at depth of 10,000 ft..51 percent

Wildcat wells through 2015:
   Total.. 176 wells
   Percentage at depths of ≥10,000 ft..61 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
   Oil...50 MMBO
   Gas.. 189.301 TCF
   Percentage of oil at depths of ≥10,000 ft ....0 percent
   Percentage of gas at depths of ≥10,000 ft ....93 percent
   Percentage of oil in oil fields at depths of ≥10,000 ft ....0 percent
   Percentage of gas in gas fields at depths of ≥10,000 ft ....93 percent

Figure 38.   Continued.

Figure 39. Map, graphs, and tables of data for oil and gas exploration through 2015 in South Africa, Namibia, Botswana, Lesotho, Swaziland, Zambia, and Zimbabwe.

Figure 39. South Africa, Namibia, and Neighboring Countries **175**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
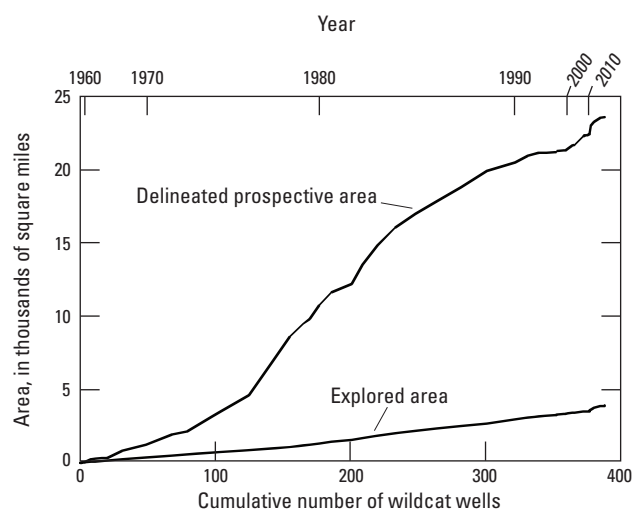
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 39. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
South Africa						
Karoo, 7355	1969	0	0	0	1,483	1,483
Orange River Coastal, 7303	1987	0	37	4	1,099	1,103
South African Coastal, 7363	1969	0	136	408	3,271	3,680
Total		**0**	**173**	**412**	**5,853**	**6,266**
Namibia						
Orange River Coastal, 7303	1974	0	0	0	1,400	1,400

Figure 39. Continued.

Figure 39. South Africa, Namibia, and Neighboring Countries 177

Exploration data

Country	Land area (mi²)
South Africa	468,909
Namibia	317,874
Botswana	218,816
Lesotho	11,720
Swaziland	6,643
Zambia	287,028
Zimbabwe	149,362
Total	**1,460,352**

Delineated prospective area through 2015:
At the surface .... 23,569 mi²
Percentage at depth of 10,000 ft .... 42 percent

Explored area through 2015:
At the surface .... 3,887 mi²
Percentage at depth of 10,000 ft .... 42 percent

Wildcat wells through 2015:
Total .... 485 wells
Percentage at depths of ≥10,000 ft .... 33 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
Oil .... 173 MMBO
Gas .... 7.967 TCF
Percentage of oil at depths of ≥10,000 ft .... 30 percent
Percentage of gas at depths of ≥10,000 ft .... 40 percent
Percentage of oil in oil fields at depths of ≥10,000 ft .... 29 percent
Percentage of gas in gas fields at depths of ≥10,000 ft .... 38 percent

Figure 39. Continued.
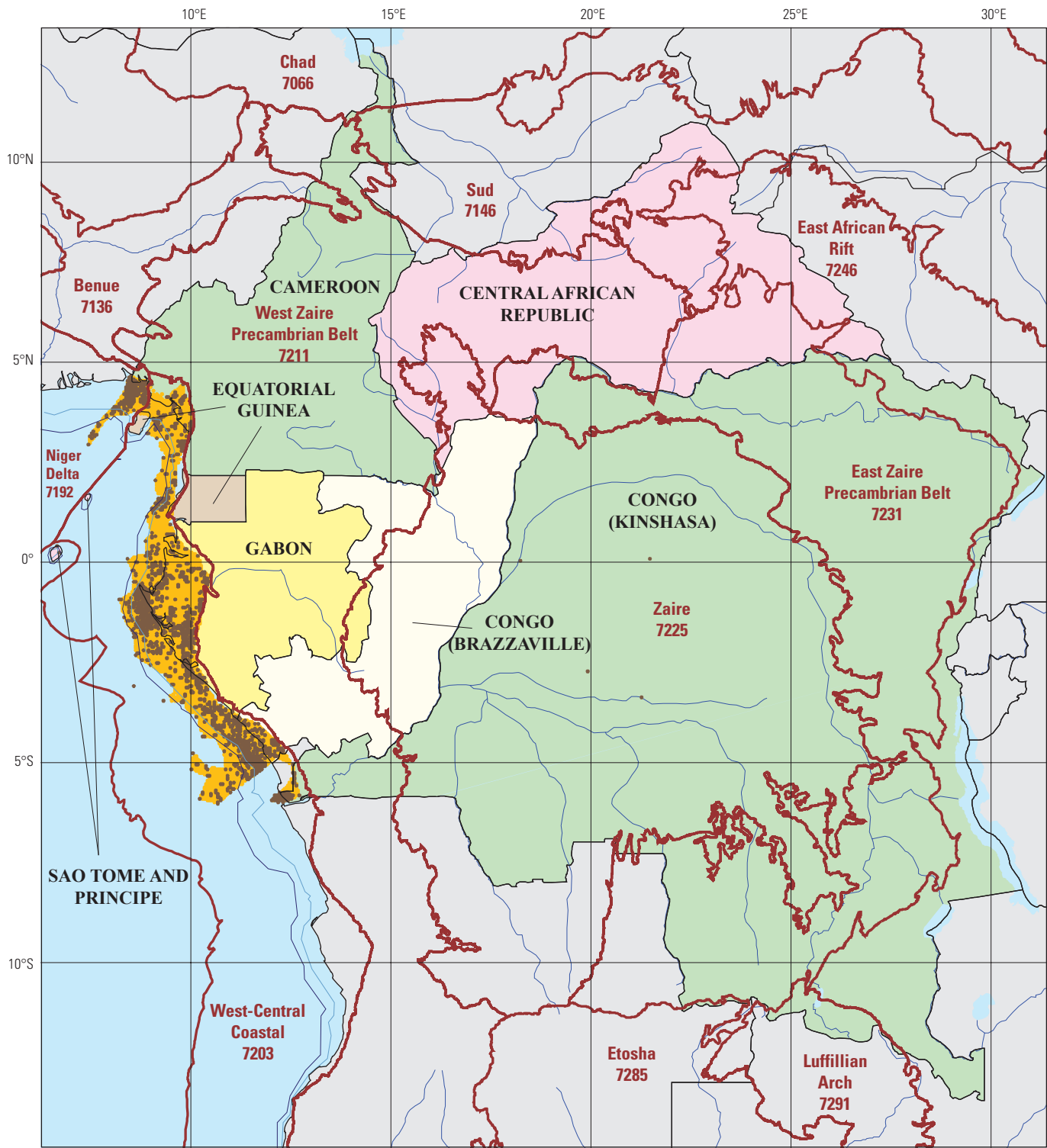
Figure 40.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Gabon, Republic of the Congo (Brazzaville), Cameroon, Equatorial Guinea, Democratic Republic of the Congo (Kinshasa), Central African Republic, and Sao Tome and Principe.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
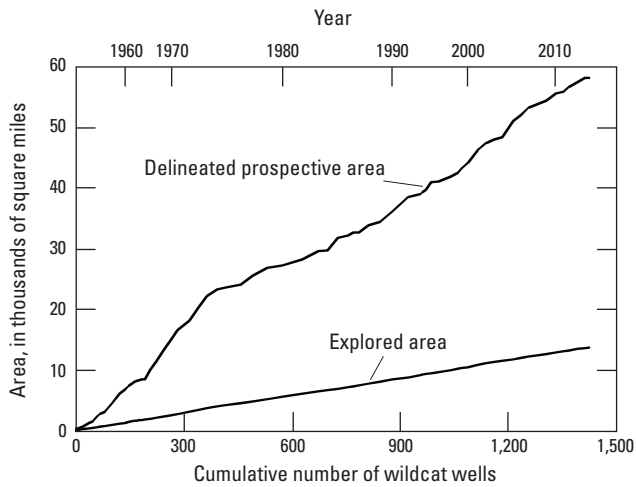
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 40. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Gabon						
West-Central Coastal, 7203	1951	2,768	5,277	4,358	5,590	9,948
Republic of the Congo (Brazzaville)						
West-Central Coastal, 7203	1957	4,100	5,600	6,160	1,796	7,956
Cameroon						
Niger Delta, 7192	1967	755	1,652	2,287	2,245	4,532
Sud, 7146	2011	0	4	1	0	1
West-Central Coastal, 7203	1954	0	200	178	3,428	3,606
Total		**755**	**1,855**	**2,466**	**5,672**	**8,138**
Equatorial Guinea						
Niger Delta, 7192	1982	1,500	1,549	1,139	10,741	11,880
West-Central Coastal, 7203	1999	489	806	1,243	1,529	2,772
Total		**1,989**	**2,354**	**2,382**	**12,270**	**14,651**
Democratic Republic of the Congo (Kinshasa)						
West-Central Coastal, 7203	1964	140	427	672	0	672

Figure 40.   Continued.

Exploration data

Country	Land area (mi²)
Gabon	99,486
Congo (Brazzaville)	131,854
Cameroon	182,514
Equatorial Guinea	10,831
Central African Republic	240,535
Congo (Kinshasa)	875,312
Sao Tome & Principe	372
Total	**1,540,904**

Delineated prospective area through 2015:

At the surface ....58,269 mi²

Percentage at depth of 10,000 ft...53 percent

Explored area through 2015:

At the surface .... 13,688 mi²

Percentage at depth of 10,000 ft...30 percent

Wildcat wells through 2015:

Total.. 1,433 wells

Percentage at depths of ≥10,000 ft..20 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil... 15.514 BBO

Gas.. 41.365 TCF

Percentage of oil at depths of ≥10,000 ft ....13 percent

Percentage of gas at depths of ≥10,000 ft ....50 percent

Percentage of oil in oil fields at depths of ≥10,000 ft ....13 percent

Percentage of gas in gas fields at depths of ≥10,000 ft ....67 percent

Figure 40. Continued.

Figure 41. Map, graphs, and tables of data for oil and gas exploration through 2015 in Sudan, South Sudan, Chad, Mauritania, Niger, Burkina Faso, Mali, Uganda, and Western Sahara.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
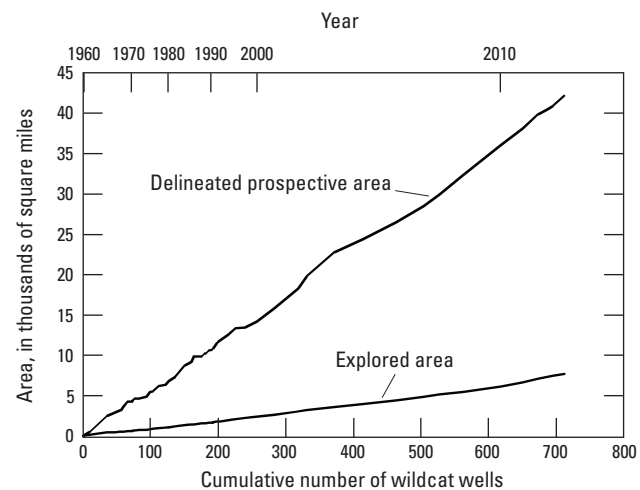
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
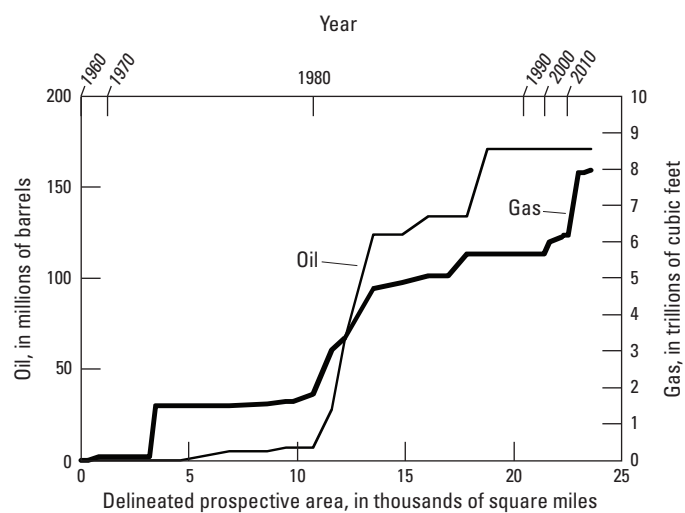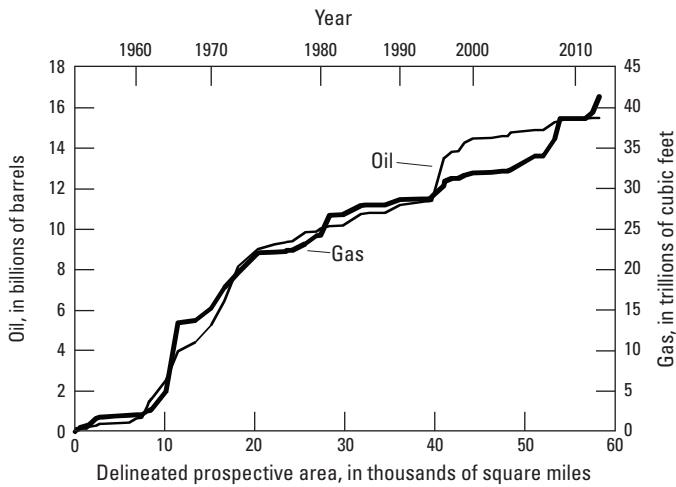

Figure 41. Continued.

Figure 41. Sudan, Chad, Mauritania, and Neighboring Countries   183

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
South Sudan						
Sud, 7146	1980	2,061	2,884	165	0	165
Sudan						
Red Sea Basin, 2071	1963	0	0	0	850	850
Sud, 7146	1979	667	1,351	147	0	147
Total		667	1,351	147	850	997
Chad						
Sud, 7146	1975	900	1,484	349	38	387
Mauritania						
Senegal, 7013	2001	0	149	457	3,059	3,516
Taoudeni Basin, 7035	1974	0	0	0	159	159
Undesignated offshore area		0	0	0	11,050	11,050
Total		0	149	457	14,268	14,725
Mali						
Taoudeni Basin, 7035	1987	0	0	0	2	2
Uganda						
East African Rift, 7246	2006	924	1,392	252	0	252

Figure 41.   Continued.

Exploration data

Country	Land area (mi²)
South Sudan	248,777
Sudan	718,723
Chad	486,180
Mauritania	397,955
Niger	489,076
Burkina Faso	105,715
Mali	471,118
Uganda	76,101
Western Sahara	102,703
Total	**3,096,347**

Delineated prospective area through 2015:

At the surface .... 42,213 mi²

Percentage at depth of 10,000 ft... 24 percent

Explored area through 2015:

At the surface .... 7,696 mi²

Percentage at depth of 10,000 ft... 17 percent

Wildcat wells through 2015:

Total... 713 wells

Percentage at depths of ≥10,000 ft....................................... 26 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil...7.889 BBO

Gas...16.860 TCF

Percentage of oil at depths of ≥10,000 ft .... 9 percent

Percentage of gas at depths of ≥10,000 ft .... 81 percent

Percentage of oil in oil fields at depths of ≥10,000 ft .... 9 percent

Percentage of gas in gas fields at depths of ≥10,000 ft .... 87 percent

Figure 41. Continued.

Figure 41. Sudan, Chad, Mauritania, and Neighboring Countries   **185**

Figure 42.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Madagascar, Comoros, Mauritius, Seychelles, and Reunion (an overseas department of France).

Figure 42. Madagascar, Comoros, Mauritius, Seychelles, and Reunion   **187**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
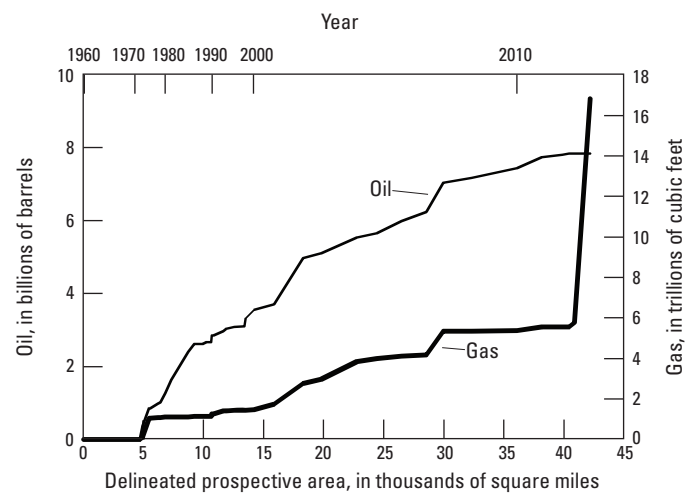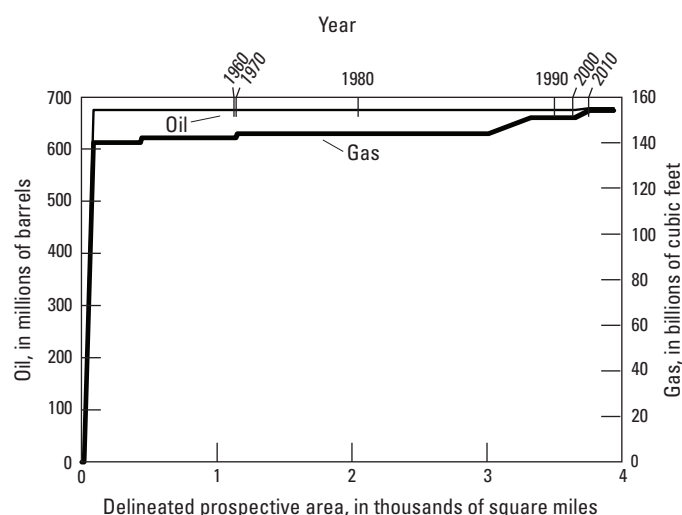

Significant petroleum province—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Madagascar						
Morondava, 7373	1955	675	678	143	11	154

Exploration data

Country	Land area (mi²)
Madagascar	224,534
Comoros	863
Mauritius	784
Seychelles	176
Reunion	972
Total	**227,328**

Delineated prospective area through 2015:
  At the surface ....3,940 mi²
  Percentage at depth of 10,000 ft...12 percent

Explored area through 2015:
  At the surface .... 667 mi²
  Percentage at depth of 10,000 ft...11 percent

Wildcat wells through 2015:
  Total.. 112 wells
  Percentage at depths of ≥10,000 ft..23 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil...678 MMBO
  Gas..154 BCF
  Percentage of oil at depths of ≥10,000 ft ....0 percent
  Percentage of gas at depths of ≥10,000 ft ....0 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....0 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....0 percent

Figure 42.   Continued.
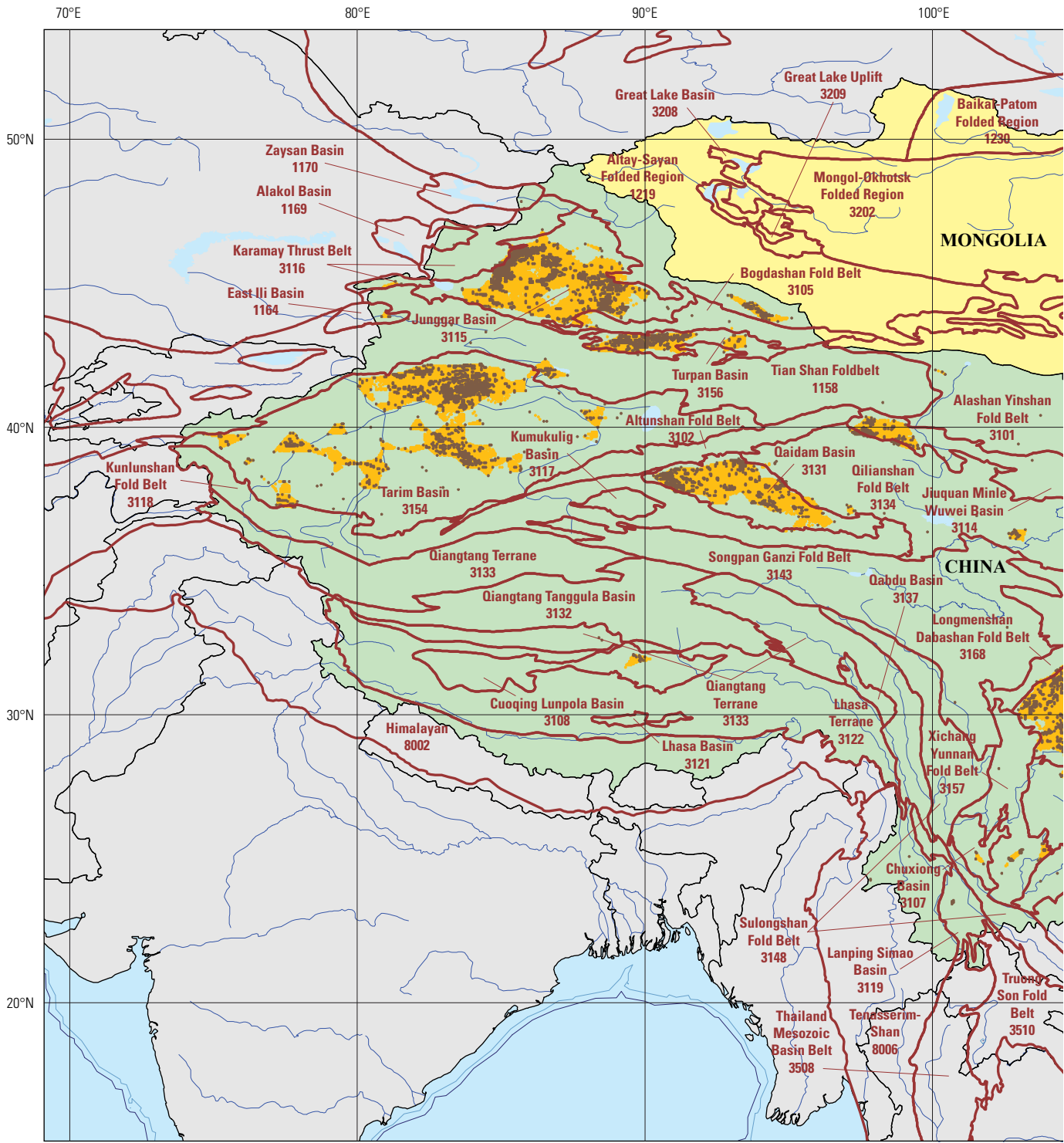
Figure 43. Map, graphs, and tables of data for oil and gas exploration through 2015 in China and Mongolia.

Figure 43. China and Mongolia **189**

Figure 43. Continued.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
China						
Altay-Sayan Folded Region, 1219	1993	0	148	59	2,038	2,097
Bohaiwan Basin, 3127	1961	17,027	24,915	13,758	5,814	19,572
East China Sea Basin, 3109	1981	0	101	608	7,488	8,095
Jianghan Basin, 3112	1965	130	397	64	0	64
Junggar Basin, 3115	1937	4,259	5,570	3,936	4,512	8,448
Luxi Jiaoliao Uplift, 3124	1973	1,067	1,659	347	10	357
Nanyang Basin, 3126	1971	348	608	66	0	66
Ordos Basin, 3128	1907	6,153	8,110	2,555	67,140	69,695
Pearl River Mouth Basin, 3130	1979	1,239	2,350	521	3,135	3,656
Qaidam Basin, 3131	1955	466	1,021	793	8,842	9,635
Qilianshan Fold Belt, 3134	1939	179	379	175	1	176
Qiongdongnan Basin, 3136	1979	0	2	1	1,668	1,669
Shanxi Plateau, 3140	1982	0	0	0	7,771	7,771
Sichuan Basin, 3142	1939	0	121	393	77,920	78,312
Songliao Basin, 3144	1959	20,915	22,456	5,556	8,197	13,753
South China Continental Shelf Slope, 3181	1984	0	348	113	4,599	4,713
Tarim Basin, 3154	1958	2,180	3,487	3,590	60,358	63,948
Temtsag Hailar Basin, 3207	1961	327	494	70	100	170
Turpan Basin, 3156	1958	233	751	1,406	943	2,349
Yinggehai Basin, 3159	1983	0	2	0	9,532	9,532
Total		54,523	72,918	34,012	270,068	304,080

Figure 43. Continued.

Figure 43. China and Mongolia   191

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015.— Continued

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Mongolia						
Temtsag Hailar Basin, 3207	1995	151	172	7	0	7

Exploration data

Country	Land area (mi^2)
China	3,600,947
Mongolia	599,831
Total	**4,200,778**

Delineated prospective area through 2015:
    At the surface .... 524,718 mi^2
    Percentage at depth of 10,000 ft .... 45 percent

Explored area through 2015:
    At the surface .... 134,862 mi^2
    Percentage at depth of 10,000 ft .... 36 percent

Wildcat wells through 2015:
    Total .... 11,640 wells
    Percentage at depths of ≥10,000 ft .... 26 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil .... 75.364 BBO
    Gas .... 306.021 TCF
    Percentage of oil at depths of ≥10,000 ft .... 17 percent
    Percentage of gas at depths of ≥10,000 ft .... 71 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft .... 17 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft .... 80 percent

Figure 43. Continued.

Figure 44.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Kazakhstan, Azerbaijan, Turkmenistan, Uzbekistan, Georgia, Kyrgyzstan, Tajikistan, and Armenia.
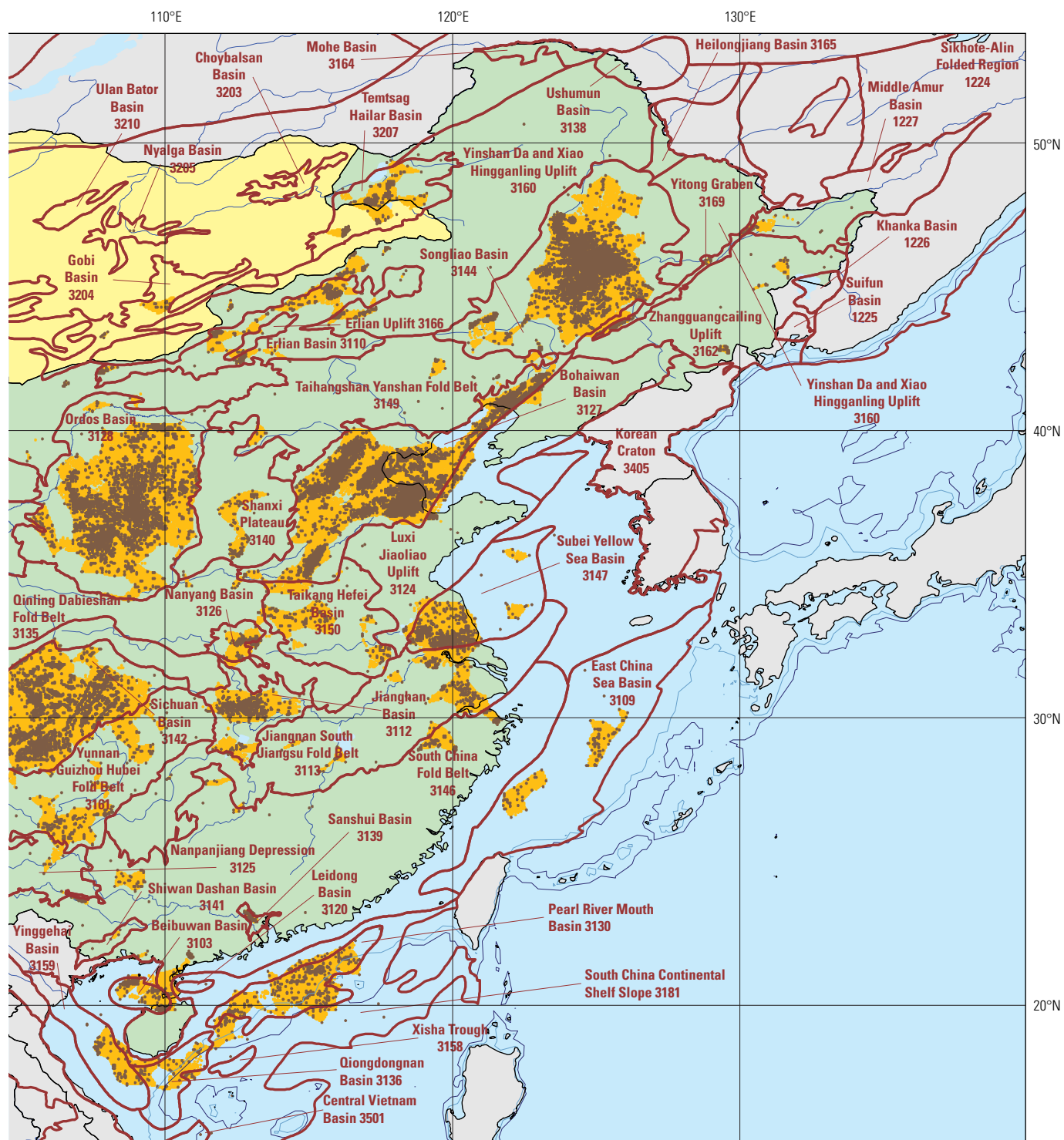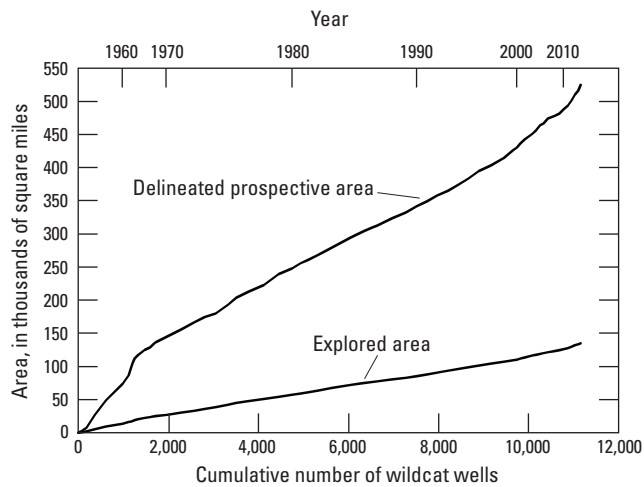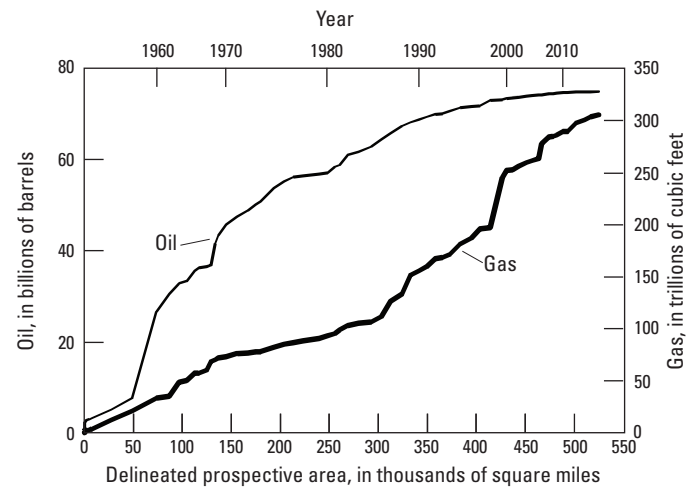
Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
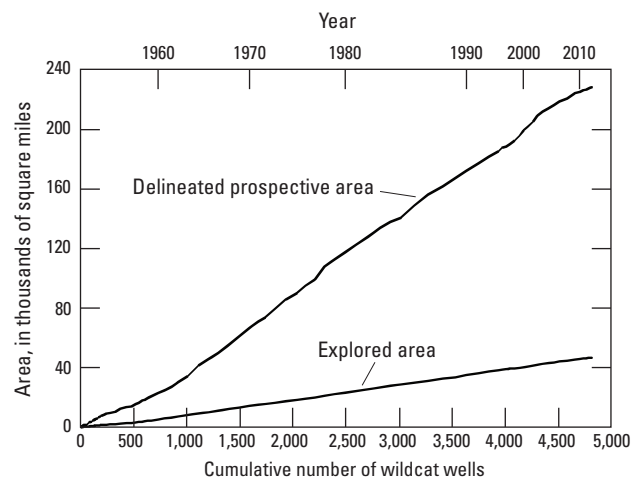
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 44. Continued.

Figure 44. Kazakhstan, Azerbaijan, and Neighboring Countries   **193**

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Kazakhstan						
Central Kazakhstan Folded Region, 1168	2003	150	150	121	0	121
Middle Caspian Basin, 1109	1952	4,740	5,384	4,476	3,576	8,052
North Caspian Basin, 1016	1892	23,972	28,217	85,210	49,048	134,258
North Ustyurt Basin, 1150	1964	2,463	2,708	1,071	1,667	2,737
South Turgay Basin, 1167	1984	1,240	1,936	1,388	55	1,443
Volga-Ural Region, 1015	1979	122	202	2,613	2	2,615
Total		**32,687**	**38,597**	**94,878**	**54,348**	**149,225**
Azerbaijan						
Kura Basin, 1113	1873	0	170	23	0	23
Middle Caspian Basin, 1109	1939	128	135	196	47	243
South Caspian Basin, 1112	1869	18,789	19,743	23,987	56,658	80,645
Total		**18,918**	**20,049**	**24,206**	**56,705**	**80,910**
Turkmenistan						
Afghan-Tajik Basin, 1156	1988	0	0	0	240	240
Amu-Darya Basin, 1154	1959	0	119	722	645,731	646,452
Middle Caspian Basin, 1109	1973	0	0	0	29	29
South Caspian Basin, 1112	1933	4,503	5,127	13,783	13,723	27,506
Total		**4,503**	**5,246**	**14,505**	**659,723**	**674,227**
Uzbekistan						
Afghan-Tajik Basin, 1156	1934	0	125	128	8,191	8,319
Amu-Darya Basin, 1154	1953	584	1,011	7,137	97,228	104,365
Fergana Basin, 1159	1901	219	561	280	232	512
Middle Caspian Basin, 1109	1964	0	0	0	1,777	1,777
North Ustyurt Basin, 1150	1968	0	1	0	7,179	7,179
Total		**803**	**1,698**	**7,545**	**114,606**	**122,152**
Georgia						
Kura Basin, 1113	1869	226	368	222	63	285

Figure 44. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015.—Continued

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Kyrgyzstan						
Fergana Basin, 1159	1901	104	302	656	350	1,006
Tajikistan						
Afghan-Tajik Basin, 1156	1949	0	49	41	156	198
Fergana Basin, 1159	1908	0	36	107	83	191
Total		**0**	**85**	**149**	**240**	**388**

Exploration data

Country	Land area (mi²)
Kazakhstan	1,042,360
Azerbaijan	31,903
Turkmenistan	181,441
Uzbekistan	164,248
Georgia	26,911
Kyrgyzstan	74,055
Tajikistan	54,637
Armenia	10,889
Total	**1,586,445**

Delineated prospective area through 2015:

At the surface .... 228,251 mi^2

Percentage at depth of 10,000 ft.. 56 percent

Explored area through 2015:

At the surface .... 46,764 mi^2

Percentage at depth of 10,000 ft.. 51 percent

Wildcat wells through 2015:

Total... 6,078 wells

Percentage at depths of ≥10,000 ft...................................... 33 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil.. 66.357 BBO

Gas...1,029.493 TCF

Percentage of oil at depths of ≥10,000 ft .... 59 percent

Percentage of gas at depths of ≥10,000 ft .... 86 percent

Percentage of oil in oil fields at depths of ≥10,000 ft .... 58 percent

Percentage of gas in gas fields at depths of ≥10,000 ft .... 86 percent

Figure 44.　Continued.

Figure 44. Kazakhstan, Azerbaijan, and Neighboring Countries   195
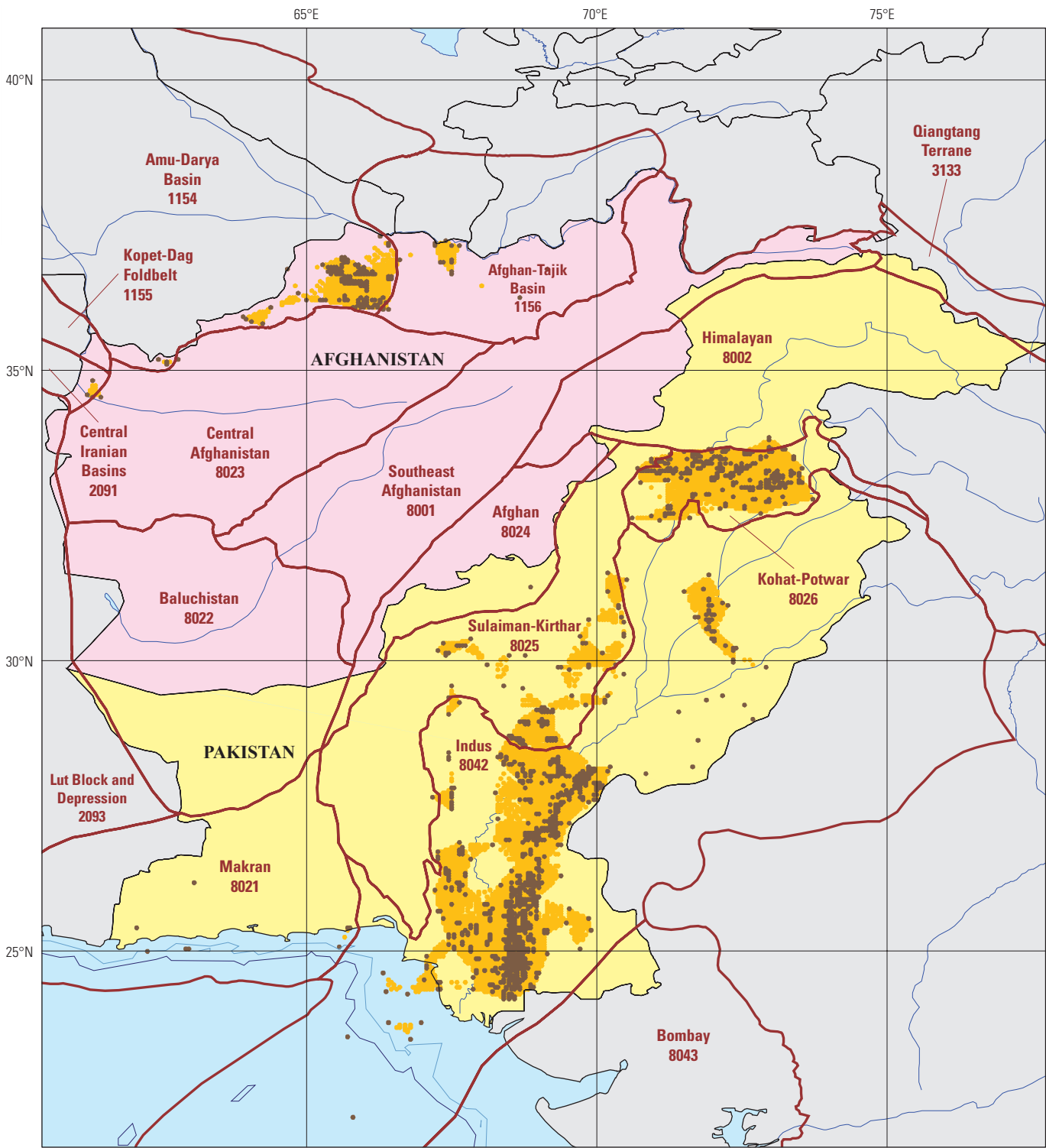
Figure 45.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Pakistan and Afghanistan.

Figure 45. Pakistan and Afghanistan **197**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
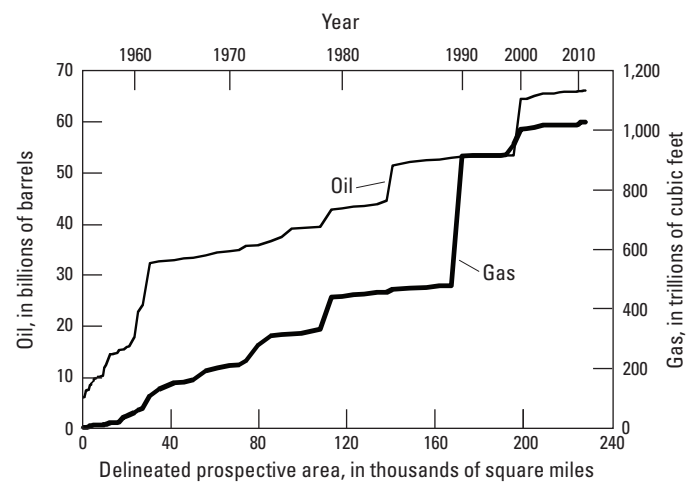

Figure 45.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Pakistan						
Indus, 8042	1957	0	405	476	29,816	30,292
Sulaiman-Kirthar, 8025	1883	0	5	0	20,683	20,683
Total		**0**	**410**	**476**	**50,499**	**50,975**
Afghanistan						
Afghan-Tajik Basin, 1156	1962	0	6	11	10	21
Amu-Darya Basin, 1154	1959	0	93	7	6,290	6,297
Total		**0**	**99**	**17**	**6,300**	**6,317**

Figure 45.   Continued.

Figure 45. Pakistan and Afghanistan   **199**

Exploration data

Country	Land area (mi²)
Pakistan	297,637
Afghanistan	251,827
Total	**549,464**

Delineated prospective area through 2015:

At the surface ....49,901 mi²

Percentage at depth of 10,000 ft..52 percent

Explored area through 2015:

At the surface ....9,649 mi²

Percentage at depth of 10,000 ft..46 percent

Wildcat wells through 2015:

Total..985 wells

Percentage at depths of ≥10,000 ft..40 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil..952 MMBO

Gas...62.070 TCF

Percentage of oil at depths of ≥10,000 ft ....34 percent

Percentage of gas at depths of ≥10,000 ft ....23 percent

Percentage of oil in oil fields at depths of ≥10,000 ft ....34 percent

Percentage of gas in gas fields at depths of ≥10,000 ft ....22 percent

Figure 45.   Continued.

Figure 46.   Map, graphs, and tables of data for oil and gas exploration through 2015 in India, Bangladesh, Bhutan, Maldives, Nepal, and Sri Lanka.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
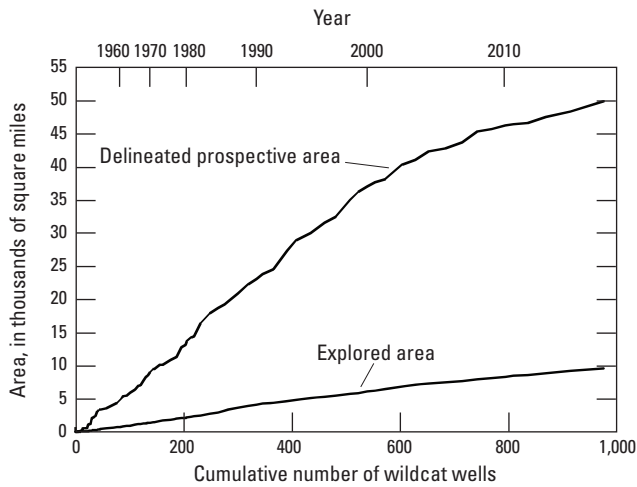
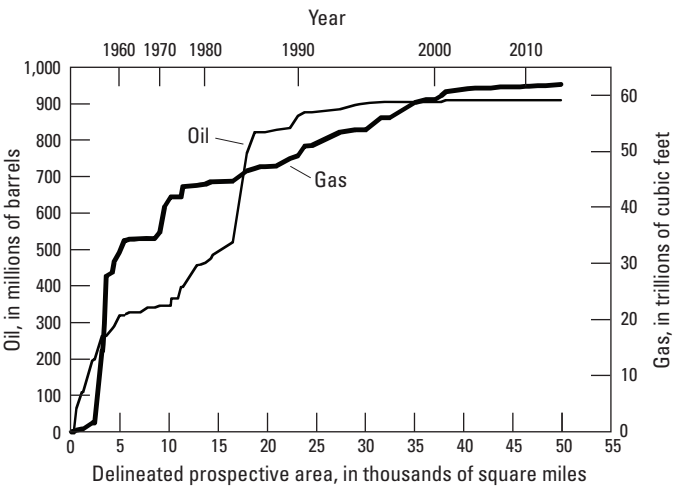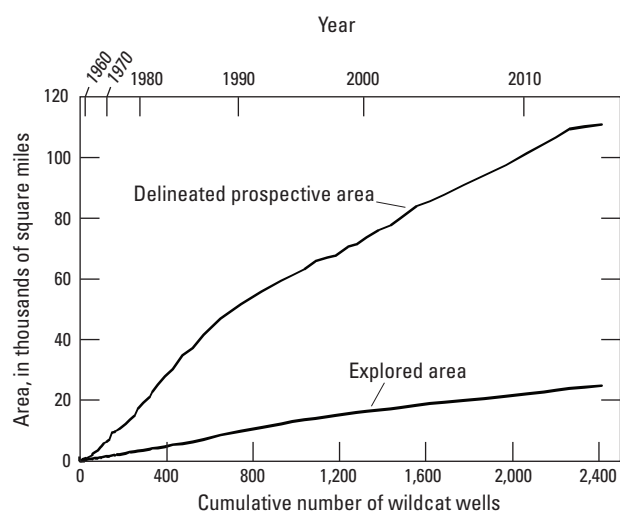**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**
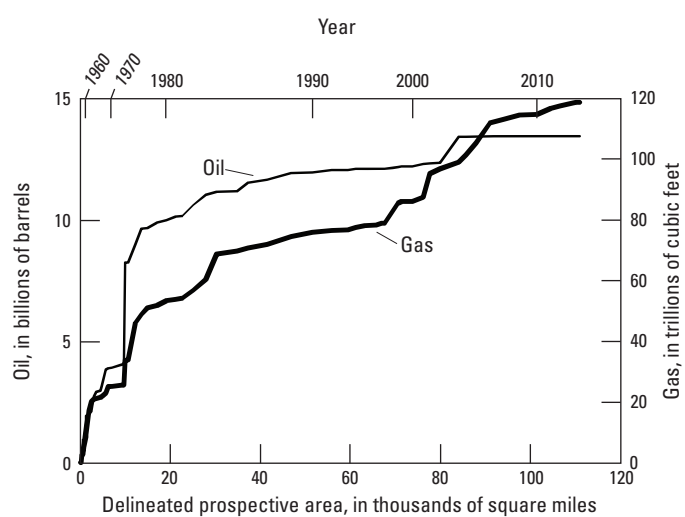
Figure 46. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
India						
Assam, 8034	1867	1,840	2,852	6,890	456	7,346
Bombay, 8043	1958	6,976	8,676	18,024	20,153	38,176
Cauvery, 8044	1969	0	131	313	3,531	3,844
Ganges-Brahmaputra Delta, 8047	1915	0	1	0	4,130	4,131
Indian Shield, 8003	1963	706	1,060	192	1,955	2,147
Indus, 8042	1967	0	69	5	2,414	2,419
Irrawaddy, 8048	2011	0	0	0	175	175
Krishna-Godavari, 8045	1979	330	788	1,614	24,149	25,763
Mahanadi, 8046	2006	0	0	0	2,697	2,697
Undesignated offshore area		0	0	0	2,610	2,610
Total		**9,851**	**13,578**	**27,038**	**62,270**	**89,307**
Bangladesh						
Assam, 8034	1959	0	0	0	474	474
Ganges-Brahmaputra Delta, 8047	1923	0	47	1	26,835	26,836
Total		**0**	**47**	**1**	**27,309**	**27,310**
Sri Lanka						
Cauvery, 8044	2011	0	0	0	770	770

Figure 46.   Continued.

Exploration data

Country	Land area (mi²)
India	1,147,956
Bangladesh	50,258
Bhutan	14,824
Maldives	115
Nepal	55,348
Sri Lanka	24,954
Total	**1,293,455**

Delineated prospective area through 2015:
  At the surface .... 110,915 mi²
  Percentage at depth of 10,000 ft..63 percent

Explored area through 2015:
  At the surface ....24,769 mi²
  Percentage at depth of 10,000 ft..40 percent

Wildcat wells through 2015:
  Total..2,488 wells
  Percentage at depths of ≥10,000 ft...36 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil... 13.625 BBO
  Gas.. 118.865 TCF
  Percentage of oil at depths of ≥10,000 ft ....25 percent
  Percentage of gas at depths of ≥10,000 ft ....48 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....25 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....54 percent

Figure 46.   Continued.
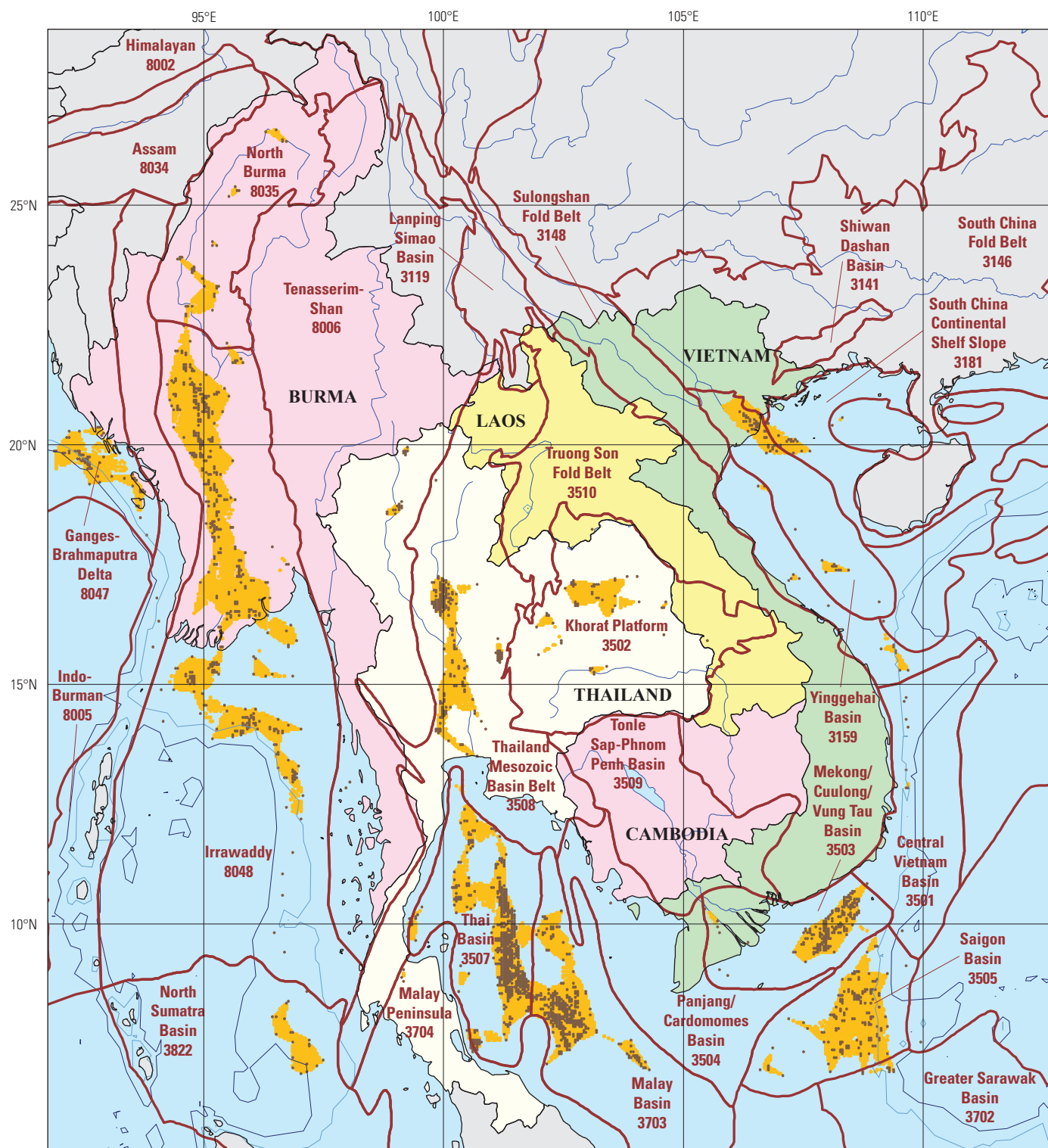
Figure 47.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Vietnam, Burma, Thailand, Cambodia, and Laos.

Figure 47. Vietnam, Burma, Thailand, Cambodia, and Laos   205

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 47.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Vietnam						
Greater Sarawak Basin, 3702	2009	0	42	244	143	387
Malay Basin, 3703	1991	0	231	1,009	5,152	6,161
Mekong/Cuulong/Vung Tau Basin, 3503	1975	3,163	3,941	4,423	1,286	5,709
Qiongdongnam Basin, 3136	1995	0	0	0	292	292
Saigon Basin, 3505	1974	111	356	828	6,944	7,771
South China Continental Shelf Slope, 3181	1990	0	61	155	2,833	2,987
Yinggehai Basin, 3159	1975	0	19	5	4,044	4,049
Total		**3,273**	**4,650**	**6,663**	**20,694**	**27,357**
Burma						
Ganges-Brahmaputra Delta, 8047	1900	0	<1	0	4,845	4,845
Irrawaddy, 8048	1864	518	673	1,049	14,709	15,758
Total		**518**	**673**	**1,049**	**19,554**	**20,603**
Thailand						
Khorat Platform, 3502	1982	0	0	0	2,322	2,322
Malay Basin, 3703	1973	0	15	0	8,822	8,822
North Sumatra Basin, 3822	1976	0	0	0	875	875
Thai Basin, 3507	1973	308	971	3,715	17,703	21,417
Thailand Mesozoic Basin Belt, 3508	1981	221	374	649	126	775
Total		**529**	**1,359**	**4,363**	**29,848**	**34,211**
Cambodia						
Malay Basin, 3703	1994	0	131	40	83	123

Figure 47.   Continued.

Figure 47. Vietnam, Burma, Thailand, Cambodia, and Laos 207

Exploration data

Country	Land area (mi²)
Vietnam	119,719
Burma	252,321
Thailand	197,256
Cambodia	68,153
Laos	89,112
Total	**726,560**

Delineated prospective area through 2015:

At the surface ....84,589 mi²

Percentage at depth of 10,000 ft...45 percent

Explored area through 2015:

At the surface ....16,747 mi²

Percentage at depth of 10,000 ft...56 percent

Wildcat wells through 2015:

Total..1,364 wells

Percentage at depths of ≥10,000 ft..35 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:

Oil..6.865 BBO

Gas...82.174 TCF

Percentage of oil at depths of ≥10,000 ft ....72 percent

Percentage of gas at depths of ≥10,000 ft ....67 percent

Percentage of oil in oil fields at depths of ≥10,000 ft ....74 percent

Percentage of gas in gas fields at depths of ≥10,000 ft ....67 percent

Figure 47. Continued.
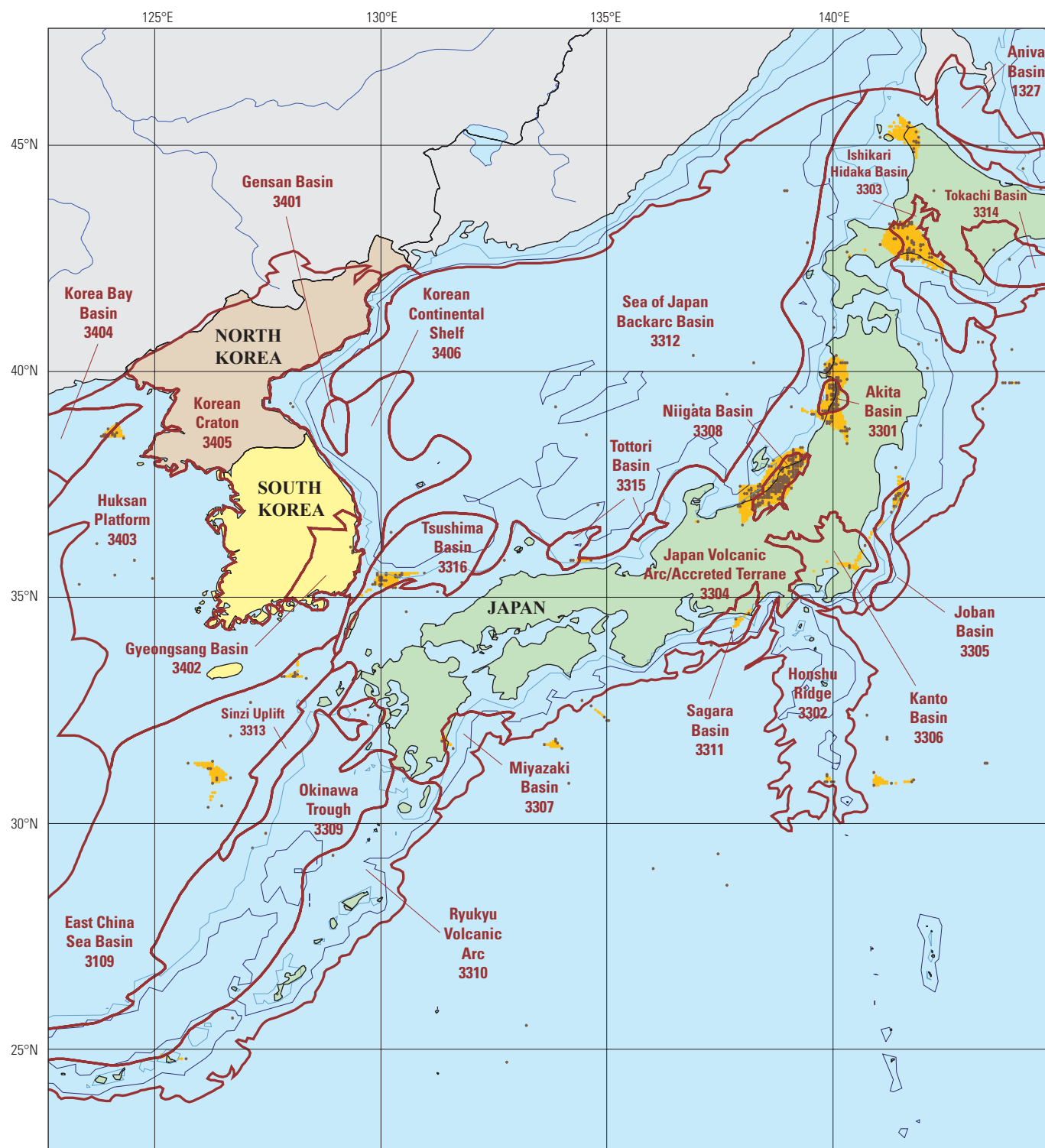
Figure 48.   Map, graphs, and tables of data for oil and gas exploration through 2015 in Japan, South Korea, and North Korea. The Japan/South Korea Joint Development Area (JDA) is not delineated on the map because a standard boundary was not available.

Figure 48. Japan, South Korea, and North Korea   **209**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
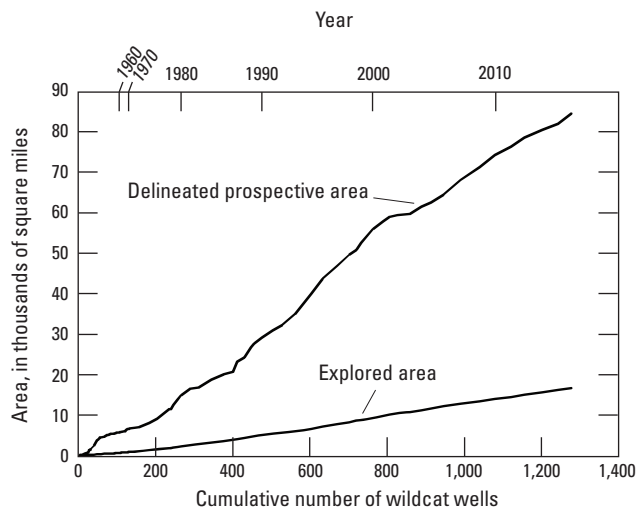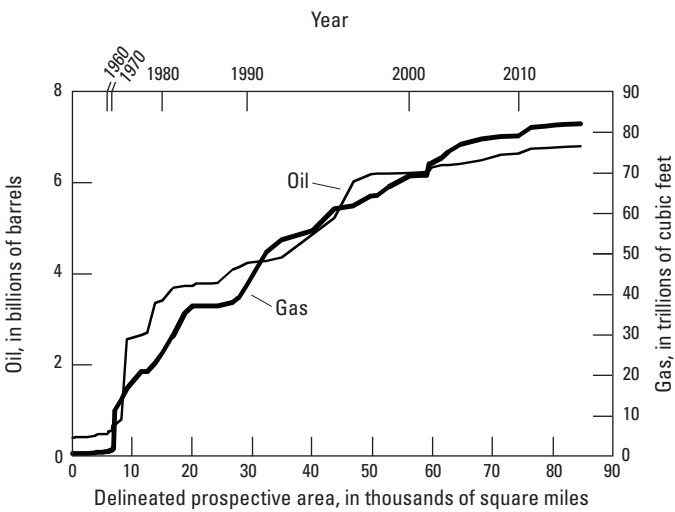
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 48.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Japan						
Japan Volcanic Arc/Accreted Terrane, 3304	1903	0	100	221	1,011	1,232
Niigata Basin, 3308	1867	0	128	274	3,477	3,751
Total		**0**	**228**	**495**	**4,488**	**4,983**
South Korea						
Japan Volcanic Arc/Accreted Terrane, 3304	1987	0	0	0	50	50

Figure 48.   Continued.

Figure 48. Japan, South Korea, and North Korea   **211**

Exploration data

Country	Land area (mi²)
Japan	140,728
South Korea	37,421
North Korea	46,490
Total	**224,639**

Delineated prospective area through 2015:
  At the surface .... 13,278 mi²
  Percentage at depth of 10,000 ft..58 percent

Explored area through 2015:
  At the surface .... 3,751 mi²
  Percentage at depth of 10,000 ft..48 percent

Wildcat wells through 2015:
  Total..441 wells
  Percentage at depths of ≥10,000 ft..40 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil...296 MMBO
  Gas.. 6.282 TCF
  Percentage of oil at depths of ≥10,000 ft ....22 percent
  Percentage of gas at depths of ≥10,000 ft ....46 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....26 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....60 percent

Figure 48.   Continued.
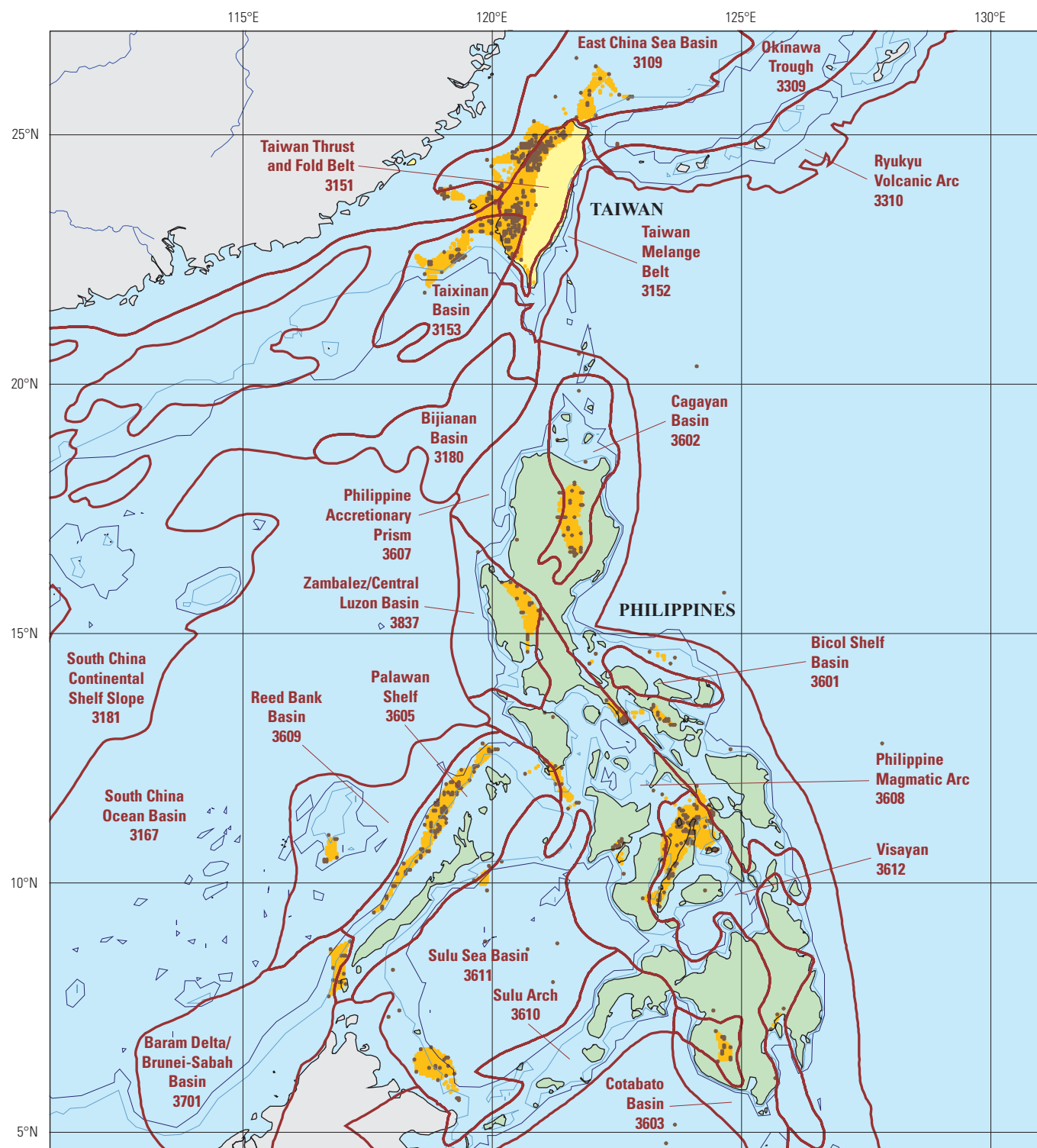
Figure 49. Map, graphs, and tables of data for oil and gas exploration through 2015 in the Philippines and Taiwan.

Figure 49. Philippines and Taiwan   **213**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

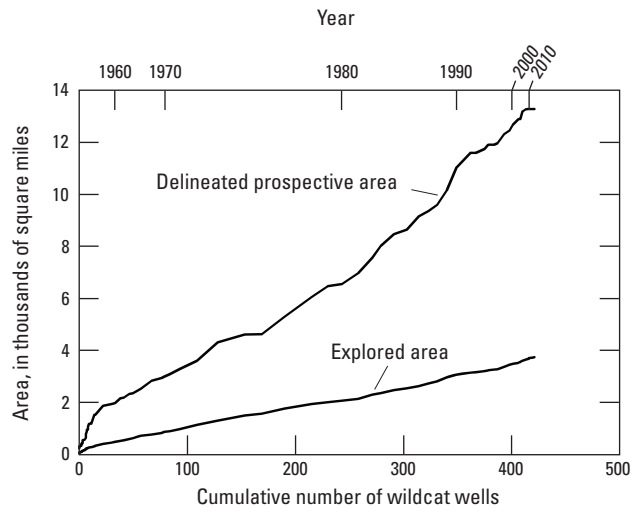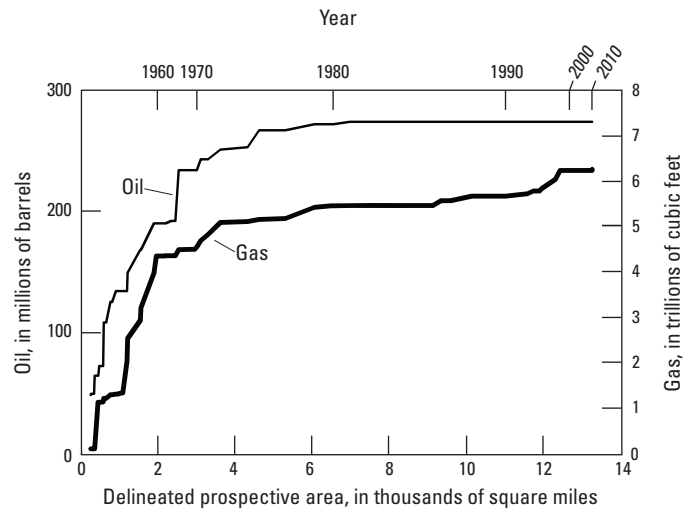**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**

Figure 49.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Philippines						
Palawan Shelf, 3605	1976	0	168	75	3,574	3,649
Reed Bank Basin, 3609	1976	0	0	0	1,822	1,822
Total		**0**	**168**	**75**	**5,396**	**5,471**
Taiwan						
East China Sea Basin, 3109	1969	0	1	1	100	101
Taiwan Thrust and Fold Belt, 3151	1876	0	1	1	2,103	2,104
Total		**0**	**2**	**2**	**2,203**	**2,205**

Figure 49.   Continued.

Figure 49. Philippines and Taiwan **215**

Exploration data

Country	Land area (mi²)
Philippines	115,124
Taiwan	12,456
Total	**127,580**

Delineated prospective area through 2015:
- At the surface ....29,881 mi²
- Percentage at depth of 10,000 ft...32 percent

Explored area through 2015:
- At the surface ....5,287 mi²
- Percentage at depth of 10,000 ft...37 percent

Wildcat wells through 2015:
- Total..617 wells
- Percentage at depths of ≥10,000 ft...30 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
- Oil...176 MMBO
- Gas...8.998 TCF
- Percentage of oil at depths of ≥10,000 ft ....20 percent
- Percentage of gas at depths of ≥10,000 ft ....91 percent
- Percentage of oil in oil fields at depths of ≥10,000 ft ....0 percent
- Percentage of gas in gas fields at depths of ≥10,000 ft ....89 percent

Figure 49.   Continued.

Figure 50. Map, graphs, and tables of data for oil and gas exploration through 2015 in Indonesia.

Figure 50. Indonesia   217

Figure 50.   Continued.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

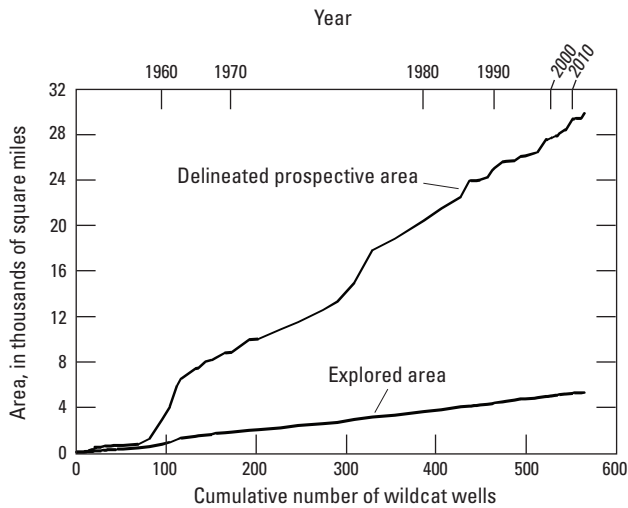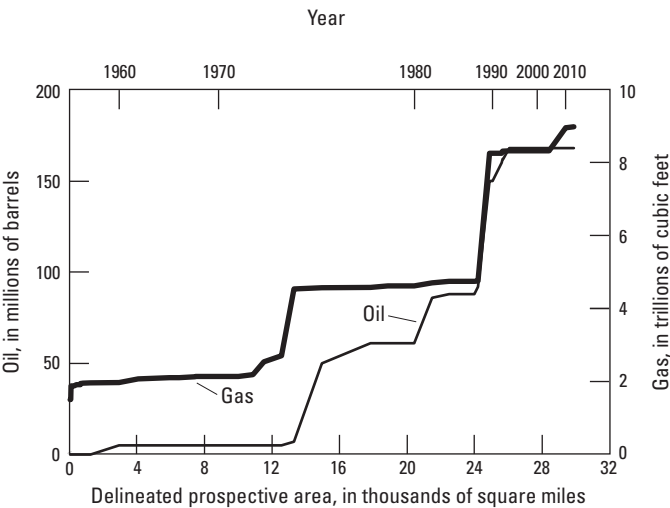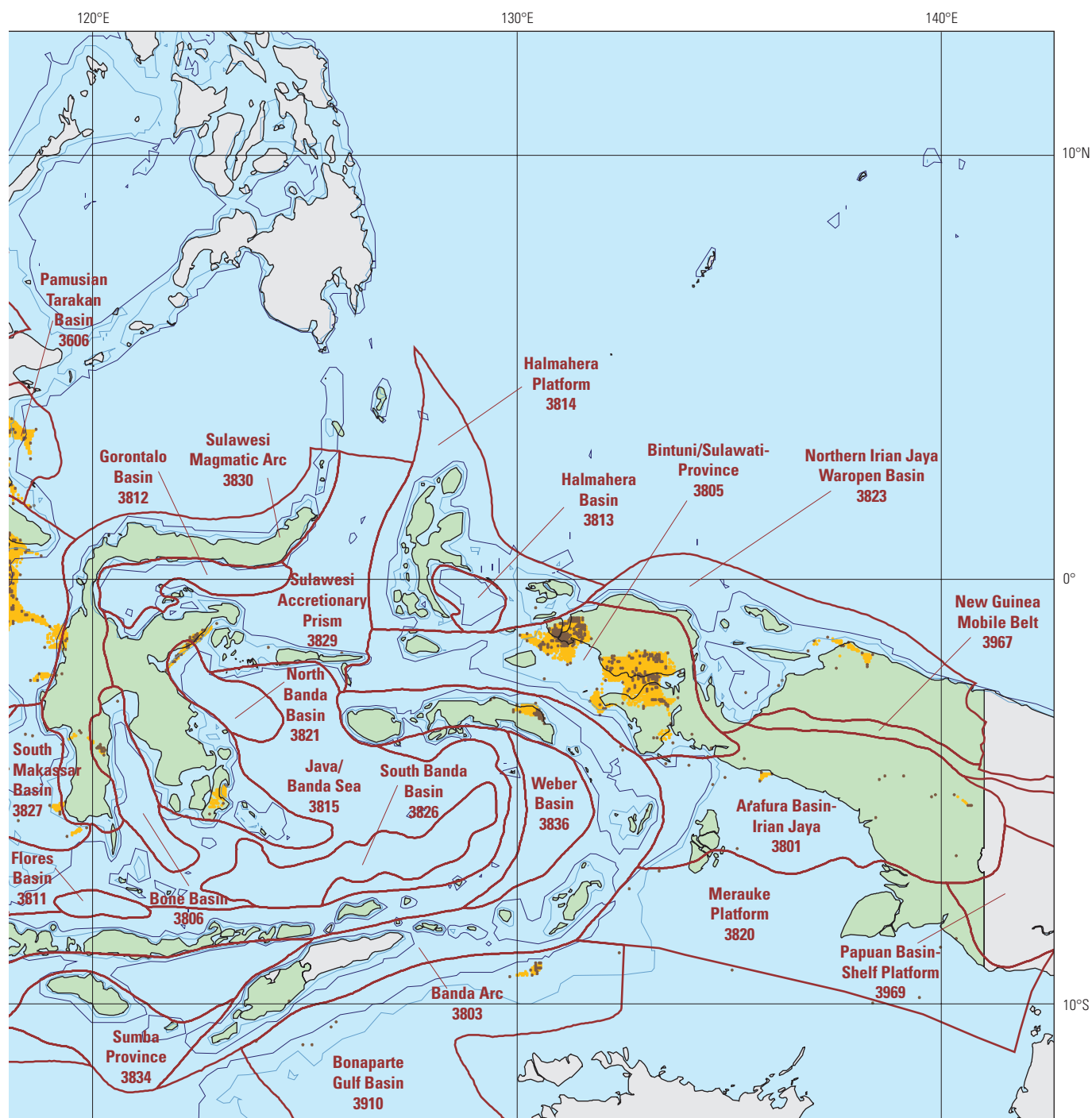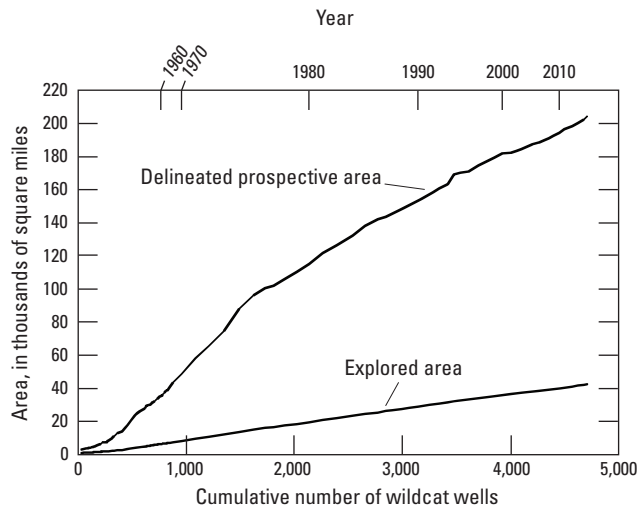**Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area**
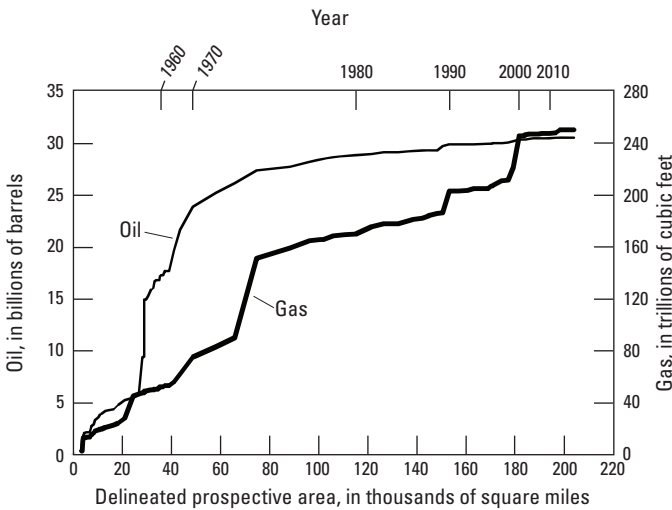

Figure 50.   Continued.

Figure 50. Indonesia   219

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Indonesia						
Banda Arc, 3803	1897	0	54	25	2,023	2,048
Barito Basin, 3804	1938	152	186	226	80	306
Bintuni/Sulawati Province, 3805	1936	215	592	154	25,494	25,648
Bonaparte Gulf Basin, 3910	2000	0	0	0	18,470	18,470
Central Sumatra Basin, 3808	1939	12,872	15,117	2,552	1,123	3,675
East Java Basin, 3809	1888	723	1,485	2,915	10,104	13,019
Greater Sarawak Basin, 3702	1970	0	58	299	47,293	47,593
Kutei Basin, 3817	1897	2,617	3,664	8,392	48,345	56,737
Malay Basin, 3703	1976	136	183	14	1,305	1,318
North Sumatra Basin, 3822	1885	298	734	1,424	21,580	23,005
Northern Irian Jaya Waropen Basin, 3823	1958	0	0	0	1,100	1,100
Northwest Java Basin, 3824	1897	1,888	3,878	6,989	7,124	14,112
Pamusian Tarakan Basin, 3606	1900	611	795	2,732	1,534	4,265
Penyu/West Natuna Basin, 3825	1972	390	847	2,102	3,644	5,746
South Sumatra Basin, 3828	1896	1,236	3,111	6,459	21,265	27,724
Sulawesi Accretionary Prism, 3829	1986	0	21	1	2,679	2,680
Total		**21,138**	**30,725**	**34,283**	**213,162**	**247,445**

Exploration data

Country	Land area (mi²)
Indonesia	699,451

Delineated prospective area through 2015:
  At the surface ....203,948 mi²
  Percentage at depth of 10,000 ft..19 percent

Explored area through 2015:
  At the surface .... 42,425 mi²
  Percentage at depth of 10,000 ft..17 percent

Wildcat wells through 2015:
  Total... 5,089 wells
  Percentage at depths of ≥10,000 ft..48 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil.. 30.803 BBO
  Gas... 250.676 TCF
  Percentage of oil at depths of ≥10,000 ft ....3 percent
  Percentage of gas at depths of ≥10,000 ft ....61 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft ....2 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft ....69 percent

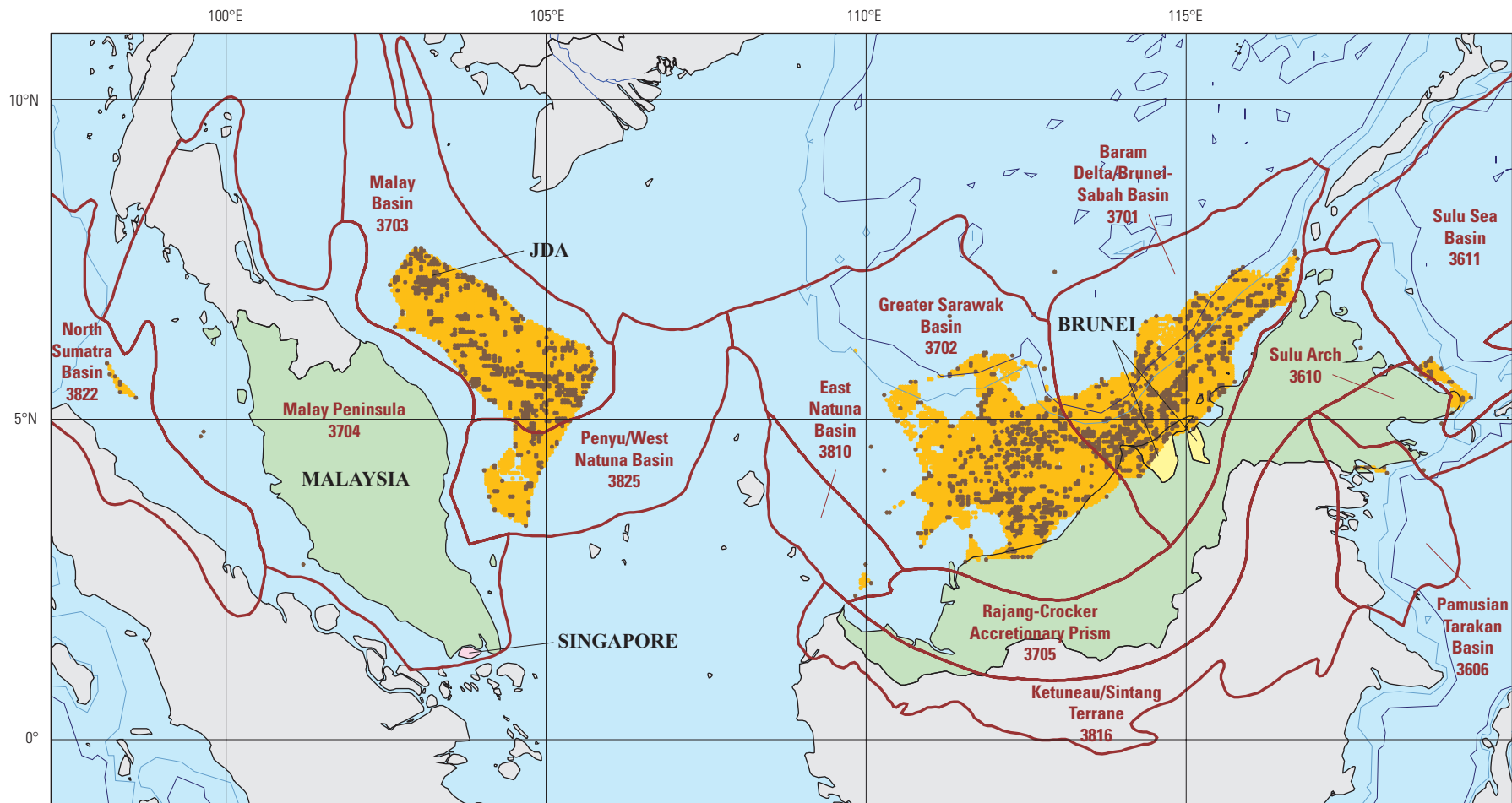**Figure 50.**   Continued.

Figure 51. Map, graphs, and tables of data for oil and gas exploration through 2015 in Malaysia, Brunei, and Singapore. The Malaysia/Thailand Joint Development Area (JDA) is not delineated on the map because a standard boundary was not available.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
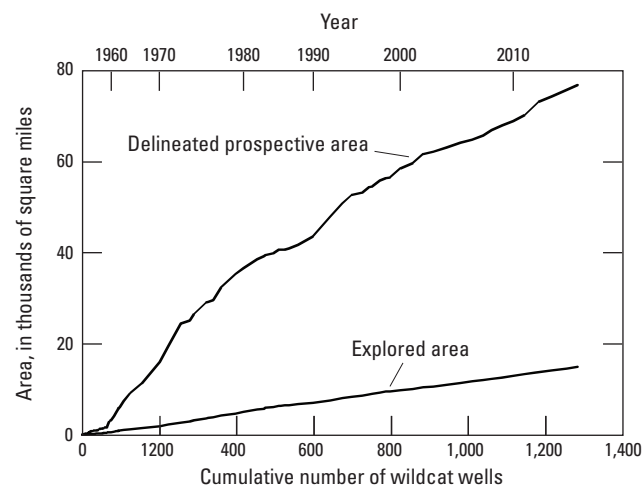
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area

Figure 51. Continued.

Figure 51. Malaysia, Brunei, and Singapore   221

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015
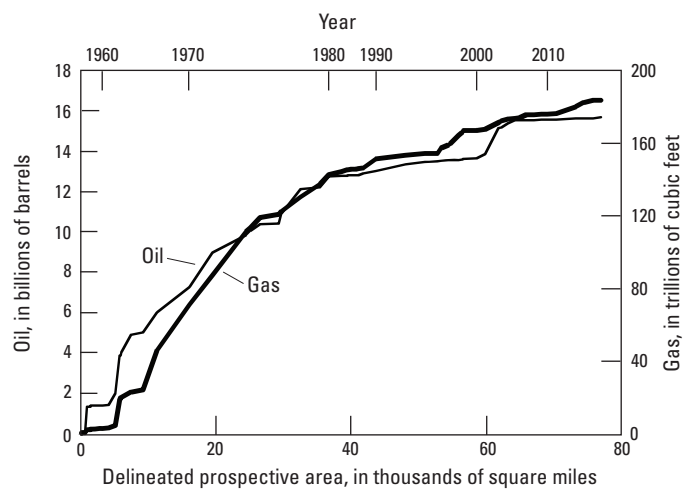
Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Malaysia						
Baram Delta/Brunei-Sabah Basin, 3701	1910	3,806	5,255	12,888	14,873	27,761
Greater Sarawak Basin, 3702	1953	442	1,303	2,850	72,480	75,330
Malay Basin, 3703	1969	3,200	4,750	13,646	23,969	37,615
North Sumatra Basin, 3822	1989	0	0	0	110	110
Penyu/West Natuna Basin, 3825	1973	0	137	52	581	632
Total		**7,449**	**11,444**	**29,436**	**112,013**	**141,449**
Brunei						
Baram Delta/Brunei-Sabah Basin, 3701	1914	3,743	4,233	21,900	7,751	29,651
Malaysia-Thailand JDA						
Malay Basin, 3703	1971	0	10	0	12,023	12,023

Figure 51. Continued.

Exploration data

Country	Land area (mi²)
Malaysia	126,895
Brunei	2,033
Singapore	265
Total	**129,193**

Delineated prospective area through 2015:
  At the surface .... 76,892 mi²
  Percentage at depth of 10,000 ft... 45 percent

Explored area through 2015:
  At the surface .... 14,927 mi²
  Percentage at depth of 10,000 ft... 30 percent

Wildcat wells through 2015:
  Total.. 1,300 wells
  Percentage at depths of ≥10,000 ft....................................... 22 percent

Reported discoveries through 2015 of cumulative recoverable crude oil
and gas in all provinces:
  Oil...15.691 BBO
  Gas...183.523 TCF
  Percentage of oil at depths of ≥10,000 ft .... 13 percent
  Percentage of gas at depths of ≥10,000 ft .... 20 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft .... 14 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft .... 24 percent

Figure 51. Continued.

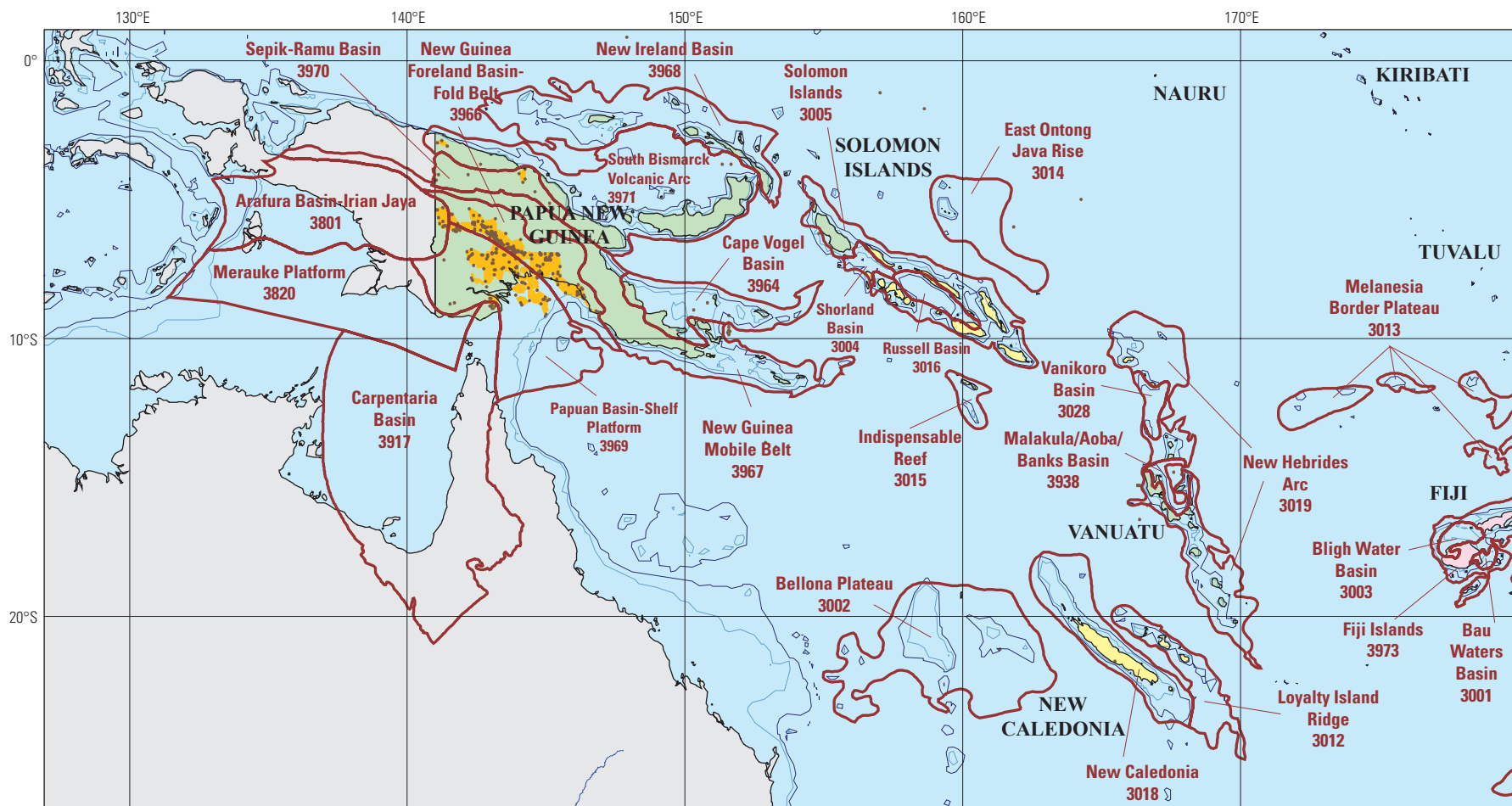**Figure 51. Malaysia, Brunei, and Singapore**   **223**

Figure 52. Map, graphs, and tables of data for oil and gas exploration through 2015 in Papua New Guinea, Fiji, New Caledonia (an overseas territory of France), Solomon Islands, Vanuatu, French Polynesia, Guam, Marshall Islands, Micronesia, Northern Mariana Islands, and Tonga. Six of these areas have delineated prospective areas and no discoveries but are outside the limits of the map: French Polynesia, Guam, Marshall Islands, Micronesia, Northern Mariana Islands, and Tonga. For completeness, three areas are labeled on the map, although they lack petroleum exploration: Nauru, Kiribati, and Tuvalu.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
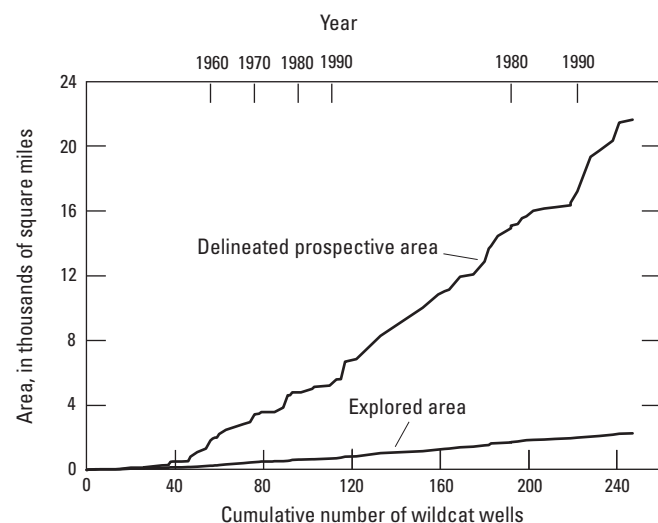
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
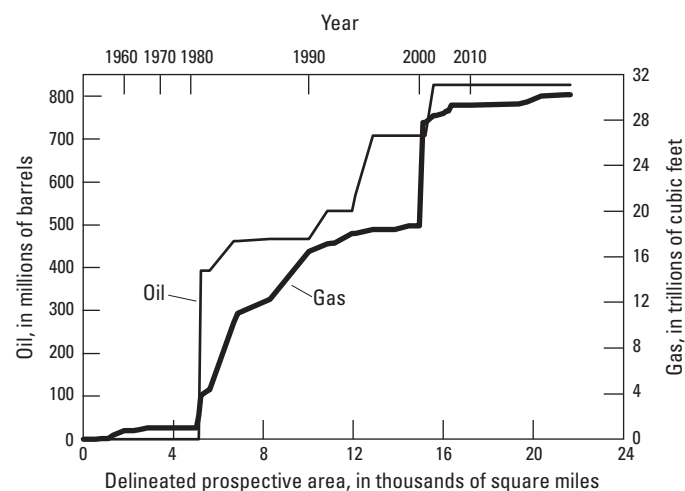
Figure 52. Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Papua New Guinea						
New Guinea Foreland Basin-Fold Belt, 3966	1949	581	829	2,810	22,154	24,965
Papuan Basin-Shelf Platform, 3969	1958	0	<1	0	4,928	4,928
Total		**581**	**829**	**2,810**	**27,082**	**29,893**

Exploration data

Country	Land area (mi²)
Papua New Guinea	174,850
Fiji	7,056
New Caledonia	7,056
Solomon Islands	10,805
Vanuatu	4,706
French Polynesia*	1,478
Guam*	210
Marshall Islands*	70
Micronesia*	271
Northern Mariana Islands*	179
Tonga*	277
Total	**206,958**

*Not shown on map.

Delineated prospective area through 2015:
  At the surface .... 21,632 mi²
  Percentage at depth of 10,000 ft.......................... 23 percent

Explored area through 2015:
  At the surface .... 2,263 mi²
  Percentage at depth of 10,000 ft.......................... 38 percent

Wildcat wells through 2015:
  Total.. 254 wells
  Percentage at depths of ≥10,000 ft...................... 27 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil.. 829 MMBO
  Gas... 30.257 TCF
  Percentage of oil at depths of ≥10,000 ft .... 10 percent
  Percentage of gas at depths of ≥10,000 ft .... 36 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft .... 10 percent
 Percentage of gas in gas fields at depths of ≥10,000 ft .... 41 percent

Figure 52. Papua New Guinea, Fiji, and Neighboring Countries   225

Figure 53. Map, graphs, and tables of data for oil and gas exploration through 2015 in Australia and Timor-Leste. The countries shared the Timor Sea Joint Petroleum Development Area (JPDA). The Timor Sea JPDA is not delineated on the map because a standard boundary was not available.

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
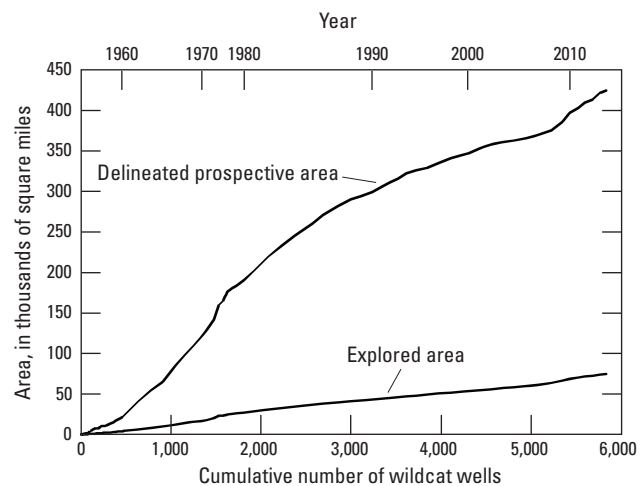
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
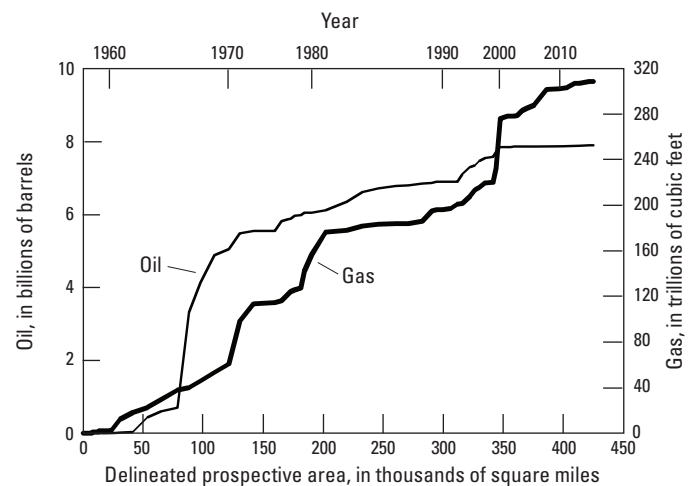

Figure 53. Continued.

Figure 53. Australia and Timor-Leste

227

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Australia						
Bonaparte Gulf Basin, 3910	1964	227	495	172	28,091	28,263
Bowen Basin, 3911	1955	0	0	0	7,570	7,570
Browse Basin, 3913	1971	0	169	217	48,874	49,092
Clarence-Moreton Basin, 3919	1968	0	0	0	2,675	2,675
Eromanga Basin, 3924	1964	0	497	1,361	19,769	21,129
Gippsland Basin, 3930	1924	3,805	4,181	2,178	12,159	14,337
Northwest Shelf, 3948	1954	895	2,462	2,569	144,249	146,818
Perth Basin, 3952	1964	0	49	38	4,295	4,333
Surat Basin, 3958	1900	0	39	126	26,076	26,201
Total		**4,927**	**7,892**	**6,660**	**293,757**	**300,418**
Timor-Leste						
Banda Arc, 3803	1961	0	<1	0	0	0
Timor Sea JPDA						
Bonaparte Gulf Basin, 3910	1974	0	93	29	4,518	4,547

Figure 53. Continued.

Exploration data

Country	Land area (mi²)
Australia	2,966,153
Timor-Leste	5,743
Total	**2,971,895**

Delineated prospective area through 2015:
    At the surface .... 424,835 mi²
    Percentage at depth of 10,000 ft... 15 percent

Explored area through 2015:
    At the surface .... 74,742 mi²
    Percentage at depth of 10,000 ft... 14 percent

Wildcat wells through 2015:
    Total... 5,876 wells
    Percentage at depths of ≥10,000 ft....................................... 16 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil..8.068 BBO
    Gas...309.769 TCF
    Percentage of oil at depths of ≥10,000 ft .... 25 percent
    Percentage of gas at depths of ≥10,000 ft .... 62 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft .... 24 percent
    Percentage of gas in gas fields at depths of ≥10,000 ft .... 64 percent

Figure 53. Continued.

Figure 53. Australia and Timor-Leste   229
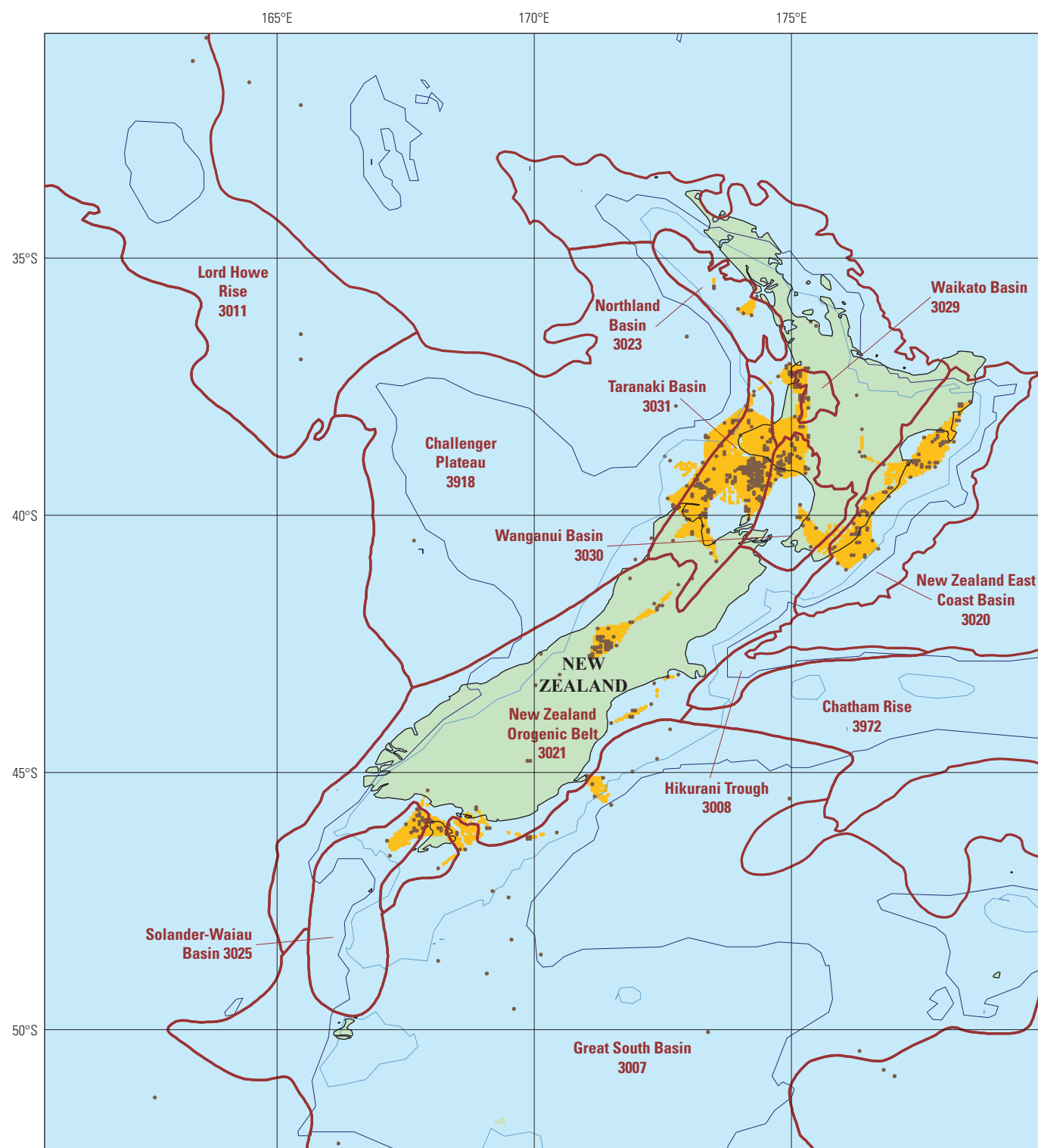
Figure 54.   Map, graphs, and tables of data for oil and gas exploration through 2015 in New Zealand.

Figure 54. New Zealand **231**

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored

Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
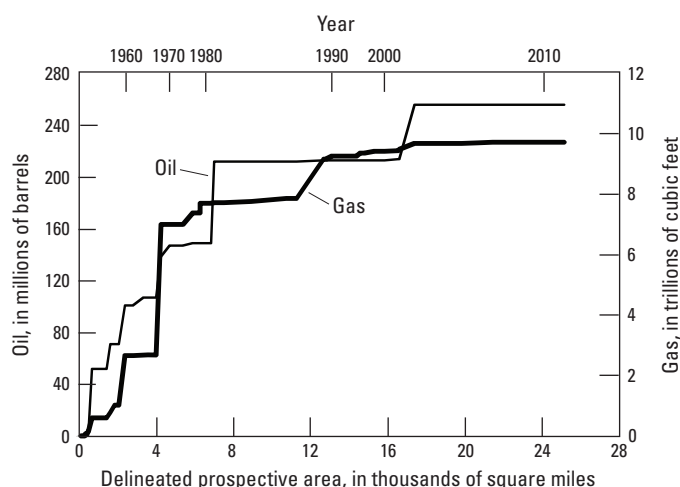
Significant petroleum province—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
New Zealand						
Taranaki Basin, 3031	1867	0	267	427	8,625	9,052

Exploration data

Country	Land area (mi²)
New Zealand	103,363

Delineated prospective area through 2015:
  At the surface .... 25,119 mi²
  Percentage at depth of 10,000 ft .... 30 percent

Explored area through 2015:
  At the surface .... 3,959 mi²
  Percentage at depth of 10,000 ft .... 29 percent

Wildcat wells through 2015:
  Total .... 585 wells
  Percentage at depths of ≥10,000 ft .... 24 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
  Oil .... 269 MMBO
  Gas .... 9.750 TCF
  Percentage of oil at depths of ≥10,000 ft .... 43 percent
  Percentage of gas at depths of ≥10,000 ft .... 90 percent
  Percentage of oil in oil fields at depths of ≥10,000 ft .... 35 percent
  Percentage of gas in gas fields at depths of ≥10,000 ft .... 100 percent

Figure 54. Continued.

Figure 55. Maps, graphs, and tables of data for oil and gas exploration through 2015 in Russia. Separate maps show exploration in the part of Russia in Europe and the part of Russia in Asia. The graphs and data tables in this figure show data for all of Russia.

Figure 55. Russia   233

Growth in delineated prospective area and explored area through 2015, graphed by the year the areas became prospective or explored
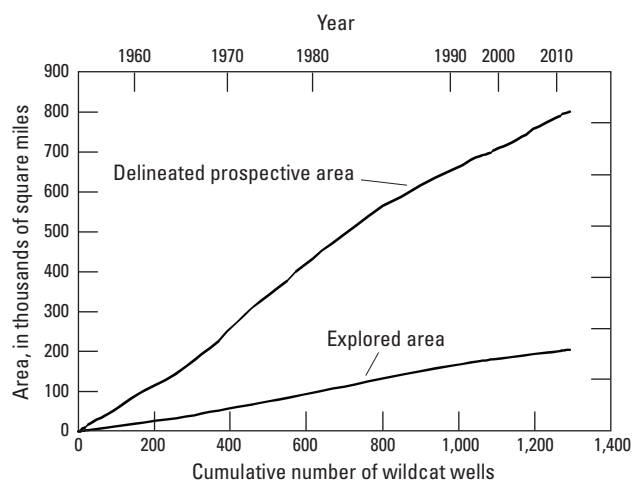
Cumulative recoverable oil and gas discoveries in all provinces through 2015, graphed by the year the field location became part of the delineated prospective area
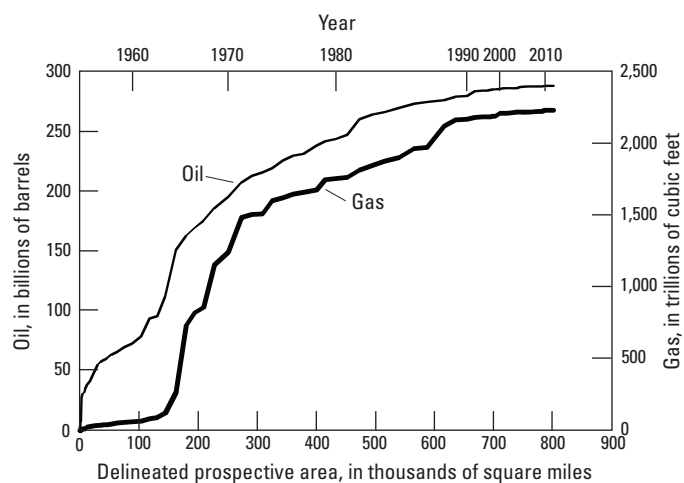

Figure 55.   Continued.

Significant petroleum provinces—Year of first discovery and cumulative recoverable oil and gas discovered through 2015

Significant petroleum province	Year of first discovery	Oil in large fields (MMBO)	Oil in all fields (MMBO)	Gas in oil fields (BCF)	Gas in gas fields (BCF)	Gas in all fields (BCF)
Russia						
Angara-Lena Terrace, 1209	1954	0	2	<1	50,680	50,680
Azov-Kuban Basin, 1108	1864	1,223	2,222	5,293	14,924	20,217
Baykit Arch, 1207	1974	1,723	1,820	7,328	5,285	12,613
Central Barents Platform, 4012	1984	0	0	0	156	156
Deryugin Basin, 1321	2006	113	133	615	4,978	5,593
Dnieper-Donets Basin, 1009	1963	0	6	9	787	796
Kempendiay Region, 1212	2009	0	0	0	700	700
Lena-Vilyuy Basin, 1214	1956	0	0	0	15,528	15,528
Ludlov Saddle, 1059	1990	0	0	0	2,470	2,470
Middle Caspian Basin, 1109	1893	5,256	7,410	11,673	22,909	34,582
Nepa-Botuoba Arch, 1210	1962	2,937	3,754	11,472	35,668	47,140
North Caspian Basin, 1016	1963	0	143	123	65,495	65,618
North Sakhalin Basin, 1322	1923	2,930	3,721	20,684	21,274	41,958
South Barents Basin, 1050	1983	0	0	0	126,034	126,034
Timan-Pechora Basin, 1008	1916	11,917	15,757	8,108	31,859	39,967
Volga-Ural Region, 1015	1929	61,094	80,354	28,891	70,347	99,238
West Siberian Basin, 1174	1953	157,293	172,142	177,166	1,469,899	1,647,065
Yenisey-Khatanga Basin, 1175	1965	0	38	2	18,546	18,549
Total		**244,485**	**287,501**	**271,365**	**1,957,539**	**2,228,904**

Figure 55.   Continued.

Figure 55. Russia   **235**

Exploration data

Country	Land area (mi²)
Russia	6,323,482

Delineated prospective area through 2015:
    At the surface ....801,354 mi²
    Percentage at depth of 10,000 ft..47 percent

Explored area through 2015:
    At the surface ....204,994 mi²
    Percentage at depth of 10,000 ft..34 percent

Wildcat wells through 2015:
    Total...14,335 wells
    Percentage at depths of ≥10,000 ft...48 percent

Reported discoveries through 2015 of cumulative recoverable crude oil and gas in all provinces:
    Oil...288.008 BBO
    Gas..2,231.388 TCF
    Percentage of oil at depths of ≥10,000 ft ....14 percent
    Percentage of gas at depths of ≥10,000 ft ....29 percent
    Percentage of oil in oil fields at depths of ≥10,000 ft ....14 percent
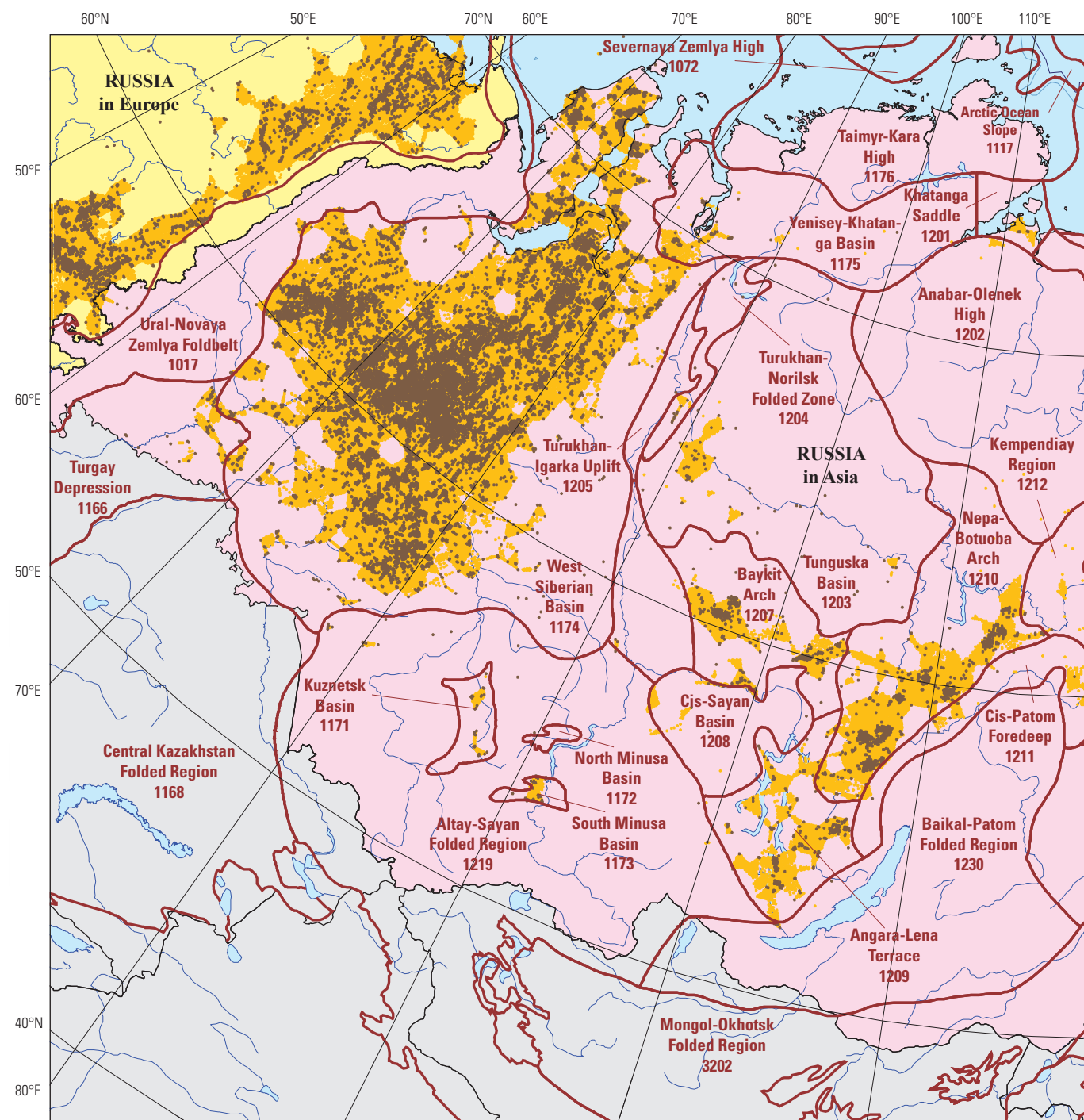   Percentage of gas in gas fields at depths of ≥10,000 ft ....31 percent

Figure 55. Continued.

Figure 55. Continued.

Figure 55. Russia   237

Figure 55. Continued.