



# 2010 Minerals Yearbook

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YEMEN [ADVANCE RELEASE]

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# THE MINERAL INDUSTRY OF YEMEN

By Mowafa Taib

Yemen's mineral resources include metals, such as cobalt, copper, gold, nickel, silver, and zinc; industrial minerals, such as celestine, clays, dolomite, feldspar, gypsum, limestone, magnesite, perlite, sandstone, scoria, talc, and zeolite; and mineral fuels, such as crude oil and natural gas. The mineral industry could account for up to 7% of the country's economic growth once the new mining law is passed by the Parliament. In 2010, the development of the mineral industry in Yemen continued to be negatively affected by several factors, including the security challenges for prospective investors owing to civil unrest and political turmoil in several regions of the country. External factors, such as global economic and financial downturns and the increased risk of piracy in the Gulf of Aden and the Red Sea, also affected the flow of foreign investment into the mineral sector of Yemen (Yemen Geological Survey and Mineral Resources Board, 2009a–d; Pamuk, 2010; U.S. Department of State, 2010, 2011).

## Minerals in the National Economy

In 2010, Yemen's gross domestic product (GDP) was valued at \$29.0 billion compared with \$28.1 billion in 2009. The real economic growth in 2010 was 7.8% compared with 4.3% in 2009. The value of Yemeni exports of goods and services increased to \$7.7 billion from about \$5.8 billion in 2009, and the value of imports of goods and services increased to \$8.7 billion from \$7.9 billion in 2009. The contribution of the mineral industry to the country's GDP increased slightly to 13.9% from 13.3% in 2009. The value of hydrocarbon sector output increased in real terms by 51% in 2010 compared with 1.6% in 2009 owing to higher crude oil prices and the start of liquefied natural gas (LNG) production in November 2009. The value of Yemen's nonfuel economic activity increased in real terms by 7.1% compared with an increase of 6.2% in 2009 (Central Bank of Yemen, 2011, p. 8, 12, 15).

In 2010, the value of hydrocarbon exports, which included crude oil and natural gas, increased by 43% to about \$6.4 billion from \$4.4 billion in 2009. The increase was attributable to higher crude oil prices and the beginning of LNG exports. Hydrocarbon exports accounted for 82% of Yemen's total merchandise exports, by value, in 2010 compared with 77% in 2009. Government revenue from the oil and gas sector increased by 40% to \$2.75 billion from \$1.96 billion in 2009 (Central Bank of Yemen, 2011, p. 52).

In addition to crude oil and LNG, Yemen exported gypsum and salt. The volume of gypsum exports increased by 518% to 68,000 metric tons (t) in 2010 from about 11,000 t in 2009. Crude oil exports decreased in volume by 31% to 7.7 million barrels (Mbbbl) from 11.3 Mbbbl in 2009. LNG exports totaled about 6.9 billion cubic meters. Salt exports increased by 78% to 5,369 t in 2010 from 3,017 t in 2009. In 2010, the value of U.S. trade with Yemen was about \$752 million. It included

about \$391 million in exports and \$181 million in imports (Central Bank of Yemen, 2011, p. 57; U.S. Census Bureau, 2011).

## Government Policies and Programs

The Government had been encouraging investment in the production of such precious metals as gold and silver, as well as other metals, such as copper, lead, magnesium, nickel, platinum-group metals (PGM), tin, and zinc. The Government created opportunities for investing in projects to produce such industrial minerals as basalt, clays, dimension stone, dolomite, feldspar, fluorite, granite, gypsum, kaolin, limestone, marble, perlite, pumice, quartz, salt, silica sand, talc, travertine, volcanic tuff, and zeolite (Ministry of Oil and Minerals, 2009).

Article 8 of the Constitution gives the state ownership of the country's mineral and energy resources. Metallic and industrial mineral exploration and production operations are governed by the Mines and Quarries law No. 24 of 2002. Mineral projects are also subject to the provisions of the investment law No. 22 of 2002. The Yemen Geological Survey and Mineral Resources Board (GSMRB) under the Yemen Mining Policy Reform Project with the support of the International Finance Corp. (IFC) of the World Bank Group and Yemen's Ministry of Oil and Minerals prepared a draft of a new mines and quarries law. The proposed law would apply an 8% royalty on the production of precious stones, a 5% royalty on the production of nonmetallic minerals, and a 3% royalty on the production of metallic and other minerals. The law also proposes a 30% to 35% income tax on remitted dividends and an exemption of import duties during mine construction. The Government approved the mining law but the Parliament did not give approval as of yearend 2010 (Pamuk, 2010).

The GSMRB, which was the state agency responsible for mineral production under the Ministry of Oil and Minerals, promoted investment in Yemen's mining sector and published reports on the mineral resources of Yemen. The reports included analyses, geologic settings, occurrences, and reserves information for celestite, copper, gold, lead, magnesite, nickel, perlite, PGMs, pumice, rock salt, scoria, zeolite, and zinc. The GSMRB reported that Yemen had 2,642 mining and quarrying operations in 18 out of the 20 Governorates of Yemen in 2009 (the latest year for which data were available). The majority of these operations were for limestone (41%), volcanic tuff (30%), basalt (about 10%), and the remaining units (19%) were for clays, granite, gypsum, marble, pumice, scoria, salt, and sandstone production (Yemen Geological Survey and Mineral Resources Board, 2009b–d; Central Statistics Organization, 2010).

## Production

The most notable increases in Yemen's mineral production in 2010 compared with that of 2009 were the increases in

marketed gas (by 338%) and gross gas (by 39%) owing to the inauguration of the Yemen LNG Co.'s project in November 2009. Other increases included a 65% increase in cement production, which was attributable to the commencement of production of two privately owned cement plants as well as a 15% increase in salt production. Crude oil and condensates production decreased by 8% in 2010 compared with that of 2009 (table 1).

### Structure of the Mineral Industry

A number of international oil companies were active in crude oil and natural gas production in Yemen. They included Calvalley Petroleum Ltd. of Cyprus; Canadian Nexen Yemen Ltd. (a subsidiary of Nexen Inc. of Canada); DNO Yemen (a subsidiary of DNO International ASA of Norway); Dove Energy Ltd. of the United Kingdom; Jannah Hunt Oil Co. (a subsidiary of Hunt Oil Co. of the United States); Korea National Oil Co. (KNOC); Occidental Petroleum Yemen (a subsidiary of Occidental Petroleum Corp. of the United States); OMV A.G. of Austria; state-owned Safer E&P Operations Co.; and Total E&P Yemen (a subsidiary of Total S.A. of France) (table 2).

State-owned Yemen General Corporation for Oil and Gas was a minor partner (held 5% to 10% interest) in petroleum exploration activity that was carried out by several international oil companies under exploration and production-sharing agreements with the Government. C.C.C. for Oil & Gas (a subsidiary of Consolidated Contractor Co. of Greece) was exploring for oil at the Al-Furt area (Block 33), the South Al-Furt area (Block 49), and the Al-Mabar area (Block 49). DNO Yemen was exploring at the North Hwarim area (Block 44), the Al-Ain area (Block 52 and Block 72), and the South Hood area (Block 47). Dove Energy had an exploration license at the Ras Hoaira area (Block 73). Eni S.p.A of Italy was exploring at the Al-Jawf area (Block 6) and the North Balhaf area (Block 17). Epsilon Energy Ltd. of Canada had a permit to explore at the West Mukallah area (Block 41). Gallo Oil (Jersey) Yemen Inc. (a subsidiary of PT Bumi Resources Tbk of Indonesia) was exploring for oil at the Al-Armah area (Block 13) and the East Al-Mabar area (Block R2). Gujarat State Petroleum Corp. Ltd. of India had exploration licenses at the Al-Jawf area (Block 19), the North Balhaf area (Block 28), and the Al Rahan area (Block 57).

Kuwait Energy had an exploration license at the Mukallah area (Block 15), the Hood area (Block 35), the Qusa area (Block 74), and the Southeast Al-Mabar area (Block 49). Midas for Oil & Gas L.L.C. of the United Arab Emirates was licensed to explore for oil at the Asaker area (Block 8) and at the Wadi Al-Banin area (Block 68). Oil Search (Roy) Ltd. of Papua New Guinea was exploring for oil at the Jardan area (Block 3) and the Barq (Block 7). OMV had an engineering and procurement and construction contract at the Al-Mabar area (Block 2) and the South Sanu area (Block 29). PT Medco Energi Internasional Tbk of Indonesia had a permit to explore for oil at the Wadi Amed area (Block 82) and the Wadi Arat area (Block 83). Reliance Industries Ltd. of India was exploring for oil at the Jeza area (Block 34) and the Marait area (Block 37). Sinopec of China had exploration and production-sharing agreements for the Mashaf area (Block 69), the Al-Qarn (Block 71), and the Amakeen area (Block 1) (Ministry of Oil and Minerals, 2010b).

Yemen LNG was the sole producer of LNG in Yemen. The company was a consortium of Total E&P Yemen (39.62%); Hunt Oil (17.22%); state-owned Yemen Gas Co. (16.73%); Republic of Korea companies of SK Energy (9.55%), KoreaGas Corp. (6%), and Hyundai Corp. (5.88%); and Yemen General Authority for Social Security and Pensions (5%) (Yemen LNG Co., 2011).

The GSMRB reported that 16 companies were exploring for base metals and industrial minerals in Yemen. They included 3S Mineral Ltd. of India and the United Kingdom, which was exploring for chalk limestone; Ansan Wakfs (Hadramaut) Ltd. of the United Kingdom, which had a license to search for rare-earth minerals; Arabian Limestone and Dolomite Co. S.A. of India and the United Kingdom, which was licensed to explore for dolomite and limestone; Arab Mining Co. of Jordan, which held a prospective permit to search for dolomite and magnesite; Jabal Salab Co. (Yemen) Ltd. of the Cayman Islands, which was close to beginning mining of a zinc oxide deposit; Meshreq Iron Ore Mining and Trading Co. of India, which had an exploration permit for titanium; Minerals and Metal Resources Shabbir Co. Ltd. of India, which held an iron ore exploitation contract and iron ore exploration license; Naine Mineral Resources of Singapore, which operated limestone and barite mines; Stone Resources (Yemen) Ltd. of China, which held an exploration permit for cobalt, copper, and nickel; Triton Resources Pty Ltd. of Australia, which held an exploration license for metallic minerals; and Yemen Iron Steel Ltd., which was exploring for iron ore (Yemen Geological Survey and Mineral Resources Board, 2008). The GSMRB did not provide up-to-date information on the status and activity of these companies in 2010.

### Commodity Review

#### Metals

**Cobalt, Copper, and Nickel.**—In November, Cantex Mine Development Corp. of Canada (Cantex) announced that it had completed its 11-hole drilling program at the Wadi Qutabah nickel-copper-cobalt and PGM project and had begun drill tests at the Suwar nickel-copper-cobalt deposit, in which Cantex was the sole owner of the exploration license. Cantex planned to complete a prefeasibility study of the Suwar project by mid-2012. Vale S.A. of Brazil, which funded the Suwar project and the Wadi Qutabah projects and had an option to purchase them, conducted 1.624 line kilometer helicopter-borne geophysical survey of the Suwar and the Wadi Qutabah project areas and identified three new anomalies that would indicate massive sulfide mineralization and a copper-nickel cobalt massive sulfides zone (Cantex Mine Development Corp., 2011).

**Gold.**—Several companies had been awarded permits to search for and explore for gold in Yemen. They included Cantex, which was also exploring for copper, nickel, and platinum; CC Mining Co. S.A. of Panama; Nagarjuna Corp. Ltd. of India; Thani Dubai Mining Ltd. (TDM) of the United Arab Emirates; and Volrock Mining Ltd. of Saudi Arabia and the United Kingdom.

Cantex continued drilling at the Al Hariqah deposit, which is located 130 kilometers (km) northwest of Sana'a. The results from assays of the samples would be used for the prefeasibility study (Cantex Mine Development Corp., 2011).

TDM, which formed a 50-50 strategic alliance with AngloGold Ashanti Ltd. of South Africa to operate gold mines in the Middle East and North Africa in 2009, held two gold exploration licenses for gold and associated minerals at the Wadi Meddan near Al Mukalla in Hadramaout Governorate and at the Wadi Sharis in Hajjah Governorate. The Wadi Meddan concession had an estimated 7.3 t (reported as 234,000 troy ounces) of measured and indicated gold resources and 28.9 t (reported as 930,000 troy ounces) of inferred gold resources. TDM drilled more than 80 wells in 15 sites at Wadi Meddan, collected more than 8,718 rock samples from mineralized zones, and started preparation for the preliminary evaluation of the deposit. The company also drilled 15 sites at the Notisha permit area and collected 7,952 samples from the mineralized zones. The company also started exploration activity at the al-Maslama area (AngloGold Ashanti Ltd., 2009; AME Info FZ LLC, 2010).

**Silver, Lead and Zinc.**—The Jabali zinc and silver mine, which was owned by Jabal Salab Co., was the first large-scale metal mine planned in Yemen. The project had the full support of the Government, which had signed a 20-year exploitation agreement with Jabal Salab. The Jabali Mine is located near Nehim about 110 km northeast of Sana'a. Jabal Salab was jointly owned by ZincOx Resources plc of the United Kingdom (52% interest) and Ansan Wikfs Investments Ltd. of Yemen (48%). The deposit was estimated to contain 12.6 million metric tons (Mt) of oxide ore grading 18.9% zinc, 1.2% lead, and 68 grams per metric ton (g/t) silver, and minable reserves were estimated to be 8.7 Mt grading 9.2% zinc with a cutoff grade of 4.4%. The Jabali bondholders withdrew from the bond after ZincOx defaulted on the terms of the bond in October 2009 by being late with the construction work at the Jabali Mine. Ansan Wikfs and ZincOx subsequently repurchased the project for \$10 million and began the process of finding new investors and financing sources. Consequently, zinc production from the mine, which had been scheduled to begin in 2010, was delayed indefinitely (ZincOx Resources plc, 2011).

### *Industrial Minerals*

**Cement.**—Three companies were responsible for cement production in Yemen—Arabian Yemen Cement Co. Ltd., National Cement Co. (AYCC), and state-owned Yemen Corporation for Cement Industry and Marketing (YCC). YCC operated three cement plants at Amran, Bajil, and Mafraq (Al Burh). The company completed more than 50% of the construction work needed to increase the production capacity at the Bajil plant to 750,000 metric tons per year (t/yr) and planned to replace residual fuel with coal to reduce cost at its three plants. In 2009 (the latest year for which data were available), the Amran cement plant produced about 1.3 Mt of cement followed by Al Burh cement plant (553,000 t), and the Bajil cement plant (300,000 t). AYCC, which was the first privately owned cement producer in the country, had operated a 1.6-million-metric-ton-per-year (Mt/yr)-capacity

plant at Wadi Saim near Aden since 2008. The Hadramaout cement plant at Al-Oyoun, which was located 60 km north of the Port of Al-Mukalla, commenced production in 2010. The 1.5-Mt/yr-capacity plant was operated by AYCC, which was owned by the Eastern Province Cement Co. of Saudi Arabia (30% interest) and other Saudi and Yemeni investors (Arabian Yemen Cement Co. Ltd., 2011; National Cement Co., 2011; Yemen Corporation for Cement Industry and Marketing, 2011).

### *Mineral Fuels*

**Natural Gas and Petroleum.**—At the end of December, Yemen's proved gas reserves were about 490 billion cubic meters (17.3 trillion cubic feet). Eighty-one percent of the gas reserves was in the Marib-Block 18 and 7% was in the Jennah-5 gasfield. Yemen exported about 6.9 billion cubic meters of LNG in 2010 compared with 535,000 million cubic meters in 2009. Commercial LNG production in Yemen began in October 2009. The Republic of Korea received the first cargo of 147,000 cubic meters in November. Other LNG shipments were destined for China. LNG was shipped using four LNG carriers (two 165,000-cubic-meter-capacity ships and two 157,000-cubic-meter-capacity ships) that were leased by Yemen LNG under a 20-year lease contract (Ministry of Oil and Minerals, 2010a; U.S. Energy Information Administration, 2011).

The construction of the first 3.35-Mt/yr train of a 2-train 6.7-Mt/yr-capacity natural gas liquefaction plant and related dock facilities at the Balhaf terminal on the Gulf of Aden for Yemen LNG Co. was completed in October 2009, and construction of the second 3.35-Mt/yr train was completed in April. The project included establishing a 320-km natural gas pipeline to carry the dry gas produced from Block 18 fields in the Marib-Jawf region of central Yemen to the natural gas liquefaction plant at Balhaf in the south (Yemen LNG Co., 2010; U.S. Energy Information Administration, 2011).

### **Outlook**

The development of Yemen's mineral industry is critical for the country's economic growth and has the potential to attract foreign investment to the country and create job opportunities in several parts of the country. The success of the mineral sector development will likely depend on the elimination of or significant reduction in the risk associated with the country's political and military unrest, achievement of stability and security in the country, and approval of the new mining law by the Parliament.

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TABLE 1  
YEMEN: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Thousand metric tons unless otherwise specified)

Commodity <sup>2</sup>	2006	2007	2008	2009	2010 <sup>c</sup>
<b>INDUSTRIAL MINERALS</b>					
Cement	1,470	1,728	2,111	2,118	3,500
Gypsum	81	92	100	100	100
Salt	53	61	65	65	75
Sand and gravel	1,162	1,328	1,500	1,500	1,500
Stone:					
Marble thousand square meters	202	244	250	250	250
Other quarried stone	3,986	4,558	4,700	5,000	5,000
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Natural gas:					
Gross million cubic meters	28,100	29,200	29,632 <sup>r,3</sup>	14,412 <sup>r,3</sup>	20,000
Marketed do.	788	817	776	1,416 <sup>r,3</sup>	6,200
Liquids thousand 42-gallon barrels	3,650	3,650	3,650	3,650	3,650
Petroleum:					
Crude do.	133,500	116,700	109,600 <sup>r,3</sup>	104,755 <sup>r,3</sup>	96,360
Refinery products:					
Liquefied petroleum gas do.	438	438	438	438	438
Naphtha do.	1,200	1,842	888	645	645
Gasoline do.	5,110	5,110	5,110	5,110	5,110
Kerosene do.	4,052	4,052	4,052	4,052	4,052
Distillate fuel oil do.	7,775	7,775	7,775	7,775	7,775
Residual fuel oil do.	14,750	14,750	14,750	14,750	14,750
Asphalt do.	775	733	703	564	564
Other do.	1,743	1,143	2,127	2,509	2,509
Total do.	35,843	35,843	35,843	35,843	35,843

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. do. Ditto.

<sup>1</sup>Table includes data available through November 30, 2011.

<sup>2</sup>In addition to the commodities listed, aggregate, feldspar, limestone, mica, pumice, rolled-steel bars, scoria, silica sand, talc, and zeolite may have been produced but available information is inadequate to make estimates of output.

<sup>3</sup>Reported figure.

TABLE 2  
YEMEN: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>c</sup>
Cement	Amran Cement Factory [Yemen Corporation for Cement Industry and Marketing (YCC), 100%]	Kilns and mills at Amran	1,500,000
Do.	Al Burh Cement Factory [Yemen Corporation for Cement Industry and Marketing (YCC), 100%]	Kilns and mills at Mafraq	800,000
Do.	Bajil Cement Factory [Yemen Corporation for Cement Industry and Marketing (YCC), 100%]	Kilns and mills at Bajil near Taiz	500,000
Do.	National Cement Co. (Hayel Saeed Anam & Co. Ltd., 100%)	Kilns and mills at Wadi Saim, Lahj	1,600,000
Do.	Arabian Yement Cement Co. Ltd. (Eastern Province Cement Co., 30%; Al-Amoudi Group, 15%; Bagshan Group, 15%; Saudi Binladin Group, 10%; Baroom Investment Holding Co. Ltd., 10%; Ali Ali Hussain Miksa, 10%; Sara Development Co. Ltd., 5%; Yemeni Group for Development of Yemen, 5%)	Kilns and mills at Al-Oyoun, Hadramaout	1,500,000

See footnotes at end of table.

TABLE 2—Continued  
YEMEN: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity <sup>e</sup>
<b>Natural gas:</b>				
Associated	million cubic meters	Jannah Hunt Oil Co. [Hunt Oil Co., 29%, and Yemen General Corporation for Oil and Gas, 71%]	Jannah field (Block 5)	227 <sup>1</sup>
Liquefied	thousand metric tons	Yemen LNG Co. (Total E&P Yemen, 39.6%; Hunt Oil Co., 17.2%; Yemen Gas Co., 16.7%; SK Energy, 9.6%; Korea Gas Corp., 6%; Hyundai Corp., 5.9%; Yemen General Authority for Social Security and Pensions, 5%)	Marib field (Block 18)	6,700
<b>Petroleum:</b>				
Crude	thousand 42-gallon barrels	Occidental Petroleum Yemen (Occidental Petroleum Corp., 65%, and Yemen General Corporation for Oil and Gas, 35%)	Damis field (Block S1)	4,000
Do.	do.	OMV Aktiengesellschaft, 68%, and Yemen General Corporation for Oil and Gas, 32%	Al-Uqla field (Block S2)	1,560
Do.	do.	Calvalley Petroleum Ltd., 59%, Yemen General Corporation for Oil and Gas, 41%	Malik field (Block 9)	2,000
Do.	do.	DNO Yemen (DNO International ASA, 48%, and Yemen General Corporation for Oil and Gas, 52%)	Hwarim field (Block 32)	3,300
Do.	do.	DNO Yemen (DNO International ASA, 62%, and Yemen General Corporation for Oil and Gas, 38%)	South Hwarim field (Block 43)	2,600
Do.	do.	Dove Energy Ltd., 49%, and Yemen General Corporation for Oil and Gas, 51%	East Saar field (Block 53)	4,000
Do.	do.	Jannah Hunt Oil Co. (Hunt Oil Co., 29%, and Yemen General Corporation for Oil and Gas, 71%)	Jannah field (Block 5)	15,700
Do.	do.	Korea National Oil Co. (KNOC), 82%, and Yemen General Corporation for Oil and Gas, 18%	West Ayad field (Block 4)	45
Do.	do.	Total E&P Yemen (Total S.A., 41%, and Yemen General Corporation for Oil and Gas, 59%)	East Shabwah field (Block 10)	13,700
Do.	do.	Safer E&P Operations Co. (Government, 100%)	Marib field (Block 18)	22,000
Do.	do.	Canadian Nexen Yemen Ltd. (Nexen Inc., 39%, and Yemen General Corporation for Oil and Gas, 61%)	Masila field (Block 14)	42,000
Do.	do.	Canadian Nexen Yemen Ltd. (Nexen Inc., 63%, and Yemen General Corporation for Oil and Gas, 37%)	East Al-Hajr oilfield (Block 51)	5,500
Refined	42-gallon barrels per day	Aden Refinery Co. (Government, 100%)	Refinery at Aden	120,000
Do.	do.	Yemen Oil Refining Co. (Yemen Hunt Oil Co. and Exxon Yemen, Inc., 75.5%, and Yukong Group, 24.5%)	Topping plant at Marib	20,000
<b>Salt:</b>				
<b>Crude:</b>				
Marine		Local private companies	Eleven saltworks near Aden	150,000
Rock		do.	Five salt mines near Salif	140,000
Refined		Salt Refining and Packing Factory (Government)	Salif	NA
Do.		Aden Salt Factory (Government)	Aden	NA
<b>Steel, rolling mills</b>				
Do.		Arab Iron and Steel Corp.	do.	40,000
Do.		Mukalla Iron and Steel Co.	Rayan	120,000 <sup>2</sup>
Do.		Yemen Steel Manufacturing Company Ltd. (Al-Rhabi Trading Group, 100%)	Al Hodeidah	120,000
<b>Stone</b>				
		About 1,900 local private companies	Dhamar, Mayana, Sana'a, Taiz, and Wadi Marek areas	5,000,000

<sup>e</sup>Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

<sup>1</sup>Most produced natural gas was stripped of hydrocarbon liquids and reinjected into oil reservoirs.

<sup>2</sup>Under construction.