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MINERAL INDUSTRIES OF

THE MIDDLE EAST



U.S.
DEPARTMENT
OF THE
INTERIOR



BUREAU
OF
MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • Bruce Babbitt, Secretary

BUREAU OF MINES

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON : 1995

Preface

This edition of the Minerals Yearbook records the performance of the worldwide minerals industry during 1993 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains annual reports on virtually all metallic and industrial mineral commodities important to the U.S. economy. In addition, a chapter on survey methods used in data collection with a statistical summary of nonfuel minerals and a chapter on trends in mining and quarrying in the metals and industrial mineral industries are included.

Volume II, Area Reports: Domestic, contains chapters on the minerals industry of each of the 50 States, Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory. This volume also has a chapter on survey methods used in data collection, including a statistical summary of domestic nonfuel minerals.

Volume III, Area Reports: International, contains the latest available mineral data on more than 175 foreign countries and discusses the importance of minerals to the economies of these nations. The reports also incorporate location maps, industry structure tables, and an outlook section.

The annual international review is presented as five area reports and one world overview: Mineral Industries of Africa, Mineral Industries of Asia and the Pacific, Mineral Industries of Latin America and Canada, Mineral Industries of Europe and Central Eurasia, Mineral Industries of the Middle East, and Minerals in the World Economy. Due to budget constraints, detailed mineral trade statistics by country will no longer be included in this publication. However, in the future abbreviated trade data for the major mineral trading countries will be made available by electronic or other means. For information on trade statistics call the Chief, Section of International Data at (202) 501-9700.

The U.S. Bureau of Mines continually strives to improve the value of its publications to users. Therefore, constructive comments and suggestions by readers of the Yearbook are welcomed.

Rhea L. Graham, *Director*

Acknowledgments

The Country Specialists in the Division of International Minerals, U.S. Bureau of Mines, in preparing the International Review regional books of Volume III of the Minerals Yearbook, extensively utilized statistics and data on mineral production, consumption, and trade provided by various foreign government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material also was obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by 10 Regional Resource Officers assigned to minerals and petroleum reporting and by economic and commercial officers and other officials of the Department of State located in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support is provided by the staff of the Section of International Data, Division of Statistics and Information Services. The text and production, structure of the mineral industry, and reserve tables of this volume were prepared by the respective country authors.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

George J. Coakley
Chief, Division of International Minerals

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THE MINERAL INDUSTRIES OF THE MIDDLE EAST

By George A. Morgan and Staff, Branch of Africa and Middle East

INTRODUCTION¹

The production and processing of crude petroleum and natural gas are the dominant economic sectors of the Middle East. Development of downstream petrochemical and fertilizer industries continues as a major investment area. In 1993, the 15 countries that constituted the region accounted for 29% of world crude petroleum output, 19% of world natural gas plant liquid production, and 6% of world dry natural gas production. Only Cyprus and Lebanon were not crude petroleum producers.

Regional output was up for most major mineral commodities. A major exception was phosphate rock, which declined sharply owing to reduced worldwide demand. Total crude petroleum output declined by over 100 Mbbls, again owing to slack demand in the major industrial countries.

Research by the Branch of Africa and the Middle East confirms the continuation of U.S. corporate interest in the region. In Bahrain, such interest included sale of an aluminum rolling mill, a powder coating plant, a sulfur derivatives plant, and floating dry docks. In Qatar, Mobil Oil Corp. took over development of the North Field LNG project.

Improvement of environmental standards for mineral processing operations continued. Bahrain provided funding for the aluminum smelter industry to install additional environmental safeguards.

The dominance of the Middle East's hydrocarbon resources over its nonfuel resources is a result of periodic marine inundations of a large inland basin within and adjacent to the existing Gulf over a period of about 100 million years. Sediment accumulations of thousands of

meters thickness exist in the region. Successive periods of evaporation and sea transgression also led to the formation of evaporite beds of borax, gypsum, and salt, the latter in places acting as traps for hydrocarbons. The shallow warm water bodies existing during the Cretaceous led to the formation of economic marine phosphate deposits.

Cambrian and Precambrian granites and gneisses contain small, but minable, deposits of iron and gold. Mesozoic ultramafic rocks, including ophiolites, in Cyprus, Iran, Oman, and Turkey contain economic deposits of chromite, copper, and pyrite. A Cenozoic and Mesozoic cover of alluvium and volcanics extends throughout much of the region and hosts economic deposits of barite, copper, lead, and zinc.

Most mineral commodity production facilities were under Government control through various parastatal companies. However, most Government's, particularly those of Iran and Turkey, promoted privatization of the sector.

Energy products were the primary mineral-based materials imported by the United States from the Middle East. Nonfuel minerals, for which the Middle East was a significant supplier to the United States, were bromine, cut gemstones, and potash from Israel, and chromite and ferrochromium from Turkey. Exports from the United States to the region were primarily food, machinery, equipment, and computers.

About 66% of total world crude petroleum reserves and 31% of total world natural gas reserves are in the Middle East. The region consumed about 5% of the world's total output of petroleum products and about 6% of the world's total production of natural gas.

Transportation and port facilities in the region are geared toward efficient and expedient shipment of these materials. Export sales of these fuels provide funding for further diversification of the mineral industry and of the national economies in general. Emphasis is on expanding value-adding downstream facilities for petroleum and natural gas. These include refineries, petrochemical and fertilizer plants, and energy-intensive industries, such as aluminum.

Earnings from the petroleum industry are channeled by several Governments in the region to mineral industry projects in Africa, the newly independent republics of the former U.S.S.R., and elsewhere. This is made possible through loans from the Islamic Development Bank and the Arab Bank for Economic Development in Africa, and through bilateral agreements.

Water resources are critical to the Middle East's economic viability. The world's largest desalinization plants operate in the region to supply potable water to Kuwait, Saudi Arabia, and others. Water resources for human consumption, agriculture, and industry in Iraq, Syria, and Turkey are from the Tigris and Euphrates Rivers that arise in Turkey. Expansion of the economies of these countries places heavy demand on traditional water supplies and increases regional concern about sustained water availability.

The region covers about 6.2 Mkm² or about 66% of the U.S. land area. The total population of the region was about 206 million in 1993 compared with 258 million for the United States. Estimated gross domestic product for the 15 countries of the Middle East was \$638 billion, compared with \$5.9 trillion for the United States. Expatriate labor was an

important factor in the economies of some of the countries of the region.

All tons are metric in this report unless otherwise specified.

¹George A. Morgan, Chief, Branch of Africa and Middle East, Division of International Minerals.

SELECTED GENERAL SOURCES OF REGIONAL INFORMATION

British Sulphur Corp. Ltd., London:

Nitrogen, bimonthly.

Phosphorus and Potassium, bimonthly.

Sulphur, bimonthly.

Bureau de Recherches Geologiques et Minières, Paris: Chronique de la Recherche Minière, quarterly.

Institution of Mining and Metallurgy, London: Transactions, monthly. Bulletin.

International Lead and Zinc Study Group, London.

International Monetary Fund, Washington, DC: International Financial Statistics, monthly and annual yearbook.

Mcclean Hunter Publishing Co., Chicago, Illinois: Engineering and Mining Journal, monthly.

Metal Bulletin Journals Ltd., London:

Metal Bulletin, semiweekly.

Mining Journal Ltd., London: Mining Magazine, monthly.

Mining Journal, weekly.

Mining Annual Review, July.

PennWell Publishing Co., Tulsa, Oklahoma: International Petroleum Encyclopedia. Oil and Gas Journal, monthly.

Society of Economic Geologists, University of Texas, El Paso, Texas: Economic Geology (and Bulletin), bimonthly.

United Nations Statistical Office, New York: UN trade statistics.

U.S. Department of Commerce:

Bureau of the Census: trade statistics.

International Trade Administration: Foreign Economic

Trends and Their Implications for the U.S.,

International Marketing Information Series.

U.S. Department of Energy, Energy Information Administration.

International Energy Annual, DOE/EIA-

0219. Annual Energy Review, DOE/EIA-

0384. Uranium Industry Annual, DOE/EIA-

0478.

U.S. Department of the Interior, U.S. Bureau of Mines: Mineral Commodity Summaries. Minerals Yearbook, v. I, Metals and Minerals; v. III, Area Reports: International.

U.S. Joint Publications Research Service, Arlington, Virginia: Foreign Broadcast Information Service Regional Publications, weekly.

World Bank, Washington, DC: Bank news releases.

World Bureau of Metal Statistics, London: World Metal Statistics, monthly.

TABLE 1
MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES, 1993

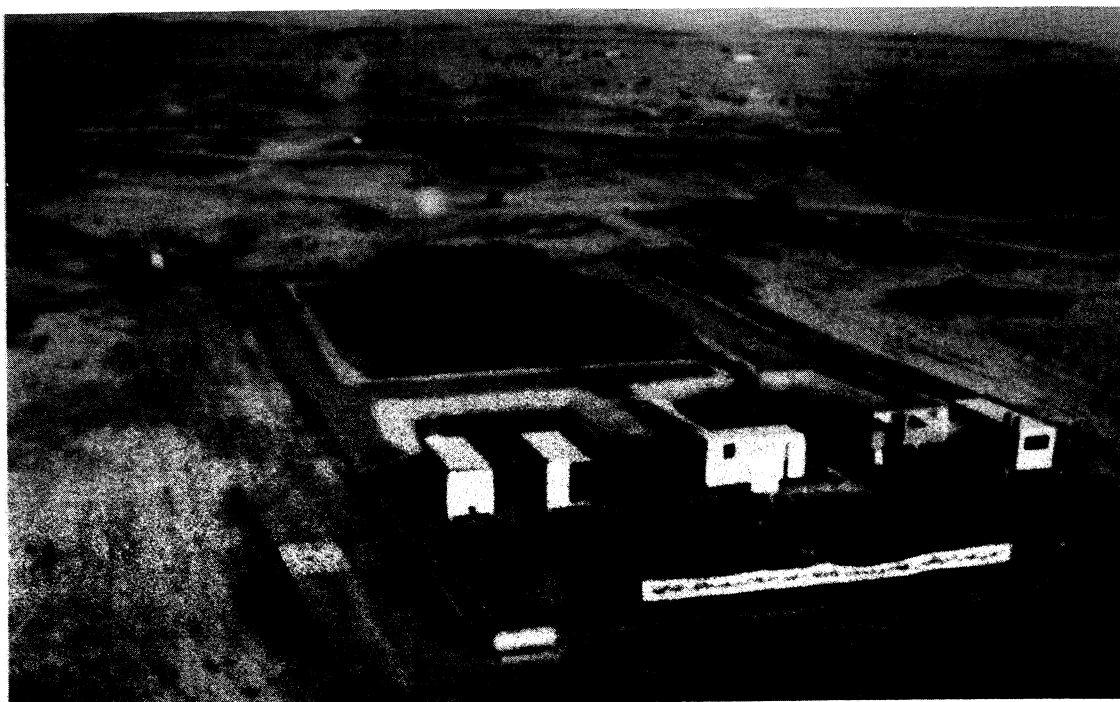
(Thousand metric tons unless otherwise specified)

	Alumi- num, metal	Cement	Chromite	Gypsum	Natural gas plant liquids (thousand 42-gallon barrels)	Natural gas dry (million cubic meters)	Nitrogen N in ammonia	Petroleum crude (thousand 42-gallon barrels)	Phosphate rock (gross weight)	Potash K ₂ O equiva- lent	Salt	Steel, crude	Sulfur
Bahrain	447	225	—	—	4,485	6,926	348	14,875	—	—	—	—	6
Cyprus	—	1,089	—	90	—	—	—	—	—	—	—	—	—
Iran	100	20,000	235	8,600	23,300	31,500	700	1,095,000	—	—	720	3,672	800
Iraq ^a	—	12,000	—	1,500	10,000	3,000	500	187,000	300	—	300	300	1,000
Israel	—	3,500	—	26	—	32	41	80	5,787	1,309	1,123	160	60
Jordan	—	3,514	—	195	—	200	—	—	3,565	800	26	181	—
Kuwait	—	500	—	—	9,125	4,470	317	683,280	—	—	30	—	175
Lebanon	—	1,000	—	2	—	—	—	—	—	—	—	—	—
Oman	—	1,000	10	—	2	3,740	—	292,500	—	—	—	—	40
Qatar	—	544	—	—	18,200	15,750	621	152,500	—	—	—	610	60
Saudi Arabia	—	15,300	—	375	217,175	35,900	1,097	2,992,270	—	—	—	2,000	2,400
Syria	—	4,500	—	235	1,800	2,800	67	195	1,275	—	130	70	30
Turkey	59	31,400	533	1,541	—	190	326	27,971	65	—	1,426	11,414	103
United Arab Emirates	242	3,500	—	95	60,000	28,000	287	817,965	—	—	—	—	146
Yemen	—	800	—	80	40	80	—	87,600	—	—	280	—	—
Total Middle East	848	98,872	778	10,739	344,127	132,588	4,304	6,333,321	10,992	2,131	4,035	18,407	4,820
Share of world total ^a	4%	7%	8%	10%	17%	6%	5%	29%	9%	10%	12%	3%	9%
United States total	3,695	72,400	—	15,226	949,000	522,500	12,865	2,499,155	10,816	1,506	34,784	88,793	10,959

^aEstimated

¹For cement manufacture only.

²Not including production for cement manufacture.

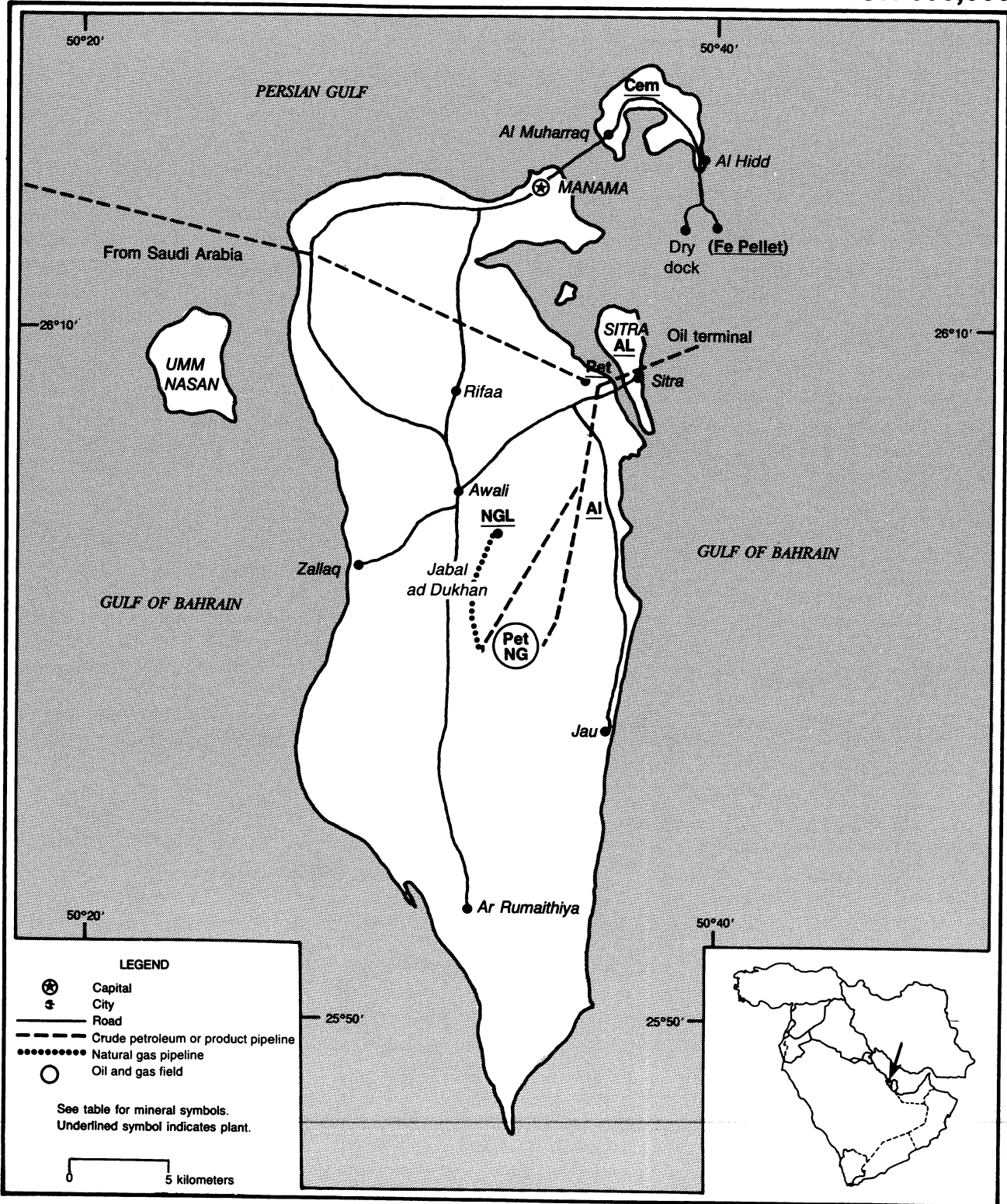


Aerial view of the 3,000 ton pilot-test pad at the Hamdah gold deposit in the Kingdom of Saudi Arabia. A total of 18.1 kg of gold and 1.1 kg of silver were recovered over a 60-day period, yielding a 75.3 percent gold recovery. Depths to the ore zone range from 0 to 21 m.

BAHRAIN

AREA 620 km²

POPULATION 600,000



THE MINERAL INDUSTRY OF

BAHRAIN¹

By Bernadette Michalski

The mineral industry, particularly hydrocarbons and aluminum, supplied about 90% of Government revenues and export earnings. The crude oil production is supplemented by a share from the Abu Saafa offshore field that is coowned with Saudi Arabia.

By capitalizing on the availability of natural gas for electric power generation, the aluminum smelting and fabrication industries experienced a constant growth pattern. Expansion programs brought aluminum smelter capacity to 460,000 mt/a resulting in Aluminium Bahrain's (Alba) smelter becoming the largest in the Middle East. Other mineral industry and related diversification efforts included iron ore pelletization, petrochemicals, and a major repair shipyard.

GOVERNMENT POLICIES AND PROGRAMS

The Bahraini Government encourages private ownership of industry. The Government has offered another 20% to 30% of Bahrain Aluminium Extrusion Co. (Balexco) to the private sector. This offering elevated private ownership of the company to approximately one-half. This company was the first state-owned company offered for privatization.

The Government has proposed the establishment of an International Arbitration Center in Bahrain. The center will operate according to the United Nation's arbitration convention of 1958. The Arbitration Center will include in its agenda disputed mineral property rights, mining interests, and commercial contracts.

ENVIRONMENTAL ISSUES

Alba announced a \$250 million

program to improve environmental protection standards at its 460,000-mt/a-capacity primary aluminum smelter.

PRODUCTION

Output of crude petroleum has been maintained at approximately 15 Mbbbl with the aid of natural gas reinjection; it is expected to continue near this level throughout this decade. Unless additional reserves are identified, domestic onshore production is expected to cease by the year 2000. Bahrain's assigned share of production from the offshore Abu Saafa Field was increased from 50% of the field's output to exactly 100,000 bbl/d in the last quarter of 1992 by Saudi Arabia, the operator and coowner of the field that lies between the two nations. The allotment from the Abu Saafa Field totaled 36.5 Mbbbl in 1993 compared with 28.6 Mbbbl in 1992 and 26.4 Mbbbl in 1991.

The Alba aluminum smelter's capacity was increased to 460,000 mt/a in November 1992. It was expected to operate near capacity levels throughout the decade. However, production targets for 1994 were reduced to 445,000 tons to help support world aluminum prices. Downstream manufacturing facilities are under expansion to take advantage of the availability of greater quantities of local aluminum. (See table 1.)

TRADE

Total exports were valued at nearly \$3.7 billion, slightly below imports valued at \$3.8 billion in 1993. Hydrocarbon and related exports accounted for more than \$2.4 billion, and aluminum exports were valued at

approximately \$0.9 billion.

Refined petroleum product exports from domestic and imported crude oil totaled 91.6 Mbbbl in 1993. Included in this total was distillate fuel oil accounting for 28.7 Mbbbl; residual fuel oil, 22.2 Mbbbl; naphtha, 13.2 Mbbbl; kerosene, 12.2 Mbbbl; motor gasoline, 7.3 Mbbbl; and jet fuel, 4.3 Mbbbl. About two-thirds of all exports was destined for Asia with the remainder distributed among the countries of the Middle East and Africa.

Combined exports of methanol and ammonia were 838,300 tons in 1993. Virtually all production was exported with markets principally in Asia and Western Europe. Urea production is contemplated for the near future, eventually resulting in a decline of ammonia exports in favor of the domestic market.

Aluminum accounted for nearly one-fourth of total exports in 1993. Nearly two-thirds of the exported aluminum was delivered to member countries of the Gulf Cooperation Council. The EC's 6% to 10% tariffs limited exports to that area. Feedstock for the aluminum plant was imported with about 75% of the alumina supply obtained from Alcoa of Australia.

STRUCTURE OF THE MINERAL INDUSTRY

Bahrain's oil and natural gas industry was wholly Government owned, and most other mineral commodity ventures were Government controlled. However, private domestic and foreign investment was being encouraged to the extent of allowing fully foreign-owned companies to register in Bahrain. This concept was prompted by the desire to promote rapid rebuilding of the economy after the disruptive 1990-91 Gulf crisis.

COMMODITY REVIEW

The modernization and expansion activities at the nation's sole aluminum smelter culminated in raising capacity to 460,000 mt/a in November 1992, 3 months ahead of schedule. Alba plans to complete the upgrading of its No. 3 kiln line by the third quarter of 1994, according that facility the same standard of operational efficiency and environmental control as the rest of the smelter. In early 1994 contracts were awarded for a \$21.2 million casthouse extension project, which would increase billet production by two-thirds to 200,000 mt/a.

Alba has invited bids in early 1994 for the construction of a reverse osmosis desalination plant with a design capacity of 10,000 m³/d. The water produced from the plant will be used partly by Alba and partly by downstream industries in the vicinity.

The Gulf Aluminum Rolling Mill Co. (Garmco), Bahrain's aluminum coil and sheet producer for the construction and foil industry, announced plans to increase capacity from its original 40,000 mt/a to 120,000 mt/a by the fourth quarter of 1995. Raytheon Co. of the United States is consultant for the expansion engineering work. Negotiations were concluded in early 1994 on the purchase of a rolling mill from Alumax Mill Products, also of the United States. Garmco converts ingots from Alba weighing up to 10 tons each into sheets for final use or further downstream processing. After hot and cold rolling, the sheets are between 0.25 and 3 mm thick, with a maximum width of 1.5 m. Bahrain is the largest shareholder in Garmco with 25.5%, followed by Saudi Basic Industries with 20.75%. The company's principal market is in the Gulf area. However, sales to the Pacific region have increased over recent years, prompting Garmco to establish an office in Hong Kong to service the company's end users.

The Middle East Aluminum Cables Ltd. has the capacity to produce 40,000 mt/a of rod and 30,000 mt/a of cable.

An expansion project is now underway to bring production capacity for high-tension cable to 50,000 mt/a. The plant uses molten metal directly delivered from Alba to make products ranging from aluminum alloy rods to steel-reinforced overhead conductors. The company also shares some equity in a consortium with BBS Kraftfahrzeugtechnik of Germany and Al Zayani Investments of Bahrain to produce wheel castings for auto manufacturers and suppliers in Europe.

Balexco has proposed construction of a third press and an aluminum recycling plant. The company produces 6,000 mt/a of extruded products using billets from Alba. The expansion plans would raise capacity to 24,000 mt/a. Interproject Corp. of the United States obtained a \$3.2 million contract to supply and install a 7,000-mt/a powder coating plant at Balexco. The company also is considering construction of a 7,000-mt/a scrap metal recycling plant. An additional 20% to 30% of equity in Balexco was offered to private investors in 1993, further reducing Government ownership to about one-half. The company is expected to be completely privatized in 3 years.

The Gulf Industrial Investment Co.'s pellet plant is to be expanded to 4 Mmt/a-capacity by the close of 1995. Expansion decisions were made following the signing of contracts to supply Iran with 1.5 Mmt/a commencing in 1994, and Malaysia with 0.5 Mmt/a. At least part of the iron ore supply will be obtained from Iran.

The bulk of Bahrain's natural gas production is extracted from the Khuff zone. Only one-fifth of the natural gas supply is derived from associated gas in the Awali Field. Nearly one-third of natural gas production is reinjected for enhanced recovery operations necessary to maintain petroleum production at approximately 15 Mbbbl/a. The remaining output is utilized in the production of electric power and as a petrochemical feedstock.

The Gulf Petrochemical Industries Co. (GPIC), a joint venture between Bahrain and Kuwait, operate an ammonia and methanol plant at Sitra producing near

capacity in recent years. Nonassociated Khuff gas is used as feedstock. The petrochemical use of natural gas was approximately 1.15 billion m³ in 1993. The GPIC has secured a \$32 million credit advanced by the Arab Investment Co. in support of constructing a 1,700-mt/d urea plant, which will consume 80% of GPIC's ammonia output. Total cost of the project is estimated at \$140 million.

The construction of a \$18.5 million sulfur derivatives plant with annual capacity of 9,000 tons of sodium sulfur and 6,000 tons of metabisulfite was contracted to the United States' Engineers International in mid-1993 and is scheduled for completion at the close of 1994. The plant will be owned by the National Chemical Industries Corp. (NACIC), with 55% of the equity held by Bahrain's United Gulf Industries Corp., 15% by Qatar Industrial Manufacturing Co., 10% by the Arab Industrial Development Co. of Saudi Arabia, 5% by the United Group for the Development of Riyadh, and 15% by other private companies. The plant will be near the Sitra refinery of the Bahrain Petroleum Corp., which will supply the feedstock.

For the foreseeable future Bahraini crude oil production appears stabilized at about 40,000 bbl/d, entirely derived from the Awali Field in south-central Bahrain. An additional 100,000 bbl/d is realized from the joint ownership of the Abu Saafa offshore field between Bahrain and Saudi Arabia.

The 250,000-bbl/d-capacity refinery at Sitra has consistently operated near or above capacity level. About 84% of the refinery's throughput was delivered by pipeline from Saudi Arabia and the remainder from the Awali Field. The refinery has been undergoing an expansion and revamping during 1993, and the project is expected to continue over the next 3 years. The two-stage program will increase the refinery's capacity to 360,000 bbl/d at an overall cost of \$600 million to \$800 million. The domestic demand for petroleum products was 9,885 bbl/d in 1993.

Proven crude oil reserves were estimated at 69.6 Mbbbl. Natural gas reserves, for the most part nonassociated

gas from the Khuff zone, were estimated at about 170 billion m³.

INFRASTRUCTURE

The island nation's basic infrastructure is in place, including a network of petroleum pipelines and storage facilities to accommodate Sitra refinery receipts from the Awali Field and the Abu Saafa Field shared with Saudi Arabia. In addition, there are 16 product pipelines extending for 5 km from the Sitra refinery storage facilities to a deepwater terminal for export. Natural gas pipelines servicing Bahrain's power generation and industry complexes totaled 32 km in length.

The Directorate of Electricity operates plants at Manama, Sitra, and Rifaa. Their combined capacity is 992 MW. An additional 200 MW from Alba's 800-MW powerplant became available with completion of a linkup to the national grid system in 1993. Bahrain Petroleum Co. also produces its own electricity from its 60-MW plant.

The Arab Shipbuilding and Repair Yard (ASRY) was established on a 450-km² constructed island with all installations and support services necessary for a shipyard specializing in the repair of very large crude carriers (VLCC). Owned by Abu Dhabi, Bahrain, Kuwait, Qatar, and Saudi Arabia, each with 18.84% equity; Iraq, 4.7%; and Libya, 1.1%, the ASRY facility included four repair berths that can accommodate up to 500,000-dwt tankers. In 1992, two floating drydocks purchased from Jacksonville Shipyards of the United States were placed in service accommodating vessels of up to 125,000 dwt.

OUTLOOK

Petroleum industry revenues enabled the Government to accelerate social and economic development and establish new energy-intensive industries. The Government is focusing on the aluminum, petrochemical, and iron ore pelletizing industries in the hope of expanding Bahrain's existing industrial base and

attracting new ventures. The Government's new strategy also puts great emphasis on private-sector involvement and intends eventually to move away from the large Government-owned companies that dominate the economy.

The 460,000-mt/a-capacity Alba aluminum smelter is the largest in the Middle East and has already fostered new downstream industries. The German car industry may blossom into a promising market because car manufacturers are looking for cheaper alternatives to domestic aluminum fabricating sources. The Aluminium Wheel Co., a joint venture of Al-Zayani and other Bahrain partners, with BBS Kraftfahrzeugtechnik is to enter production in 1994 with an initial capacity of 500,000 vehicle wheels, a possible first step in entering a huge market. Aluminum marketing is further promising in view of the rising demand with new building projects in Bahrain, Kuwait, Saudi Arabia, and the United Arab Emirates.

Because domestic onshore petroleum reserves are near depletion, it becomes even more imperative that the question of sovereignty over the Hawar Islands and the reefs of Fasht al-Dibal and Qitaa Jaradah are resolved to permit offshore exploration in these areas of considerable hydrocarbon potential. The International Court of Justice in The Hague has scheduled preliminary hearings into the disputed territories between Bahrain and Qatar in 1994.

¹Manuscript prepared May 1994.

²Where necessary, values have been converted from Bahraini dinars (BD) to U.S. dollars at the rate of BD0.377=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Industry and Development
Manama, Bahrain
Bahrain National Oil Co.
P.O. Box 25504
Awali, Bahrain
Telephone: (973) 754 666
Fax: (973) 753 203
Bahrain Petroleum Co.

Awali, Bahrain
Telephone: (973) 754 444
Fax: (973) 752 924
Bahrain National Gas Co.
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Rifaa, Bahrain
Telephone: (973) 756 222
Fax: (973) 756 991

Caltex Bahrain
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Awali, Bahrain
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Fax: (973) 753 122

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Publications

Bahrain National Oil Co. (BANOCO), Annual Report.
Bahrain National Gas Co. (BANAGAS), Annual Report.

TABLE 1
BAHRAIN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993	Annual capacity* (Jan. 1, 1994)
Aluminum, smelter output, primary metal	186,889	212,505	227,000	292,400	447,000	460,000
Cement	158,000	148,000	150,000	220,000	225,000	225,000
Gas, natural:						
Gross million cubic meters	7,733	8,110	8,027	9,415	9,798	10,000
Dry do.	5,947	6,000	5,522	4,015	6,926	7,000
Methanol	[†] 404,000	[†] 432,000	[†] 435,000	[†] 413,691	424,458	425,000
Natural gas plant liquids:						
Butane thousand 42-gallon barrels	917	975	1,102	[†] 1,236	1,471	1,500
Propane do.	890	1,150	1,474	[†] 1,608	1,166	1,600
Naphtha do.	1,287	1,380	1,569	1,848	1,800	2,000
Nitrogen N content of ammonia	319,400	325,000	[†] 319,500	[†] 332,800	348,375	350,000
Petroleum:						
Crude thousand barrels	<u>15,595</u>	<u>15,875</u>	<u>15,434</u>	<u>15,123</u>	<u>14,875</u>	<u>15,000</u>
Refinery products:						
Gasoline do.	6,931	7,500	7,840	7,900	9,228	9,300
Jet fuel do.	8,419	9,000	7,477	7,500	4,410	4,500
Kerosene do.	7,359	7,500	10,427	10,500	12,282	12,300
Distillate fuel oil do.	28,698	28,500	28,110	28,000	29,360	29,300
Residual fuel oil do.	21,983	22,500	23,570	23,500	22,188	22,800
Other do.	16,285	16,300	16,300	16,300	12,190	14,000
Total do.	<u>89,675</u>	<u>91,300</u>	<u>93,724</u>	<u>93,700</u>	<u>89,658</u>	<u>92,200</u>
Sulfur [†]	5,399	5,273	5,400	6,150	6,210	8,000

*Estimate. [†]Revised.

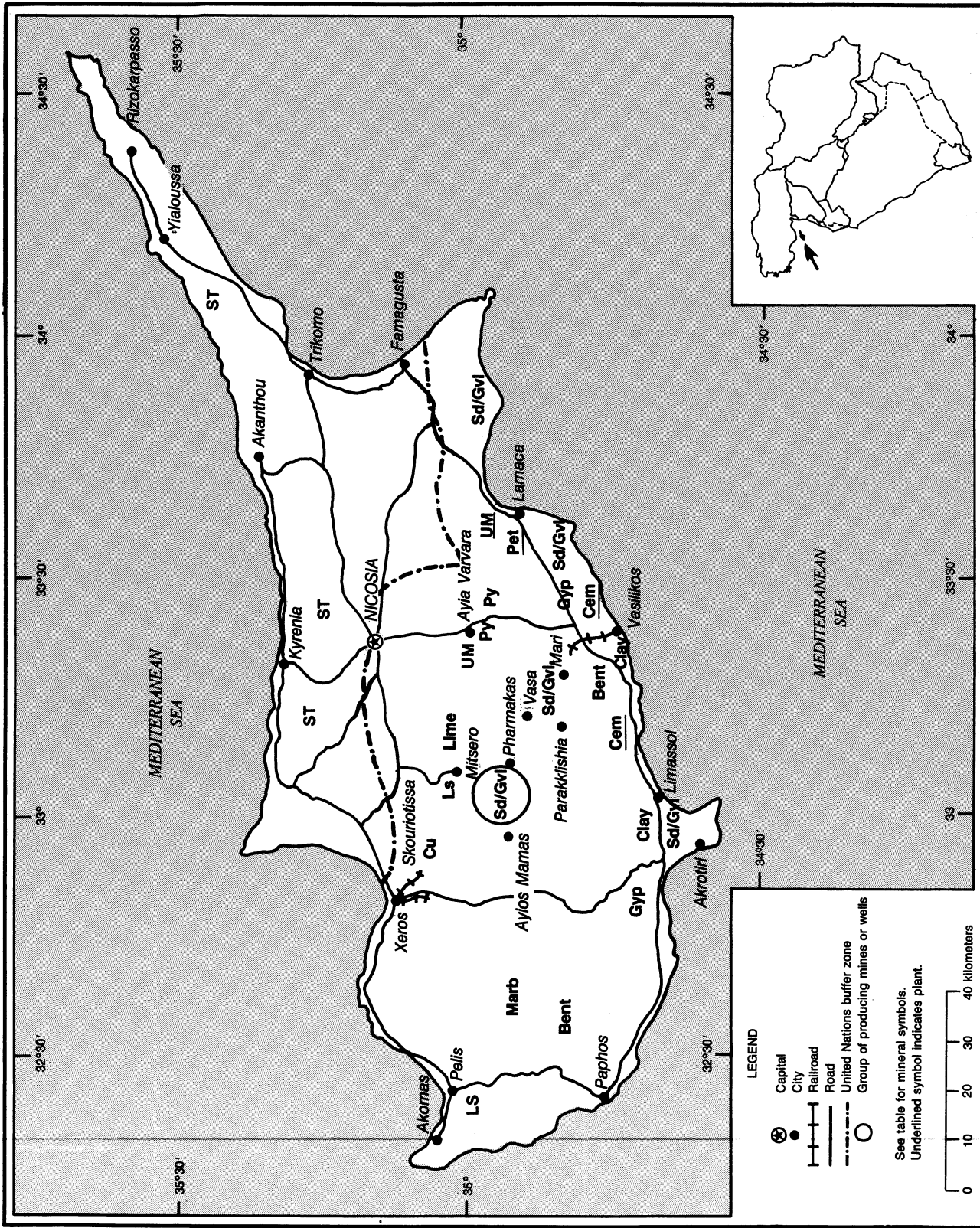
¹Table includes data available through Mar. 1, 1994.

Sources: Petroleum and natural gas: Ministry of Development and Industry, Directorate of Oil, Jan-Dec. 1993

CYPRUS

AREA 9,250 km²

POPULATION 723,000



THE MINERAL INDUSTRY OF

CYPRUS¹

By Philip M. Mobbs

The Cypriot² mineral industry appeared to rebound in 1993 from the previous trend of decreasing mineral production and exports. Over the past few years, operations in Cyprus' historically important export commodities—(asbestos, celestite, chromite, copper concentrate, and iron pyrite)—have effectively ceased, although the country has remained a significant source for the world's supply of umber and yellow ochre. The value of mining and quarrying products rose by about 8%, from \$110.5 million³ in 1992 to \$119.9 million in 1993, with hydraulic cement production accounting for approximately 42% of the total value of Cyprus' nonfuel mineral industry output. Mineral production was mainly by small companies working small deposits. (See table 1.)

Cyprus' economy, which was primarily based on tourism and foreign trade, rebounded in 1992, the last year for which data were available, when an 8.2% growth rate resulted in a gross domestic product (GDP) of approximately \$6,827 million.⁴ However, preliminary projections indicate that 1993 GDP growth would only be approximately 2%.

The Mines Service administered mineral operations under the Mines and Quarries (Regulation) Law, Chapter 270, 1959; the Mines and Quarries Regulations, 1958-79; the Petroleum (Production) Law, 1974; and the Cyprus Standard and Control of Quality Law, 1975. Mining operations in Cyprus have been owned and operated privately under leases and licenses issued by the Mines Service since 1958. (See table 2.) Royalties on extracted mineral commodities ranged from 1% to 5%. The Economic Geology Section of the Geological Survey Department was responsible for mineral exploration

programs and the evaluation of the country's resources. The Environmental Service was responsible for coordinating the environmental efforts of the Government departments.

Sales volumes increased dramatically for most of Cyprus' exported mineral commodities during the year, and the total value of mineral exports increased in 1993 to \$4.5 million from \$3.9 million in 1992. Copper export revenue dropped, despite a 24% export volume increase, owing to lower world prices. Overall, the country recorded an increase in mineral exports and a significant increase in value received for its bentonite, gypsum, and sandstone exports. During 1993, Hellenic Mining Co. Ltd. continued its copper solvent extraction and bioleaching studies at Skouriotissa.

The Cypriot mining industry, which had been in a steady decline for more than a decade, appears to be recovering. However, most of the country's traditional mineral enterprises were either shut down or were operating at a small fraction of past production levels. The resource base of some commodities, such as asbestos, bentonite, celestite, chromite, iron oxide pigments, pyrite, and salt, is still significant. The producers of these commodities could resume operations or step up production if economic conditions turned more favorable and international markets could be secured. Copper exports may increase if Hellenic Mining's leaching project proves to be commercial. Industrial mineral output and cement production destined for the domestic construction industry should continue to enhance the nation's economy.

related to the Turkish Cypriot area are sparse or unavailable.

³Where necessary, values have been converted from Cypriot pounds (£) to U.S. dollars at the rate of £0.49=US\$1.00.

⁴U.S. Department of Commerce: Foreign Economic Trends Report (Cyprus), Washington, DC, 1993, annual.

OTHER SOURCES OF INFORMATION

Agency

Mines Service Ministry of Agriculture and Natural Resources Nicosia, Cyprus

Publications

Ministry of Commerce and Industry, Mines Service, Annual Report.

Ministry of Finance, Department of Statistics and Research, Economic Report, Annual Report.

Ministry of Finance, Department of Statistics and Research, Industrial Statistics, Annual Report.

¹Text prepared June 1994.

²Unless specifically stated, all data in this chapter are for the southern Greek-administered area because data

TABLE 1
CYPRUS: PRODUCTION OF MINERAL COMMODITIES^{1 2}

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993	Annual capacity* (Jan. 1, 1994)	
METALS							
Copper:							
Cupreous pyrite concentrate:							
Gross weight	1,752	—	—	—	—	—	
Cu content	251	—	—	—	—	—	
Cement copper:							
Gross weight	1,080	1,032	535	473	278	1,100	
Cu content	465	472	226	172	103	500	
INDUSTRIAL MINERALS							
Cement, hydraulic	thousand tons	1,042	1,133	1,134	1,131	1,089	1,660
Clays, crude:							
Bentonite		59,744	82,000	58,500	58,840	60,000	111,500
Other:							
For brick and tile manufacture	thousand tons	390	400	440	463	450	500
For cement manufacture ³	do.	330	300	300	346	350	400
Total ³	do.	720	700	740	809	810	900
Gypsum:							
Crude		*34,000	37,000	*37,000	35,470	90,000	110,000
Calcined		*4,000	4,600	6,200	6,150	3,000	10,000
Lime, hydrated		7,060	7,326	6,566	5,540	6,100	8,000
Pigments, mineral: Umber		8,534	7,700	5,800	5,000	6,000	20,000
Stone, sand, and gravel:							
Limestone, crushed (Havara)	thousand tons	2,580	2,700	2,700	2,800	3,000	3,000
Marble	do.	96	82	74	58	50	100
Marl, for cement production	do.	692	700	1,400	*1,400	1,500	1,500
Sand and gravel ⁴	do.	4,850	5,250	5,450	5,750	6,000	6,000
Unspecified building stone	do.	166	200	200	*250	100	250
Sulfur:							
Pyrite, gross weight		57,455	—	—	—	—	—
S content		25,855	—	—	—	—	—
MINERAL FUELS AND RELATED MATERIALS							
Petroleum refinery products:⁵							
Liquefied petroleum gas	thousand 42-gallon barrels	*301	300	*315	300	300	400
Gasoline	do.	*1,191	1,100	*1,032	*1,100	1,100	1,400
Kerosene and jet fuel	do.	*232	*200	*301	300	300	400
Distillate fuel oil	do.	*1,451	*1,900	*2,076	*2,200	2,100	2,200
Residual fuel oil	do.	*1,268	*1,200	*1,574	1,500	1,500	1,800
Asphalt	do.	*266	*250	*171	200	200	300
Refinery fuel and losses	do.	*198	200	*208	200	200	200
Total ³	do.	4,907	*5,150	5,677	*5,800	5,700	6,570

*Estimated. *Revised.

¹Table includes data available through July 1, 1994.

²Mineral production data from the northern Turkish-occupied section of the country are not included in this table, as available information is inadequate to make reliable estimates of output levels.

³Data may not add to totals shown because of independent rounding.

⁴Includes crushed aggregate.

⁵Reported figure.

TABLE 2
CYPRUS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bentonite	Bentex Minerals Co. Ltd. (private, ¹ 100%)	Vasilikos area	*5.5
Do.	D. Mitides Import-Export (private, ¹ 100%)	Paphos area	*10
Do.	Drapia Mining Co. Ltd. (private, ¹ 100%)	Near Limassol	30
Do.	Oryktaco Ltd. (private, ¹ 100%)	Nicosia	6
Do.	Peletico Plasters Ltd. (Peletico, 96%, private, ¹ 4%)	10 kilometers west of Vasilikos	60
Cement	Vasiliko Cement Works Ltd. (Hellenic Mining Co. Ltd., 31%; Italcementi, 20%)	Vasilikos	1,260
Do.	Cyprus Cement Co. Ltd. (Holderbank, major shareholder)	10 kilometers east of Limassol	400
Clays	Vasiliko Cement Works Ltd. (Hellenic Mining Co. Ltd., 31%; Italcementi, 20%)	Near Limassol	*600
Do.	Peletico Plasters Ltd. (Peletico, 96%, private, ¹ 4%)	West of Limassol	*120
Copper, cement	Hellenic Mining Co. Ltd. ²	Skouriotissa	*1.1
Diabase	do.	Various quarries	*280
Gypsum	Gypsum and Plasterboard Co. Ltd. (private, ¹ 100%)	Vasilikos	22
Do.	United Gypsum Ltd. (Hellenic Mining Co. Ltd., 100%)	do.	68
Do.	Peletico Plasters Ltd. (Peletico, 96%, private, ¹ 4%)	West of Larnaca	30
Lime, hydrated	Hellenic Mining Co. Ltd. ²	Mitsero	*8
Limestone	do.	do.	*280
Do.	Vasiliko Cement Works Ltd. (Hellenic Mining Co. Ltd., 31%; Italcementi, 20%)	Vasilikos	*1,500
Marble	Chrisostomos Peppos Ltd. (private, ¹ 100%)	Paphos area	*20
Do.	Elepem Ltd. (private, ¹ 100%)	do.	*12
Do.	D. Mitides Import-Export (private, ¹ 100%)	do.	*8
Do.	Takis Marble Enterprises Co. Ltd. (private, ¹ 100%)	do.	*7.5
Do.	Nearchos Eliades and Sons Ltd. (private, ¹ 100%)	do.	*1.5
Do.	Evagoras Andreou Ltd. (private, ¹ 100%)	do.	*3.8
Marl	Cyprus Cement Co. Ltd. (private, ¹ 100%)	Vasilikos	1,500
Petroleum, refined			
thousand barrels	Cyprus Petroleum Refinery Ltd. (private, ¹ 100%)	Larnaca	6,570
Sand	Hellenic Mining Co. Ltd. ²	Mitsero	*160
Do.	do.	Mari	*24
Sand and aggregates	Hellenic Mining Co. Ltd. ²	Vasa	*200
Do.	Skyra Lima Ltd. (private, ¹ 100%)	Ayia Varvara	*600
Do.	K.M.G. Quarries Ltd. (private, ¹ 100%)	Pharmakas	*220
Do.	Mosphiloti Quarries Ltd. (private, ¹ 100%)	do.	*196
Do.	Costas Kythreotis and Son Ltd. (private, ¹ 100%)	do.	*250
Do.	General Construction Co. Ltd. (private, ¹ 100%)	Parakklisia	*270
Do.	Eskal Ltd. (private, ¹ 100%)	Ayios Mamas	*175
Do.	Skyropiia "Leonik" Ltd. (private, ¹ 100%)	Mitsero area	*135
Sand and gravel	Neefa Ltd. (private, ¹ 100%)	Akrotiri	*150
Do.	Geomichanikai and Ergoliptikai Epichirisis Merra Ltd. (private, ¹ 100%)	do.	*65
Umber	The Cyprus Umber Industrial Co. Ltd. (private, ¹ 100%)	Numerous small surface workings near Larnaca and Nicosia	3
Do.	Mantovani Umber Industries Ltd. (private, ¹ 100%)	do.	*2
Do.	Oryktaco Ltd. (private, ¹ 100%)	Numerous small surface workings near Nicosia	2
Do.	Umber Corporation of Larnaca Ltd. (private, ¹ 100%)	Surface workings, 20 kilometers northwest of Larnaca	*13

*Estimated.

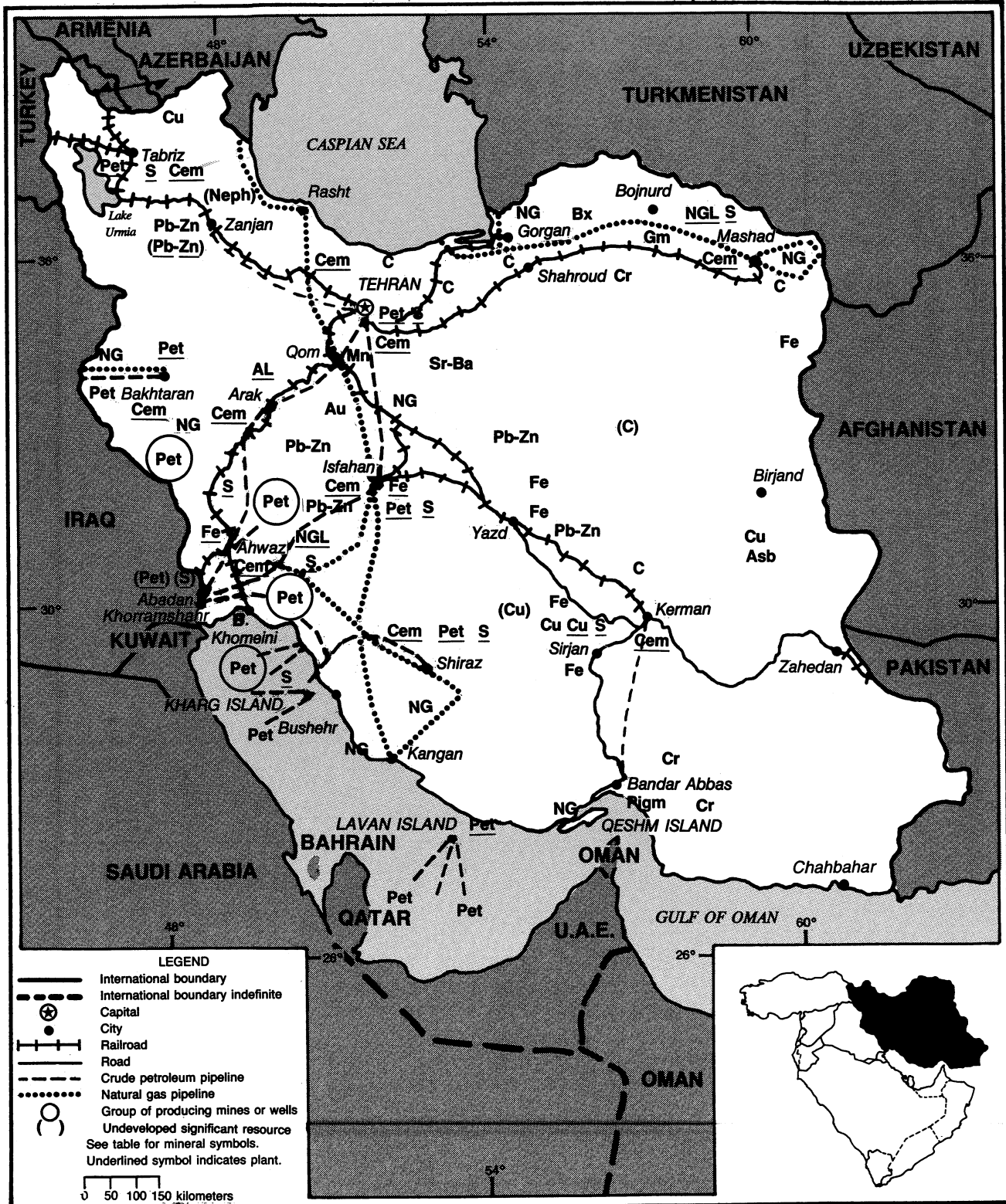
¹Ownership by individual citizens of Cyprus and/or individual foreign investors.

²Hellenic Mining Co. Ltd. is 100% owned by the Archbishop of Cyprus, trustee to the Greek community of Cyprus.

IRAN

AREA 1,648,000 km²

POPULATION 63.4 million



THE MINERAL INDUSTRY OF

IRAN

By Michael Mir Heydari

Mining continued to be an expanding sector of the Iranian economy in 1993. The Government considered mining to be of high priority, although some expansion projects in the ferrous and nonferrous metal sectors appeared to have fallen victim to Iran's financial problems. The crude petroleum and natural gas sectors played a prominent role in Iran's economy. Oil and gas provided about 80% of the country's foreign exchange. Iran was the world's fourth largest petroleum producer, even though the production level dropped about 14% owing to weak demand to an average of about 3 Mbb/d.¹ Its petroleum reserves were among the world's top five. Iran was among the top 10 producers of natural gas, with reserves second only to Russia. About 70 Mmt of 43 other mineral products, ranging from iron ore to base metals, coal, industrial minerals, and dimension stone, were produced in 1993.

In 1993, the gross domestic product (GDP) grew 3.7% and reached \$34.8 billion.² The nonpetroleum mining sector's contribution to GDP was 4.2% compared with 3.4% in 1992. The Government's target is to increase the latter to 10% by the year 2000. The value of nonpetroleum raw minerals produced in 1993 amounted to \$283 million compared with \$252 million in 1992.

Oil revenues fell, from \$20 billion in 1990 to \$14 billion in 1993, and were projected to drop further to less than \$12 billion in 1994. The debt crisis aggravated in 1993 as Iran's total external debt reached an estimated \$17 to \$20 billion, with nearly one-half of this amount in arrears.

As Iran fell further into arrears on its largely short-term debt, it sought to renegotiate the payments with its major

debtholders. Despite the U.S. opposition, Germany, with the highest exposure in Iran, took the lead and rescheduled an estimated \$2.6 billion of Iran's debt. The German model, which other nations have followed, includes a 1-year grace period on late payments accumulated up to December 31, 1994. Starting January 1996, the payments will be spread over 4 years into 16 quarterly installments. The exception to this is arrears plus interest, to individual small firms, of less than \$580,000 and totaling about \$50 million, which have to be paid in 1994.

Italian and French state export credit guarantee agencies immediately followed Germany's lead and rescheduled \$2 billion of Iran's debt. Japan, also using the German model, rescheduled about \$700 million of Iran's debt, but included a longer, 2-year, grace period. Austria, Belgium, Denmark, and Switzerland also have adopted the German model and rescheduled Iran's debt. In sum, as of early 1994, Iran successfully rescheduled more than \$7 billion of its debt.

GOVERNMENT POLICIES AND PROGRAMS

Iran's post Iraq-Iran war import spree has brought about a major debt crisis undermining foreign and local confidence at a crucial stage in the Government's economic reforms. The local banking system is in arrears on payments for up to \$7 billion worth of letters of credit. Most exposed are Iran's top three suppliers: Germany, Japan, and Italy. The reasons for Iran undermining its creditworthiness range from bad management to hard currency shortages. Relying on Iran's trouble-free payment record prior to 1990, many European and Japanese institutions freely extended

credit to Iranian agencies in the early 1990's. However, these institutions, still unsure of Iran's political stability, did not guarantee trade financing for Iran, forcing it to borrow from banks through short-term letters of credit (LC). The Iranian Government artificially induced the utilization of LC's, and in essence, subsidized loans by providing favored Iranian enterprises with highly favorable exchange rates. Thus, many Government ministries and state-owned factories, lured by cheap foreign currency, borrowed heavily and imprudently to import excessive quantities of materials and equipment. It is reported that some factories have imported up to a 10-year supply of their raw material.

In an attempt to reform its previous ill-perceived policies, the Government cut back hard currency spending on imports, including wheat, rice, cooking oil, sugar, and meat. This coincided with Iran's Central Bank's (Bank Markazi) devaluing the rial against the foreign currencies by more than 100% in 1993.

Other Government moves aimed at addressing economic distortions included reduction of costly state subsidies, such as those for gasoline and electricity. The resulting inflationary effects of such policies have had a considerable impact on the economy. State-owned industries, which imported much of their materials and equipment, have, on average, reduced output to about 50% of capacity, while thousands of workers have been laid off.

The Government proposed the Second Five-Year Plan (SFYP) to be implemented over the period March 1994 to March 1999. The plan's targets include phasing out of subsidies on fuels, electricity, and air transport. It encourages a shift from oil to natural gas

for industrial and household consumption, and emphasized free market reforms. Although a complete performance report for the First Five Year Plan (March 1989 to March 1994) was not available, it is widely accepted that the plan's targets were not met partly as a result of overestimated revenue and underestimated expenditure projections.

One of the Government's most important priorities was the development of the mining sector to ensure that the country developed its own raw materials to meet the needs of domestic industry and to minimize imports of raw materials. One of the key areas was iron ore and steel.

The Mining Act of 1983, consisting of 42 articles and 17 notes, delineates ownership and production procedures for the mining sector. It provides for a Supreme Council of Mining as the highest authority. It is responsible for mine classification, production rates, employment, investment, geographical issues and other related political, and social and economic considerations. Under the initial version of the Mining Act, four mine categories existed as follows: class 1 includes limestone, gypsum, sand and gravel, salt, and construction stones; class 2 includes metals, mica, graphite, refractories, bentonite, bauxite, gemstones, and coal; class 3 includes oil, natural gas, tar, and oil shales; and class 4 includes uranium and other radioactive minerals. Originally, only Government agencies were authorized to operate class 2, 3, and 4 mines. In addition, the Ministry of Mines and Metals (MMM) had authorization to assume operation of any mine classified as "large and significant." Thus, many choice mines were nationalized by MMM in the early 1980's. An amendment to the Mining Act was passed in 1985, however, dividing the class 2 mines into small and large mines and allowing for private ownership of small mines. Currently MMM monitors class 1 and 2 operations nationwide, with the Oil Ministry and the Iranian Atomic Energy Organization having authority over class 3 and 4 operations, respectively.

In recent years, Iran has attempted to offset the effects of obstructive nature of the Mining Act by relaxing many investment constraints created by the legislation. As inducement for private investment, size restrictions on private involvement have been relaxed while regulations for exploitation permits have been liberalized. One-year licenses are now available to individuals for the exploration of up to 40 km², extendable on the basis of work progress. MMM also has the authority to issue 5-year permits for private, small-scale mining, based on low royalties. After the initial 5-year period, permits are renewable by rebidding royalty and taxation terms in competition with other potential producers.

ENVIRONMENTAL ISSUES

Major environmental effects of mining and metallurgical processes in Iran are in terms of emission of particulate matters and other toxic substances that can cause occupational, safety, and health problems. In Iran, environmental activities in the mining sector have yet to be recognized as a priority by the Government although significant problems exist. Examples of these are: emission of nearly 100 mt/d of sulfur dioxide from the Sar Cheshmeh copper smelter, near Rafsanjan, close to agricultural areas; water and air pollution at steel mills and aluminum smelting plants and oil refineries in Isfahan, Ahwaz, and Arak; and emissions from a lead smelter on the outskirts of Zanjan, adjacent to agricultural areas. The Iranian News Agency reported that the Zanjan smelter had a rotating-system furnace with a closable gas hood, capable of meeting stringent environmental standards; the cost of pollution prevention and other related equipment and systems, installed at the smelter, was reported at about \$10 million. Arak, the site of an aluminum plant, an oil refinery, and a nearly completed petrochemical complex with a population of 300,000, is reported to be the most polluted city in Iran.

Indepth environmental impact assessments and comprehensive procedures for new investment are

lacking. MMM and environmental authorities are not linked in an integrated manner. Establishing an efficient environmental framework, particular to the regional and geological circumstances in Iran, will require the coordination of environmental policies and operational linkages with other environmental agencies. The Department of the Environment is the main Government agency responsible for environmental protection and monitoring. The Iranian Parliament passed a bill amending the law for preserving and improving the environment. In April 1993, the Government announced the creation of an International Center for Advanced Technological and Environmental Science. Environmental cooperation agreements have been signed with Germany, India, and Oman. Iran became a member of the Basel Convention on the control of cross-border transfer and dumping of toxic waste. German companies are in a prime position to take advantage of the growing interest for environmentally friendly technology in Iran. Salzgitter Anlagenbau of Germany is bidding with a Russian partner for a project at Iran's Tabriz industrial complex. A new propylene oxide plant for the complex is environmentally safer.

PRODUCTION

A total of 43 different minerals was produced by 1,373 active mines in 1992, the last year for which complete data were available. According to official MMM figures, Iran possessed 1,850 mines at the development and production stages. The majority of these mines were small-scale quarries. From 1989 to 1992, the number of active mines increased by 64% while gross output increased by more than 30% to 61 Mmt/a. For 1993, the total output is estimated at 70 Mmt. The output of aluminum, cement, copper, lead and zinc, and iron and steel was being expanded. Dimension stone was also the focus of attention as a major export revenue earner.

The increase of metal production was high on the Government's agenda for postwar reconstruction and expansion of

the economy. MMM pursued plans for major increases in steel production. Steel output was to increase to 5.5 Mmt/a by 1994 and to 7 Mmt/a a few years later. Output rates in nonferrous metals also were to grow. Copper was to increase to 200,000 mt/a by 1995. Aluminum output from the Arak plant was to increase to 300,000 mt/a by 1995. The first lead smelter, at Angouran Mine near Zanjan, came on-stream in 1992 with output capacity of 40,000 mt/a. Iran is also a major producer of industrial minerals. In particular, the country is the world's third largest producer of gypsum, mainly from the mines, about 200 km east of Tehran, in the Semnan region. (See table 1.)

TRADE

In 1993, total exports are estimated at \$17 billion, down from \$20 billion in 1992. Of this total, oil and gas exports were estimated at \$14 billion, down from \$17 billion in 1992. The seven main export markets for Iranian products, particularly crude oil and gas, were, in order of importance, Japan with \$1.96 billion worth of imports from Iran during the first half of 1993, compared with \$2.6 billion during the whole year of 1992; France with \$826 million during the first 9 months of 1993, compared to \$1.09 billion in 1992; Italy with \$696 million for the first 9 months of 1993, compared with \$1.8 billion in 1992; the Republic of Korea with \$1.02 billion in 1992, the latest period for which data were available; Germany with \$383 million during the first 9 months of 1993, compared with \$750 million in 1992; and the United Kingdom with \$308 million during the first half of 1993, compared with \$290 million in 1992.

Total imports are estimated to be about \$16 billion in 1993, down from \$21.5 billion in 1992. The seven leading suppliers of goods and services to Iran were, in order of importance, Germany with \$1.31 billion worth of exports to Iran during the first half of 1993, compared with \$5.3 billion during the whole year of 1992; Japan with \$1.26 billion during the first 9 months of 1993, compared with \$2.65 billion in 1992;

Italy with \$766 million for the first half of 1993, compared with \$2.2 billion in 1992; The United Kingdom with \$570 million during the first 9 months of 1993, compared with \$1 billion in 1992; France with \$346 million during the first half of 1993, compared with \$770 million in 1992; the United States with \$506 million during the first 9 months of 1993, compared with \$748 million in 1992; the Republic of Korea with \$557 million in 1992, the latest period for which data were available. In addition, the proximity of United Arab Emirates, particularly Dubai's free port, to Iran has made it a busy reexport point for goods destined for Iran. Estimated at more than \$1 billion annually, this trade is mainly luxuries and consumer goods.

Germany, Iran's largest trading partner, saw its Iranian exports soar once its substantial trade with Iraq had to stop because of the Persian Gulf war and international sanctions imposed on Iraq. Machinery accounts for more than one-third of all German goods purchased by Iran, followed by electronic products and vehicles. Japan, which ranks second in terms of Iran's export and import value, also experienced a steady growth in bilateral trade with Iran during the early 1990's. Imports from Japan include mainly heavy machinery and automobiles while exports to Japan are largely petroleum and petroleum products. Trade with Italy, Iran's third largest trading partner, also follows this pattern. Among Iran's largest trading partners, France is the only country with whom Iran maintains a trade surplus. This was partly a result of an increase in France's purchases of Iranian oil and related energy products. Iran's purchase of French goods, mainly food and agricultural products, manufactured industrial products, vehicle products, and consumer goods, also rose in 1993.

The country's export of nonpetroleum minerals during the first Five-Year Plan was valued at \$1.4 billion. Export earnings from non-oil and gas minerals amounted to \$443 million in 1992, accounting for 16% of Iran's nonpetroleum export revenues, and were expected to reach \$1 billion per year,

nearly one-third of projected nonpetroleum export revenues, by the mid-1990's. The most significant minerals exported were lead and zinc. These were about 75% of nonpetroleum mineral exports, and chromite was 15%. Main export destinations for minerals in 1992 were Belgium, China, India, Japan, and North Korea. Reversing its previous trend for imports, Iran has become an exporter of various steel products. Iranian National Steel Industries Group (INSIG), the Ahwaz-based producer of bar, wire rod, sections, and pipes, entered the export market during the third quarter of 1992. Iranian mills are in a favorable position on export markets, particularly to China. The Kudremukh Iron Ore Co. of India was to supply 1.5 Mmt of iron ore concentrates during the Iranian year starting March 21, 1994. Iran continued to import phosphate rock from Senegal. Mercury purchased from a major western producer, for an Iranian chlor-alkali plant, amounted to 12,000 flasks at \$127 per flask. The Iran-Iraq war caused destruction of the plant, which was recently rebuilt.

Prior to the Iranian Revolution of 1979, the United States was firmly entrenched and widely represented economically in Iran. The trade vacuum left by the United States after the souring of relations with Iran amounted to annual Iranian imports of about \$5 billion and annual U.S. imports of about \$4.3 billion. Since the end of the Iran-Iraq war, much of this position has been filled by European and Japanese concerns.

Although there is no blanket prohibition against U.S. companies doing business with companies in Iran, there are restrictions on U.S. exports to Iran as well as on importation of Iranian-origin goods and services into the United States. As a result of the Iran-Iraq Non-Proliferation Act passed by the U.S. Congress and signed by the President on October 23, 1992, all goods exported to Iran that require a validated export license will be subject on application to a policy of denial. This does not affect general license goods. U.S. exports to Iran were \$506 million for the first 9 months of 1993, compared with \$748

million in 1992, and included oil drilling and engineering equipment, chemicals, gas turbines, medical equipment, and spare parts for machinery.

Official direct trade between Iran and the United States is relatively small and limited as a result of the U.S. trade policy. However, a very large volume of unofficial, indirect trade occurs between the two countries. For example, U.S. oil companies may not buy Iranian crude for the U.S. market. However, foreign subsidiaries of these companies purchase Iranian oil for their foreign refineries, which in turn, allows them to supply the U.S. market with crude that would have otherwise been designated to the foreign refineries. In 1992, Exxon was the largest single lifter of Iranian crude, accounting for approximately 20% of Iran's oil exports. U.S. exports to Iran follow the same pattern. Foreign subsidiaries of U.S. companies manage to circumvent many of the official trade barriers through the use of their subsidiary status or by the use of reexport mechanisms. When no U.S. content is involved, subsidiaries of U.S. companies are not subject to trade restrictions and may trade freely with Iran. In other situations, many firms first export their product to Persian Gulf ports like Dubai in the United Arab Emirates, where trade restrictions do not apply. From Dubai, the products are then reexported less than 240 kilometers across the Persian Gulf to Iran. Accounting for all direct and indirect U.S. exports to Iran, a more accurate estimate of recent annual exports would be closer to \$1.5 billion.

STRUCTURE OF THE MINERAL INDUSTRY

The overall management of the minerals sector is under the authority of MMM, which was created by law in June 1984. MMM's domain of influence covers all mining except oil and gas and radioactive minerals. MMM also has authority over the nation's entire metal smelting industry.

MMM is the umbrella ministry for several agencies and parastatals, including: Geological Survey of Iran;

National Iranian Mines and Metals Smelting Co.; National Iranian Steel Co. (NISCO); National Iranian Mining Explorations Co.; National Iranian Copper Industries Co. (NICICO); National Iranian Lead and Zinc Co. (NILZCO); Iran Mines Export Development Co. (IMEDCO); Iran General Mine Co.; Iranian Aluminum Co. (Iralco); and Almahdi Aluminum Corp., a Government joint venture with foreign entities.

Most of the principal nonpetroleum mineral commodity production facilities were under Government control in 1993 through more than 30 companies administered by MMM. These included the aforementioned parastatals as well as entities categorized as joint-stock companies. The latter were mostly partially nationalized private enterprises in which the Government has taken a majority position by assuming at least a 50% share of the operation's stock. Examples of such joint-stock operations include the Emarat Mine Co., the Calcimine Co., the Bafg Mining Co., and the Bama Co., all of which are lead and zinc mining operations.

The "private" or "nonpublicly owned" sector contained two subclassifications: mines operated by cooperatives and foundations ("Bonyads") and mines operated privately or on a contractual basis. In 1992, there were 395 and 688 operations in these categories, respectively. Individually the foundations operate the largest share of Iran's nonpublic-sector mines. Foundations are giant organizations functioning independently of parliamentary oversight, enjoy special rights and privileges, and operate without the economic incentives and constraints faced by a private enterprise. In the aftermath of the 1979 Iranian Revolution, about 40% of the private industrial sector was nationalized and placed under the control of foundations. These included mining operations owned by the deposed Shah and his surrogates and previously managed by the Pahlavi Foundation. During the post-1979 revolution years, the largest number of transferred properties went to the Mostazafan Foundation, later named Mostazafan and

Janbazan (translation: "oppressed" and "life sacrificers or martyrs") Foundation, created to provide for the needs of the war handicapped and other deprived persons. The foundation's Industry and Mining section consists of 141 enterprises employing more than 50,000 persons. In some enterprises there are still private individual shareholdings, estimated at between 10% and 20% of the enterprise's total value. Privately held mines and mines operated on a contractual basis, akin to an oil and gas lease operation, constitute the second division of the nonpublic sector. The mines in this category are relatively small; however, the 100% increase in the number of operations during the 1989-93 period signifies the efforts of privatization and industry expansion.

Mining operations included as a part of "National and Provincial Projects" (NPP) are yet another category considered neither public nor private, having the blessing of the Government while operating for the benefit of a specific region's or state's population. NPP's are in many respects similar to those classified as foundation owned. They, however, function on a smaller scale and benefit a certain region of the nation, whereas foundations are large, national-level organizations. Examples of NPP's are regional mining companies of the Provinces of Azerbaijan, Mazandaran, and Hormozgan.

The Government continued to emphasize privatization of mining industry. This included mostly small mines and excluded large operations such as the Sar Cheshmeh copper complex; the Chadormalu, Choghart, Golgohar, and Sangan iron deposits; and the Angouran lead-zinc mine. However, many of the operations for sale, which deteriorated owing to ineffective management and lack of technical expertise in the 1980's, did not attract buyers.

COMMODITY REVIEW

Metals

Aluminum.—The aluminum production from the reconstructed Arak plant reached 107,000 tons in 1992. The

Arak expansion project increased plant capacity to 120,000 mt/a.

Construction of the Almahdi Aluminum Corp.'s \$1.5 billion smelter, at the Persian Gulf port of Bandar Abbas, is behind schedule owing to unavailability of credit. Initially scheduled to commence production in 1994 at an initial rate of 220,000 mt/a and expand to 330,000 mt/a of aluminum, the startup date is now unknown. The plant will rely on Iran's abundant natural gas reserves as a readily available cheap source of power. Almahdi Aluminum Corp. is 60% owned by MMM and 40% by the Dubai-based International Development Corp., a partnership of Arab, United Kingdom, and Swiss investors and traders.

Technical assistance was being received from Technoexport of Czechoslovakia for construction of a \$400 million plant in Jajroum, 150 km northeast of Shahroud, to produce 150,000 mt/a of alumina. The plant, which was due to become operational in 1995, will feed the aluminum smelters at Arak and Bandar Abbas. The ore will be from bauxite deposits near Jajroum, having estimated reserves of 22 Mmt averaging 48% Al_2O_3 . Lack of hard currency, however, has postponed implementation of this project.

Chromium.—Faryab Mining and Chrome Smelting Co., a state-owned entity, started construction of a ferrochromium smelter near Bandar Abbas, the major port on the Persian Gulf. The plant consists of two 15-MV·A Chinese-made electric furnaces with a combined production capacity of 14,000 mt/a. Ore would be supplied by local mines. A 50,000-mt/a ferrochrome plant is planned in the free trade zone on Qeshm Island. Several other ferrochromium projects, ranging from 5,000 mt/a to 50,000 mt/a, are in the planning stage.

Two companies are involved in the production of sodium bichromate. Bichromate and Zaj Kahak Sabzevar Co. has a 2,000-mt/a plant near Sabzevar, 200 km west of Mashad. Chrome Chemical Co. has a 4,000-mt/a plant in Mazandaran Province, close to the

Caspian Sea, in northern Iran. Two other chemical chromium production projects, with capacities of 5,000 mt/a and 10,000 mt/a, respectively, received Government approval for implementation.

Copper.—Expansion of the Sar Cheshmeh copper mine-concentrator-smelter-refinery complex of NICICO, about 150 km southwest of Kerman, continued in 1993. A new smelter is to be built 40 km from the complex. NICICO awarded a \$23.4 million contract to a consortium of contractors for the design, supply, construction, supervision, and commissioning of a heap-leach solvent extraction-electrowinning plant at Sar Cheshmeh. Kloeckner INA Industrials Plants Ltd. and its consultants Techpro Mining and Metallurgy were the contractors. The company ultimately plans to produce 300,000 mt/a of copper, more than twice its current production. The heap-leach plant is to treat 27 Mmt of stockpiled low-grade oxide ore over the next decade, producing 41 mt/d of cathode copper. Meanwhile, Techpro and Kloeckner Industrie-Analgen are already working together on studies for the expansion of the main smelter and associated sulfur fixation plant. NICICO signed an agreement with China's National Non-Ferrous Metals Co. to build a \$60 million copper smelter in Iran in the southeastern Province of Kerman with a capacity of 80,000 mt/a. Iran will pay for about \$17 million of the cost by exporting copper to China.

An underground copper mine and concentrator, Qal'eh Zari, about 150 km south of Birjand, also was operated by NICICO. The mine has about 1.8 Mmt of sulfide ore containing 2% to 4% copper, 2 to 3 g/mt of gold, and 15 to 20 g/mt of silver. About 30 mt/d of copper concentrate, grading 25% copper, was trucked to Sar Cheshmeh.

A new copper mine at Meiduk, 120 km northwest of Sar Cheshmeh, was being developed by NICICO, with the assistance of Outomec, a subsidiary of Finland's Outokumpu. Economic reserves of the deposit vary from 50 Mmt to 125 Mmt, depending upon copper prices under consideration. Mining at

Meiduk, which has been described as "a mini Sar Cheshmeh," is by open pit. Extraction of 30- to 70-m-thick overburden and premining work has started in 1993. The project includes the construction of an on-site concentrator to treat 3 Mmt/a to 5 Mmt/a of ore grading about 1.1% Cu. Capital costs are projected at \$300 million for the open pit mine and concentrator.

Excavation work continued at the large Sungun porphyry deposit in the East Azerbaijan Province, north of Tabriz. Mineralization extends to a depth of at least 1,000 m. Reserves in excess of 100 Mmt of ore grading 1% Cu have been outlined.

Gold.—A number of small gold deposits occur at an elevation of 1,800 m to 2,000 m in the vicinity of Mouteh, 140 km northwest of Isfahan. The total geological resource is estimated at 5.1 Mmt of ore grading 4 g/mt gold based on a cutoff grade of 1 g/mt. The largest deposit, Chahar-khaton, which accounts for about 50% of total area resources, was developed by Iranian General Mine Co., with technical assistance from Broken Hill Pty. Ltd. (BHP) of Australia. Mining is by open pit. Construction of surface facilities and infrastructure and a gold refinery plant have been completed, at a cost of \$35 million, with assistance from BHP. The operation produced 417 kg of gold in 1993. The feasibility study conducted by Professor Osanloo of Amirkabir University of Tehran concluded that about 165,000 mt/a of ore could be excavated by open pit mining at a stripping ratio of 1:6, ore to waste. The mining and processing cost is estimated at about \$32 per ton of ore. At an average grade of 4 g/mt, this translates to about \$250 per troy ounce of gold.

The precious-metals recovery plant at Sar Cheshmeh, which treats the copper anode slimes, is targeted to produce about 800 kg/a of gold and 14 mt/a of silver. Other gold deposits are due to be explored at Zarkouh, 200 km east of Tehran; Astaneh near Arak; and on the Zarshouran River north of Takab, 100 km west of Zanjan.

Iron and Steel.—Iron ore exploitation was stepped up to feed a fast growing steel manufacturing industry. The Government-owned NISCO, under the direction of MMM, owned and operated all major iron mines and steel plants. Iron ore output was estimated at just less than 10 Mmt in 1993. Crude steel production increased by more than 25% and sponge iron produced by direct reduction plants was up by a staggering 130%.

Iran has four main iron mines: Chadormalu, 125 km northeast of Yazd; Choghart in Bafq, 200 km east of Yazd; Golgohar, 55 km southwest of Sirjan; and Sangan, about 250 km southeast of Mashad, close to the border with Afghanistan. To meet the country's anticipated iron ore needs of well over 10 Mmt/a, the combined 2 billion tons of reserves of these four mines is being developed or expanded. In 1993, most of the iron production came from the Choghart Mine. This mine, and the adjacent Se-Chahun Mine, have more than 300 Mmt of combined reserves with a current output of approximately 4.5 Mt/a of lumpy ore. NISCO has embarked on the Choghart Iron Ore Expansion Project to achieve the national objective of creating more added-value domestically and providing cheaper raw materials for more competitive steel exports from Iran. The Golgohar Mine, with 180 Mmt of proved ore reserves, came into production at the end of March 1994. It should produce 2.7 Mmt/a of concentrate with output rising to 5 Mmt/a by 1997. The Chadormalu Mine, with 400 Mmt of reserves, is scheduled to come on-stream in 1998 at an initial capacity of 5 Mmt/a of concentrate. Eisenbau Essen of Germany carried out the engineering studies, and a consortium of Japanese steel companies, comprising Kobe Steel, Marubeni, and Mitsubishi, are to provide all the process equipment worth \$400 million. Additionally, feasibility and preengineering studies for the Sangan iron ore project are being carried out by Australia's BHP Minerals, based on an eventual production of 3.4 Mmt/a.

All these projects are to provide iron ore concentrates for the steel plants at

Mobarakeh, near Isfahan, and for the plants in Ahwaz. NISCO's main steelworks, originally built by the former U.S.S.R. before the 1979 revolution in Iran and now being expanded, are in Mobarakeh, about 70 km west of Isfahan. Ahwaz Steel Co. (ASCO) is a subsidiary of NISCO operating the Ahwaz steel complex in southwestern Iran.

Direct-reduced-iron (DRI) production is growing at a rapid pace as 12 gas-fueled DRI modules, with a total capacity of 5.84 Mmt/a, are either in operation or are being constructed in Ahwaz and Mobarakeh. In 1993 alone, 1.65 Mmt/a of new DRI capacity came on-stream in Mobarakeh and Ahwaz. As of January 1, 1994, the country's total DRI production capacity stood at 4.46 Mmt/a. Additional new DRI capacities of 1.01 Mmt/a and 0.37 Mmt/a are to be added in 1994 and 1995, respectively. DRI modules are of three different designs, namely Midrex of the United States, HYL of Mexico, and Purofer of Germany. The oldest DRI unit, a 330,000-mt/a Purofer module, has been in operation since 1977 by ASCO in Ahwaz. ASCO also operates, at its Ahwaz works, three 400,000-mt/a Midrex modules, commissioned in 1985, 1990, and 1992, respectively. DRI production at ASCO's Ahwaz steel complex started as planned in 1993 from its first Mexican HYL module. Total DRI capacity from ASCO's three HYL units, to be completed by 1995, is targeted at 1.11 Mmt/a. Total planned DRI capacity of the Mobarakeh's five Midrex units is 3.2 Mmt/a. Two of the 640,000-mt/a Midrex units started operation in 1992. Three other units were commissioned in 1993. The last unit (unit E) is scheduled to come on-stream in 1994. A 4.5-Mmt/a iron ore pellet plant was commissioned to feed Mobarakeh's five Midrex DRI modules. Iron ore concentrate is railed 1,000 km from the Golgohar Mine.

Construction work at Iran's first strip products steelworks in Mobarakeh has been completed. Production will gradually be increased at the hot-strip mill as upstream parts of the plant come on-stream. The rolling mill also has the option of raising its capacity by 1 Mmt/a

to 3.5 Mmt/a with the addition of two more reheating furnaces and extra stands. The Mobarakeh plant will be facing competition in the Iranian strip products market as early as 1995, if nearby Isfahan's Steel Plants plans proceed according to schedule. Commissioning of Isfahan's strip mill, which will partly use imported slabs, is planned for the latter part of 1994. It is believed that the domestic demand will be high enough to absorb the whole production from these two plants.

The equipment supply contract for Iran's first major stainless steel project at Isfaraieen was awarded to Italy's Simimpianti Co. for \$150 million. Isfaraieen, in northeastern Iran, was chosen as the plant site because of the availability of energy in the form of natural gas and water. The new 250,000-mt/a stainless slab, bloom, and ingot plant should come on-stream by the end of 1996. The stainless steel plant, called the Heavy Foundry and Forging Project, is being built for Iran's Industrial Development and Renovation Organization. It will have two 50-ton electric arc furnaces, each equipped with a ladle furnace and vacuum degassing.

International Finance Corp. (IFC) may take an equity stake up to 25% in a hot-briquetted iron (HBI) plant on Qeshm Island. The Qeshm HBI plant is to be built by Qeshm Iron Co. It is a joint venture set up in June 1992 consisting of Japan's Kobe Steel Corp. and an Iranian consortium of five Government public companies, including the Qeshm Island Free Trade Zone Development Co. Qeshm Iron Co. is carrying out a detailed feasibility study following a preliminary feasibility study by Kobe. The HBI plant is due to start producing 1 Mmt/a in late 1994, rising to 5 Mmt/a in five stages.

Iran's new 25,000-mt/a standard-grade ferrosilicon plant in Semnan, 200 km east of Tehran, under construction by Mannesmann Demag of Germany for the privately owned Iran Ferrosilice Co., was hit by further delays. It is not expected to come on-stream until at least the end of 1994. The project, described as the largest private-sector project since the 1979 revolution, was being appraised by

IFC for possible participation. Mannesmann also will build a 22,000-mt/a manganese alloy plant for the state-owned steel producer NISCO.

An international consortium consisting of Mitsubishi Corp. of Japan and Danieli & Co. of Italy won a turnkey contract to build a new alloy and specialty steels plant near Yazd. Initial capacity was to be 140,000 mt/a at the planned startup in 1995, reaching 260,000 mt/a within 3 years. The ore for the plant will come from the nearby Chadormalu Mine.

Lead and Zinc.—The bulk of lead and zinc production comes from eight principal mines—Ahangan, Angouran, Douna, Emarat, Irankouh, Kushk, Nakhlak, and Ravanj. The deposits have a wide regional distribution but, except for the Angouran Mine, southwest of Zanjan, the major mines are centered near Yazd and Isfahan. A new 40,000-mt/a-capacity lead smelter came on-stream in late 1992 at the Angouran Mine, considered to be the largest lead-zinc mine in the Middle East. A 60,000-mt/a zinc smelter, also planned for Angouran, is scheduled to start up in 1997. A second zinc smelter, with the capacity of 27,000 mt/a, is proposed for the Kushk Mine, near Yazd.

Industrial Minerals

Cement.—Iran continued to expand its cement industry owing to an aggressive postwar rebuilding program. More than 20 plants were either under construction or planned for future construction.

F. L. Smidth is supplying four 2,300-mt/d, five-stage precalciner kilns with Folax grate cooler to Khorasan Cement Co.'s cement plant at Qaen, 100 km north of Birjand; Shahroud Cement Co.'s new plant at Shahroud; Kordestan Cement Co.'s plant at Bijar; and Heqmatan Cement Co.'s new plant near Hamadan. Tehran Cement Co. is working on the extension and conversion of its No. 5 production line. The kiln system will be fitted with an additional five-stage preheater with a calciner supplied by Humboldt Wedag of Germany.

Dimension Stone.—The Government continued its efforts to promote expansion of the production of decorative and dimension stone from the extensive deposits in Iran. With a rapid growth of 9% in international trade, this sector provides a great opportunity to earn export revenues for the country. In addition to marketing quantities of marble, onyx, and travertine, Iran is actively seeking export markets for its substantial range of granites. In view of the added value of the finished stone products, companies related to MMM have purchased, during the past 5 years, several modern stone processing plants. Most plants were purchased from Italy. Some of the plants are in production and the rest in the process of being erected.

Phosphate.—Phosphate reserves in Iran are mostly low-grade sedimentary ore averaging 10% P₂O₅. Iranian Phosphate Co. announced the discovery of the country's largest phosphate deposit with an estimated reserve of 400 Mmt in southwestern Iran. Two other phosphate deposits, with a combined estimated reserves of 140 Mmt, have been identified 700 km southwest of Tehran. The two fertilizer plants at Shiraz and Bandar Khomeini are using imported phosphate rock, mainly from Syria and India. There are plans to start producing phosphoric acid from the Esfordi apatite deposit near Yazd.

Mineral Fuels

Coal.—The Babnizou and Pabedana coal mines near Kerman and other mines around Shahroud, all operated by NISCO, supplied about 55% of the coking coal used in Iran's steel industry. Imports supplied the remaining coking coal requirements. A major new underground coal mine at Tabas, 300 km northeast of Yazd, is being considered for development. Current mine design calls for three longwalls, each capable of producing 2,500 mt/d of coal with future expansion to five longwalls with a total production of 3.3 Mmt/a. The project also would necessitate construction of

access roads, an airport, a 100-km-long water pipeline, and a 200-km-long railway. The total cost of the project is estimated at \$400 million. However, due to the lack of sufficient foreign exchange, the Government has balked at the cost and is hesitant about proceeding with the Tabas project.

NISCO's total coal production from the Elborz and Kerman Mines in 1993 was 1.4 Mmt, equivalent to 725,000 tons of washed coal. There are about 15 other small coal mines operated by co-operatives, mostly in the Elborz mountains, around Shahroud, and north and northwest of Tehran. They produce a total of about 280,000 mt/a of coking and heating coal for local demand.

Petroleum and Natural Gas.—Petroleum production averaged about 3 Mbbbl/d in 1993, down from 3.5 Mbbbl/d in 1992. Under the previous plan, production was scheduled to reach 4 Mbbbl/d in 1993 and, by 1994, capacity was planned to be increased to 5 Mbbbl/d. Natural gas output was estimated at about 50 billion m³/a. Iran's petroleum crude export was about 2.4 Mbbbl/d. Several U.S. oil companies bought Iranian oil for their refineries outside of the United States.

The country's eight refineries treated a total of about 1 Mbbbl/d of crude oil for domestic consumption. The four major refineries, in order of importance, at Abadan, Isfahan, Tehran, and Arak, treated about 320,000 bbl/d; 280,000 bbl/d; 225,000 bbl/d; and 90,000 bbl/d of crude, respectively.

Projects for rehabilitation of the Abadan refinery were completed by the National Iranian Oil Co. (NIOC), with throughput reaching 320,000 bbl/d in October 1993. NIOC started up its new 150,000-bbl/d Arak refinery, 240 km southwest of Tehran. Throughput was 90,000 bbl/d in 1993. Crude is delivered via trucks pending completion of a pipeline. The Arak refinery would be Iran's first to produce high-octane

unleaded fuel. Construction of a new refinery in Bandar Abbas continued. The export terminal at war-damaged Kharg Island, including its 500,000-bbl reservoir, was repaired and expanded. McDermott International Inc., a U.S. energy-service company, under a subcontract to a Japanese consortium, completed a state-of-the-art reconstruction of the huge Salman production platform that was destroyed by the U.S. Navy in early 1988 in retaliation for Iranian attacks on tankers. Likewise, repair and modernization of the Lavan Island 220,000-bbl/d-capacity installations, fed from the Salman Field by underwater pipelines, was completed.

Development of the South Pars Gasfield in the Persian Gulf, an apparent extension of Qatar's giant North Field and one of the largest fields in the world with estimated reserves of 3 trillion m³ of gas and 2.5 billion bbl of natural gas liquids, has been suspended because of cash shortages in Iran and the failure to raise foreign finance. An international consortium, including Saipem of Italy, Machinoimport of Russia, and Mitsubishi Corp. of Japan, had been awarded the \$1.7 billion contract in 1992. The scheme was to start producing up to 30 Mm/a of gas for the Iranian market and up to 60,000 bbl/a of condensate for export in 1996.

The production of petrochemical products totaled about 5.4 Mmt in 1992, the last year for which data were available. Iran's petrochemicals industry was undergoing an expansion that had already produced nearly a tenfold increase in output since 1988. By the mid-1990's, existing capacity is to be doubled. Notwithstanding the country's current credit crunch, a total investment of about \$11 billion during the 1990's is scheduled to give Iran an installed capacity of more than 12 Mmt/a—from more than 10 petrochemical plants. Most of the construction activity is concentrated at the three complexes in Bandar Khomeini, Arak, and Tabriz. The Bandar Khomeini complex is the country's largest, costing more than \$5 billion. The German firm Krupp Koppers, a division of Fried Koppers,

was granted a \$700 million turnkey contract for work on the chemical complex at Bandar Khomeini. The contract is for a vinyl chloride monomer (VCM) plant and a polyvinyl chloride (PVC) plant. The 180,000-mt/a PVC plant, to be completed in 1995, will use feedstock from the VCM plant, which is to be completed in 1994. Isfahan also has become an important center for the petrochemicals industry.

Reserves

Published reserve data are inadequate to provide a meaningful inventory of Iran's mineral resources. The Oil Ministry has reported the country's total oil and gas reserves at 92 billion bbl and 20 trillion m³, respectively. The Geological Survey of Iran was actively involved in a number of exploration programs for base and precious metals and had commissioned French and German companies to carry out a nationwide survey of all mineral resources. A collaborative mapping program on the scale of 1:100,000 is under way with technical teams from China, Czechoslovakia, and Germany.

INFRASTRUCTURE

Major efforts were being made to rehabilitate and/or improve transportation facilities throughout the country. A rail link from Kerman to Bandar Abbas was a high priority. It was needed for imports and exports as well as internal trade. A rail extension from Kerman to Zahedan was a longer term project that would open trade to Pakistan and India as well as aid development of the southeast. Another rail line extension also was planned in the northeast from Mashad into Turkmenistan to link the rail systems of the central Asian republics to the Iranian network and the Persian Gulf. A dedicated 220-km rail spur was planned to link Chadormalu Mine with the existing rail route running through Yazd to Isfahan. A strategic road linking Isfahan and the country's central regions to the Persian Gulf ports was being constructed. This road will reduce the

distance between the two areas by about 250 km. A 310-km-long, 35-cm-diameter petroleum pipeline between Tehran and Zanjan and a 100,000-bbl/d pipeline between Bandar Abbas and Kerman were commissioned in 1992.

Abadan port, destroyed in the 1980-88 Iran-Iraq war, resumed limited operation accepting smaller vessels. The nearby Khorramshahr port, the largest Iranian port before it was destroyed during the war, was partly reopened. Dredging work started on the Shatt al-Arab border waterway shared with Iraq, which gives the two ports access to the Persian Gulf. The southeast port city of Chahbahar was designated as a free trade zone. Construction of large mineral loading and unloading facilities at the Persian Gulf port of Bandar Abbas was under way. The facilities will be used for the export of mineral products from eastern and southeastern mines, as well as the import of iron ore for the large steel complexes of Isfahan and Ahwaz.

Qeshm Island, strategically located on the Strait of Hormuz, between the Persian Gulf and the Gulf of Oman, is being developed by Iran as a major free trade zone for energy-intensive manufacturing, including HBI and petrochemical plants. Iran intends to convert Qeshm Island, which is about three times the size of Singapore, into the commercial and tourist heart of the Gulf. The Cyprus-based Sante Trading Co. and Acer Consultants have been commissioned by Iran's Qeshm Free Trade Authority to finance, develop, design, and build a 2.5-km road and rail bridge to link Qeshm Island to the mainland. The project is estimated to cost about \$100 million. The smaller Kish Island, in the center of the Persian Gulf, will be more trade oriented. The Kish Island Development Organization (KIDO) hoped to create a trade center rivaling Dubai's extremely successful Jebel Ali.

Electricity generated by the country's powerplants totaled about 48,000 GW·h in the first 9 months of 1992, the latest period for which data were available. Thermoelectric plants accounted for about 85% of power generation. An ambitious electric power generation and distribution

program was under way throughout the country. Several new powerplants were connected to the national power grid. The new plants added more than 1,000 MW to the total power capacity of Iran. The total installed capacity amounted to more than 16,000 MW. The Ministry of Energy plans call for an addition of 2,000 MW/a over the next 6 years to achieve a balance between power supply and demand. A consortium led by Asea Brown Boveri (ABB) of Switzerland started work on a \$1.25 billion contract to build a 2,000-MW hydroelectric plant on the Karun River in southwestern Iran. The first 500-MW of capacity is due to come on-stream before 1997. Several smaller dams and hydropower stations were being constructed in various parts of the country.

An agreement was signed between the Government and China for construction of two nuclear power stations in the southern part of the country, near the Persian Gulf. The agreement for two 300-MW reactors, as well as two 30-MW research reactors, followed a nuclear energy cooperation accord between the two countries. The Government also purchased from Russia two 440-MW power reactors. The Government failed to convince Germany's Kraftwerk Union (KWU) to complete construction of two 1,200-MW nuclear reactors in Bushehr's powerplants. The power station, which was 80% complete at the time of the Iranian revolution, was heavily damaged during the Iran-Iraq war.

OUTLOOK

Expansion of the mineral industry can be expected to continue by means of encouraging a larger role by private enterprise at home and relying on finance from abroad. The mineral resource base is estimated to be large, and the trends toward privatization and extending opportunities for foreign investment should persist. This should result in expansion of the industry and the economy in general.

Iran has a number of comparative advantages in terms of steel production. Low labor costs, cheap energy from

natural gas, sizable iron ore deposits, and domestic supplies of coking coal and limestone favor the development of a world-class steel industry. With a number of projects in their construction and commissioning phase, Iran is projected to become a major producer and exporter of various types of steel in the next few years.

Iran will be forced to further tighten control over public spending owing to the prospect of relatively weak oil prices. Unless oil prices rise dramatically, Iran appears to have no choice but to continue imposing on itself a tough regime of import cuts at least through 1996, to catch up on its debt payment. It is estimated that the GDP will rise by an average of only 0.7% per year during 1994-98.

Ironically, many experts believe that lower than expected oil revenues in 1994 would lead to smaller than anticipated balance of payments deficits for Iran. They contend that Iran can no longer run deficits because it can no longer afford them and furthermore, foreign institutions are no longer willing to lend Iran money to finance the deficit. The consensus is that Iran will have a current account surplus in 1994 as the Government cuts imports as a result of the liquidity squeeze.

The Government's main challenge during the next few years is to implement its economic restructuring phase without creating a level of public dissatisfaction whereby the political order is threatened. Since taking effect in 1993, the Government's economic reform measures have met widespread hostility from Iran's cleric-led right-wing, which has seized the opportunity for political gain. As Iran continues its painful shift to a less centralized economy, the antireformist's divisive tactics will certainly increase. This will possibly prolong Iran's economic difficulties while further complicating the task. Such is the tightrope for the Government.

¹Most yearly statistics are for the Iranian year starting on Mar. 21 of the year stated. See footnote 1 of table 1.

²As a result of a long-awaited currency reform, in early

1993, the Government eliminated the three-tier exchange rate system, relying on a variable, or floating, rate of IRI,538=US\$1.00 and keeping the old official rate of IRI70=US\$1.00 for \$3,800 million worth of essential imports. The floating rate dropped to IRI,640=US\$1.00 in April 1993 and continued its decline throughout 1993. By yearend, the rate had reached the IRI2,000=US\$1.00 level. In a reversal of policy, the Government reintroduced the multiple exchange rate in 1994. Where necessary, values have been converted from the Iranian rial (IR) to U.S. dollars at the average rate of IRI,750=\$1.00 for 1993.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Mines and Metals

P.O. Box 1416

14155 Tehran, Iran

Telephone: (98) 21 836050

Ministry of Petroleum

Taleghani Street

Tehran, Iran

Telephone: (98) 21 895905 through 08

Geological Survey of Iran

P.O. Box 13185-1491

Tehran, Iran

Iranian Mining Development and Services Co.

96 Ibn Sina Ave., Yussef Abad

Tehran, Iran

National Iranian Steel Co.

Valiye Asr Ave.

Tehran, Iran

TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
METALS						
Aluminum: Metal, primary ingot*	54,000	60,000	80,000	92,000	100,000	120,000
Arsenic: Orpiment and realgar, concentrates	1,039	382	552	¹ 492	500	1,000
Chromium: Chromite, mine output, concentrate (46% to 52% Cr ₂ O ₃):						
Gross weight	72,628	77,189	90,119	¹ 130,265	² 235,000	250,000
Cr ₂ O ₃ content*	35,000	38,000	44,000	¹ 64,000	120,000	125,000
Copper:						
Mine output:						
Ore mined (1% to 1.2% Cu):						
Gross weight thousand tons	5,680	6,833	9,243	9,229	² 10,800	15,000
Cu content	67,024	78,579	105,375	¹ 105,000	120,000	180,000
Concentrate (30% to 33% Cu):						
Gross weight	¹ 167,440	219,728	289,621	303,987	320,000	350,000
Cu content	¹ 54,837	¹ 71,675	¹ 88,248	91,561	100,000	120,000
Metal:						
Smelter output, blister/anode	¹ 76,051	¹ 92,203	¹ 125,947	128,047	140,000	160,000
Refinery output, cathode	¹ 43,167	¹ 58,249	¹ 81,870	86,363	100,000	120,000
Gold: Mine output, Au content* kilograms	400	500	¹ 500	¹ 500	² 417	500
Iron and steel:						
Ore and concentrate:						
Gross weight thousand tons	2,296	3,240	4,890	¹ 5,647	² 9,870	10,000
Fe content* do.	1,300	1,800	2,700	¹ 3,000	4,800	3,500
Metal:						
Pig iron do.	² 250	1,267	1,952	2,053	¹ 1,961	2,300
Direct-reduced iron do.	40	264	470	709	¹ 1,631	3,000
Steel, crude (ingots and castings) do.	1,081	1,425	2,203	¹ 2,937	² 3,672	4,000
Lead:						
Mine output, concentrate (56%* to 60% Pb): ³						
Gross weight	21,866	19,310	27,468	¹ 50,000	50,000	50,000
Pb content*	13,000	11,000	16,000	25,000	25,000	25,000
Refinery output, secondary*	9,000	10,000	¹ 8,000	¹ 7,800	8,000	10,000
Manganese, mine output, (30%* to 35% Mn):						
Gross weight	80,953	54,404	48,422	¹ 39,831	² 108,000	120,000
Mn content*	24,000	18,000	16,000	¹ 13,000	35,000	40,000
Molybdenum, mine output, concentrate (56% Mo):						
Gross weight	¹ 1,396	¹ 967	707	¹ 1,510	1,700	2,000
Mo content	¹ 785	¹ 542	¹ 395	¹ 847	1,000	1,200
Silver: Mine output, Ag content*	41	38	40	50	60	70
Zinc, mine output, concentrate (50%* to 55% Zn): ³						
Gross weight	54,995	54,762	135,180	¹ 170,000	180,000	200,000
Zn content*	29,000	29,000	70,000	¹ 90,000	95,000	100,000
INDUSTRIAL MINERALS						
Asbestos:						
Concentrate, (3% to 8% marketable fiber)	65,000	51,467	62,032	¹ 86,223	90,000	100,000
Marketable fiber*	3,300	2,800	3,000	¹ 4,300	4,500	5,000

See footnotes at end of table.

TABLE 1—Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued						
Barite	59,660	77,423	191,238	¹ 181,174	² 105,000	200,000
Boron: Borax	466	1,818	1,030	¹ 420	500	1,000
Cement, hydraulic* thousand tons	12,500	13,000	15,000	18,000	20,000	25,000
Clays:						
Bauxite and refractory clays	74,097	92,509	98,425	¹ 215,418	220,000	250,000
Bentonite	31,547	51,096	40,452	¹ 47,659	² 85,000	60,000
Other:						
Industrial clays	² 299,000	213,181	216,710	¹ 120,242	250,000	300,000
Kaolin*	150,000	150,000	² 150,473	² 264,083	452,000	500,000
Total ⁴	449,000	³ 363,180	367,183	³ 384,325	² 702,000	800,000
Diatomite	—	2,152	90	¹ 100	² 85	100
Feldspar	20,458	32,071	64,754	¹ 52,120	² 25,000	70,000
Fluorspar: Fluorite	⁶ 6,000	4,767	12,260	⁹ 1,82	10,000	15,000
Gemstones: Turquoise kilograms	17,408	24,855	² 20,000	¹ 1,000	5,000	25,000
Gypsum thousand tons	7,858	7,724	8,050	⁸ 7,16	⁸ 6,600	10,000
Industrial sand and gravel (quartzite and silica)	822,853	⁸ 70,000	832,441	⁷ 55,656	² 932,000	1,000,000
Lime* thousand tons	650	650	650	650	650	650
Magnesium compounds: Magnesite and huntite ⁵	6,967	1,405	29,291	³ 6,165	40,000	45,000
Mica	2,294	1,352	4,135	⁷ 8,46	8,000	8,000
Nitrogen: Ammonia, N content	336,000	420,000	467,700	656,600	700,000	800,000
Perlite	2,240	2,266	6,275	⁵ 0,000	6,000	7,000
Pigments, mineral, natural iron oxide	4,869	3,720	3,753	² 3,07	2,500	3,000
Pumice and related volcanic materials	212,442	237,868	215,149	³ 30,016	² 185,000	350,000
Salt	989,932	848,098	900,965	¹ 1,108,137	² 720,000	1,200,000
Sodium compound: Caustic soda*	12,000	15,000	15,000	15,000	15,000	15,000
Stone:						
Construction and building, crushed, n.e.s. thousand tons	3,086	3,515	3,073	⁴ 3,342	4,500	5,000
Dimension and decorative:⁶						
Granite:						
Blocks do.	20	20	² 9	² 16	20	20
Crushed do.	1	1	² 2	² 4	5	5
Slabs do.	—	—	—	4	5	5
Marble:⁶						
Blocks do.	4,000	4,400	² 4,468	³ 3,969	3,200	4,500
Crushed do.	500	600	² 425	² 786	400	800
Slabs do.	70	80	² 73	² 19	20	70
Travertine:						
Blocks do.	300	300	² 463	² 341	300	500
Crushed do.	60	70	² 56	² 86	50	80
Slabs do.	—	—	—	² 7	10	20
Total ^{2 4} do.	4,947	5,469	5,495	⁵ 2,232	4,010	6,000
Dolomite do.	77	71	105	² 27	² 173	250
Limestone do.	17,527	20,546	24,180	² 3,831	26,000	30,000
Seashell do.	85	81	73	⁷ 1	75	90

See footnotes at end of table.

TABLE 1—Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993 ^a	Annual capacity ^a (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued						
Strontium: Celestite	56,849	34,140	28,500	¹ 13,138	20,000	60,000
Sulfates, natural:						
Aluminum potassium sulfate (alum) ^a	12,000	12,000	12,000	12,000	12,000	12,000
Sodium sulfate	184,848	176,951	144,204	² 237,459	² 280,000	270,000
Sulfur:^a						
Byproduct of petroleum and natural gas	460,000	635,000	650,000	700,000	750,000	800,000
Byproduct of metallurgical processing, S content of acid	40,000	45,000	50,000	50,000	50,000	55,000
Total	500,000	680,000	700,000	750,000	800,000	855,000
Talc	11,039	31,087	6,676	² 23,707	² 18,000	25,000
MINERAL FUELS AND RELATED MATERIALS						
Coal thousand tons	1,457	1,435	1,480	¹ 1,508	² 1,680	1,700
Coke ^a do.	400	400	400	400	400	400
Gas, natural:						
Gross ^a million cubic meters	² 43,600	² 46,500	50,000	54,000	55,000	60,000
Dry ⁷ do.	22,200	23,800	29,450	32,000	² 35,500	40,000
Natural gas plant liquids thousand 42-gallon barrels	9,900	12,775	18,250	20,000	² 31,500	28,000
Petroleum:						
Crude do.	1,025,650	1,127,120	1,216,910	1,300,000	² 1,095,000	1,500,000
Refinery products:						
Motor gasoline do.	39,055	43,800	² 49,640	² 49,640	49,640	50,000
Jet fuel do.	2,920	3,650	² 7,300	² 7,300	7,300	8,000
Kerosene do.	24,820	31,025	² 29,200	² 35,040	35,040	40,000
Distillate fuel oil do.	75,555	94,900	² 90,520	² 100,000	100,000	100,000
Residual fuel oil do.	83,220	109,500	² 95,265	² 114,975	114,975	120,000
Liquefied petroleum gas do.	8,760	9,855	² 13,505	² 13,140	13,140	15,000
Lubricants (including greases) do.	3,285	4,015	² 6,205	² 6,205	6,205	6,000
Other ⁸ do.	10,585	20,805	² 33,580	² 33,580	33,580	35,000
Total⁹ do.	248,200	317,550	²325,215	²359,880	359,880	374,000

^aEstimated. ²Revised.

¹Data are for Iranian years beginning Mar. 21 of that stated, except data for natural gas plant liquids, and petroleum, which are for Gregorian calendar years. Table includes data available through July 30, 1994.

²Reported figure.

³Total lead and zinc ore mined in 1991 and 1992 amounted to 787,687 tons and 1,081,827 tons, respectively.

⁴Total may not add up to sum of details owing to independent rounding.

⁵Figures for 1989 and 1990 are for magnesite; the 1991 and 1992 figures include 3,336 tons and 220 tons of huntite ("white clay"), Mg₃Ca(CO₃)₄, respectively.

⁶Includes marmarite and varieties of dolomitic crystalline marble.

⁷Excludes natural gas used for reinjection, flaring, venting, or consumed in the extraction of liquids.

⁸Includes asphalt, coke, aviation gasoline, naphthas, paraffin wax, petrochemical feedstocks, unfinished oils, white spirits, and blending components.

⁹Refinery fuel and losses are included in output of individual products; totals are as follows, in thousand 42-gallon barrels: 1989—9,490; 1990—12,045; 1991—12,410; 1992—14,600 (estimated); and 1993—14,600 (estimated).

THE MINERAL INDUSTRY OF

IRAQ¹

By Lloyd E. Antonides

Petroleum retained its key role in the Iraqi economy during 1993. However, it provided only a fraction of the 95% of more than \$10 billion foreign earnings and of the 70% of more than \$40 billion gross domestic product (GDP) that it had for several years prior to Iraq's defeated attempt to annex neighboring Kuwait in the 1990-91 Gulf War. Other mineral commodities were also significant to the economy.

Government reports indicated that by the end of 1993 production capacities were generally restored to prehostilities levels. However, all output was limited severely by the continued United Nations embargo on any trade not required for humanitarian needs. The ban was to remain as long as the Government failed to comply with all the terms of the cease fire.

Before that conflict, and even during the 1980-88 Iran-Iraq War resulting from Iraq's unsuccessful attempt to annex land along the river channels near the Gulf, Iraq had been for some time among the world's top 10 crude oil producers—with reserves of 100 billion barrels that were only exceeded by Saudi Arabia's reserves—and top dozen sulfur producers from native deposits by the Frasch hot-water process as well as from oil and gas processing. Additionally, Iraq was an important factor in Middle Eastern cement, phosphate, and nitrogen-urea production. Output of all these commodities continued but at much less than the restored capacity because any surplus over domestic consumption and covert exports had to be stored.

¹Text prepared May 1994.

TABLE 1
IRAQ: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	1989	1990	1991	1992	1993	Annual capacity (Jan. 1, 1994)
METALS						
Iron and steel:						
Pig iron (direct reduced sponge)	200	170	—	—	—	750
Steel, crude	300	150	20	100	300	750
INDUSTRIAL MINERALS						
Cement, hydraulic	12,500	10,000	5,000	10,000	12,000	16,000
Gypsum ³	450	380	190	380	450	610
Nitrogen: N content of ammonia	474	240	40	200	500	1,200
Phosphate rock:						
Beneficiated (³⁰ % P ₂ O ₅) ⁴	1,140	900	400	900	1,000	1,500
P ₂ O ₅ content	342	270	120	270	300	450
Salt	300	250	120	250	300	400
Sulfur, elemental:						
Native, Frasch	960	800	250	500	800	2,000
Byproduct ⁵	370	380	50	100	200	700
Total	1,330	1,180	300	600	1,000	2,700
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross						
million cubic meters	11,500	9,100	1,900	2,400	5,000	12,000
Dry do.	6,100	4,200	1,100	1,400	3,000	7,200
Natural gas plant liquids						
thousand 42-gallon barrels	19,700	11,000	3,000	6,000	10,000	40,000
Petroleum:						
Crude (including lease condensate) do.	1,057,000	745,000	111,000	164,000	187,000	900,000
Refinery products do.	160,000	164,000	100,000	120,000	150,000	200,000

¹Revised. ²Estimated.

³Includes data available through Mar. 1, 1994.

⁴In addition to commodities listed, the following also were produced but information is inadequate to reliably estimate output: limestone for cement (about 1.3 tons per ton of finished cement), lime and construction stone; clay and/or shale for cement (about 0.4 ton per ton of finished cement); other construction minerals (clay for brick and tile, sand and gravel, stone); uranium and fluorine compounds from phosphate rock processing; industrial sand for foundry use and glass manufacture; and clays for ceramics and refractories.

⁵Estimated for cement manufacturing only; additional quantities are undoubtedly produced at least for construction plaster, mortar, etc.), but available information is inadequate to reliably estimate output.

⁶Last report on crude rock production was for 1988: 3.5 Mmt estimated to contain 22% P₂O₅.

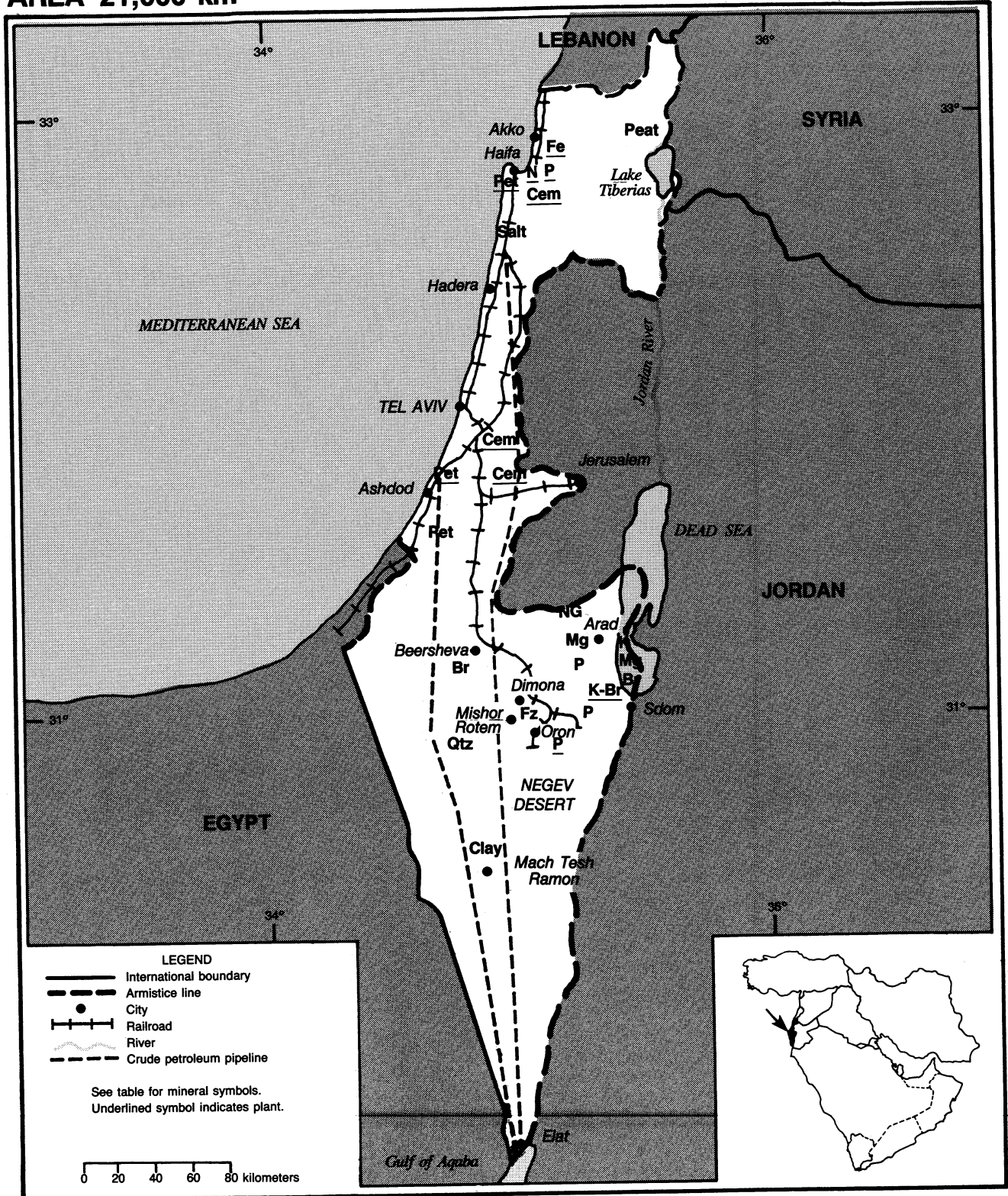
⁷Presumably from petroleum and natural gas processing.

⁸Not including new 100 million barrels per year refinery under construction at Babylon, first phase of which was due on-stream mid-1993.

ISRAEL

AREA 21,000 km²

POPULATION 4.9 million



THE MINERAL INDUSTRY OF

ISRAEL¹

By David Izon

The mineral industry of Israel is based mainly on the extraction of evaporites from the Dead Sea, phosphate rock mining, the manufacture of fertilizers, and gem cutting from imported stones, particularly diamonds.

Israel was the world's second largest producer of bromine and bromine compounds, the third largest producer of potash, and the seventh largest producer of phosphate rock. The country accounted for about 1% of the world's refractory-grade magnesia, produced from Dead Sea brine.

Israel processed a number of imported raw materials for reexport, such as cut diamond, polished gemstones, fertilizer, petroleum products, inorganic chemicals, and primary metal products. The diamond cutting and polishing trade alone accounted for about 16% of the value of total imports and about 25% of the value of total exports.

Investment by foreign interests was encouraged through the 1990 Investment Encouragement Act. In August 1993, the Government approved a draft minerals right law that exempted the Dead Sea Works from obtaining planning permission for a list of specific projects.

GOVERNMENT POLICIES AND PROGRAMS

Israel continued to encourage foreign private investment and offered favorable tax treatment and full repatriation of capital and profits, in addition to other incentive programs, under the Investment Encouragement Act, as amended in 1990. The Government's industrial expansion program continued with the expansion of the chemicals and construction industries. Several programs were being implemented to create more jobs and

train technicians and engineers.

New incentives encouraged import and export businesses as foreign exchange for authorized imports were granted and exporters were permitted to deposit 10% of their foreign currency earnings in foreign banks for up to 1 year. Also, Israeli residents were permitted to keep foreign currency they received from abroad in resident foreign currency accounts and purchase foreign securities on approved stock exchanges.

Although the Government remained committed to freeing up the economy, it has been slow to implement proposed privatization reforms.

ENVIRONMENTAL ISSUES

The Ministry of the Environment was established in 1989 to issue guidelines and regulations for stricter air pollution controls in major cities and industrial areas. The Government looked to the United States for expertise in this field and generally adopted the U.S. standards, and in most cases preferred the U.S. controls. Pollution control equipment was supplied by U.S. companies. These guidelines or regulations provide specific standards for industrywide operations in the country.

PRODUCTION

The traditional market for Israel's mineral products, particularly in Western Europe and North America, remained slow, mainly owing to the relatively sluggish economies in these regions. Production for most of Israel's fertilizer products rose by 5% in 1993. Potash production rose slightly in 1993 despite a decrease in exports because Dead Sea Works Ltd. decided to produce at

capacity and sell the surplus when world market conditions improved. (See table 1.)

TRADE

Israel is one of the most trade-dependent countries in the world, with more than 55% of the country's gross domestic product dependent on trade. The major mineral commodities traded are mostly evaporites for chemicals, fertilizers, salt, and cut and polished gemstones, particularly diamond.

Israel's most important trading partners were the European Union (EU) and the United States, accounting for two-thirds of all exports and imports. The EU accounts for about one-half of merchandise imports and one-third of merchandise exports. Growth in the industrial sector other than diamond accounted for about 70% of total exports.

Israel's key exports to the United States were polished diamonds and gemstones; machinery and mechanical instruments; medical, optical, and measuring instruments; vehicles and transport equipment; chemicals; textiles and clothing; and metals.

Imports from the United States included machinery and military equipment, agricultural products, vehicles and transport equipment, optical and measuring instruments, chemicals, rough diamonds and precious stones, cardboard, and paper.

A trade agreement, signed in 1985, would eliminate custom duties between the United States and Israel by 1995.

STRUCTURE OF THE MINERAL INDUSTRY

The Government was still the principal owner of most of the country's mineral-

related industries. The diamond cutting and polishing industry was privately owned, as were the cement and potassium nitrate manufacturers.

The total evaporite industry employed about 5,000 workers at many sites throughout the country, mostly along the Dead Sea and in the Negev Desert. The diamond processing industry employed about 9,000 persons.

COMMODITY REVIEW

All cement produced in 1993 was for domestic consumption. The main cement producer, Neshor Israel Cement Enterprises Ltd. (Neshor), anticipated a demand level of about 38,000 tons for 1993. Work on a 1-Mmt/a clinker line at the Ramala plant that began in 1992 continued in 1993 and was expected to be commissioned by July 1994, at a cost of \$135 million.² The plant capacity is expected to be increased to 1.5 Mmt/a on its second stage of development. A new 10,000-ton cement silo was installed at Har-Tuv in 1993. Pelletizing equipment also was installed that would allow Neshor to market cement in 50-kg bags.

Israel does not produce diamonds, but cuts and polishes imported rough diamonds and gemstones. These polished diamonds were exported mainly to the United States and the Pacific countries. Israel purchased most of its diamonds through De Beers' Central Selling Organization. In 1993, imports of rough diamond amounted to about 10 million carats valued at \$2,800 million, accounting for about 19% of world sales.

Israel Chemicals Ltd. (ICL) controlled most of the Dead Sea-based evaporite minerals industry. The Dead Sea contained 42,430 parts per million (ppm) of magnesium, 39,700 ppm of sodium, 17,000 ppm of calcium, and 7,590 ppm of potassium. ICL operated several subsidiary companies, such as Dead Sea Works (DSW), a leading producer of bromine, magnesium chloride, and potassium chloride. Among other ICL subsidiaries were Dead Sea Periclase Ltd. and Rotem Amfert Negev Ltd.

The Government was taking steps to implement privatization of ICL

subsidiaries by an agreement signed between the Ministry of Finance and five other ministries. The agreement permitted subsidiaries of DSW to proceed with investment and development programs without being subject to building and development licenses. To this end, ICL approved a \$155 million plan to expand production of sulfuric and phosphoric acids at Rotem to 1.1 Mmt/a of H₂SO₄ and 300,000 mt/a of P₂O₅, plus cogeneration facilities and infrastructure. Other projects include DSW's \$250 million magnesium project, scheduled to start operations at the end of 1995, the \$42 million monopotassium phosphate (KH₂PO₄) plant at Mishor Rotem that was completed in 1993, and the \$40 million, 700,000-mt/a solar evaporating salt facility at Sdom on the shores of the Dead Sea.

The supply of bromine, chlorine, potash, and magnesium salts from Dead Sea brine was virtually unlimited. Reliable information on Israel's phosphate reserve base was not available.

INFRASTRUCTURE

Israel had 4,500 km of roads, the majority of which was paved. There were three ports at Ashdod, Elat and Haifa. A total of 708 km of pipelines carried crude oil from the Port of Elat, on the Gulf of Aqaba, to the Haifa and Ashdod oil refineries. There were also 89 km of natural gas pipelines and 290 km of pipelines carrying refined petroleum products. About 85% of the traffic on Israel's 594-km rail system was involved in the transport of potash and phosphate materials from the Dead Sea and the Negev Desert to the Ports of Ashdod and Haifa.

OUTLOOK

The mineral industry in Israel is expected to continue experiencing significant economic growth for the next decade as the country struggles to improve its relationship with neighboring Arab States. Israel may continue to experience higher than normal levels of unemployment because of the influx of

immigrants from the former U.S.S.R. However, the immigrants provide a growing skilled work force, which coupled with increasing regional political stability, should benefit the economy in the long run. Israel's economic success can be attributed to its ability to utilize its abundant work force. Expansion programs in the cement, fertilizer, gem cutting, and salt industries should translate into increased jobs. Israel's mineral industry is expected to remain export-oriented and continue to fluctuate with world commodity prices. Its economic growth could increase the domestic consumption of mineral commodities. Trends to export higher valued mineral products, such as custom fertilizers, technical-grade chemicals, and other high-tech specialty items, should continue.

¹Text prepared Sept. 1994.

²Where necessary, values have been converted from new Israeli shekels (NIS) to U.S. dollars at the rate of NIS2.98=US\$1.00 in Dec. 1993.

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Monthly Bulletin of Statistics.
Israel Economist International Enterprises,
Jerusalem: The Israel Economist, monthly.
Office of Technical Data Services
Geological Survey of Israel
30 Malkhe Yisrael Street
Jerusalem 95501
Israel

TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1989	1990	1991	1992	1993	Annual capacity* (Jan. 1, 1994)
METALS						
Iron and steel: Steel, crude ^o	118,000	144,000	160,000	160,000	160,000	160,000
INDUSTRIAL MINERALS						
Bromine:						
Elemental	¹ 134,725	130,000	135,000	135,000	130,000	140,000
Compounds	¹ 102,300	120,000	125,000	125,000	121,000	130,000
Cement, hydraulic	thousand tons	2,289	2,868	³ 3,550	3,500	4,000
Clays:						
Bentonite	(^o)	(^o)	(^o)	(^o)	(^o)	NA
Flint clays	⁷ 5,598	13,955	30,000	30,000	40,000	45,000
Kaolin	³ 1,245	42,212	53,000	53,000	40,000	55,000
Other	¹ 17,369	⁶ 6,800	3,000	3,000	8,500	10,000
Fertilizer materials, manufactured:						
Nitrogenous: N content of ammonia and urea						
Phosphatic: P content	⁴ 7,650	⁴ 2,030	33,835	33,800	38,743	40,000
Potassic: K content	29,685	25,831	23,462	23,400	30,363	35,000
Gypsum ^o	18,203	20,938	18,612	18,600	16,007	20,000
Lime ^o	31,000	38,000	² 5,570	25,500	25,500	30,000
Magnesia, Mg content	80,000	230,000	208,000	208,000	210,000	240,000
Phosphate rock:	³ 4,261	³ 8,600	38,600	38,600	42,223	45,000
Beneficiated						
Beneficiated	thousand tons	3,922	3,516	3,370	³ 595	5,787
P ₂ O ₅ content	do.	1,231	1,104	1,070	1,125	1,794
Potash, K ₂ O equivalent	do.	¹ 1,273	¹ 1,311	1,320	1,300	1,309
Salt, marketed (mainly marine)	do.	475	426	1,115	605	1,123
Sand:						
Glass sand	65,300	84,759	60,000	100,000	83,000	100,000
Other ^o	thousand tons	4,500	⁴ 6,616	⁶ 4,408	7,012	7,063
Sodium and potassium compounds: Caustic soda ^o	30,897	³ 1,575	³ 2,180	32,200	32,200	35,000
Stone:^o						
Crushed	thousand tons	13,000	¹ 6,372	¹ 7,094	17,100	31,515
Dimension, marble	10,000	⁸ 0,000	¹ 2,000	12,000	12,000	13,000
Sulfur:						
Byproduct from petroleum ^o	thousand tons	⁶ 8	⁶ 4	66	60	70
Sulfuric acid	do.	161	154	136	130	150
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:^o						
Gross	thousand cubic meters	⁴ 44,400	³ 9,900	32,300	32,300	33,000
Dry	do.	⁴ 44,400	³ 9,900	32,300	32,300	33,000
Peat	(^o)	(^o)	(^o)	(^o)	(^o)	NA
Petroleum:						
Crude	thousand 42-gallon barrels	¹ 117	⁹ 4	82	80	90
Refinery products:						
Gasoline	do.	11,600	12,200	12,700	12,700	13,000
Kerosene and jet fuel	do.	5,800	6,100	6,400	6,400	6,500
Distillate fuel oil	do.	15,600	16,400	17,100	17,100	18,000

See footnotes at end of table.

TABLE 1—Continued
ISRAEL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1989	1990	1991	1992	1993	Annual capacity ³ (Jan. 1, 1994)	
MINERAL FUELS AND RELATED MATERIALS—Continued							
Petroleum—Continued:							
Refinery products—Continued:							
Residual fuel oil	thousan 42-gallon barrels	13,700	14,400	15,000	15,000	15,000	16,000
Other	do.	4,400	4,600	4,800	4,800	4,800	5,000
Refinery fuel and losses ⁴	do.	1,800	1,900	2,000	2,000	2,000	25,000
Total	do.	52,900	55,600	58,000	58,000	58,000	83,500

⁴Estimated. ⁵Revised.

¹Table includes data available through Sept. 14, 1994.

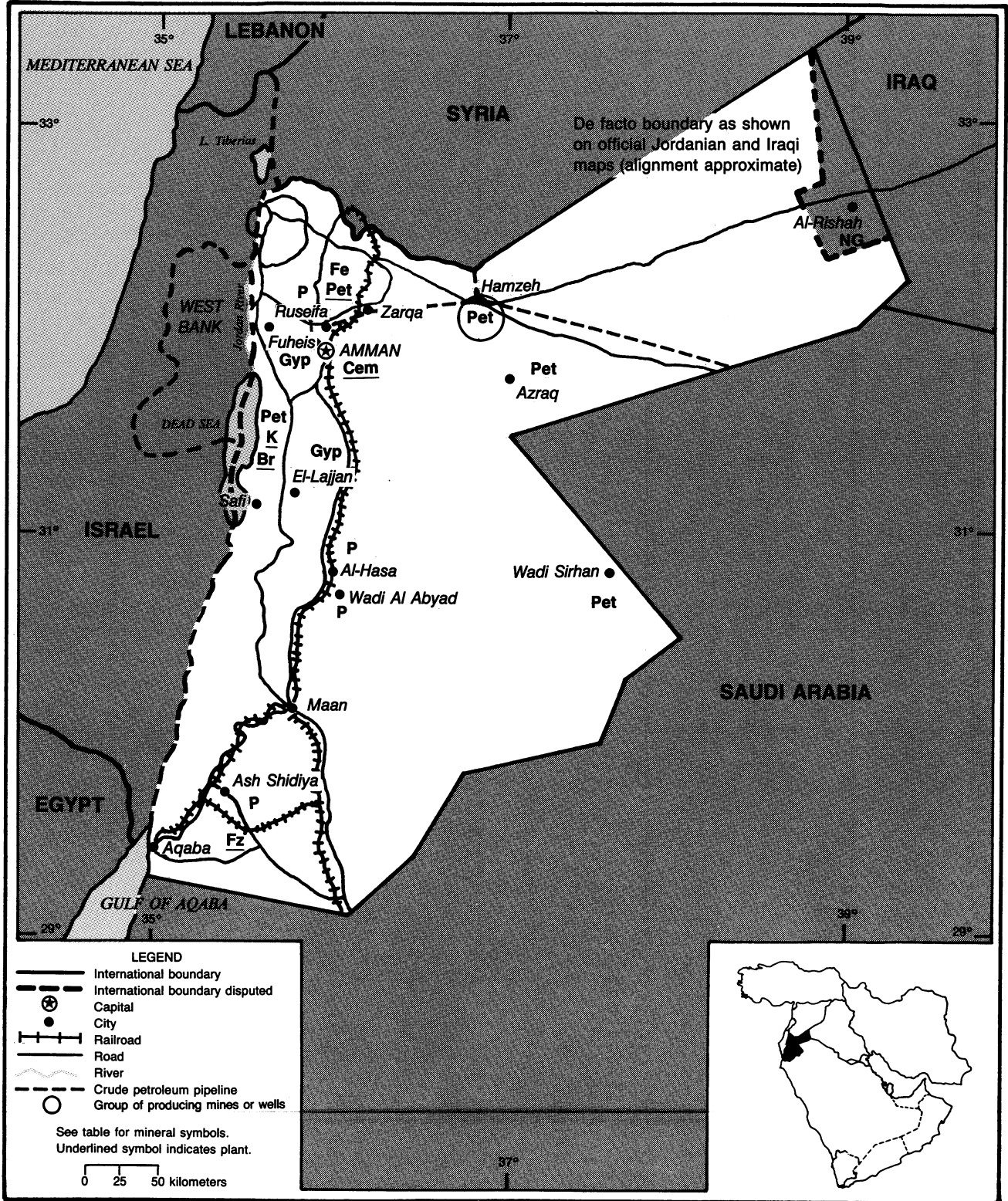
²In addition to the commodities listed, a variety of other crude construction materials are produced, but available information is inadequate to make reliable estimates of output levels.

³Revised to zero.

JORDAN

AREA 91,880 km²

POPULATION 3.8 million



THE MINERAL INDUSTRY OF

JORDAN¹

By Thomas P. Dolley

The major mineral commodities produced in Jordan were bulk phosphate rock, phosphatic fertilizers, potash, and limestone. In 1993, Jordan ranked fourth in the world in phosphate rock production and third in phosphate exports. Typically, revenues for bulk phosphate and fertilizer exports accounted for almost one-third of total export revenues. Jordan's total export revenues in 1992, the last year for which data were available, were about \$1.2 billion.²

Declining international markets for phosphates and phosphatic fertilizers placed pressure on that sector of the Jordanian mining industry. Despite these market conditions, the parastatal Jordan Phosphate Mines Co. (JPMC), the most important industrial company in Jordan, was attempting to increase its global market share of phosphate and derivative products through aggressive marketing and third-party trading.

GOVERNMENT POLICIES AND PROGRAMS

The Provisional Law of Natural Resources 37 of 1966, amended, was the basic mining law of Jordan. The law allowed for private Jordanian or foreign national ownership of a mine or quarry with the provision that mine management be conducted by a Jordanian operator.

ENVIRONMENTAL ISSUES

Declining water resources represented the most significant environmental concern in Jordan. The increasing population was putting further demands on the water supply. In 1993, approximately 60% of Jordan's water supplies came from aquifers in the eastern part of the country. However, the

overwhelming percentage of the country's population and demand was in the west, and intermittent rainfall did not supply sufficient recharge to aquifers in the east. The Water Authority of Jordan was planning to transport water from the Disi aquifer near the border with Saudi Arabia to Amman. However, Amman is significantly higher in altitude than at the site of the aquifer, and thus this project would require a pumping system; its cost had been estimated at \$350 million. Additionally, several new dam projects were planned to maximize water storage.

The Government desired to increase its share of available water in the Middle East and disputes have arisen accordingly. Jordan had ongoing disputes with neighboring nations over water rights. These disputes centered on certain nations obtaining too much water from sources feeding into the Jordan River. The Government felt that recent multilateral peace talks in the region did not deal sufficiently with the problem.

PRODUCTION

Official Government production figures for minerals were unavailable for 1993, but, production levels of all mineral commodities were estimated to have remained approximately at 1992 levels. (See table 1.)

TRADE

Phosphate exports in 1992, the last year for which data were available, totaled about 4.3 Mmt. Jordan produced more than 1.3 Mmt of potash in 1992, all for export. In 1993, Jordan produced 72,600 tons of clinker with an export value of about \$845,000. Jordan imported most of its petroleum needs, primarily

from Iraq and Saudi Arabia. In 1992, Jordan imported about 21 Mbbl of crude petroleum from Iraq. (See tables 2 and 3.)

STRUCTURE OF THE MINERAL INDUSTRY

The Jordan Natural Resources Authority (NRA) was the Government agency responsible for all activities related to the exploration and development of minerals and mineral fuels. The exploitation of the major mineral commodities of Jordan—cement, kaolin, phosphates, potash, and rock wool—were all controlled by parastatals. Aggregates, basalt, calcium carbonate, dimensional stone, glass sand, and natural sand were produced by private-sector firms.

COMMODITY REVIEW

In 1992, the last year for which data were available, profits from JPMC's phosphate sales fell to \$23 million from \$48 million in 1991. This was due to the severe downturn in the early 1990's of phosphate markets of the former U.S.S.R and Eastern Europe and has been exacerbated by a declining trend in Western European consumption. A combination of economic and environmental reasons led to declining fertilizer use in Western Europe. Despite this, JPMC was pressing ahead with three significant phosphate development projects. The first was the further development of the phosphate reserves at the active Ash Shidiya Mine, valued at about \$189 million during the next 2 years. The Ash Shidiya Mine, after full development, was to replace the existing Al-Hasa Mine and the mine at Wadi Al

Abyad by the year 2000. Financing for the project was being supplied by the World Bank and the Arab Fund for Economic and Social Development. A second project planned by JPMC was to construct a 300-kmt/a compound fertilizer plant at Aqaba. The project was a joint venture with Jordan's Arab Potash Co. (APC) and a Japanese consortium comprised of Mitsubishi Corp. and Asahi Industries. Construction is scheduled to commence in 1994, with the \$40 million contract still to be awarded. A third project is a \$30 million contract to upgrade JPMC's existing ammonium phosphate fertilizer plant at Aqaba from 600 kmt/a to 750 kmt/a. The work is to be completed in 1994 by France's Bouygues and Coppée Lavalin of Belgium. By yearend 1993, JPMC had issued 9.8 million publicly offered shares to generate an estimated \$42 million to help fund all of the aforementioned projects.

Potash was produced by APC from brines at its Dead Sea facility. Since 1985, APC had sustained potash production at levels greater than 90% of capacity. In 1993, Ireland's Jacobs International was the consultant on a construction project to raise APC's capacity from 1.4 Mmt/a to 1.8 Mmt/a. Construction work on the existing refinery for the recovery of potash is to be completed in 1994. The expanded capacity will enable APC, a global exporter of potash, to target potash sales to third world markets. Additionally, APC was considering upgrades to its plant to recover bromine from the Dead Sea; the cost was estimated at \$140 million and a joint venture with an existing foreign bromine producer was being considered. Australia's Neumann Equipment Ltd. will supply APC with a new \$2 million bucket wheel suction dredge by midyear 1994. The new dredge will mine salt from shallow excavation ponds in the Dead Sea. Neumann Equipment will supervise the shipping, assembly, and commissioning of the dredge at the Dead Sea site.

As indicated in table 1, Jordan did not have significant oil production. Though hydrocarbons had been detected in areas

around the Dead Sea, no development had taken place. Domestic production accounted for less than 1% of the petroleum utilized in Jordan. Petroleum reserves at Azraq were estimated at only 5 Mbbl. Petroleum production at Hamzeh, which was never significant, was declining slowly.

Seismic surveys near the Dead Sea were being conducted in 1993 by the United Kingdom's Seismograph Service. Previous exploration for economic amounts of crude petroleum conducted by foreign operators have been unsuccessful.

The NRA estimated Jordanian phosphate rock reserves at 1 billion tons. Potash was obtained primarily from Dead Sea brines. The World Bank estimated that of the dissolved solids contained in the Dead Sea, 33 billion tons was NaCl and MgCl and about 2 billion tons was KCl. Geological surveys showed that Jordan had additional unexploited mineral deposits of bromine, dolomite, gypsum, glass sands, iron, lead, oil shale, pyrite, tin, travertine, and tripoli.

INFRASTRUCTURE

Jordan's infrastructure is sufficient for current mining operations. Railroads within Jordan consisted of 619 km of 1.05-m-gauge single track. Crude oil pipelines within the country totaled 209 km. Primary export terminals were at the Port of Aqaba, where potash storage capacity was about 160 kmt.

OUTLOOK

Various projects to improve the mining industry infrastructure indicate the Government's willingness to improve that sector of the economy. Jordan's apparent lack of domestic energy sources, mainly hydrocarbons, will continue to stress the nation's balance of trade owing to fuel importation costs.

¹Text prepared Mar. 1994.

²Where necessary, values have been converted from Jordanian dinars (JD) to U.S. dollars at the rate of JD0.70=US\$1.00.

OTHER SOURCES OF INFORMATION

Agency

Jordan Natural Resources Authority
P.O. Box 220
7 Amman, Jordan

Publication

Jordan Natural Resources Authority, Natural Resources in Jordan, Dec. 1988, 224 pp.

TABLE 1
JORDAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Cement, hydraulic thousand tons	1,930	1,820	1,754	2,733	² 681	2,700
Clays	38,600	38,800	46,200	34,446	² 47,174	46,000
Gypsum	132,400	92,700	55,300	83,038	² 194,981	195,000
Iron and steel: Steel, crude	176,500	179,100	200,300	243,700	² 181,400	240,000
Lime	3,100	5,400	4,600	7,115	² 7,267	7,000
Petroleum:						
Crude* thousand 42-gallon barrels	110	116	50	50	50	50
Refinery products: ²						
Gasoline do.	² 2,514	² 3,396	3,300	3,300	3,300	3,400
Jet fuel do.	² 85	² 115	110	110	110	115
Kerosene do.	² 1,179	² 1,584	1,500	1,500	1,500	1,500
Distillate fuel oil do.	² 4,845	² 5,556	5,500	5,500	5,500	5,500
Residual fuel oil do.	² 4,887	² 5,140	5,100	5,100	5,100	5,100
Liquefied petroleum gas do.	² 670	² 185	1,100	1,100	1,100	1,100
Other do.	² 2,500	² 2,103	2,100	2,100	2,100	2,500
Total do.	² 16,680	² 18,079	18,710	18,710	18,710	19,215
Phosphate:						
Mine output:						
Gross weight thousand tons	6,900	6,082	4,433	4,296	² 3,565	6,900
P ₂ O ₅ content* do.	2,277	2,007	1,458	1,409	1,140	2,200
Phosphatic fertilizers	602,000	596,000	599,700	570,001	² 490,788	615,000
Potash:						
Crude salts thousand tons	1,320	1,403	1,364	1,346	² 1,370	1,400,000
K ₂ O equivalent do.	792	841	² 818	² 808	822	840,000
Salt	57,000	55,000	57,000	56,000	² 26,000	57,000
Stone:						
Limestone*	3,600	3,600	136,000	115,397	² 5,336	136,000
Marble	3,560	484,200	180,000	² 200,000	² 112,250	480,000

*Estimated.

¹Table includes data available through Mar. 1994.

²Reported figure.

TABLE 2
JORDAN: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Destinations, 1992	
			United States	Other (principal)
METAL				
Aluminum:				
Ore and concentrate	117	—		
Oxides and hydroxides	3,811	3,000	NA	NA.
Metal including alloys:				
Scrap	1,298	2,370	—	Japan 1,430; Syria 307; Republic of Korea 285.
Unwrought	—	21	—	All to Syria.
Semimanufactures	250	346	NA	Saudi Arabia 33; United Arab Emirates 28; unspecified 134.
Copper:				
Ore and concentrate	644	—		
Metal including alloys:				
Scrap	4,937	2,866	11	Japan 1,024; Republic of Korea 869; Belgium-Luxembourg 489.
Unwrought	—	8	—	All to Japan.
Semimanufactures	123	132	NA	Belgium-Luxembourg 115; Saudi Arabia 8.
Gold: Metal including alloys, unwrought and partly wrought kilograms				
	—	5,282	—	Switzerland 5,121; United Kingdom 161.
Iron and steel: Metal:				
Scrap	535	1,003	—	Saudi Arabia 348; Pakistan 252; United Arab Emirates 199.
Pig iron, cast iron, related materials	—	20	NA	NA.
Steel, primary forms	756	557	NA	Saudi Arabia 106; United Kingdom 25; unspecified 424.
Semimanufactures:				
Flat-rolled products: Of iron or nonalloy steel, clad, plated, coated	1,114	2,588	NA	Pakistan 25; Ethiopia 10; unspecified 2,539.
Bars, rods, angles, shapes, sections	1,396	1,876	NA	Syria 719; Saudi Arabia 382.
Wire	379	246	NA	Syria 94; unspecified 152.
Tubes, pipes, fittings	3,788	9,427	NA	Syria 8,041; Sudan 259.
Lead: Metal including alloys:				
Unwrought	67	158	—	Saudi Arabia 132; Syria 26.
Semimanufactures	—	88	—	All to Saudi Arabia.
Titanium: Oxides				
	20	—		
Zinc:				
Oxides	—	2	NA	NA.
Metal including alloys:				
Scrap	221	473	—	India 252; Germany 79; Syria 38.
Semimanufactures	—	18	NA	NA.
Other: Ores and concentrates				
	21	—		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	7	2	—	All to Yemen.
Grinding and polishing wheels and stones	20	45	NA	Yemen 9; unspecified 36.
Boron materials: Oxides and acids				
	—	158	NA	NA.
Cement	thousand tons	1,265	1,045	—
				Thailand 376; Sri Lanka 139; Singapore 81.
Clays, crude: Kaolin		70	1,102	—
				Saudi Arabia 963; Germany 139.

See footnotes at end of table.

TABLE 2—Continued
JORDAN: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Destinations, 1992	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Fertilizer materials: Manufactured:				
Nitrogenous	(²)	594,386	—	India 232,960; Iran 133,075; Ethiopia 129,400.
Phosphatic	2	—		
Potassic	570	2,443	—	Egypt 1,388; Syria 555; Lebanon 500.
Unspecified and mixed	314	1,090	—	Saudi Arabia 919; United Arab Emirates 86.
Graphite, natural	6	—		
Gypsum and plaster	1,046	135	—	Yemen 100; Syria 35.
Lime	25	170	—	Syria 120; Saudi Arabia 50.
Phosphates, crude	thousand tons	(³)	4,264	— India 1,275; Indonesia 540; Netherlands 302.
Potassium salts, crude	do.	(⁴)	1,235	— India 307; China 192; Indonesia 168.
Salt and brine	8,650	6,213	82	Iraq 5,799; Germany 107.
Sodium compounds, n.e.s.: Soda ash, manufactured	598	502	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	4,139	6,690	20	Lebanon 6,295; United Arab Emirates 140.
Worked	7,237	18,586	—	United Arab Emirates 10,924; Saudi Arabia 3,086; Qatar 841.
Gravel and crushed rock	68	3,326	—	Saudi Arabia 2,143; Lebanon 1,091.
Sand other than metal-bearing	—	8	NA	NA.
Sulfur: Sulfuric acid	value, thousands	(⁵)	\$1	NA NA.
Talc, steatite, soapstone, pyrophyllite	249	88	NA	NA.
Other:				
Crude	4	—		
Slag and dross, not metal-bearing	174	101	—	Germany 100.
MINERAL FUELS AND RELATED MATERIALS				
Coal: Briquets of anthracite and bituminous coal	50	24	—	All to Yemen.
Peat including briquets and litter	—	12	—	All to Lebanon.
Petroleum refinery products:				
Mineral jelly and wax	42-gallon barrels	315	—	
Lubricants	do.	1,288	3,836	133 Iraq 350; unspecified 2,758.
Residual fuel oil	do.	206	—	
Bitumen and other residues	do.	6	(⁵)	NA NA.
Bituminous mixtures	do.	—	78	— All to Lebanon.

NA Not available.

¹Table prepared by Virginia A. Woodson.

²Unreported quantity valued at \$126,650,000.

³Unreported quantity valued at \$180,716,000.

⁴Unreported quantity valued at \$142,064,000.

⁵Less than 1/2 unit.

Source: The United Nations.

TABLE 3
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Sources, 1992	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	2,247	26	NA	NA.
Oxides and hydroxides	31,501	23,620	1	Australia 23,500.
Metal including alloys:				
Scrap	1,009	1,118	—	Saudi Arabia 570; Yemen 477.
Unwrought	4,799	2,997	—	Bahrain 1,612; Egypt 1,342.
Semimanufactures	1,815	3,413	15	Lebanon 952; Italy 545; Turkey 364.
Cadmium: Metal including alloys, all forms	(²)	1	—	Mainly from Germany.
Chromium: Oxides and hydroxides	5	67	—	Germany 61; Netherlands 4.
Cobalt: Oxides and hydroxides	6	4	(²)	Germany 3; Italy 1.
Columbium and tantalum: Tantalum metal including alloys, all forms	—	\$8	—	All from Germany.
value, thousands				
Copper: Metal including alloys:				
Ore and concentrate	1,050	—		
Metal including alloys:				
Scrap	328	475	—	Germany 286; Italy 133.
Unwrought	154	295	—	Turkey 128; Germany 62; unspecified 98.
Semimanufactures	2,700	3,154	61	Saudi Arabia 2,780; Italy 348; Turkey 220.
Gold:				
Waste and sweepings	kilograms	11	—	
Metal including alloys, unwrought and partly wrought	do.	433	54	Switzerland 310; Italy 95; United Kingdom 7.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	—	600	—	All from Algeria.
Metal:				
Scrap	4,948	5,034	—	Lebanon 4,416; Japan 250.
Pig iron, cast iron, related materials	154	112	—	France 30; Italy 28; Czechoslovakia 15.
Ferroalloys	149	900	—	Belgium-Luxembourg 600; Russia 300.
Steel, primary forms	193,945	265,038	—	Zimbabwe 111,723; Russia 86,181; Turkey 28,071.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel, clad, plated, coated	47,022	61,182	244	Zimbabwe 11,586; Czechoslovakia 9,992; Germany 7,985.
Of alloy steel	26,488	32,747	76	Hungary 11,971; Zimbabwe 8,654; Republic of Korea 4,884.
Bars, rods, angles, shapes, sections	34,210	156,499	68	Lebanon 39,890; Turkey 38,038; Zimbabwe 27,011.
Rails and accessories	147	2,021	—	United Kingdom 2,000; Belgium-Luxembourg 21.
Wire	8,458	10,315	42	Czechoslovakia 2,176; Lebanon 1,877; Saudi Arabia 1,473.
Tubes, pipes, fittings	12,668	33,385	228	Turkey 15,414; Libya 3,402; Egypt 3,254.
Lead:				
Oxides	175	1	—	All from Germany.
Metal including alloys:				
Scrap	115	11	—	All from Sweden.
Unwrought	2,015	1,255	—	Saudi Arabia 2,038; Australia 103.
Semimanufactures	17	5	—	All from Germany.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Sources, 1992	
			United States	Other (principal)
METALS—Continued				
Magnesium: Metal including alloys:				
Scrap	—	9	—	All from Syria.
Unwrought	12	31	—	Ukraine 19; France 12.
Manganese: Oxides	(²)	1	—	All from Germany.
Mercury	value, thousands	\$57	\$3	— Do.
Nickel:				
Matte and speiss	5	6	—	Canada 4; Germany 2.
Metal including alloys, semimanufactures	—	5	—	Mainly from United Kingdom.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	value, thousands	\$11	\$9	— Switzerland \$6; Turkey \$3.
Silver: Metal including alloys, unwrought and partly wrought	do.	\$53	\$124	\$8 Switzerland \$36; France \$35; Italy \$19.
Tin: Metal including alloys:				
Scrap	6	448	—	Saudi Arabia 438; United Kingdom 5.
Semimanufactures	value, thousands	\$24	\$1	— All from Germany.
Titanium: Oxides	1,968	2,674	434	United Kingdom 580; Australia 280.
Tungsten: Metal including alloys, unwrought	value, thousands	\$1	—	
Zinc:				
Oxides	11	8	—	All from Germany.
Metal including alloys:				
Scrap	868	1,336	—	Belgium-Luxembourg 737; Saudi Arabia 438; Poland 410.
Semimanufactures	6	44	3	United Kingdom 35; Belgium-Luxembourg 5.
Other:				
Ores and concentrates	1,461	95	—	United Kingdom 55; Germany 20; Turkey 20.
Base metals including alloys, all forms	22	20	—	All from Netherlands.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	241	582	—	Japan 141; United Arab Emirates 123; Turkey 92.
Artificial: Corundum	—	—	—	
Grinding and polishing wheels and stones	224	361	—	Italy 208; Germany 79; China 28.
Barite and witherite	224	252	—	Thailand 180; Turkey 50; Norway 22.
Boron materials:				
Crude natural borates	50	86	—	All from Turkey.
Oxides and acids	11	17	—	Germany 16; United Kingdom 1.
Bromine, fluorine, iodine	—	41	41	
Cement	40	—	—	
Chalk	504	1,164	—	United Kingdom 546; France 420; Egypt 175.
Clays, crude:				
Bentonite	2,904	3,844	15	United Kingdom 1,818; India 1,243; Turkey 498.
Kaolin	850	876	2	United Kingdom 816; China 40.
Cryolite and chiolite	721	1,009	—	Turkey 902; China 88.
Diamond: Natural, gem, not set or strung	value, thousands	\$373	\$441	— Ireland \$260; Romania \$69; Belgium-Luxembourg \$63.
Diatomite and other infusorial earth	30	51	—	United Kingdom 42; France 9.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Sources, 1992	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Feldspar	189	—		
Fertilizer materials:				
Crude, n.e.s.	92	130	—	Germany 61; Italy 19; unspecified 50.
Manufactured:				
Ammonia	180,565	57,711	—	Ukraine 47,145; Bahrain 10,299.
Nitrogenous	39,356	75,229	—	Egypt 24,499; Iran 10,294; Bulgaria 6,620.
Phosphatic	947	363	20	Lebanon 325; Greece 18.
Potassic	590	1,307	—	All from Germany.
Unspecified and mixed	1,968	4,485	815	Netherlands 1,100; Italy 447.
Gypsum and plaster	3,221	3,231	25	Egypt 1,890; Lebanon 824.
Magnesium compounds: Oxides and hydroxides	621	860	—	Austria 604; Italy 141; Greece 40.
Mica:				
Crude including splittings and waste	2	—		
Worked including agglomerated splittings	14	—		
Pigments, mineral: Iron oxides and hydroxides, processed	264	174	—	Germany 141; Spain 20; United Kingdom 12.
Precious and semiprecious stones other than diamond:				Republic of Korea \$30; Italy \$20; United Kingdom \$9.
Synthetic value, thousands	\$61	\$53	—	
Pyrite, unroasted	—	24	—	All from Saudi Arabia.
Salt and brine	286	360	—	Netherlands 245; Germany 49; United Kingdom 23.
Sodium compounds, n.e.s.: Soda ash, manufactured	6,640	4,661	—	India 1,950; Turkey 1,516; Russia 761.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10,026	15,614	—	Italy 11,497; Syria 1,656; Albania 1,365.
Worked	18	—		
Dolomite, chiefly refractory-grade	22	127	—	Norway 102; Netherlands 25.
Gravel and crushed rock	2,546	2,691	—	Italy 1,088; Saudi Arabia 736.
Limestone other than dimension	—	4	—	All from United Kingdom.
Sand other than metal-bearing	406	160	1	Syria 70; United Kingdom 40; United Arab Emirates 30.
Sulfur:				
Elemental:				
Crude including native and byproduct	281,154	64,811	—	Saudi Arabia 63,768.
Colloidal, precipitated, sublimed	22,720	50,884	—	Saudi Arabia 50,799.
Dioxide	—	20	—	All from United Kingdom.
Sulfuric acid	597	117	2	United Arab Emirates 26; Netherlands 24; Belgium-Luxembourg 41.
Talc, steatite, soapstone, pyrophyllite	940	1,685	18	China 594; Norway 538; Austria 251.
Other: Crude	645	824	—	Greece 695; Italy 25.
Carbon black	14	135	16	Saudi Arabia 50; Germany 39; China 20.
Coal:				
Briquets of anthracite and bituminous coal	173	36	—	Germany 24; Syria 12.
Lignite including briquets	—	25	—	All from Syria.
Coke and semicoke	562	502	—	Germany 224; Egypt 155; Iraq 121.
Peat including briquets and litter	1,740	3,000	—	Germany 1,771; Finland 438; Netherlands 285.
Petroleum:				
Crude thousand 42-gallon barrels	17,247	22,172	—	All from Iraq.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	1992	Sources, 1992	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Petroleum—Continued:				
Refinery products:				
Liquefied petroleum gas	thousand 42-gallon barrels	486	—	
Gasoline	do.	266	1,275	2 Iraq 1,273.
Mineral jelly and wax	do.	2	3	(⁴) Mainly from China.
Lubricants	do.	80	290	4 Iraq 158; France 78.
Residual fuel oil	do.	4,320	4,271	— All from Iraq.
Bituminous mixtures	do.	(⁴)	4	(⁴) Saudi Arabia 2; Egypt 1.
Petroleum coke	do.	1	1	— All from Saudi Arabia.

¹Revised. NA Not available.

²Table prepared by Virginia A. Woodson.

³Unreported quantity valued at \$1,000.

⁴Unreported quantity valued at \$2,000.

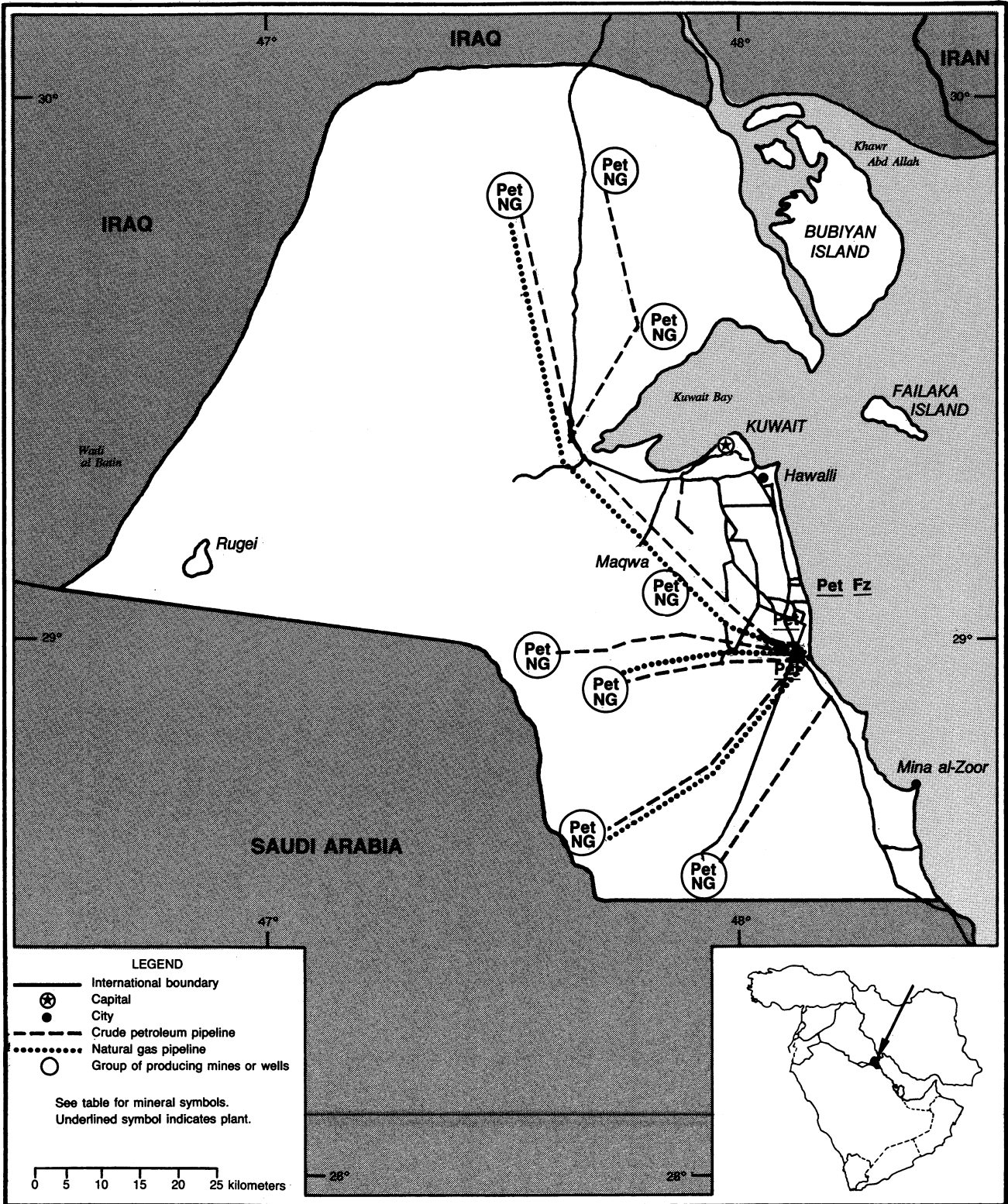
⁵Less than 1/2 unit.

Source: The United Nations.

KUWAIT

AREA 17,820 km²

POPULATION 1.7 million



THE MINERAL INDUSTRY OF

KUWAIT

By Bernadette Michalski

The production and refining of crude oil provided the bulk of Government revenues and about 60% of the gross domestic product (GDP). GDP for 1993 was estimated at \$26 billion compared with \$15 billion in the previous year. By the close of 1993, Kuwait's total public debt was estimated at about \$40 billion. Oil revenues, as estimated by the National Bank of Kuwait, were placed at \$2.4 billion for the fiscal year commencing July 1, 1991, to June 30, 1992, and projected to \$6.9 billion in 1992-93 as crude oil production was restored to preoccupation levels. Oil prices were depressed in the second half of 1993 resulting in the spot price of Kuwait Export declining from a high of \$15.69/bbl in May of 1993 to a low of \$11.20/bbl in December of that year. Revenues fell below budget forecasts, prompting the Government to make substantial cuts in public spending and to impose charges for public services that were traditionally available gratis.

GOVERNMENT POLICIES AND PROGRAMS

Kuwait's many investments, which include the participation in foreign petroleum exploration, the acquisition of foreign petroleum refining and distribution networks, and the participation in overseas petrochemical facilities, have aided Kuwait in developing an economy with globally dispersed assets. In January 1993, the National Assembly passed a bill authorizing that body to examine investments of all companies in which the Kuwaiti Government holds 25% or more equity. The bill also defines penalties for the misappropriation of public funds. Kuwaiti investments in Spain that resulted

in an estimated loss of \$4 billion received particular scrutiny.

The full restoration of crude oil production and exports was recognized by the Government as the key element in financing reconstruction that was estimated at about \$22 billion over the first 5 years after liberation. The Kuwaiti Government, at least for the immediate future, abandoned its ambitions for an economy that included a non-oil industrial and manufacturing sector.

Under a privatization plan the Kuwaiti Government, which employs most of the work force, is considering selling off state enterprises in the next 5 years. The plan includes shedding a total of \$2.68 billion in equity distributed among 62 companies and privatizing services that are currently subsidized or provided free by the Government. These include power production, transportation, and communications.

Postwar national security concerns have been eased by military cooperation pacts entered into with France, Russia, the United Kingdom, and the United States.

Bechtel Group, Inc. of the United States continued to have overall responsibility for reconstruction contracts.

ENVIRONMENTAL ISSUES

The environmental damages resulting from the Iraqi occupation have not yet been fully realized. There is no precedent upon which to draw to make an assessment, and it may be several years before the full extent of the damage is understood. An estimated 30 Mbbbl of crude oil was spilled onto the ground, forming oil lakes in Kuwait; about 20 Mbbbl was considered recoverable. By 1993, all of the recoverable amount had been gathered by vacuum trucks and

transported to treatment facilities in Kuwait's refineries or to special tanks for sale as weathered crude.

PRODUCTION

The restoration of mineral production was focused on petroleum extraction and processing. These sectors of the mineral industry were recognized as the most expeditious means of replenishing depleted cash reserves.

Crude oil production, including the Kuwaiti share of the Divided Zone fields, rose to 1.8 Mbbbl/d in January and exceeded 2 Mbbbl/d in February 1993. However, the Organization of Petroleum Exporting Countries (OPEC) assigned a quota of 1.6 Mbbbl/d for the second quarter of 1993. Production averaged 1.65 Mbbbl/d for March through May but was raised progressively to 1.75 Mbbbl/d in June when OPEC extended all quotas through the third quarter. By July, production was up to 1.9 Mbbbl/d. In August, production averaged 1.95 Mbbbl/d and 2.05 Mbbbl/d in September. Kuwait's share of the OPEC quota was increased by 400,000 bbl/d at OPEC's September meeting, and output averaged 2 Mbbbl/d between the fourth quarter of 1993 and the first quarter of 1994. Production for the year averaged 1.87 Mbbbl/d, including nearly 200,000 bbl/d from the Divided Zone shared with Saudi Arabia. (See table 1.)

TRADE

Total exports for 1993, virtually all hydrocarbon related, were estimated at \$11,250 million compared with \$5,060 million in 1992. Total imports, principally vehicles and other consumer goods, were valued at \$7,500 million, about \$1,000 million more than those of

the previous year.

The United States imported 125 Mbbbl of crude oil and 3.3 Mbbbl/d of products, mostly residual fuel oil, from Kuwait in 1993. Import data available for the first 5 months of 1994 were running slightly higher than the same period in 1993 with crude oil reported at 54.6 Mbbbl and jet fuel, the only product import reported in the first 5 months, totaling 678,000 bbl. Kuwait supplies approximately 5% of the U.S. petroleum imports.

STRUCTURE OF THE MINERAL INDUSTRY

The Government of Kuwait imposed few restrictions on trade or financial flows and placed considerable emphasis on the private sector to develop the economy. The petroleum and natural gas extraction and processing industries, however, were under Government control. Total control of the Kuwait Oil Co. (KOC) and the Kuwait National Petroleum Co. (KNPC) was in effect since 1975. In 1980, the Government established a state umbrella company for hydrocarbon operations known as the Kuwait Petroleum Corp. (KPC). This organization oversees all the state hydrocarbon companies and also manages Government shareholdings in various oil ventures, including those operations in the Kuwait-Saudi Arabia Divided Zone and the acquired interests in foreign operations. Despite the liquidation of several billion dollars in stocks and bonds since the invasion, Kuwait retains substantial worldwide investments, including an extensive refining and distribution network in Western Europe as well as several downstream investments in Eastern Europe and Southeast Asia. Kuwait also has interest in oil exploration and production activities in many nations, including the Yacheng Gasfield in southern China. (See table 2.)

COMMODITY REVIEW

Metals

Kuwait's aluminum extrusion and fabricating industries completed war

damage repairs by yearend. Arabian Light Metals Co. has restored its extrusion capacity to 5,000 mt/a. The company uses billet imported from Bahrain, Dubai, and Egypt. Demand for aluminum products has grown rapidly in the light of postinvasion reconstruction.

Industrial Minerals

Cement.—Before the occupation of Kuwait, the Saudi-Kuwaiti Cement Co. took the lead in coordinating efforts with other cement companies to improve marketing operations and promote exports. However, plant and infrastructure damage caused by retreating Iraqi troops combined with the nation's own heavy reconstruction demands ended any export plans for the near future.

Fertilizers.—The Petrochemical Industries Co. (PIC) operated the Shuaiba Fertilizer Complex, which had the capacity to produce almost 1 Mmt/a of ammonia and 800,000 mt/a of urea. This complex, particularly the urea plant, was severely damaged by Iraq. However, production was restored by the close of 1993.

Mineral Fuels

Natural Gas.—The nation is dependent on natural gas associated with crude oil production for domestic power stations and petrochemical plants. Associated natural gas was flared at gathering centers where condensate recovery units were not yet restored to service, compelling electric powerplants to supplement fuel oil for natural gas as the source of power.

When fully restored, the gas system will be able to handle associated gas from as much as 3 Mbbbl/d of oil production, stripping liquids for export and using dry gas for Kuwait's domestic needs.

Before the Iraqi invasion, Kuwait's domestic supply of associated natural gas from the Raudhatain and Sabiriya Fields near the northern Iraqi border was processed in northern Kuwait, and a mixed liquids stream was delivered by

pipeline to the fractionator at Shuaiba. Natural gas from the Minagish, Umm Gudair, and South Umm Gudair Fields near the western border with Saudi Arabia flowed as wet gas to the processing plant at Shuaiba. Natural gas from the Burgan and Maqwa-Ahmadi Fields was processed at two field recovery plants. The recovered liquids were then delivered by pipeline to Shuaiba for fractionation. Although the Burgan and Maqwa Fields were restored, the natural gas-gathering and processing system was not yet fully restored, and the associated gas recovered from these fields was of necessity flared.

Petroleum.—Production.—Field reconstruction has brought Kuwait's production, including output from its share in the Divided Zone, close to 1.9 Mbbbl/d by early 1993. Although all 26 gathering centers were damaged or destroyed during the occupation, 17 gathering centers were functioning with capacities totaling 2.4 Mbbbl/d by the first quarter of 1993. The bulk of production is derived from the Burgan complex which includes the Maqwa and Ahmadi Fields. The KOC reported production from the Greater Burgan area at 1.55 Mbbbl/d in February with another 450,000 Mbbbl/d spread among Raudhatain, Sabriya, Umm Gudair, and five smaller fields.

Two successful experiments in horizontal drilling have been undertaken and resulted in a significant increase in capacity. One horizontal well drilled in the Mauddud formation of the Maqwa Field showed initial production of about 5,000 bbl/d compared with just 500 bbl/d from the only producing vertical hole in the same formation.

By the close of 1993, the country's sustainable crude oil production capacity was estimated at about 2.5 Mbbbl/d, including 200,000 bbl/d in the Divided Zone. The Government has announced its objective of increasing sustainable crude oil production capacity to 3 Mbbbl/d between the years of 2003 and 2005. Much of the expansion in capacity will result from the development of the light crude oil reservoirs in the deep Marat,

Naja, and Sarjelu formations. The capacity expansion program includes provision for the installation of enhanced recovery systems.

Refining.—Overall damage to the Mina al Ahmadi refinery was relatively light, while the Mina Abdullah and Shuaiba refineries were subjected to extensive damage during the Gulf war. The petroleum refinery reconstruction program continued through 1993, and capacity was restored to 670,000 bbl/d by early 1994, just 100,000 bbl/d short of the 1990 preinvasion capacity. The most severely war-damaged refinery, Shuaiba, was restored to 150,000 bbl/d capacity by January 1994. The Mina Abdullah refinery operated at 230,000 bbl/d, slightly above its 200,000-bbl/d preinvasion levels, by the fourth quarter of 1993. The Mina al-Ahmadi refinery attained an effective capacity of 290,000 bbl/d in early 1994, still below the preinvasion capacity of 370,000 bbl/d.

KNPC has decided to restore Shuaiba to its preinvasion capacity of 200,000 bbl/d and to increase the Mina al-Ahmadi capacity to 400,000 bbl/d by the beginning of 1995. This would raise total capacity to 830,000 bbl/d, or 60,000 bbl/d above Kuwait's preinvasion refining capacity.

Petrochemicals.—The nation's principal petrochemical complex is in Shuaiba and is operated by PIC, a wholly owned subsidiary of KPC. Initially commissioned in 1966, the complex has steadily expanded, including a fertilizer complex and salt and chlorine plants. Union Carbide Corp. of the United States entered into a joint-venture agreement with PIC in mid-1993 to construct and operate a 650,000-mt/a-capacity ethane cracker to produce ethylene, 450,000 mt/a of polyethylene, and 350,000 mt/a of ethylene glycol. Plant construction is expected to commence in late 1995 and is scheduled to be completed by 1998. The United States' Flour Daniel was confirmed as project manager for the planned \$2 billion expansion program at the Shuaiba petrochemical complex.

Reserves

Kuwait's proven reserves of crude oil as of January 1, 1994, were officially estimated at 96.5 billion bbl, including 2.5 billion bbl representing Kuwait's share of the Divided Zone reserves. Kuwait enjoys a reserve-production ratio of 132 years. The bulk of crude oil reserves is contained in the Greater Burgan Field, containing about 65 billion bbl.

Natural gas reserves were estimated at 1,480 billion m³. The reserves are entirely based on associated natural gas as intensive exploration programs during the past decade uncovered no nonassociated gas reservoirs.

INFRASTRUCTURE

Not only were the mineral production and processing facilities damaged or destroyed during the Iraqi occupation, but most of the supporting infrastructure as well. The United Nations (UN) War Reparations Commission estimated the Iraqi occupation and ensuing war resulted in total losses of \$170 billion for Kuwait. Reconstruction priority has been given to the restoration of infrastructure supporting the revenue-producing petroleum industry; the greatest results have been experienced in that area. The pipeline network and storage facilities supporting petroleum production, processing, and transportation were fully restored in 1993. The natural gas gathering facilities have for the most part been restored.

OUTLOOK

The UN Security Council Resolution 687 provides for receipt of a portion of Iraq's oil revenues in compensation for the human and material losses suffered. Although compensation payments remain to be seen, restoration priority is to the wealth-creating sectors of the economy—petroleum production and downstream processing. Swift action to cut spending was highlighted after consultations with the International Monetary Fund and World Bank, which advocated wholesale privatization, economic liberalization, and

a reduction in the welfare state. Further growth is dependent upon the price of oil and the progress in privatizing and liberalizing its economy. If world oil demand is strong and Government programs for privatization are successful, the Kuwaiti budget deficit could be dissolved in this decade.

The Government has begun to reduce some of the barriers to foreign investment, which have long isolated Kuwait from the worldwide flow of capital. Investment confidence has grown, not only as the result of strong defense treaties but also because the national elections produced a National Assembly that enjoys the confidence of the Kuwaiti people.

OTHER SOURCES OF INFORMATION

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TABLE 1
KUWAIT: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Chlorine	23,610	19,000	—	—	25,000	35,000
Cement thousand tons	1,110	900	300	500	500	1,500
Clay products, nonrefractory: Sand lime bricks cubic meters	354,800	300,000	100,000	100,000	100,000	300,000
Lime: Hydrated and quicklime	65,000	50,000	5,000	5,000	35,000	65,000
Natural gas: ²						
Gross million cubic meters	11,100	7,070	¹ 16,000	3,600	18,000	20,000
Dry do.	8,160	5,230	500	2,040	12,000	13,000
Natural gas liquids thousand 42-gallon barrels	38,500	30,500	—	—	40,000	40,000
Nitrogen: N content of ammonia	664,600	292,100	—	140,100	316,900	700,000
Petroleum:						
Crude ² thousand 42-gallon barrels	<u>657,700</u>	<u>427,780</u>	<u>68,255</u>	<u>380,430</u>	<u>682,500</u>	<u>900,000</u>
Refinery products: [*]						
Gasoline, motor do.	22,265	¹ 16,460	7,665	9,380	15,000	25,000
Jet fuel do.	19,690	14,000	NA	NA	NA	15,000
Kerosene do.	22,200	² 20,33	9,300	12,000	15,000	20,000
Distillate fuel oil do.	71,200	¹ 55,370	6,500	20,500	30,000	60,000
Residual fuel oil do.	99,350	¹ 71,75	13,300	61,700	65,000	80,000
Other do.	44,700	² 29,820	1,850	29,900	35,000	40,000
Total do.	<u>279,405</u>	<u>²207,739</u>	<u>38,615</u>	<u>133,48</u>	<u>160,00</u>	<u>240,000</u>
Salt	31,950	30,00	—	NA	30,000	30,000
Sodium and potassium compounds: Caustic soda	15,700	12,00	—	NA	16,000	25,000
Sulfur:						
Elemental, petroleum byproduct	375,000	350,000	30,000	150,000	175,000	300,000
Sulfuric acid	5,000	4,000	—	NA	5,000	40,000
Urea thousand tons	190,000	292,100	—	140,100	300,000	485,000

*Estimated. ¹Revised. NA Not available.

¹Table includes data available through Mar. 15, 1994.

²Includes Kuwait's share of production in the Kuwait-Saudi Arabia Divided Zone.

TABLE 2
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

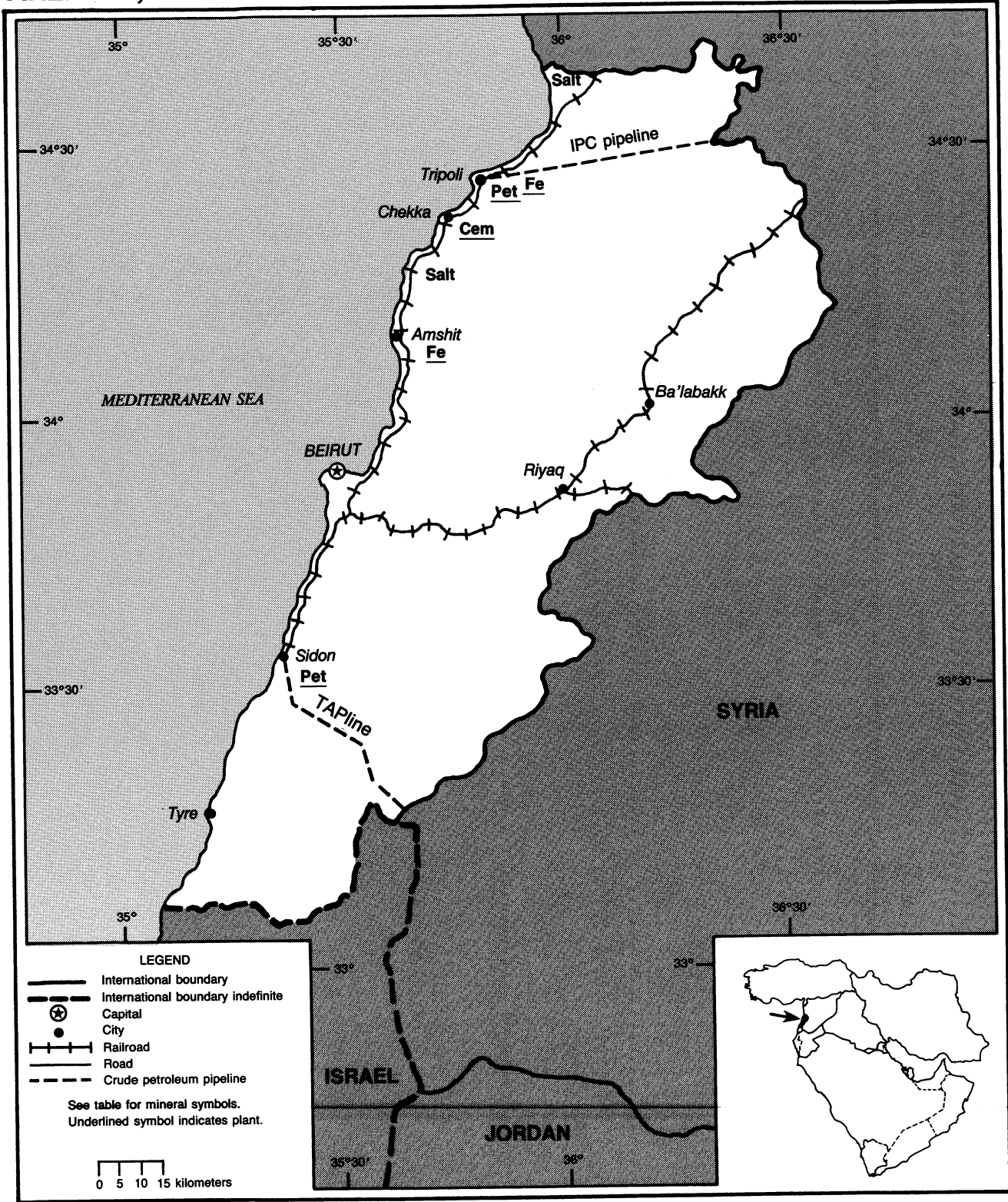
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nitrogen		Petrochemical Industries Co. (Government, 100%)	Shuaybah do.	150 ammonia, 125 urea.
Petroleum, crude	million 42-gallon barrels	Kuwait Oil Co. (Government, 100%)	Burgan	400.
Do.		do.	Maqwa	20.
Do.		do.	Raudhatain	80.
Do.		do.	Sabriya	30.
Do.		do.	Ahmadi	20.
Do.		do.	Minagish	20.
Do.		do.	Umm Gudair	20.
Do.		do.	Bahra	15.
Do.		Wafra Oil Co. (Saudi Arabian Texaco 50%; Kuwait Oil Co., 50%)	Wafra	35.
Do.		do.	South Fuwaris South Umm Gudair	2. 10.
Do.		Arabian Oil Co. (Japanese Petroleum Trading Co., 80%; Saudi Arabia, 10%; Kuwait, 10%)	Khafji Hout	85. 10.
Petroleum, products	million 42-gallon barrels	Kuwait National Petroleum Co. (Government, 100%)	Mina Al-Ahmadi	100.
Do.		do.	Shuaybah	10.
Do.		do.	Mina Abdulah	85.

LEBANON

AREA 10,400 km²

POPULATION 3.6 million



THE MINERAL INDUSTRY OF

LEBANON¹

By Bernadette Michalski

Lebanon's industrial facilities and infrastructure, including those related to its minerals sector, were seriously damaged during the course of the civil war that spanned more than 15 years. Most seriously affected was the fuel supply network and, consequently, the generation of electric power.

The Taif Agreement, sponsored by the Arab League, required that all militia forces withdraw as well as surrender all weapons by April 1991. The relative political and military calm since that date resulted in the influx of loans and aid to rebuild the nation's infrastructure while providing stimulus to the economy. Included among the grants, loans, and credits extended during 1993 was a loan of \$185 million from Italy. In addition, Saudi Arabian investors have underwritten \$500 million for the Lebanon Development Fund. The World Bank approved a \$175 million loan for emergency infrastructure work. The funds were allocated to power generation, water supply, education, urban development, and technical assistance programs. The Arab Fund for Economic and Social Development granted Lebanon \$127 million and the Kuwait Fund extended \$87 million.

The influx of capital has fostered a surge in economic activity. According to the Beirut Chamber of Commerce, the Lebanese gross domestic product grew by 7% in 1993 and is forecast to increase by at least 8% in 1994.

GOVERNMENT POLICIES AND PROGRAMS

The Government has announced the goal of restoring the gross domestic product (GDP) to its pre-civil war level by the year 2005. The Government expects to balance the budget by 1995

and to generate a surplus of 10% of GDP by 2000. Total foreign and local debt is expected to average 59% of the GDP over the next 10 years with debt servicing kept to a maximum of 6% of the GDP. The total cost of the damage sustained during the long civil war was estimated by the Government at \$25 billion. The reconstruction program's initial phase covering 1993-95 requires a total investment of \$2.7 billion, and an additional \$2.9 billion has been allocated to debt servicing during that period. Lebanon's Council for Development & Reconstruction has awarded nearly 100 contracts valued in excess of \$2 billion in 1993 alone.

PRODUCTION

Mineral output entirely from indigenous deposits was limited to the production of salt and the quarrying of raw materials for the construction industry. The petroleum processing and steel industry relied on imported crude oil and scrap as raw materials. Actual production data have not been reported in recent years. Data reported in this chapter are estimates based upon best available information. (See table 1.)

TRADE

Trade in mineral commodities firmed with the returning stability to the region and to the Lebanese economy. Iraqi crude oil and petroleum products shipments were replaced by Syrian crude oil and for the most part Syrian products between 1990 and 1992. Crude oil imports were interrupted in mid-1992 with the suspension of operations at the Tripoli refinery. Kuwait may be the major source of petroleum product imports in the near future pending current negotiations.

The Government was the sole importer of crude oil and petroleum products until June of 1987 when private companies were authorized to import gasoline for the domestic market. With the return of a centralized Government, the import of both crude oil and all petroleum products was reestablished under the sole authority of the Government in early 1993. Petroleum product imports were estimated at approximately 15 Mbbls in 1992, with gasoline accounting for about one-half of all petroleum product imports. Phosphate rock reexports were reported at 215,000 tons in 1992.

Total imports were reported in excess of \$3.6 billion in 1993 with petroleum accounting for \$329 million. Lebanon's balance of payments recorded a surplus of \$1.1 billion in 1993, a significant increase over the \$0.05 billion recorded surplus in 1992.

STRUCTURE OF THE MINERAL INDUSTRY

Lebanon was basically a private-sector-oriented economy. Most mineral operations in Lebanon remained privately owned, including all cement plants, steel mills, and building material quarries. However, petroleum imports, as well as the nation's refineries near Tripoli and Sidon, are controlled by the Ministry of Industry and Petroleum. The Zahrani Refinery near Sidon suspended operations in mid-1989. The Tripoli refinery supplied about 15% of the nation's petroleum product consumption requirements until mid-1992 when it also suspended operations. The lack of funds to purchase crude oil was one of the reasons for these suspensions. Furthermore, the Zahrani Refinery suffered extensive war damage. A decision was reached in early 1994 to

refrain from war-damage repair in favor of completely scraping the refinery because of the obsolescence of its equipment. The Tripoli refinery is scheduled for refurbishing and expansion, increasing its effective capacity from 20,000 bbl/d to 50,000 bbl/d at an estimated cost of \$150 million. The Ministry of Industry and Petroleum plans to engage in a joint venture with a foreign partner to undertake the project.

COMMODITY REVIEW

The bulk of cement manufacturing was centered in the north coastal region of Chekka. Production in recent years has been curtailed for lack of electric power and equipment, as well as other problems inherited from the country's civil war and caused by world market conditions.

As Lebanon's regional conflicts diminish, the increased stability should lead to expansion of the construction industry and an improved outlook for the industrial minerals sector.

INFRASTRUCTURE

The Railways & Transport Authority invited tenders for the construction of an electrified railway along much of the Lebanese coastline. The line is expected to run from Tyre in the south for 205 km to the Syrian border in the north. Construction is to begin in the summer of 1994 and completion is scheduled in 1997. The track is expected to service both passengers and freight. Other infrastructure tenders are for the updating and expansion of the Beirut airport and the construction of a combined conference and commercial center.

The Ports of Tripoli and Sidon were the Mediterranean terminals of two major oil transit pipelines originating respectively in Iraq and Saudi Arabia. The pipelines operated intermittently, frequently halted by disputes over pricing and transit agreements or acts of sabotage. At the close of 1988, Iraq announced that it had decided to abandon all plans to reactivate the pipeline. A small portion of the IPC pipeline, however, was reopened by Syria to allow Syrian crude to flow to the Tripoli

refinery. The transit of crude oil through the Trans Arabian Pipeline (TAPLine) to the Port of Sidon for shipment to world markets ceased in 1975. Intermittent deliveries of Saudi Arabian crude continued to the Zahrani refinery until 1984, when the portion of TAPLine that crossed Syria was closed and the TAPLine facilities in Lebanon were transferred to the Lebanese Government.

The 1993 actual operating capacity of powerplants was 500 MW, although the nominal generation capacity was 1,200 MW. A repair program was under way and is scheduled to be completed by the close of 1994, at which time electric power operating capacity should be at least doubled. Finance is available from the World Bank, Arab funds, Italy, and the European Investment Bank.

Electricite du Liban estimates that generating capacity should reach 2,800 MW by the year 2,000.

OUTLOOK

The country should enjoy a high rate of economic growth for the remaining decade as a result of the economic stimulus encouraged by the newly available finance.

The International Finance Corp. provided five Lebanese commercial banks with a US\$45 million long-term credit line facility for onlending to local small- and medium-sized businesses, for projects that are too small for IFC's direct involvement. The line of credit is designed to assist in the reconstruction of Lebanon. Specifically, it will help small- and medium-scale enterprises that have survived the civil war to replace or modernize plant and equipment or expand their scale of operation.

¹Text prepared Apr. 1994.

OTHER SOURCES OF INFORMATION

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TABLE 1
LEBANON: PRODUCTION OF MINERAL COMMODITIES¹

Commodity	1989	1990	1991	1992	1993*	Annual capacity* ² (Jan. 1, 1994)
Cement, hydraulic* thousand metric tons	900	900	900	1,000	1,000	1,000
Gypsum* metric tons	2,000	2,000	2,000	2,000	2,000	2,000
Iron and steel: Metal, semimanufactures* do.	75,000	75,000	75,000	80,000	80,000	80,000
Lime* do.	10,000	10,000	10,000	15,000	15,000	15,000
Petroleum refinery products:						
Liquefied petroleum gas thousand 42-gallon barrels	'35	3	30	11	—	—
Gasoline do.	'620	'74	'794	'533	—	—
Kerosene do.	'94	'2	'45	'30	—	—
Distillate fuel oil do.	'896	'74	'962	'665	—	—
Residual fuel oil do.	'1,523	'142	'1,876	'1,030	—	—
Other do.	'201	'12	'183	200	—	—
Total do.	3,369	231	3,890	2,469	—	—
Salt* thousand metric tons	3	3	3	3	3	5

*Estimated. †Revised.

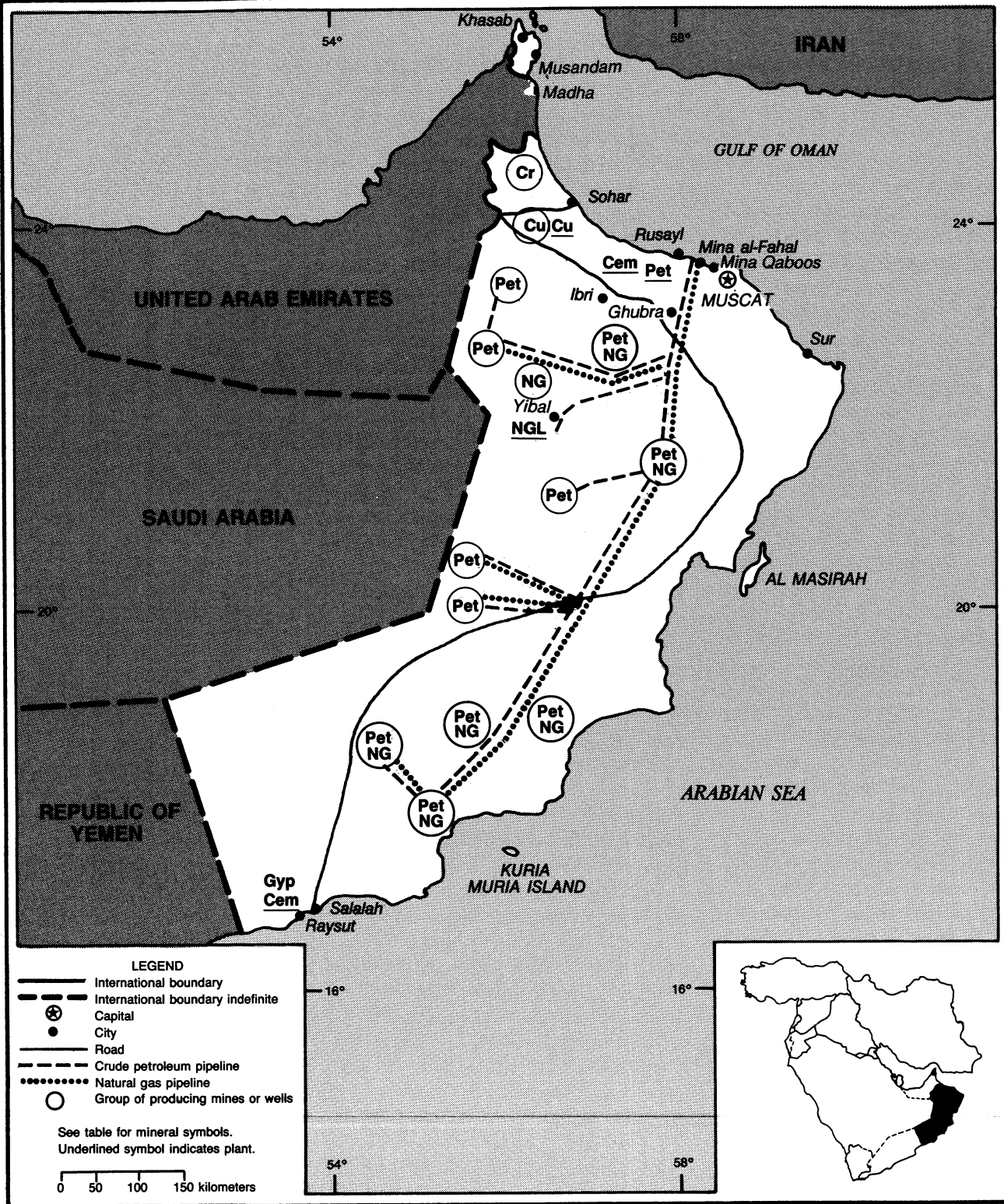
¹Table includes data available through Mar. 15, 1994.

²The first of Lebanon's two petroleum refineries ceased operations in 1989 and is scheduled to be scrapped. The second refinery suspended operations in mid-1992 and is scheduled to be refurbished and expanded to capacity of 50,000 bbl/d by 1995.

OMAN

AREA 212,460 km²

POPULATION 1.6 million



THE MINERAL INDUSTRY OF

OMAN¹

By Bernadette Michalski

Petroleum and natural gas continued to underwrite Oman's developing economy, providing more than 80% of Government revenues. Commercial solid mineral ventures include the mining of chromite, the mining and refining of copper with gold and silver as byproducts, the manufacture of cement, and the production of crushed and dimension stone and sand and gravel. The main industrial facilities also include a petroleum refinery and natural gas processing plants. In 1993 the mineral industry accounted for about one-half of the gross domestic product (GDP), estimated at more than \$12 billion.²

GOVERNMENT POLICIES AND PROGRAMS

Oman, which is not a member of the Organization of Petroleum Exporting Countries (OPEC), plays a prominent role in the Independent Petroleum Exporting Countries group, often acting as a liaison between that group and OPEC. The Sultanate has on several occasions cut oil production in support of OPEC. The latest reduction being in December 1993 as Oman announced a 5% production cut from 800,000 bbl/d to 760,000 bbl/d to help bolster world prices.

The Government has engaged in several international ventures to diversify and broaden its hydrocarbon revenue base. These include the Government's participation in the Caspian Pipeline Consortium, which will transport crude oil from the Tengiz Field in Kazakhstan to the Black Sea; an Omani natural gas liquefaction project to supply growing Asian markets; construction of an undersea pipeline capable of delivering 50 Mm³/d of Omani natural gas to India's west coast industries; the construction of two 120,000-bbl/d petroleum refineries in

partnership with India's Hindustan Petroleum Co. and Baharat Oil Co.; and the construction of a 130,000-bbl/d refinery in Thailand in partnership with Caltex and the Petroleum Authority of Thailand for which Oman is to provide 60% of crude oil throughput.

PRODUCTION

Crude oil production increased to record levels as development activity and enhanced recovery operations continued. Omani crude oil production reached 825,000 bbl/d in late 1993 and averaged about 800,000 bbl/d for the year. About 6% of the crude oil production was refined in Oman. One-half of the resulting product yield was absorbed by the domestic market. Surplus refined products, mostly fuel oil, was exported.

Chromite production was reinitiated in the last half of 1992. Output is entirely destined for export markets. Copper ore output totaled 1.15 Mmt in 1993, down from 1.30 Mmt in the previous year. (See table 1.)

TRADE

Oman exported about 94% of its crude oil production or 275 Mbbl in 1993. This represents an increase of approximately 25 Mbbl over the previous year's exports. Both the heavier crudes of the south and the lighter crudes of the north are gathered and blended into the Omani Export Blend. During 1993, the official price averaged \$15.59 bbl for the year from a high monthly average of \$17.05 bbl in April to a low monthly average of \$12.74 bbl in December. This represented a considerable reduction from the \$18 bbl average price recorded for Omani Export Blend in 1992 resulting in reduced export earnings in spite of increased volume. The Asian nations

were the destination for more than 90% of Oman's petroleum exports. Japan alone received nearly 90 Mbbl. Other importers, by order of magnitude, included the Republic of Korea, Singapore, China, Thailand, and India. The United States imported more than 10 Mbbl of crude oil and nearly 5 Mbbl of unfinished oils from Oman in 1993.

STRUCTURE OF THE MINERAL INDUSTRY

The Petroleum and Mineral Law of Oman, effective since January 1, 1975, governs mineral activities in the country. All minerals are considered Government property until extracted. The royalty tax rate is fixed by a 1976 decree at 20% of the value of production. A 1972 Royal Decree fixed Oman's territorial waters at 12 nautical miles (22.2 km) from the coast, and established sovereignty over the continental shelf to a depth of 200 m.

The Government maintains a majority interest in most companies; however, foreign partnerships are encouraged. The Oman Chrome Co. has limited Government participation with major equities held by private companies and private share distributions.

COMMODITY REVIEW

Oman's copper production was extracted from several operations near Sohar. More than one-half of the ore production was derived from the Lasail underground mine and the Lasail West open pit operations. Mining operations were transferred from the Aarja open pit mine to underground operations in early 1993, supplying less than one-half of total ore output for the year. Only a minor input was realized from the Bayda Mine, where reserves are near exhaustion. The blended ore from all mines was

beneficiated to yield a concentrate that was processed at the adjacent smelter and refinery. Copper cathodes are exported from the Port of Majis, about 17 km northwest of Sohar.

Commercial deposits of copper with a relatively high gold content were discovered at Hajl al Safi and al Raka in Ibri, about 150 km south of the Oman Mining Co.'s smelter at Sohar. The deposits have proven reserves of 7 Mmt grading 2% copper and 1 g/mt of gold.

Oman has signed a \$2 million contract with Minproc Holdings Ltd. of Australia at the close of 1993 for the recovery of gold from sulfide deposits in the Az Zahirah region, about 50 km northwest of Ibri.

The Oman Chrome Co., capitalized at \$7.8 million with 15% Government ownership, 45% allocated to local companies, and the remainder floated on the stock exchange, was formed to develop the chromite reserves across the country. As many as 600 sites have been identified, 3 of which are under exploitation. The chromite produced in 1993 averaged 42% Cr₂O₃, 22% Al₂O₃, 15% FeO, 18% MgO, 1.49% SiO₂, and 0.17% CaO.

About 7 Mm³/d of natural gas was produced from the Yibal Field while the Fahud and Sayh Nuhaydah Fields each accounted for almost 1 Mm³/d. The Bukha natural gas field started production at yearend 1993 at the initial rate of 5,600 bbl/d of natural gas liquids (NGL) and 1.1 Mm³/d of dry natural gas. Natural gas from this field will be transported by underwater pipeline to the Khor Khwair plant in Ras Al Khaimah, one of the United Arab Emirates, for processing.

The collection and processing of natural gas in Oman is networked to three plants: the Fahud gas processing plant, the 2.2-Mm³/d-capacity Sayh Nuhaydah gas treatment plant, and the Yibal gas processing plant with an expanded capacity of 16.6 Mm³/d in 1993. The Government Gas System received more than one-third of production, which is primarily used as fuel for electric power generation. It also is piped to the Sultan Qaboos University, and connecting lines extend up the Batinah Coast to Sohar at the site of the copper refinery. The Government Gas System includes a pipeline that carries gas from Yibal to the

Ghubrah desalination and powerplant and to the Rusayl Industrial Estate, near Muscat. A pipeline also extends south from Sayh Nuhaydah to Zufar, transporting gas for use in the southern oilfields. Field operations, including reinjection, absorbed about one-half of the natural gas produced. Virtually all natural gas production is utilized as less than 10% is flared or lost in transmission.

The Government, reserving a majority equity, formed a consortium responsible for natural gas liquefaction, shipping, and marketing with Royal Dutch/Shell, Total, Mitsubishi Corp., Mitsui & Co., Partex, and the Itochu Corp. The group's proposed \$6 billion natural gas liquefaction project is expected to yield 5 Mmt of liquefied natural gas (LNG) annually with a proposed 1999 startup date. The LNG plant site is to be at Bimmah, 150 km southeast of Muscat.

Petroleum production over the past decade maintained a constant growth spiral. The Petroleum Development Oman Co. (PDO) accounted for 96% of the nation's total petroleum production in 1993. The company operates 1,600 crude oil production wells from 72 producing fields that are linked to 40 gathering stations.

The Tarkep Al Barakan Field, in Occidental Oman's Sumeimah concession in central Oman, was brought on-stream in late 1993. The field's initial capacity is 12,000 bbl/d, raising Occidental Oman Co.'s total production to about 40,000 bbl/d.

The Omani-sponsored Caspian Pipeline Consortium appointed the Bechtel Group and Willbros to build a pipeline system linking the Caspian and Black Seas. The 750-km-long pipeline will carry oil from Kazakhstan, Azerbaijan, and Russia terminating at the port of Novorossiysk. Completion of the link is scheduled for the close of 1995. Initial capacity will be 300,00 bbl/d, rising eventually to 1.5 Mbbl/d. Each of the four members of the consortium has an equal interest in the company. The Government took a 20% interest in Caltex Petroleum's project to set up a 120,000-bbl/d refinery in Rayong, Thailand. The new refinery will accept Omani crude for processing.

The Ministry of Petroleum and Minerals has reported proven copper ore reserves at 8 Mmt and proven chromite ore reserves at 1.6 Mmt. Recoverable

petroleum reserves were estimated by the Ministry of Petroleum and Minerals at 5.1 billion bbls. Reportedly, at least an additional 1.5 billion bbls could be recovered through steam soak, polymer and steam flooding, hot-water injection, and/or electromagnetic heating of the reservoirs. Recoverable reserves of natural gas are reported at 600 billion m³, most of which is nonassociated natural gas. Coal resources in the Misaw Valley are reported at 36 Mmt.

INFRASTRUCTURE

Petroleum and natural gas pipelines total more than 1,600 km. The bulk of crude oil production is serviced by the central pipeline running from the Dhiab Field in the south to the Mina al-Fahal export terminal near Muscat. This terminal can accommodate tankers up to 550,000 dwt. The port has eight storage tanks with a combined capacity of 3.6 Mbbl.

An agreement was signed with the Kuwait Fund for Arab Economic Development for \$20.4 million to help finance an expansion of the Port of Mina Qaboos at an estimated total cost of \$65 million. The port's annual handling capacity is to be expanded from 1.6 Mmt to 2.6 Mmt. In view of the anticipated increased traffic, the port entrance channel and basin were to be dredged to a depth of 13 m. A cargo storage area of 15 ha will be created by using landfill from the dredging to level the existing terrain. New port complexes also are being considered near Sohar and Bimmah.

Projects augmenting the central grid generating capacity and extending the power network are in various stages of implementation. Expansion work at Ghubra, Oman's largest power station, is to be completed in 1995, including the installation of two additional 125-MW-capacity natural gas turbines.

Foreign workers made up 67% of Oman's labor force of 422,000 in 1993. The Government has introduced legislation to minimize dependence on expatriate workers. The legislation bans expatriates from taking a range of jobs in an attempt to create job opportunities for nationals. Jobs now restricted only to Omanis include mechanical equipment operation.

OUTLOOK

The Sultanate of Oman has enjoyed a stable economy sustained by hydrocarbon revenues for more than a decade, and the economy is expected to continue in this vein. The discovery of new reserves outpace reservoir withdrawals, affording a substantial economic base for at least the next 15 years at the current rate of production. Increasing overseas investments should place Oman in a more secure position when its own petroleum reserves are depleted.

The formation of the Oman Chrome Co., 15% state owned, 45% allocated to local companies, and the remainder floated on the stock exchange, reflects the

Government's policy of encouraging private involvement in mineral industries.

¹Text prepared Apr. 1994.

²Values were converted from Omani rial (RO) to U.S. dollars at the rate of RO.3862=US\$1.00.

OTHER SOURCES OF INFORMATION

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TABLE 1
OMAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Cement, hydraulic	947,672	999,887	995,000	970,000	1,000,000	1,000,000
Chromite, gross weight	12,810	—	—	1,764	10,000	15,000
Copper:						
Mine output, Cu content	16,600	14,000	14,000	13,600	12,000	14,000
Metal:						
Smelter	15,200	12,100	12,200	14,973	² 27,673	28,000
Refinery	15,080	12,010	¹ 11,413	¹ 16,236	³ 20,539	22,000
Gas, natural:						
Gross million cubic meters	4,850	5,290	5,292	5,313	5,400	6,000
Dry do.	2,682	3,007	3,025	3,110	3,150	5,000
Gold kilograms	³ 35	³ 54	³ 58	94	90	95
Natural gas liquids thousand 42-gallon barrels	2,135	2,129	2,200	2,300	2,300	2,300
Petroleum:						
Crude do.	233,800	250,100	² 258,500	270,800	² 292,500	300,000
Refinery products:						
Gasoline do.	3,848	4,056	4,077	4,440	4,500	4,500
Jet fuel do.	1,116	2,170	2,380	2,370	2,500	2,500
Kerosene do.	80	85	85	80	90	90
Distillate fuel oil do.	4,406	4,565	4,565	4,582	4,600	4,600
Residual fuel oil do.	9,174	11,317	11,317	12,070	12,500	13,000
Other do.	780	800	800	850	900	900
Total do.	19,404	22,993	23,224	24,392	25,090	25,590
Sand and gravel thousand tons	5,539	5,899	5,900	6,536	6,500	7,000
Silver kilograms	2,650	³ 3,000	² 2,834	³ 3,205	3,300	3,500
Stone:						
Marble do.	33	35	35	54	55	60
Other do.	1,396	1,973	2,000	2,000	2,000	2,000
Sulfur: [*] Hydrocarbons	25,000	30,000	40,000	40,000	40,000	40,000

*Estimated. Revised.

¹Table includes data available through Mar. 15, 1994.

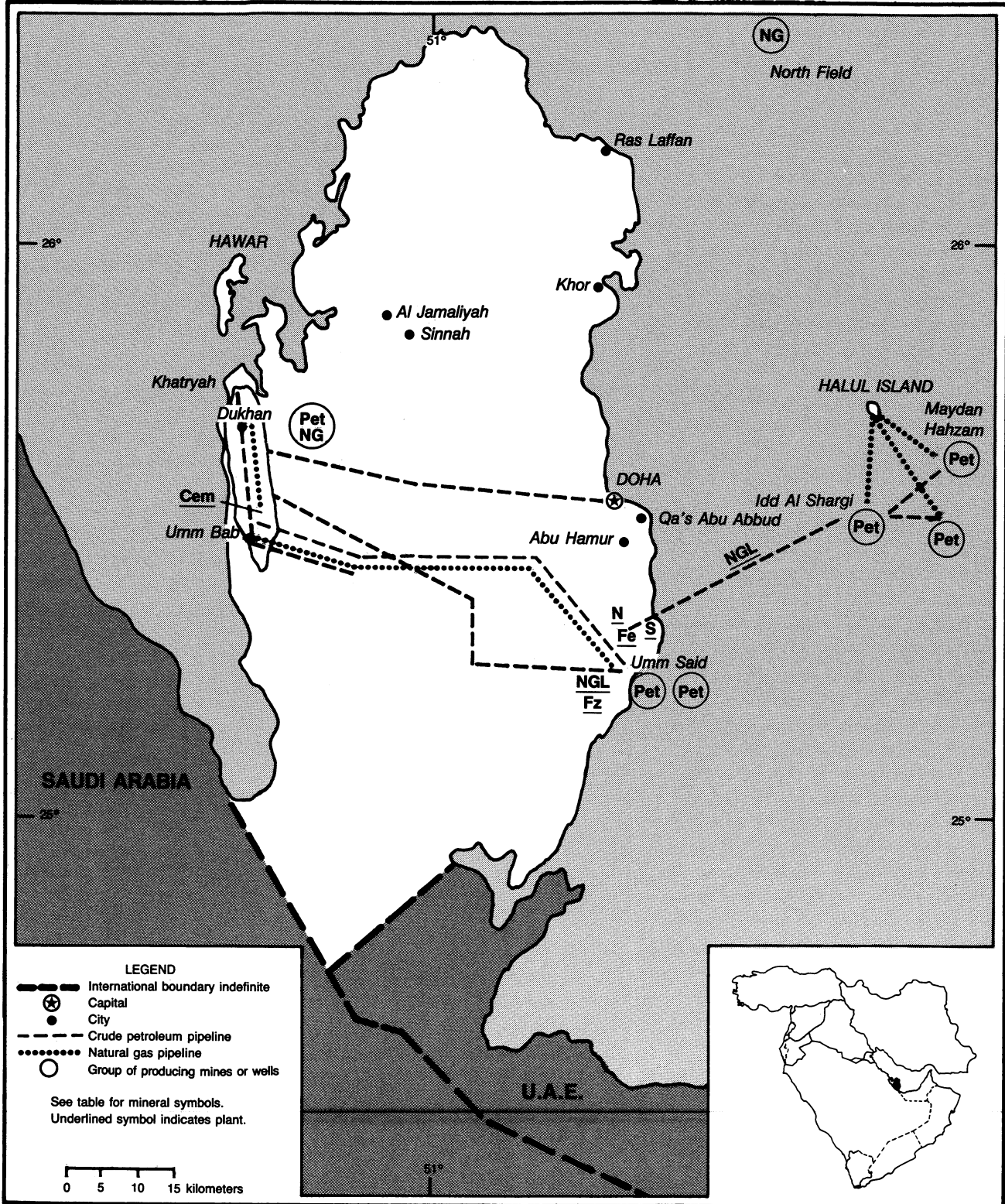
²Reported figure. Includes 17,829 tons of anode as toll/custom output.

³Reported figure. Includes 12,610 tons of cathode as toll/custom output.

QATAR

AREA 11,000 km²

POPULATION 0.49 million



THE MINERAL INDUSTRY OF

QATAR¹

By David Izon

Qatar produced less than 1% of the world's output of crude oil in 1993, its major mineral product, along with natural gas. The Government sought to develop the North Field by studying the expansion of two existing joint ventures to streamline the liquefied natural gas (LNG) program. Development of the North Field's phase 1 and phase 2 gas projects could determine the economic future of Qatar. The huge nonassociated gas reserves of the North Field were considered to be the largest in the world at about 5 trillion m³. Qatar's economy continued to be largely dependent on the oil industry, which accounted for more than 28% of a gross domestic product of about \$8.1 billion² in 1993. Oil- and gas-related exports dominated the external trade sector and generated about 90% of Government revenues and 95% of mineral export.

The Government's shipping company acquired more ships to boost the country's capacity to handle its shipping needs, particularly for LNG. It transports petrochemicals, fertilizers, steel bars, and other locally manufactured goods to overseas markets and vice versa.

The Government stepped up measures to attract foreign and local investors to participate in the economy and particularly in the natural gas industry. The investment laws of 1980 were amended to allow foreign equity participation in private-sector joint ventures.

GOVERNMENT POLICIES AND PROGRAMS

The Government focused more attention on the development of the North Field gas projects. Gas was to be the main energy source and feedstock, such

as at Ras Laffan industrial city. Also, expansion of facilities at Umm Said was mostly dependent on the North Field developments. The Government signed several contracts and agreements on the LNG and petrochemical projects.

The Government, through Qatar General Petroleum Corp. (QGPC), was involved in two major ventures; both were at Ras Laffan, the nearest landfall to the North Field. The LNG export terminal and liquefaction plant were currently under construction. Mobil Corp. of the United States and QGPC also signed an agreement to establish a second LNG venture in Ras Laffan, in which QGPC held a 70% share and Mobil, 30%. Mobil would be the operator of the facility, scheduled to start production in 1998 at 10 Mmt/a. The Chamber of Commerce and Industry's standing committee continued to act as intermediary between Government and business to promote the role of the private sector in industry and boost economic activity.

The Government encouraged foreign investments. Foreign investors entering into joint ventures with Qatari partners could hold a maximum 49% share of business. Importers were required by law to have an import license for almost all products, but import licenses were issued only to Qatar citizens. Even in the case of joint ventures, the import license is issued to the Qatari partner. Although wholly foreign-owned firms were allowed to operate in Qatar, they must have a local sponsor. Investment in major chemical, oil and gas, and steel industries were restricted to the Government through QGPC and specialized international firms.

PRODUCTION

Production of nonfuel minerals, such

as cement, fertilizer, and steel, increased. Cement is produced from domestic and imported clinker. Production in excess of plant capacity at the steel and fertilizer facilities continued and stemmed from minor technological improvements made at the plants. Also, the frequency and length of shutdown and maintenance time was reduced significantly to meet demand. (See table 1.)

TRADE

Qatar's mineral economy continued to be largely dependent on the oil sector. Oil exports accounted for about 90% of Government revenue and about 95% of export earnings. Qatar continued to sell crude oil and refined products under term contracts to Japan and Far Eastern countries. The country's major trading partners, in order of importance, outside its neighbors were Japan, the Republic of Korea, Brazil, Western Europe, and the United States. Qatar also traded its other commodities, such as cement, fertilizer, and iron and steel, to neighboring gulf countries.

Qatar imported pelletized iron ore from Bahrain and equipment and raw materials for the steel and construction industries from Japan, Western Europe, and the United States. Other imports from the United States included medicinal and pharmaceutical products, machinery and transport equipment, power generating machinery and equipment, nonferrous metals, such as copper and copper alloys, aluminum semimanufactures, zinc and zinc alloys, vehicles, and heavy machinery.

STRUCTURE OF THE MINERAL INDUSTRY

Qatar's mineral industry continued to

be dominated by the oil and gas sector. In 1993, about 25% of the labor force of about 1,700 was employed in oil-related industries. The 600,000-mt/a aluminum smelter's new equity partners with the Government included Trafalger House, Glynweld International, Southwire Group, and British Aerospace, all of the United Kingdom. The only known company without any Government interest was Al Jabor, a sponge iron plant with a capacity of 1.2 Mmt/a. Its joint-venture partners were Ferrostal of Germany (35%) and an Indian group (30%). Al Jabor owns 35% interest in the company.

COMMODITY REVIEW

Qatar Steel Co. (QASCO) chose M N Dastur Engineering International of India and Mitsui & Co. of Japan to conduct technical and marketing feasibility studies for expansion of its plant. The \$275 million project would increase production to 1.2 Mmt/a from its present capacity of 560,000 mt/a. The expansion project would include building a new plant that would produce reinforced steel bars with a capacity of between 300,000 and 500,000 tons. Production in the past 4 years has been above design capacity by about 80%, (83% in 1993). Annual profit in 1993 was 44% higher compared with that of 1992, \$40 million. About 90% of QASCO's output is exported to Gulf Cooperation Council States and to the international market. The remainder is sold to the domestic market. QASCO distributed 3% of its annual profits to its employees. The expansion is expected to start in parallel with Qatar Electricity and Water Co.'s increase in local generating capacity. Qatar anticipates utilizing much of the less expensive gas from its North Field.

Qatar Fertilizer Co. (QAFCO), the sole producer of fertilizer, was a 75-25 joint venture of Qatar General Petroleum Corp. and Norsk Hydro of Norway, respectively. QAFCO's \$500 million expansion project moved closer to fruition after a letter of intent was signed by QAFCO and a consortium of Uhde of Germany and Belleli of Italy. Completion of QAFCO III, a 1,500-mt/d ammonia

and 2,000-mt/d urea plant, is planned for 1997. Uhde would carry out the project's design and engineering, together with supply of equipment, while the Italian partner would undertake fabrication of units and on-site construction. The facility would use Uhde's process for ammonia production and Stamicarbon's for urea. QAFCO also appointed Eurotenica of Italy to conduct a feasibility study for a planned 20,000-mt/a melamine project. The \$60 million project would be built at Umm Said next to the QAFCO plant.

Qatar Liquefied Gas Co. (Qatargas) was established in 1984 to develop the North Field for the production of natural gas and condensate and to build and operate a gas liquefaction plant to produce LNG for export. Several projects were undertaken, entailing the development of the North Field to provide feedstock for such gas liquefaction facilities as the LNG plant, tankers, port, and powerplants. Qatar could become a major gas exporter by the turn of the century. Sale of gas by pipeline also was being studied. Contract for sale of 4 Mmt/a of LNG to Chubu of Japan was finalized in early 1994. Mobil Oil Corp. of the United States replaced British Petroleum Co. in development of phase 2 of the North Field LNG project. Mobil's share held at 10%, but Mobil took a 30% share in a new venture with QGPC at Ras Laffan (RASGAS) to start production of 10 Mmt/a of LNG after 1998. Construction work for phase 2 progressed in 1993 and completion is scheduled for 1997. The U.S. firm's "Air Process" was selected for use at the LNG plant. The country's recoverable oil reserves were about 3.7 billion bbl.

INFRASTRUCTURE

Qatar has continued to develop its infrastructure, although the petroleum and natural gas transportation facilities were already quite modern. There were 235 km of petroleum and 400 km of natural gas pipelines, running east to west from Doha to Dukhan, and from Umm Said through Umm Bab to Dukhan. Other pipelines also link offshore fields in the Persian Gulf to Umm Said. Crude oil and

gas exports were from four terminals: Halul Island, which serves the offshore fields; Umm Said, which serves the onshore fields; and Ras Abu Abbud and Abu Hamur, which are used for refined products. Major cargo ports were at Ad Dawhah and Musayid. The construction of the new port at Ras Laffan should provide a center for exploitation of natural gas from the offshore North Field.

OUTLOOK

The North Field gas projects are to be given top priority because of abundance of natural gas and the expected growth in demand worldwide. Development of the gasfields to full capacity by the year 2010 remained an urgent program that should guarantee its economic well-being into the next century. Electricity generating facilities of European and Far Eastern countries are particularly targeted because of the high demand from this part of the world, the low price of gas, and the limited effect on the environment. The addition of Mobil Oil Corp. to the LNG project should prove beneficial to Qatargas.

¹Text prepared Sept. 1994.

²Where necessary, values have been converted from Qatari riyals (QRls) to U.S. dollars at the rate of QRls3.64=US\$1.00 in 1993.

OTHER SOURCES OF INFORMATION

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TABLE 1
QATAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Cement, hydraulic	300,000	267,000	526,527	544,348	544,000	544,000
Gas, natural:						
Gross million cubic meters	6,750	7,500	8,000	12,000	17,500	18,000
Dry do.	6,090	6,800	7,200	10,800	15,750	16,000
Iron and steel: Metal:						
Direct-reduced iron thousand tons	531	530	530	567	601	620
Steel, crude do.	550	580	561	588	610	620
Semimanufactures do.	530	540	540	588	609	620
Natural gas liquids ³ thousand 42-gallon barrels	³ 13,231	14,600	18,250	18,250	18,200	18,500
Nitrogen: N content of ammonia	586,908	583,620	568,965	³ 621,662	621,000	622,000
Petroleum:						
Crude thousand 42-gallon barrels	117,214	148,044	142,788	154,891	152,500	155,000
Refinery products:						
Gasoline do.	3,650	4,750	4,750	4,750	4,700	4,700
Jet fuel do.	2,920	3,800	3,800	3,800	3,800	3,800
Kerosene do.	1,310	1,710	1,710	1,700	1,700	1,700
Distillate fuel oil do.	4,745	6,175	6,170	6,100	6,100	6,100
Residual fuel oil do.	5,840	7,595	7,500	7,500	7,500	7,500
Other ⁴ do.	1,825	1,800	2,000	2,000	2,000	2,000
Total do.	20,290	25,830	25,930	25,850	25,800	25,800
Stone: Limestone ⁵ thousand tons	900	³ 810	850	900	900	900
Sulfur	52,000	50,000	40,000	60,000	60,000	60,000

*Estimated.

¹Table includes data available through Sept. 20, 1994.

²In addition to the listed commodities, Qatar also produced clays, gypsum, and sand and gravel for construction purposes.

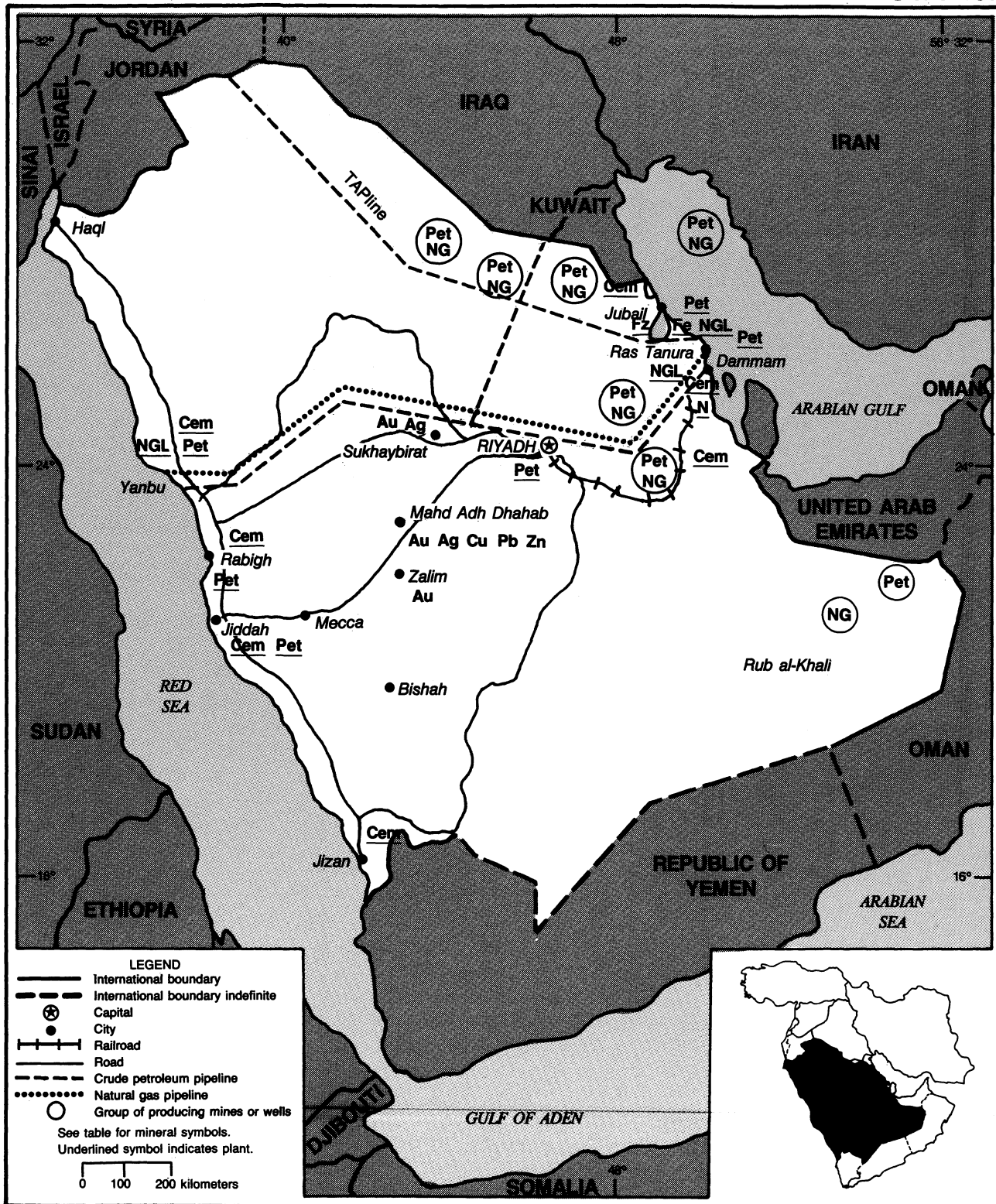
³Reported figure.

⁴Includes refinery fuel and losses.

SAUDI ARABIA

AREA 2.0 million km²

POPULATION 18 million



THE MINERAL INDUSTRY OF SAUDI ARABIA

By Bernadette Michalski

The Kingdom achieved a significant diversity in its mineral industry through its copper and gold mining operations, cement, fertilizer, and steel manufacturing facilities. Newly developing bauxite, iron ore, and zinc mining operations will increase this diversity. The bulk of revenues and export earnings continue to be generated by the hydrocarbon industries, including downstream refining and petrochemicals. Saudi Arabia remains the world's largest producer of crude oil and the third largest producer of natural gas.

The gross domestic product (GDP) was \$110,200 million;¹ nominal GDP growth was reported at 5% in 1992 and 1% in 1993. The oil sector accounted for 34% of GDP, 75% of Government revenues, and 90% of total exports.

The Saudi Government announced a total budget of \$52.5 billion for 1993, 8.8% higher than the previous year's budget. Total Government revenues for 1993 were estimated at \$45.1 billion. The forecast budget deficit was estimated at \$7.4 billion.

GOVERNMENT POLICIES AND PROGRAMS

As did its predecessors, the Economic Development Plan for 1990-95 continued to emphasize the maintenance of national economic stability through careful management of Government expenditures. It also placed emphasis on the diversification and expansion of the economic base while securing a more balanced allocation of resources between the different regions of the country. During 1993, the Directorate General of Mineral Resources (DGMR) focused on the economic assessments of resources of bauxite, gold, iron ore, phosphate rock,

and zinc. The Government continued to encourage private capital to participate in the Kingdom's economic development.

In mid-1993, the council of ministers announced the merger of the Saudi Arabian Marketing and Refining Co. (Samarec), with 12,000 employees, into Saudi Aramco, with 47,000 employees. The resulting entity became the world's largest integrated petroleum company. In August, the Government transferred the General Organization for Petroleum and Mineral's (Petromin) share of the joint-venture refineries with Shell, Mobil, and Petrobra to Saudi Aramco.

PRODUCTION

Crude oil, the Kingdom's principal mineral commodity, averaged production of 8.2 Mbbbl/d in 1993 and 8.1 Mbbbl/d during the first quarter of 1994. The first stage of the 5-year expansion project came on-stream in May 1993, increasing production capacity by 500,000 bbl/d from the offshore Marjan Field. Similar expansion work at the Abqauq, Hawiyah, Safaniya, and Zuluf Fields was effected. Additional capacity was brought on at three new fields south of Riyadh in the second half of 1993, adding a further 150,000 bbl/d to 200,000 bbl/d capacity. Saudi Aramco attained a sustainable capacity of 10 Mbbbl/d by early 1994, well ahead of its 1995 target. (See table 1.)

TRADE

Saudi Arabia's major export markets are in Asia, which accounts for about one-half of total exports; North America, 24%; Western Europe, 20%; and the countries of Africa, South America, and the Cooperation Council for the Arab

States of the Gulf (GCC), the remainder.

Saudi Arabian exports are dominated by hydrocarbon products and derivatives. Crude oil exports averaged 6.34 Mbbbl/d while product exports averaged 849,000 bbl/d in 1993. Spot prices for Saudi Arabian crude oils ranged from a high in March of \$17.39 per bbl for 34° Arabian Light and \$14.44 per bbl for 27° Arabian Heavy to a low of \$12.50 per bbl and \$10.20 per bbl in December, respectively. The value of petroleum exports in 1993 was estimated at \$37.9 billion, about \$5.5 billion below the previous year owing to price declines resulting from lower demand.

The geographical distribution of crude oil exports has changed dramatically over the past decade from a focus on the Far East toward a more balanced global distribution. In the early 1980's, more than 50% of annual crude oil exports was delivered to clients in the Far East, particularly Japan, and less than 10% to North America. In 1993, about 35% of crude oil shipments was directed to Europe, 25% to North America, and 25% to the Far East. During 1993, Europe imported 2.2 Mbbbl/d, and Japan imported 1.3 Mbbbl/d. Petroleum imports by the United States totaled 1.4 Mbbbl/d, including 131,000 bbl/d of petroleum products, mostly unfinished oils, liquefied petroleum gases, and gasoline. Saudi Arabia remained the leading supplier to the United States, accounting for 17% of the U.S. petroleum imports in 1993. During the first half of 1994, U.S. petroleum imports from Saudi Arabia exceeded 1.4 Mbbbl/d. Saudi Arabian exports of natural gas liquids, which averaged 583,000 bbl/d, earned a reported \$2.5 billion in 1993.

The value of non-oil exports increased rapidly over the past decade. In 1983,

they were valued at about \$1 billion, rising to \$5.5 billion in 1993. This increased value is principally attributed to the expansion in petrochemical exports, although the Kingdom has recently become a net exporter of iron and steel products as well.

Total imports were valued at \$30 billion in 1992. The United States remained the largest exporter to the Kingdom, accounting for 20% of Saudi Arabia's imports. Japan is second with 13.7% of the market share, while the United Kingdom is in third place with 11.3% of the market share.

Most imports were subject to customs duties at rates ranging from 12% to 20%. Imports from members of the GCC were exempted, provided that at least 40% of the value added was affected in GCC countries and at least 51% of the capital of the producing firm was owned by citizens of GCC member countries.

The monetary authorities and all other residents, including private persons, can freely and without license purchase, hold, and sell gold in any form, at home or abroad. They can also without license and without payment of any customs duty or tax trade gold in any form with the exception of gold of 14 carats or less, the import of which was prohibited.

STRUCTURE OF THE MINERAL INDUSTRY

All minerals, including the vast petroleum and natural gas reserves, are owned by the Government. Their exploitation was predominantly controlled by Government organizations. (See table 2.) The parastatal, Saudi Aramco, is the only company authorized to engage in oil exploration and development in the Kingdom.

COMMODITY REVIEW

Metals

Bauxite.—The DGMR invited applications for a feasibility study covering the exploitation of the Az Zabirah bauxite deposit about 470 km

northwest of Riyadh. The deposit is part of a cretaceous paleolaterite that outcrops in three main zones over a distance of 105 km. Movable reserves are estimated at 102 Mmt of essentially monohydrate ores averaging 57.5% Al_2O_3 , 6% SiO_2 , and 8% Fe_2O_3 .

Ferroalloys.—The Gulf Ferroalloys Co. (Sabayek), owned by GCC investors, confirmed plans to construct a ferroalloy complex at Jubail, a location that will enjoy the advantage of accessibility to high-quality quartz and inexpensive energy. The complex will include a 25,000-mt/a-capacity ferrosilicon plant, one 10,000-mt/a silicon metal furnace, and a 30,000-mt/a silicomanganese and 10,000-mt/a ferromanganese production. The ferrosilicon production will be slated for export because domestic needs do not exceed 3,000 mt/a. Silicon metal, silicomanganese, and ferromanganese production is intended for local consumption. About one-half of the financing for the \$120 million project will be supplied by the Saudi Industrial Development Fund, Sabayek's equityholders will fund 30%, and bank loans will supply the remainder.

Gold.—Several commercially significant gold deposits have been discovered in the Arabian Shield. In 1993, gold recovery continued at Mahd Adh Dhahab, 275 km northeast of Jiddah, and at Sukhaybirat, about 480 km northwest of Riyadh. Production from Mahd Adh Dhahab was reported at 4,973 kg while production at Sukhaybirat was reported at 2,546 kg.

DGMR is investigating other potential sites, including Jabal Shayban, about 140 km northeast of Jiddah; at Hamdah; at Najadi, about 40 km north-northeast of Sukhaybirat; and at Murayjob, 90 km north-northeast of Yanbu and in the Amayir al-Madan area.

By the close of 1993, construction commenced on Dhahab Co. Ltd.'s 110-mt/a gold refinery in Jiddah. Completion is scheduled for mid-1995.

Iron and Steel.—A feasibility study by British Steel Consultants recommended

construction of a 2.2-Mmt/a pelletizing plant to process concentrates from the Wadi Sawawin deposit 60 km from the Red Sea coast and 900 km north of Jiddah. The Fe content of the fine-grained-taconite ore body ranges from 42% to 45%. Pilot plant tests produced a concentrate with an Fe content of 67.5% at 75% recovery. The method of beneficiation developed for the project requires 1 m³ of clean water for every ton of ore processed. The basic technology was developed using the Tilden process pioneered by the U.S. Bureau of Mines in the 1970's. The projected startup date is 1997.

The expansion program at the Saudi Iron and Steel Co.'s (Hadeed) complex at Al-Jubayl was completed in 1993, raising capacity to 2.3 Mmt/a. The plant's feedstock is a combination of sponge iron and scrap. Hadeed is also considering the development of a flat products complex for which it commissioned a preliminary feasibility study. The Saudi market for flat products is projected at 800,000 by mid-decade.

Silver.—Production in conjunction with gold mining operations at Mahd Adh Dhahab yielded 15,022 kg in concentrate and 2,757 kg in doré bullion.

Zinc.—During the year, the Arabian Shield Development Co. (Dallas, Texas) was issued a lease to develop the Al-Masane polymetallic sulfide deposit containing demonstrated reserves of 7 Mmt averaging 5.33% Zn, 1.44% Cu, 1.2 g/mt Au, and 43 g/mt Ag. The prefeasibility study on the Khnaguiyah deposits, about 170 km west southwest of Riyadh, also was completed during the year. Site production projections are 34,400 tons of Zn concentrates and 2,400 tons of Cu concentrates to be trucked to the ports of Al-Jubayl or Yanbu for shipment to smelters.

Industrial Minerals

Cement.—The Saudi Consolidated Cement Co., with an annual capacity of 3.4 Mmt, accounted for more than 20% of the Kingdom's available cement capacity. This company was formed by

the merger of the Saudi Cement Co. and the Saudi-Bahraini Cement Co.

Saudi Arabian cement demand rose to 18 Mmt in 1993 as a result of the current construction boom. Consequently, the expansion of the domestic cement industry accelerated as six plants are either implementing or planning expansion programs. Projects under consideration include increasing the capacity at Saudi Consolidated Cement Co.'s plant at Hofuf from 1.4 Mmt/a to 2.4 Mmt/a kiln conversion and capacity expansion at Yamamah Cement Co.'s plant near Riyadh, and increasing capacity by 1.5 Mmt at Southern Province Cement Co. The Arabian Cement Co. in Rabigh announced plans to add 1 Mmt to 1.5 Mmt to the plant's current capacity of about 1.4 Mmt/a. Plant upgrading and expansion is planned at Qasim Cement Co.'s 1.4-Mmt/a-capacity plant in Buraidah, raising output to 1.5 Mmt/a. The addition of 2.5 Mmt/a of capacity at Yanbu Cement Co. was underway. Sales at Yamama Cement Co. were reported at 2.9 Mmt in 1993.

The Tabuk Cement Co., established in 1992, proceeded with plans to construct a 1.1-Mmt/a-capacity cement plant at Duba on the Red Sea coast. Investment is projected at \$240 million.

Fertilizers.—A reorganization of the Kingdom's fertilizer industry is under consideration by the Saudi Basic Industries Corp. (Sabic). A merger of three state-owned companies, Ibn Al Baytar, Safco, and Samad, was planned by the third quarter of 1994. The three companies have the combined capacity to produce more than 3 Mmt/a of fertilizers. The merger is intended to increase efficiency and boost earnings as a part of a general effort to reduce the budget deficit.

Phosphate.—In early 1994, prequalifying bids were invited to exploit phosphate rock deposits in Al-Jalamid, about 120 km from Turayf, near the Jordanian border. DGMR reported proven reserves as 213 Mmt of ore averaging 21% P₂O₅. Companies were

invited to submit bids for the project, including mining, beneficiation, pipeline transport, and the building of a 2.9-Mmt/a diammonium phosphate plant in Al-Jubayl. Extraction is scheduled by conventional open pit method. The beneficiation process is expected to involve the manufacture of 4.5 Mmt/a of phosphate concentrate that will be transported by slurry pipeline to Al-Jubayl. The DGMR projects the total investment at \$147 million for mining and beneficiation, \$887 million for the fertilizer plant, and \$714 million for associated infrastructure.

Soda Ash.—The International Chemical Industries and Trading Co. Ltd. (ICIT) is proceeding with the construction of a 264,000-mt/a-capacity soda ash plant at Al-Jubayl. Total project cost was estimated at \$270 million. The Arabian Mining and Manufacturing Co. (AMAM) has been set up as a Saudi joint stock company to secure finance for and manage the soda ash project. ICIT has taken 35% of the new company's equity of 265 million Riyal. The plans are to float AMAM publicly on the stock exchange.

Limestone feed for the plant will be obtained from a deposit between Riyadh and Oman. The current domestic market, principally the glass industry and water-treatment industry, consumes about 100,000 mt/a. Consumption is expected to rise to 120,000 mt/a by 1995. The remaining production is slated for export to other Gulf nations.

Titanium Dioxide.—The National Titanium Dioxide Co., Cristal, has inaugurated its 54,000-mt/a-capacity TiO₂ plant at Yanbu. The plant was built by Bechtel of the United States at a cost of \$200 million. It employs a chloride route process on rutile and ilmenite imported from Australia. To ensure a chlorine supply, Cristal has formed a joint-venture company, Arabian Chlorine Industries, with Basic Chemical Industries.

Mineral Fuels

Natural Gas.—The Kingdom's master gas system has the capacity to process 45

billion m³. This amount is associated with a crude oil production of about 8.2 Mbbbl/d. Natural gas processing capacity has not kept pace with the recent expansion in crude oil output. Consequently, Saudi Aramco flared or reinjected substantial quantities of gas during the recent periods of peak production. The demand for natural gas has risen by about 10% annually in this decade. Exploration for nonassociated gas may be increased and local industries may be encouraged to reduce natural gas use. However, the production of natural gas liquids (NGL) has substantially increased during the past few years with output approaching 200 Mbbbl/a. Most of this production is exported. Saudi Arabia is the world's largest exporter of NGL with fractionation plants at Yanbu, Ras Tanura, and Ju'aymah.

Petrochemicals.—Sabic ranks as the world's third largest producer of petrochemicals, and most of its output is delivered to world markets. Sabic reported profits of \$565 million in 1993, a slight increase over the previous year, despite a continued downturn in world petrochemicals demand. Production amounted to 17 Mmt in 1993, of which 13.6 Mmt was exported. The principal markets for these products were the Far East, Western Europe, and Southeast Asia.

Plans continued for the construction of new facilities while upgrading and expansion were underway on many of the company's existing facilities. Total production capacity is projected to reach 20 Mmt/a by 1995.

Affiliates of Sabic will have a total production capacity of 2.6 Mmt/a of methyl tertiary butyl ether (MTBE) by 1996. Two production units came on-stream in Saudi European Petrochemical Co., more than doubling capacity from 500,000 tons to 1.2 Mmt by the close of 1993. The National Methanol Co., the Saudi Petrochemical Co., and the Aramco-Mobile Refinery Co. will each have one unit manufacturing MTBE.

The first polyester fiber plant in the Arabian peninsula should be operational in 1995. The 140,000-mt/a-capacity plant

costing an estimated \$350 million was proposed by the Arabian Industrial Fiber Co., a partnership formed in early 1993 by Sabic and local industrial investors.

Petroleum.—Production.—Saudi Arabia attained an average production level of 8.2 Mbb/d in 1993. The Wafra Field in the Saudi-Kuwaiti Partitioned Zone under joint operation by Saudi Arabian Texaco and the Kuwait Oil Co. was not restored to prewar levels by the close of 1993. Production did reach 100,000 bbl/d by November, about 20,000 bbl/d short of prewar levels.

Saudi Arabia's crude oil production consisted of about 700,000 bbl/d of Extra Light Crude, almost 5 Mbb/d of Arabian Light, about 1.2 Mbb/d of Arabian Medium, and about 1.3 Mbb/d of Arabian Heavy.

The majority of Saudi Aramco's expansion projects is in the Eastern Province where new development and exploratory wells are being sunk and older wells worked over. In the north, extra platforms are in place in the Berri Field, gas-oil separators plants have been commissioned, and pipeline networks demothballed. About 60 wells have been recompleted in Safaniya, the world's largest offshore field. The seven fields in the Hawtah group, discovered in 1989-90, are about 100 to 200 km south of Riyadh. Crude oil from these fields will be piped northward to a new junction with the East-West pipeline. This will afford Saudi Aramco the option to switch the flow either eastward to the Ras Tanura refinery and or export terminals on the gulf or westward to the expanded facilities at Yanbu on the Red Sea.

As part of its field development operations, Saudi Aramco has drilled more than 20 horizontal wells. Most wells were drilled at the offshore fields of Safaniya, Zuluf, Marjan, and Berri. Horizontal onshore wells were successfully completed at the Ghawar and Abqaiq Fields. A 150% to 400% increase in productivity by the use of horizontal drilling should enable Saudi Aramco to improve oil recovery rates by 5% to 10%.

Refining.—The combined capacity of eight refineries, including the 30,000-bbl/d Khafji refinery in the Divided Zone, is reported at 1.625 Mbb/d. (See table 2.)

During 1993, Saudi Aramco downsized its ambitious 10-year refinery upgrade and expansion of its Ras Tanura refinery from a planned \$12.5 billion upgrade to a more modest \$1.7 billion upgrade and expansion. The revised upgrade plans call for the installation of a 100,000-bbl/d hydrocracker, a 40,000-bbl/d continuous catalytic reformer, a visbreaker, a sulfur recovery unit, a hydrogen plant, and a sour water treatment plant. The Aramco board of directors approved the revised upgrade program in November 1993. The upgrades are scheduled to come on-line in mid-1998. The project manager is Brown and Root.

Saudi Arabia continued to acquire a worldwide network of refining, storage, and distribution facilities. In addition to its position in the United States through Star Enterprise, Saudi Aramco acquired interests in downstream oil activities in the Republic of Korea. In early 1994, Saudi Aramco finalized an agreement for the acquisition of a 40% holding at the cost of \$502 million in Petron, the refining and distribution subsidiary of the Philippines National Oil Co. However, the refining venture with a Japanese group headed by Nippon Oil collapsed in 1993. Negotiations for positions in China, France, Indonesia, and Italy continue. Direct investment in foreign refining, marketing, and distribution operations establishes for Saudi Arabia a guaranteed market for crude oil and provides stability in the face of market fluctuations.

Reserves

Saudi Arabia's subsoil has the world's largest known concentration of oil. Proven oil reserves were reported at 261.5 billion bbl at the close of 1993, representing more than 26% of total world proven reserves. This current figure does not take into account the central oilfields because appraisal and delineation work is still underway in the

area. At the present accelerated rate of output, Saudi Arabia enjoys a reserve-production ratio sufficient to last 86 years at current production levels. The bulk of the Kingdom's reserves is contained in a few massive fields. These include Ghawar, the world's largest onshore field with remaining reserves of about 70 billion bbl; Safaniya, the world's largest offshore field with 19 billion bbl; Abqauq, with 17 billion bbl; Berri, with 11 billion bbl; Manifa, with 11 billion bbl; Zuluf, with 8 billion bbl; Shayba, with 7 billion bbl; Abu Saafa, with 6 billion bbl; and Khursaniya, with 3.5 billion bbl.

Natural gas reserves were reported at 5.3 trillion m³. Most of the Kingdom's reserves are in the form of associated gas contained in the country's oilfields. The giant Ghawar Field is thus the largest source of natural gas, accounting for approximately 35% of total gas reserves.

INFRASTRUCTURE

Expansion of the East-West pipeline was completed in the second quarter of 1993. The maximum throughput on Petroline, which runs for about 1,270 km from Abqaiq in the Arabian Gulf to Yanbu on the Red Sea, was increased from 3.2 Mbb/d to 4.8 Mbb/d through the installation of additional pumps and turbines at the 11 pumping stations already in operation along the line.

Saudi Arabia has a substantial generating capacity from power units attached to its string of desalination plants. The Kingdom is the world's largest producer of desalinated water, having an installed capacity of 1.9 Mm³/d. Electric power generation capacity was 16,500 MW. Expansion of several existing power and desalination stations and the development of new plants were underway.

Extensive port and harbor facilities serve Al-Jubayl on the east coast and Yanbu on the west coast. Al-Jubayl has an industrial port with a 10-km-long causeway for dry and liquid bulk cargo and a commercial port for general cargo. A fertilizer terminal was completed in November consisting of two jetties for

loading vessels from 5,000 to 50,000 dwt. In Yanbu, the 15-km-long King Fahd Industrial Port is the largest oil port on the Red Sea and one of the longest in the world. The oil terminal at Yanbu has been expanded to handle 6.6 Mbbl/d and can accommodate tankers from 80,000 to 500,000 dwt.

OUTLOOK

Saudi Arabia has emerged from the Gulf War not only in a strong political position but also with a vibrant private sector and renewed prominence as the world's largest oil producer and exporter. The Kingdom's business climate had developed favorably since the Gulf War, contributing to a significant construction boom. Both state and private companies are expanding although the former has somewhat scaled down its programs in view of the 1993-94 downturn in petroleum prices.

Demand for cement began to soar in early 1992 and continued through the present. Prices escalated amid the mounting shortages and total demand increased by nearly 20% in 1993, suggesting that total demand was about 18 Mmt for the year. Modernization and expansion plans were under implementation throughout the Kingdom's cement facilities. Upon completion, domestic cement capacity is projected to attain 20 Mmt/a, virtually doubling the prewar capacity. It is doubtful that the construction industry can maintain this momentum beyond the immediate future and the additional capacity may be absorbed in the world export market.

The merger of Samarec into Saudi Aramco should cut overlapping positions, affording the Kingdom opportunities to reduce the number of foreign nationals employed in the Kingdom while providing more positions for Saudi Arabians. The merger should result in productivity and marketing enhancement as well as a more unified and coherent management of the refining segment. At the same time, Saudi Aramco's expansion program will place the Kingdom in a position to take advantage of the expected growth in world oil demand later in this

decade. Saudi Arabia is eager to secure an outlet for its crude oil in markets with consumer proximity.

Because most of the national income is dependent on markets outside the Kingdom, the economy will remain vulnerable to sudden changes in volume and pattern of worldwide trade in crude and refined petroleum and petrochemicals. Purchasing equity in refining, marketing, and distribution companies in the United States, the Republic of Korea, the Philippines, and Europe eases that vulnerability.

Saudi Arabia is in conflict with the Republic of Yemen over the demarcation of their mutual frontier, which is a region of considerable oil potential. Prospects for a compromise are promising as talks between Riyadh and Sana continue.

In spite of a nearly 30% oil price decline in 1993, the Kingdom remains one of the most attractive credits in the Middle East. Despite the downturn in the public sector, the private sector is bullish. Business confidence remains solid because the private sector, which accounts for more than two-thirds of economic activity, is liquid and is continuing to invest.

The Government announced that public spending in 1994 would be 20% lower than that in 1993 and that the state would achieve the first balanced budget since 1982. There is a partial freeze in capital spending programs, and efforts are being made to restrain recurrent spending. The Kingdom plans to maintain total oil production at no less than 8 Mbbl/d. It has refused to resume the role abandoned in 1985 of supporting oil prices by making unilateral and ad hoc adjustments to its crude oil output. In response to calls for action to bolster oil prices in 1993, the Kingdom affirmed that it would support measures by oil exporters that were equitable and effective but it would no longer make unilateral cutbacks. The Kingdom is committed to a prudent fiscal policy by holding output at present levels, taking a realistic view of oil prices and slashing the deficit.

¹Where necessary, values have been converted from

Saudi riyals (SRIs) to U.S. dollars at the rate of SRIs3.7450=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

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TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity (Jan. 1, 1994)
Copper: Cu content of concentrate and bullion ²	765	895	900	868	*925	*925
Cement, hydraulic thousand tons	11,442	11,983	11,371	15,325	*15,300	*15,500
Gold:						
Mine output, gross weight:						
Ore	100,000	146,000	450,000	806,000	*859,353	*900,000
Concentrate ²	6,977	7,000	7,800	3,900	*4,492	*8,000
Bullion, crude, gross weight kilograms	3,642	5,630	6,400	9,343	*9,253	*10,000
Au content of concentrate and bullion do.	2,900	3,536	4,300	5,626	*7,519	*8,000
Gas, natural: ³						
Gross million cubic meters	46,400	51,265	52,000	66,100	67,200	68,000
Dry do.	29,900	30,800	31,500	34,000	35,900	40,000
Gypsum*	375,000	375,000	375,000	375,000	375,000	375,000
Iron and steel:						
Direct reduction iron do.	1,205	1,085	1,117	1,610	1,700	1,750
Iron and steel: Metal, steel, crude thousand tons	1,810	1,833	1,850	1,900	2,000	2,200
Lead: Pb content of concentrate ²	205	250	250	250	250	250
Lime*	12,000	12,000	12,000	12,000	12,000	12,000
Natural gas liquids:	153,645	194,630	258,400	262,800	265,000	265,000
Propane thousand 42-gallon barrels	70,810	91,250	109,135	114,245	*120,450	*122,000
Butane do.	41,975	57,000	57,000	59,495	*56,575	*59,500
Natural gasoline and other do.	41,000	46,725	41,600	43,435	*40,150	*43,800
Nitrogen: N content of ammonia thousand tons	863	942	827	904	950	1,000
Petroleum: ³						
Crude thousand 42-gallon barrels	1,848,500	2,353,900	2,963,000	3,075,100	2,992,270	*3,200,000
Refinery products:						
Liquefied petroleum gas do.	7,909	7,320	8,380	8,000	8,000	8,500
Gasoline and naphtha do.	124,104	135,991	128,594	140,500	146,000	153,000
Jet fuel do.	18,214	37,800	39,900	40,000	40,000	40,000
Kerosene do.	29,918	51,866	42,000	30,000	25,000	30,000
Distillate fuel oil do.	145,670	124,200	112,500	162,000	165,000	170,000
Residual fuel oil do.	148,348	183,863	161,700	172,000	171,500	175,000
Unspecified do.	13,437	18,033	22,501	32,000	30,000	30,000
Total do.	487,600	561,236	517,256	584,500	*585,500	*606,500
Silver: Ag content of concentrate and bullion ² kilograms	13,321	16,237	4,200	4,350	5,000	5,000
Sulfur: Byproduct, hydrocarbons thousand tons	1,423	1,435	2,000	2,370	2,400	2,400
Urea thousand tons	500	568	598	644	650	700

See footnotes at end of table.

TABLE 1—Continued
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993*	Annual capacity (Jan. 1, 1994)
Zinc: Zn content of concentrate ²	2,580	2,472	2,475	2,475	2,450	2,500

*Estimated. [†]Preliminary. [‡]Revised.

¹Table includes data available through Mar. 15, 1994.

²Mahd Adh Dhahab final products include a bulk flotation concentrate containing gold, silver, copper, lead, and zinc and a crude bullion containing gold, silver, and copper. Ore containing gold and silver from the Sukhaybarat surface mine included since 1991.

³Includes Saudi Arabian one-half share of production in the Kuwait-Saudi Arabia Divided Zone.

⁴Reported figure.

TABLE 2
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Saudi Consolidated Cement Co. (Government, majority shareholder)	Ayn Dar, 75 kilometers southwest of Dammam	3,400
Do.	do.	Al-Hufuf	1,350
Do.	Saudi-Kuwait Cement Co. (Saudi Arabia, 55%; Kuwait, 45%)	Al-Kharsaniyah, 64 kilometers northwest of Al-Jubayl	3,000
Do.	Arabian Cement Co. Ltd. (Government, 100%)	Rabigh	1,500
Do.	Southern Province Cement Co. (Government, 100%)	Suq al-Ahad, 10 kilometers northeast of Jizan	2,500
Do.	Yanbu Cement Co. (Government, 100%)	Yanbu	3,500
Do.	Yamama Cement Co. (Government, 100%)	Riyad	3,000
Do.	Qasim Cement Co. (Government, 100%)	Buraydah	1,320
Ferroalloys	Gulf Ferroalloys Co. (Sabayek) (United Gulf Industries Corp., 26%; Sabc, 15%; Demetal Aussenhandels-gesellschaft, 7%; remainder owned by private Arab investors and financial institutions)	Al-Jubayl	75
Fertilizer:			
Urea	Al-Jubayl Fertilizer Co. (Samad)	do.	632
Amonia	(Sabic, 50%; Taiwan Fertilizer Corp., 50%)		300
Urea	National Chemical Fertilizer Co. (Ibn al-Baytar)	do.	500
Amonia	(Sabic, 50%; Safco, 50%)		500
NPK			500
TSP			200
DAP			350
Liquid fertilizer			10
Urea	Saudi Arabian Fertilizer Co. (Safco)	Dammam	330
Amonia	(Sabic, 41%; Saudi Arabian private interests, 59%)		200
Sulfuric acid			100
Melamine			20
Gold:			
Ore	General Organization for Petroleum and Mineral Resources	Mahd Adh Dhahab, 270 kilometers northeast of Jiddah	180
Metal	(Petromin) (Government, 100%)		5,000
Gold:			
Ore	The Saudi Company for Precious Metals (Petromin, 50%; Boliden International Mining, 50%)	Sukhaybirat, 480 kilometers northwest of Riyadh	700
Meta			2,600

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Natural gas	million cubic meters	Saudi Aramco (Government, 100%)	All oilfields, Eastern Province	35,000
Do.		do.	Khuff Zone, Eastern Province	20,150
Do.		do.	Abqaiq Gas Cap, Eastern Province	4,600
Natural gas liquids ¹	million barrels	do.	Ju'aymah, 33 kilometers northwest of Ras Tanura	145
Do.		do.	Yanbu	110
Do.		do.	Shedgum, 150 kilometers southwest of Dammam	55
			Uthmaniya, 30 kilometers west of Al Hufuf Berri, 15 kilometers north of Al-Jubayl	110 20
Petrochemicals:				
Ethylene		Saudi Petrochemical Co. (Sadaf) (Sabic, 50%; Pecten Saudi Arabia, 50%)	Al-Jubayl	760
Ethylene dichloride				560
Styrene				360
Industrial ethanol				300
Caustic soda				450
Do.		National Methanol Co. (Ibn Sina) (Sabic, 50%; Celanese Arabian, 25%; Texas Eastern Arabian, 25%)	do.	770
Methanol		Saudi Methanol Co. (Al-Razi) (Sabic, 50%; Japan Saudi Arabia Methanol Co., 50%)	do.	1,200
Ethylene		Arabian Petrochemical Co. (Sabic, 100%)	do.	650
Polystyrene				100
Methyl-tertiary-butyl-ether		Saudi European Petrochemical Co. (Ibn Zahr) (Sabic, 70%; Ecofuel, 10%; Neste Oy, 10%; Arab Petroleum Investments Corp., 10%)	do.	700
Petroleum, crude	million barrels	Saudi Aramco (Government, 100%)	Eastern Province and offshore	3,000
Do.	do.	Arabian Oil Co. (AOC) (Japan Petroleum Trading Co., 80%; Kuwait, 10%; Saudi Arabia, 10%)	Khafji Al Hout	90 10
Do.	do.	Texaco (former Getty Oil Co.) (Neutral Zone production shared by Saudi Arabia and Kuwait)	Wafra South Fawaris South Umm Gudair	(?) (?) (?)
Petroleum products	do.	Saudi Aramco (Government, 100%)	Ras Tanura	95
Do.	do.	Rabigh Petroleum Refining Co. (Saudi Aramco, 50%; Petrola, 50%)	Rabigh	115
Do.	do.	Jubail Petroleum Refining Co. Saudi Aramco, 50%; Shell, 50%)	Jubayl	105
Do.	do.	Yanbu Petroleum Refining Co. (Saudi Aramco, 50%; Mobil, 50%)	Yanbu	110
Do.	do.	Saudi Aramco (Government, 100%)	do.	60
Do.	do.	Jeddah Oil Refinery Co. (Saudi Aramco) (Government, 100%)	Jeddah	40
Do.	do.	Riyadh Oil Refinery Co. (Saudi Aramco) (Government, 100%)	Riyadh	50
Do.	do.	Arabian Oil Co. (Japan Petroleum Trading Co., 80%; Kuwait, 10%; Saudi Arabia, 10%)	Al-Khafji	10
Steel		Saudi Iron and Steel Co. (Hadeed) (Sabic, 95%)	Al-Jubayl	2,300

See footnotes at end of table.

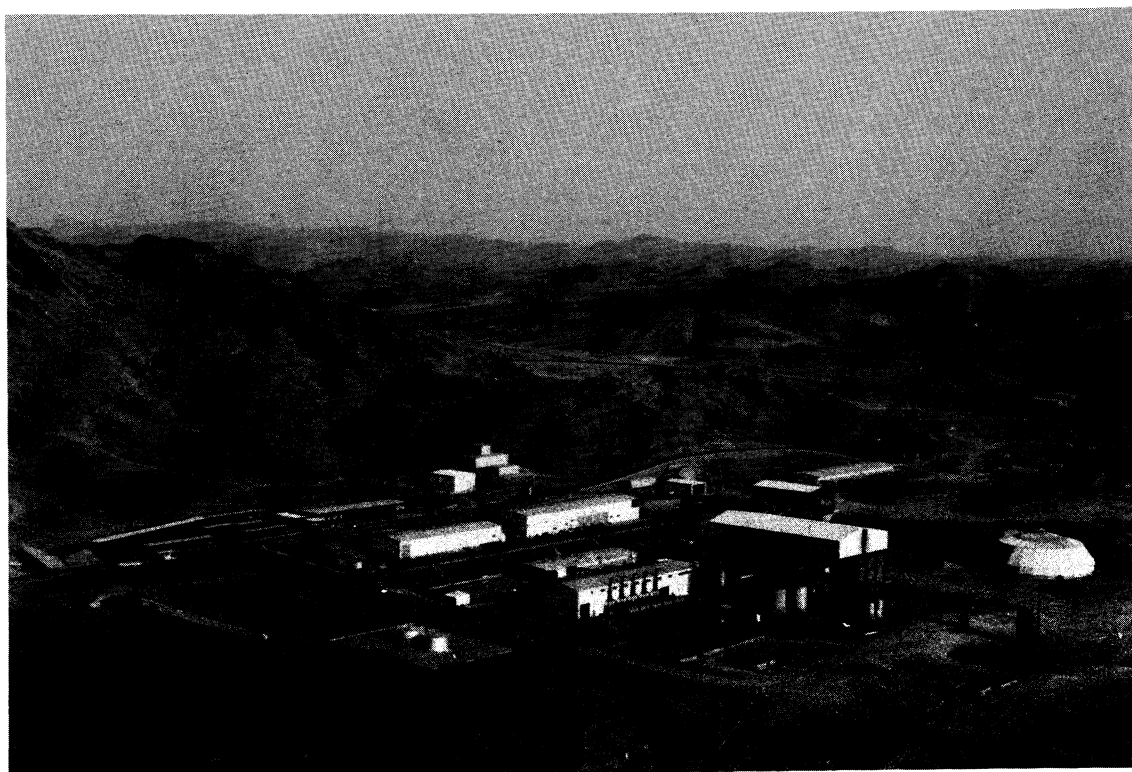
TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Titanium dioxide	The National Titanium Dioxide Co. (Crystal) (Shairco for Trading and Contracting, 25%; National Industrialization Co., 24%; Gulf Investment Corp., 24%; Kerr-McGee Chemical Corp., 25%; private individuals, 2%)	Yanbu	52

¹Natural gas is pumped through the Master Gas System to three processing plants at Berri, Shedgum, and Uthmaniya. Part of their NGL output is delivered to the fractionation plants at Ju'aymah and Yanbu.

²These fields were severely damaged during the Gulf crises and even partial production was not resumed at Wafra until March 1992 while production from the South Fawaris and South Umm Gudair Fields resumed by yearend. Combined production from all three fields did not exceed 50,000 bbl/d by the close of 1992 and attained combined production levels of 100,000 bbl/d by the fourth quarter of 1993.

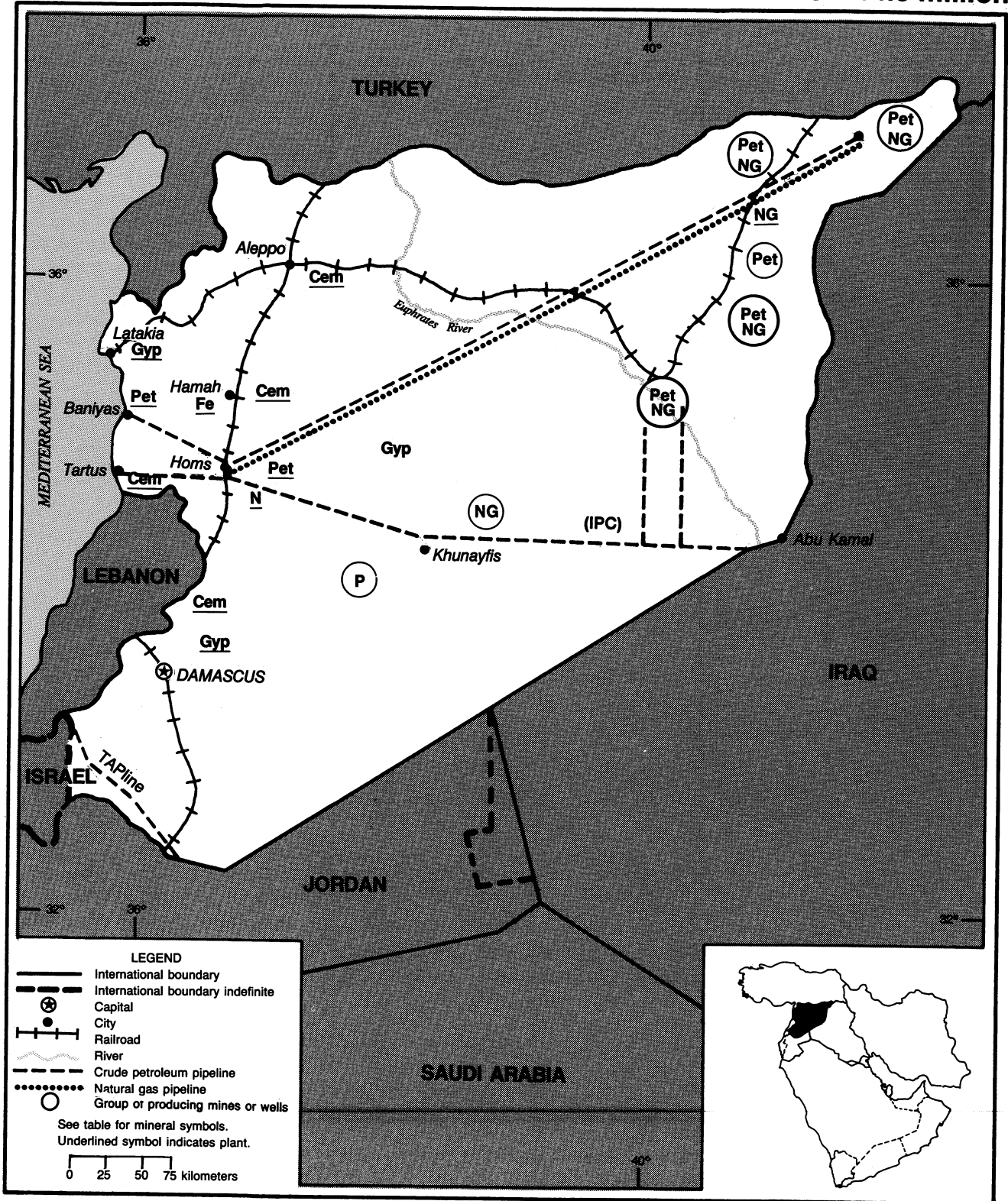


Aerial view of the Mahd Adh Dhahab mining operations where annual gold production was reported at 5,000 kg. Photo: Courtesy of the General Petroleum Minerals Organization, the Kingdom of Saudi Arabia.

SYRIA

AREA 185,180 km²

POPULATION 14.3 million



THE MINERAL INDUSTRY OF

SYRIA¹

By Bernadette Michalski

The mineral industry accounted for approximately \$6 billion of the nation's \$30 billion gross domestic product.² Hydrocarbons continued to dominate the country's mineral industry, improving the nation's balance of payments position. The discovery and development of domestic reservoirs containing light, low-sulfur crude oils provided suitable blends for Syria's traditionally heavier crudes as well as a higher priced export crude. The development of nonassociated natural gas deposits in the north and northeast released additional fuel oil for export markets as more natural gas became available for the generation of electric power. Natural gas also provided a feedstock for the production of ammonia and the further development of the fertilizer industry. Eventually, natural gas exports to neighboring countries are planned via pipeline.

Other significant mineral industries include gypsum and phosphate rock mining, the manufacture of fertilizers and cement, and the manufacture of steel from domestic and imported scrap.

GOVERNMENT POLICIES AND PROGRAMS

An investment law encouraging domestic and foreign private participation by lifting restrictions on foreign-exchange transactions, as well as providing tax and customs concessions, was adopted. At present, most private investment is directed toward agricultural and tourism activities. Early private involvement in the minerals industry is most likely to occur in petrochemical ventures.

PRODUCTION

Crude oil production averaged 570,000 bbl/d in 1993, an increase of nearly 40,000 bbl/d over the previous year's level. The increased output is attributed to the Al-Furat Petroleum Co.'s

operations at Dayr az-Zawr and Al-Sham.

Production of the nonhydrocarbon minerals is expected to show improvement following the receipt of financial aid for Syria's support in the expulsion of the Iraqi forces from Kuwait. Until recently, the lack of investment capital has precluded mineral exploration, deposit development, or equipment repair, replacement, or improvement. (See table 1.)

TRADE

After three decades of negative trade balances, Syria reported a trade surplus for each year since 1989. Total exports were estimated at \$4 billion, of which approximately \$2.5 billion was derived from petroleum exports. Shipments to the United States in 1993 totaled 8.7 Mmbl of crude and unfinished oils.

Exports of Syria's other significant mineral, phosphate rock, was reported at nearly 1 Mmt in 1993. Although Europe accounted for most of Syria's phosphate rock exports, shipments to India commenced in midyear.

STRUCTURE OF THE MINERAL INDUSTRY

Syria has a state socialist economic system with a growing and vigorous private sector. However, the mineral industry remains owned and controlled by the Government. All mining, processing, and distribution companies are Government-operated firms. Hydrocarbon exploration concessions, however, have been granted to foreign companies on behalf of the Syrian Government.

COMMODITY REVIEW

The construction of an integrated iron and steel plant at Al-Zara near Hamah in east-central Syria is proposed. The plant will include a U.S. Midrex direct

reduction unit of 800,000-mt/a capacity. Two electric arc furnaces capable of producing 770,000 mt/a of liquid steel and two ladle furnaces for refining the liquid steel will be constructed. The plant will include two five-strand continuous casting billet casters to produce 740,000 mt/a of 130-mm billets, a high-speed, single-strand mill to roll wire rods of 5.5- to 12-mm diameters in coil weight of 1,750 kg, and a continuous merchant bar mill with 18 strands. The cost is projected at \$750 million. Saudi Arabia has pledged \$500 million in support of the project.

Phosphate rock production levels have been reduced and surpluses added to growing stockpiles following 5 years of reduced foreign and domestic sales. To enhance its sales, particularly in northern and western Europe, the General Co. for Phosphate and Mines has reorganized production to offer three different phosphate rock grades. Each grade has a dust content from 4% to 6% below 63 microns in deference to environmentally conscious markets.

Construction of a phosphatic fertilizer complex at Palmyra was reported under way by the General Fertilizer Co. The project is budgeted between \$300 and \$350 million. The plant design capacity includes 500,000 mt/a of triple superphosphate (TSP). Arab financing agencies have pledged most of the capital necessary for construction.

The overhauling of the fertilizer complex at Homs was behind schedule, and completion originally scheduled for 1993 is not expected before early 1995.

Encouraged by Marathon Oil Co.'s discovery of major natural gas fields in the Palmyra (Tadmur) region, with combined reserves of 85 billion m³, the Government has put a high priority on increased utilization of natural gas. Consumption is expected to rise rapidly in this decade, eventually accounting for 30% of the total annual energy

consumption by the year 2000. At present, natural gas accounts for less than 10% of annual energy consumption. Several projects are underway, including the conversion of two power stations to natural gas fuel, the Baniyas with a 680-MW capacity and the Mardikh with a 630-MW capacity, and the construction of a gas-fueled power station at Tishrin of 400-MW capacity. The latter project was granted a partial financing of \$89.4 million by the Kuwait Fund for Arab Economic Development in late 1993. Two cementworks will be gas fueled, and the construction of a natural-gas-based fertilizer plant is planned for Homs. Syria also is considering piping natural gas to Lebanon and Turkey.

The Al-Furat Petroleum Co. development plans now under way include construction of a natural gas gathering system encompassing the Umar, North Umar, Sharifah, Ash Shajar, Shahil, Al Isba, and Tanak Fields.

The Syrian Government encourages foreign interest in petroleum areas that have been relinquished and in promoting the use of secondary recovery in fields that have been considered mature. The Syrian Petroleum Corp. has entered into exploration and production-sharing agreements with foreign companies. Although most of the new exploration activity was centered in east-central Syria near Dayr az-Zawr, concessions also were awarded in the Palmyra area, in a region south of Damascus, and in the extreme northeast region near the Syrian Petroleum Co.'s producing fields.

Syrian refining policy has been to operate its two refineries at full capacity to maximize the production of middle distillates; however, this policy has resulted in large surpluses of fuel oil that have been difficult to export because of their high-sulfur content while gasoline and diesel oil production fell short of domestic consumption requirements. A study conducted by Universal Oil Products of the United States has recommended the installation of catalytic cracking units at each of the refineries and a hydrocracking unit at Homs. Tenders for these projects were scheduled for mid-1994.

The Syrian Ministry of Oil, Electricity and Natural Resources reported recoverable natural gas reserves at 225 billion m³, of which 37 billion m³ was

associated natural gas, 128 billion m³ was nonassociated natural gas, and 60 billion m³ was cap gas. Proven petroleum reserves were virtually unchanged at 1.7 billion bbl. Much of the nation's oil and gas reserves are in seven major fields, the largest of which is Suwaydiyah in the extreme northeast section of the country. Proven reserves of this field alone are reported at 1 billion bbl of liquid hydrocarbons and 5.6 billion m³ of natural gas.

INFRASTRUCTURE

Railway transportation is available in northern and western Syria servicing the major cities and the three principal ports of Baniyas, Latakia, and Tartus. The existing hydrocarbon pipelines include the Iraq Petroleum Co. (IPC) pipeline traversing Syria from east to west. The pipeline has been closed for Iraqi use since 1982; however, sections of the pipeline have been converted to domestic use. More than 100 km of the IPC pipeline is used for natural gas transmission forming part of the 377-km pipeline from the Jubaisseh gas processing plant to the fertilizer complex and refinery in Homs. Another section of the IPC line transports crude oil to the Homs refinery from the Al-Thayyim, Al Ashara, and Al-Ward Fields, which are connected by spur lines to the main pipeline. With the onset of production, two spur lines were constructed connecting the Al-Thayyim Field along with its smaller satellite fields and the Umar Field to the IPC pipeline.

Installed power generation capacity is 3,000 MW, with thermal power stations accounting for about 2,100 MW and hydroelectric powerplants accounting for about 900 MW.

OUTLOOK

Syria's posture during the Gulf crisis ended years of isolation from the Gulf States, gaining the Government substantial financial resources to undertake several infrastructure rehabilitation projects as well as projects to revitalize ailing state enterprises. In addition to about \$2 billion in Arab funds, Japan has provided a \$460 million loan, most of which is to be spent on the 600-MW Jandar combined cycle power

station. The European Community provided about \$210 million, and smaller amounts were pledged by other nations. This surge in aid and the passage of less restrictive investment laws have made Syria one of the more active business locations in the Middle East.

The public-sector development program includes a 750,000-mt/a-capacity iron and steel complex, a 500,000-mt/a-capacity TSP plant near Palmyra, and two cement factories with a combined capacity of nearly 2 Mmt/a.

The discovery of nonassociated natural gas fields and the increased utilization of associated natural gas should reduce the demand for fuel oil and thus increase refined product export potential. Refurbishing of the two petroleum refining facilities now operating at low levels of efficiency and high levels of pollution should bring marked improvement to Syria's downstream petroleum operations.

By the year 2000 total installed electric capacity is scheduled to reach 5,000 MW. At that time, natural gas-fired generating capacity should account for more than one-half the total, and hydroelectric capacity is scheduled to rise to 1,700 MW.

Syria has been self-sufficient in fertilizer production for the past decade. It continues to develop its fertilizer industry for export to take advantage of both the growing availability of natural gas feedstock and its indigenous reserves of phosphate.

¹Text prepared May 1994.

²Where necessary, values have been converted from Syrian pounds (£Syr) to U.S. dollars at the rate of £Syr22.0=US\$1.00.

OTHER SOURCES OF INFORMATION

Baniyas Refining Co.
P.O. Box 26
Baniyas, Syria
Telephone: [963] 238/307
General Company of Homs Refinery
P.O. Box 352
Homs, Syria
Telephone: [963] 22771/22768
General Company for Phosphate and Mines
Palmyra Road, P.O. Box 288
Homs, Syria
Telephone: [963] 31 20405

TABLE 1
SYRIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Country and commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Cement, hydraulic thousand tons	3,501	3,500	3,500	3,700	4,500	4,500
Gas, natural: ^a						
Gross million cubic meters	2,822	3,750	4,470	5,000	5,000	5,000
Dry do.	900	1,200	1,400	2,800	2,800	3,000
Gypsum	180,000	175,451	175,000	234,432	235,000	250,000
Iron and steel: Steel, crude ^a	70,000	70,000	70,000	70,000	70,000	70,000
Natural gas liquids thousand 42-gallon barrels	700	750	800	1,800	1,800	2,000
Nitrogen:						
N content of ammonia	122,500	103,600	17,200	80,500	150,000	300,000
Urea	—	111,300	3,300	43,700	75,000	400,000
Petroleum:						
Crude thousand 42-gallon barrels	130,000	140,000	171,550	193,600	195,000	195,000
Refinery products:						
Liquefied petroleum gas do.	1,825	1,900	1,825	1,800	1,800	2,000
Gasoline do.	10,950	11,100	9,600	9,800	9,800	11,000
Naphtha do.	5,000	5,000	5,000	5,000	5,000	5,000
Jet fuel do.	4,000	4,000	4,200	4,500	4,500	4,500
Kerosene do.	1,500	1,500	1,500	1,600	1,600	1,600
Distillate fuel oil do.	23,700	24,000	24,800	25,000	25,000	26,000
Residual fuel oil do.	35,800	36,000	35,700	35,000	35,000	36,000
Asphalt do.	1,400	1,400	1,300	1,400	1,400	1,500
Other do.	1,700	1,700	1,700	1,800	1,800	1,800
Total do.	85,875	86,600	85,625	85,900	85,900	90,000
Phosphate rock:						
Gross Weight thousand tons	2,256	1,633	1,359	1,266	1,275	2,500
P ₂ O ₅ content ^a do.	690	511	425	395	400	800
Salt	137,950	127,172	127,000	127,000	130,000	140,000
Stone, sand and gravel:						
Stone: Dimension, marble ^a cubic meters	18,000	18,000	18,000	18,000	18,000	20,000
Sand and gravel thousand tons	8,000	8,000	8,000	4,095	4,200	8,000
Sulfur, byproduct of petroleum and natural gas	40,000	29,652	30,000	30,000	30,000	40,000

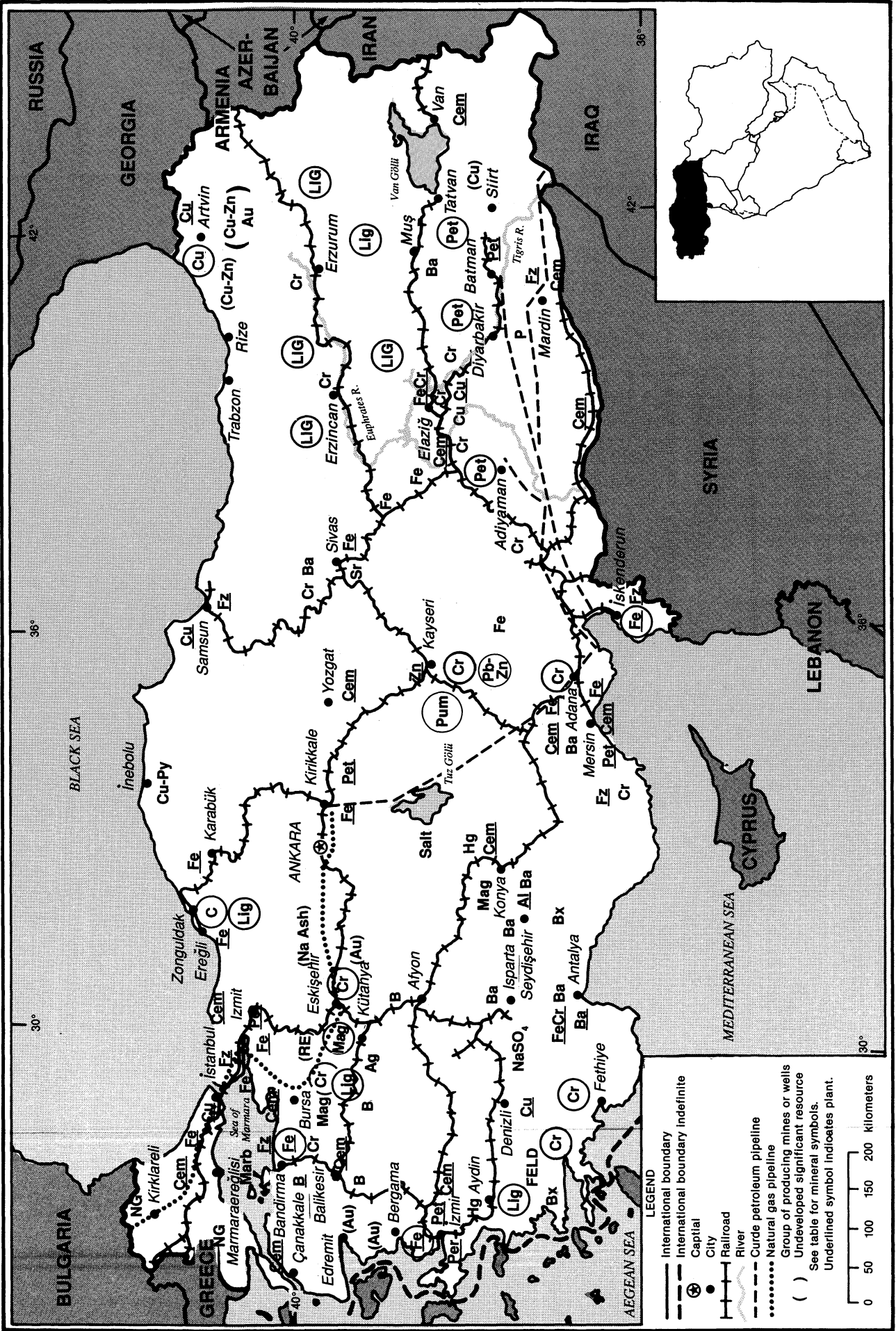
*Estimated. Revised.

¹Table includes data available through Mar. 15, 1994.

TURKEY

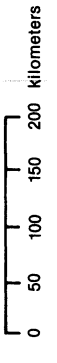
AREA 780,580 km²

POPULATION 61 million



LEGEND

- International boundary
- - - International boundary indefinite
- ⊕ Capital
- City
- Railroad
- River
- - - Curde petroleum pipeline
- Natural gas pipeline
- Group of producing mines or wells
- () Undeveloped significant resource
- See table for mineral symbols.
- Underlined symbol indicates plant.



THE MINERAL INDUSTRY OF

TURKEY

By Hendrik G. van Oss

Turkey's diverse mineral industry in 1993 continued to be adversely affected by low world mineral prices and oversupply. Primary mineral export revenues during the year were lower overall than those in 1992, notwithstanding a similar level of tonnage. The secondary or value-added mineral commodity sector has for many years generated far greater revenues than the primary mineral sector. Although output levels in the secondary sector increased in 1993, sales revenue increases were modest. The Turkish economy suffered from high levels of inflation, particularly in the later half of the year, and severe devaluation of the Turkish lira.¹

According to official data, Turkey's gross domestic product (GDP) in 1993 was about \$172.3 billion, about 12% higher than that in 1992. It was 73% higher in terms of Turkish lira. The primary mineral sector (reported as "mining and quarrying") accounted for 1.2% of GDP, down from the 1.7% of GDP in 1992. However, these data understate the contribution of minerals to the Turkish economy because comparable data for the important secondary or value-added mineral sector are lumped within data for the "manufacturing" sector (22% of GDP). This sector is dominated by refined petroleum products, steel, cement, glass, and ceramics. It is estimated that secondary mineral commodities accounted for about one-half of the "manufacturing" sectoral contribution; sales of refined petroleum products alone accounted for an estimated 7% of GDP.

Total mineral commodity exports in 1993 were about \$3 billion, or about 20% of total exports. Imports of mineral commodities were an estimated \$9 billion

in 1993, or about 30% of total imports.

A wide variety of metallic, nonmetallic, and energy minerals are mined in Turkey; this diversity is a reflection of the extreme complexity of the country's geology. Turkey is best known for its industrial minerals. The country was second only to the United States in boron mineral output and was one of the top world producers of strontium minerals and the natural abrasives emery and pumice. The country remained a major producer of barite, feldspar, limestone, magnesite, marble, perlite, and pumice. Among secondary industrial mineral commodities, Turkey was a major world producer of refined boron chemicals, cement, ceramics, and glass. Among metallic minerals, Turkey is best known for its production of chromite and, until recently, was a significant producer of mercury. In terms of secondary metallic mineral commodities, Turkey in 1993 was a major regional and significant world producer of ferrochromium and steel. It is a significant producer of lignite.

Turkey had more than 800 mining establishments and about 3,000 mines. Depressed markets and inflation-driven production cost increases led to the idling of a significant number of these mines in recent years. The overwhelming majority of Turkish mines, including many in the public sector, are small by world standards. However, the cumulative production of these mines for several commodities in 1993 was significant.

Turkey had extensive primary and secondary mineral trade with many regions of the world. Its once major trade with the Middle East, particularly Persian Gulf countries, had yet to significantly recover from the disruptions caused by the Gulf War, particularly those relating

to sanctions against Iraq. For some commodities, particularly steel, this decline was offset by sales to other regions; Asia was a particularly lucrative market for Turkish steel in 1992 but less so in 1993. Turkey is an Associate Member of the European Union (EU) and has structured many of its trading practices and investment regulations in accord with those of the EU. Import tariff reductions continued to be implemented in line with Turkey's achieving full customs union with the EU in 1995. Turkey has extensive trade with the former U.S.S.R. It has ethnic and cultural ties to the former Soviet Turkic republics that favor closer economic links, and economic relations are being strengthened with other countries along the Black Sea. A Black Sea Economic Cooperation Zone was created in 1991, and a number of meetings have been held since among the member countries. Membership includes Turkey, Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Russia, Romania, and Ukraine. Apart from trade, Turkish parastatal and private companies were pursuing direct mining investment opportunities in the region.

Capacity expansion projects were underway at many secondary mineral production facilities, particularly those in the private sector. The Government was reducing its extensive involvement in the industrial sector through privatization. Progress in this regard was uneven and was subject to trade union and political opposition. Privatization efforts were largely in the secondary mineral sector.

Mineral exploration by foreign companies in Turkey was largely for gold, copper, and zinc.

GOVERNMENT POLICIES AND PROGRAMS

The Government is actively involved in many sectors of the minerals industries through various parastatal corporations and shareholdings in some other companies. In the early 1980's, the Government began to actively encourage foreign and Turkish private participation in the mining industry, with enabling legislation in the form of a new mining law passed in 1985. One of the most significant outcomes of this legislation was that foreign companies have the same rights as domestic companies, including parastatals, in terms of factors such as taxation and access to exploration permits. Efforts to draft new mining legislation, largely to streamline certain permitting procedures in the 1985 law, were made in 1991 and 1992, but no new mining legislation appeared in 1993.

During the 1980's, Government economic policies focused on encouraging industrial growth, particularly for export industries. The Turkish steel sector, in particular, was a beneficiary of these policies. Overall, a high level of industrial growth was achieved, but not without incurring high levels of inflation and of public and private debt—problems that have not significantly abated since. A related outcome was a dramatic increase in wages, commonly negotiated only after lengthy work stoppages. In recent years, inflation forced many Turkish industries to raise prices for their products, but this has caused conflict with export competitiveness. On the domestic market, price increases have been constrained, commonly, to below inflation levels. Further constraints to Turkish industrial growth have come from political disruptions to several of Turkey's traditional trading regions. The EU has pressured Turkey to reduce export subsidies and import tariffs.

A longstanding burden on the Turkish economy has been the high level of Government borrowing and spending to maintain large parastatal corporations. A privatization program began in 1989, but by yearend 1993 only a small number of

parastatals had been privatized, most notably in the cement industry. Some sales of parastatal companies were transacted only after extensive political and legal debate, and opposition to privatization remains strong. Privatization has been conducted through the intermediate transfer of Government shares to the Public Participation Fund Administration (PPFA). The PPFA may then sell the shares on the Istanbul stock exchange and/or seek direct purchases by foreign or domestic corporations. Apart from cement, mineral entities to be privatized include those in coal, petroleum refining, petrochemicals, and steel.

ENVIRONMENTAL ISSUES

The rapid growth of industry and the urban population in Turkey has led to a heightened public awareness of environmental issues. Of particular concern was the severe air pollution resulting from the widespread use of lignite and coal both for domestic heating and for electricity generation. The lack of adequate sewage treatment facilities for several large cities also has been an issue. Probably the most significant step taken in recent years to abate pollution has been the ongoing construction of a natural gas pipeline grid to serve several major cities. The gas, in part, is consumed as a clean-burning substitute for lignite.

Rapidly strengthening public opposition to new lignite-fired powerplants for the Aegean and Mediterranean coast regions has led to the suspension of these projects or to their proposed relocation to less populated regions. Moreover, plans were being implemented to install fly ash and sulfur gas scrubbers on the existing plants. Some plants have even been mooted for closure. To meet the anticipated increased demand for electricity without additional lignite plants, the Government proceeded with plans to build additional hydroelectric power facilities and revived plans to build one or more nuclear powerplants.

Environmental issues have become a factor in Turkey's foreign economic

relations. Proposed energy mineral developments in Kazakhstan and other landlocked Turkic republics could result in oil spills or other shipping hazards if the fuels are shipped by supertanker via the Black Sea through the narrow Bosphorus and Dardanelles channels. Turkey, instead, proposed routing the fuels via pipeline through Turkey to the Mediterranean oil port at Yumurtalık, either from Turkish Black Sea ports, or through Azerbaijan and/or Armenia and Iran to link with the existing twin pipeline from Iraq. The Turkish option would not only avoid the environmental hazards of a Bosphorus transit, but would have the advantage of earning Turkey considerable transit fees. The disadvantages of the routes are the initial cost(s) of the pipeline(s) and political instability in the regions to be transited.

In 1993, there was strong local public opposition to the proposed use of cyanide in the gold recovery circuits at three advanced gold projects in western Anatolia. Permitting delays continued in 1993 for all three projects, notwithstanding formal approval of the mines' engineering and operating plans by the Ministry of Energy and Natural Resources.

PRODUCTION

Turkey produces a wide variety of mineral commodities. Output of metallic minerals in 1993 was mixed, with important increases seen in the secondary sector, particularly ferroalloys, refined copper, and steel (*see table 1*). The precipitous decline in chromite production seen in 1992 was followed by only a modest decline in 1993 (small increase in marketable component), but this reflected increased domestic processing of chromite to ferrochromium rather than a stabilization of the export market. Blister copper production increased modestly, evidently owing to improved levels of copper concentrate deliveries to the country's only operating smelter. Refined copper production increased markedly as a result of capacity improvements at the largest of the country's private-sector refineries. The refineries utilize both

domestic and imported blister and/or anode copper. The large increase in steel production reflected, mainly, capacity expansion projects at a number of electric arc furnace steel mills in the private sector. Zinc output fell significantly, owing to continued depletion of high-grade zinc oxide ore reserves.

Among industrial minerals, barite production declined dramatically owing to poor local demand and attendant closures and despite strong export levels. Cement production increased significantly in response to continued strong domestic and export demand. Clay output increased in response to strong demand in the domestic ceramics and paper industries and on the European market. Feldspar output, too, responded to strong demand in the ceramics industry in Turkey and in Europe. Fluorspar output is believed to have increased owing to production increases at a new mine that started up in late 1992. Magnesite production declined significantly, owing in part to modest demand for refractory brick and to preparations for privatization of the country's parastatal mines. Pumice production increased sharply in response to improved demand in the construction sector; exports (largely for textile processing) were relatively stagnant. Increased recovery capacity at Turkish oil refineries led to an increase in recovered sulfur.

Production levels fell throughout most of the energy mineral sector, most notably in hard coal and crude petroleum. Mining difficulties and low demand continued to impact hard coal production in the Zonguldak region. Security problems in southeast Anatolia were partly responsible for reduced crude petroleum output levels. In contrast, output of most refined petroleum products increased significantly.

TRADE

Turkey's trade in minerals is diverse, reflecting its own needs and the fact that it serves as an entrepôt for some other countries in the region. In 1993, total exports were reported as \$15.3 billion and total imports were \$29.4 billion.

Total exports of mineral commodities amounted to about \$3 billion and imports amounted to about \$9 billion.

As in recent years, mineral commodity exports were dominated in value by secondary or value-added products. By far the most valuable exports were of steel, which totaled about \$1.9 billion, up almost 22% from the previous year. Exports of glass and ceramics totaled about \$178 million, down significantly from levels in 1992 because of improved domestic demand. Owing to strong prices, cement and clinker exports fell only 4% to \$135 million, despite a 38% drop in tonnage. The decline in tonnage exported was due to very strong domestic demand. Refined petroleum products exports fell 9% to \$180 million, again a reflection of strong domestic demand. Exports of refined borates and boric acid fell 5.4% to \$64.5 million owing to lackluster prices. Exports of manufactured fertilizer were worth about \$50 million. Exports of ferrochromium increased slightly to \$45.5 million, despite a 27.5% increase in tonnage. Alumina exports increased 22% to \$8.5 million, owing to increased production and export levels.

Total exports of primary minerals fell 10% to \$260.4 million in 1993, although exports did not decline in value for all commodities. Turkey's most important primary commodity remained boron minerals, exports of which declined almost 6% to \$114.1 million as a result of lower prices; export mass (about 616,000 tons) fell only 1.5%. Exports of polished ornamental stone increased modestly to \$33 million; exports of other categories of dimension stone were mixed and totaled about \$15 million. Magnesite exports fell almost 16% to \$32.3 million, owing to a fall in demand for refractory brick. In contrast to ferrochromium, exports of chromite fell almost 40% in value to \$19.4 million; the mass exported fell 22% to about 339,000 tons. However, these data include 125,550 tons worth \$6 million reported as transferred to the Mersin Free (Trade) Zone, and it is unclear if this material left the country during the year. Pumice exports were virtually unchanged at \$11 million.

Copper ore exports fell 38% in value to \$7.4 million; this may have reflected low-grade material, as the mass exported was almost 24% higher than in 1992, at about 80,000 tons. Feldspar exports increased almost 23% to \$7.3 million, owing to continued strong demand in the European ceramics industry. Despite the sharp drop in production and poor domestic demand, barite exports increased 36% to \$3.6 million in response to an increased level of petroleum exploration drilling in the neighboring Turkic republics. Strontium (celestite) exports increased about 12% to \$3 million. Diasporite exports fell 21% to \$1.5 million.

Detailed data were unavailable for Turkish mineral commodity imports in 1993. As in years past, the most significant category of mineral commodity imports was mineral fuels. Crude petroleum imports amounted to about \$2.55 billion, refined petroleum products about \$630 million, and natural gas about \$400 million. Steel imports amounted to about \$3 billion. Gold imports were estimated at about \$1.5 billion. Manufactured fertilizer imports totaled about \$460 million. Imports of crude ores amounted to about \$67 million.

STRUCTURE OF THE MINERAL INDUSTRY

Notwithstanding some progress in privatization, several sectors of the Turkish minerals industry remained dominated by large, state-owned conglomerates (*see table 2*). Although, overall, the parastatal corporations tended to have many thousands of employees each, many of the individual operations controlled by the parastatals were small. In 1993, private companies were dominant or important in some mineral sectors, notably cement and steel, and ranged from large concerns with several hundred workers to family operations with just a few employees. In 1990, the latest year for which data were available, there were 837 mining "establishments," of which 585 were private sector. Since 1990, low commodity prices and escalating costs have led to the closure, if

only temporarily, of a number of mines, particularly small operations. Private companies have been harder hit in this regard. The main commodities affected include antimony, asbestos, barite, chromite, mercury, and tungsten. Companies producing value-added or secondary mineral commodities have been less affected. Apart from the mining establishments, the minerals industry also has about 46 cement plants (41 private), 22 steel mills, and a number of independent base metals refineries, glass factories, and fertilizer plants.

Parastatal companies are major players in the minerals sector. The various subsidiaries of Etibank dominate or produce the country's entire output of aluminum, boron minerals and chemicals, blister copper, ferrochrome, and zinc. Etibank is the largest chromite producer in Turkey (39% of total), but its output is less than that of the overall private sector. Turkish hard coal mining is all by Türkiye Taşkömürü Kurumu, and almost 90% of Turkey's total lignite output is accounted for by Türkiye Kömür İşletmeleri. Türkiye Demir ve Çelik İşletmeleri (TDÇİ) and the partially private Ereğli Demir ve Çelik Fabrikaları T.A.Ş. (Erdemir) have all of the country's integrated steel capacity and produced 37% of total steel output in 1993. About 80% of Turkey's total output of crude petroleum, all of its natural gas, and almost all of its refined petroleum products were produced by Türkiye Petrolleri Anonim Ortaklığı (TPAO). Until recently, cement production was dominated by the parastatal Türkiye Çimento ve Toprak Sanayii T.A.Ş. (ÇİTOSAN), but by yearend 1993, privatization had reduced its sectoral share to about 20%.

As there have been some retrenchments, overall employment levels in the primary mineral sector in 1993 were probably somewhat less than those in 1990, the latest year for which detailed data were available. In 1990, the primary mineral sector had about 100,300 employees and wages totaled about \$740 million. Wage data for 1993 were not available but likely exceeded the 1990 levels by a significant margin, owing to

various wage settlements in the interim. The public-sector component of wages in 1990 was almost 90%. The largest employers in the primary mineral sector were the coal and lignite producers, with about 73,000 employees; the metal mines, with about 14,000 workers; industrial minerals mines and stone quarries, about 11,000 employees; and the oil and gas producers, with about 1,400 workers. The primarily value-added mineral sector employed another 100,000 workers, of which about 40,000 were employed in the steel industry, 20,000 in the glass and ceramics industries, and the remainder in metals refining and the production of certain minerals-related chemicals such as borates and fertilizers. Wage data for the value-added mineral sector were not available, but likely exceeded by 25% to 50% the wages in the primary mineral sector.

Maden Tetkik ve Arama Genel Müdürlüğü (MTA) is the state agency responsible for geologic exploration and research in Turkey.

COMMODITY REVIEW

Metals

Aluminum.—Although several companies in Turkey produced aluminum products from purchased ingot, there was only one primary aluminum smelter: Etibank's integrated facility at Seydişehir. This facility was undergoing modernization, including automation of the potlines and computerization of the control systems. Etibank had plans to increase both reduction plant and rolling mill capacity to 100,000 mt/a. Although the company had originally hoped to fund the expansion through Government or other loans, the Government's new privatization philosophy and low world aluminum prices have eliminated this option. Efforts in 1992 and 1993 to find a private partner for the expansion project failed, and a decision to proceed with the expansion program was postponed until at least 1994.

Chromite.—As with the previous year,

poor international market conditions for chromite and ferrochromium in 1993 depressed the Turkish industry. A number of companies had greatly reduced mine output, if any, during the year. Etibank's production of chromite was relatively unaffected, because all of it was used to manufacture ferrochromium, output of which increased. Overall, Turkey's output of chromite fell significantly, although the marketable component was relatively unchanged because much of the mining was restricted to higher grade ores. Turkish consumption of ferrochromium in 1993 remained insignificant owing to the negligible production of stainless steel. Domestic consumption of chromite was restricted to small amounts for the manufacture of refractories, particularly furnace brick, and for leather-tanning chemicals.

Total exports of chromite were about 339,000 tons. However, for the first time, these included material (125,500 tons) transferred to the Mersin Free Trade Zone; it was unclear if any of this material actually left the country during the year. Data on overseas shipments showed the major customers for Turkish chromite in 1993 to be Norway, Sweden, China, and Croatia (about 20,000 to 40,000 tons each). The United States remained by far the largest customer for Turkish ferrochromium, taking almost 85,000 tons.

Copper and Zinc.—Karadeniz Bakır İşletmeleri A.Ş. (KBİ), a subsidiary of Etibank, was by far Turkey's largest producer of copper ore and concentrates in 1993 and had the only production of blister copper during the year. Copper concentrate feed for Samsun comes mainly from KBİ mines and concentrators in the Murgul district near Artvin. Some concentrates, as needed, have been imported.

Pyrite output from the KBİ mines is cupreous (0.7% Cu), but is not smelted for copper. Instead, some is exported and the remainder is sold to fertilizer producers for sulfuric acid production.

Although copper smelting is entirely in the public sector, virtually all copper refining is in the private sector, mostly at

facilities near İstanbul. The sole exception is about 4,000-mt/a capacity installed at the parastatal Makina ve Kimya Endüstrisi Kurumu (MKEK) at Kırıkkale. Turkey's total refining capacity in 1993 was 170,000 mt/a. Blister and/or anode requirements for the copper refineries was met partly through imports.

Engineering work was well advanced to develop the Çayeli copper-zinc-silver underground mine, 23 km northeast of Rize. The new mine will be operated by Çayeli Bakır İşletmeleri A.Ş., a joint venture of Metall Mining Corp., Canada, 49%; Etibank, 45%; and Gama Industri Tesisleri İmlat ve Montaj A.Ş., Turkey, 6%. Commercial production was planned for late 1994 at a mining rate of 600,000 mt/a. The mill, a conventional grinding and flotation facility, is to produce 100,000 mt/a of copper concentrates grading 22% Cu and 70,000 mt/a of zinc concentrates grading 52% Zn. The ore has significant gold and silver credits. A 15-year mine life was planned, but that could be extended through the delineation of additional reserves. Concentrates would be trucked to Rize for shipping to toll smelters, as yet unannounced. Tailings were to be deposited, via pipeline, in the Black Sea at a depth of 350 m. Anoxic conditions exist below a depth of 150 m.

No decision was made by Cominco Resources International Ltd. of Canada in 1993 as to whether it would proceed with development of the Cerattepe copper-gold property in the outskirts of Artvin. The economics of the deposit appeared to hinge on the gold resources, which were still under evaluation at yearend.

Gold and Silver.—Except for some erratic artisanal production, Turkey's output of gold in recent years has all been as credits in base metal refinery slimes exported to Europe. The slimes also contain silver. Beginning in 1987, Turkey has had formal mine production of silver. No precious metals were refined in Turkey. But with the recent liberalization of Turkish import restrictions on gold, attendant increases in gold transactions, and the expected influx of gold from

nearby Turkic republics of the former U.S.S.R., there was interest in building a gold refinery in İstanbul.

A number of foreign and domestic exploration companies explored for gold in Turkey during the year, mostly in the Aegean and eastern Black Sea coastal regions.

Despite having earlier received all required technical permits, there were three advanced gold projects in Turkey awaiting final mine permits from the Ministry of the Environment as of yearend 1993. At issue was the proposed use of sodium cyanide, albeit in closed-circuit vat-leach plus carbon-in-pulp (CIP) circuits, to recover the gold. The projects affected involved the Ovacık, Küçükdere, and Kaymaz deposits.

The Ovacık (Dikili) gold deposit is about 12 km west-southwest of Bergama and is owned by Eurogold Madencilik Ticaret ve Ltd. A.Ş., a joint venture of ACM Gold Ltd. of Australia (66.67%) and Metall Mining of Canada (33.33%). The Ovacık Mine is planned as a combination open pit-underground operation, exploiting epithermal auriferous quartz-adularia-calcite veins hosted within Tertiary andesites. Mining is planned for a rate of about 300,000 mt/a to produce about 3,100 kg/a of gold in doré.

Tüprag Madencilik Ticaret ve Ltd. Şti., a subsidiary of Gencor of the Republic of South Africa, owned the Küçükdere deposit, about 10 km southeast of Edremit. The deposit is geologically similar to the Ovacık deposit. A 250,000-mt/a open pit operation was planned to recover about 3,100 kg/a of doré, grading about 33% gold and 67% silver. Tüprag also held the Kaymaz property, about 145 km west-southwest of Ankara. Little information was available on the property, but it was reported to be an epithermal deposit hosted by altered serpentinites. Tüprag was actively exploring a number of other properties in the country.

Cominco continued to explore a number of gold properties in northeast Turkey. The best of these appeared to be an auriferous gossan capping the Cerattepe copper deposit at Artvin. A

feasibility study for the property was planned.

Apart for silver credits in base metals concentrates, smelter, and refinery products as aforementioned, Turkish silver production in 1993 was all from Etibank's Aktepe (Gümüşköy) Mine, about 20 km west of Kütahya. Silver production at Aktepe in 1993 declined about 10% to 70,970 kg.

Iron and Steel.—The Turkish steel industry in 1993 continued to be one of the most rapidly growing in the world, with crude steel output for the year 11% higher than in 1992. This performance ranked 8th in Europe and 16th in the world. As in previous years, most of the growth in 1993 was by private-sector electric arc furnace (EAF) producers; EAF crude steel output increased 19% to 7.26 Mmt. Many of the EAF producers continued to have expansion programs.

The Turkish steel industry remained characterized by an imbalance of products: flat products accounted for only about 2 Mmt of total production and long products the rest. Erdemir was the sole flat products producer but was undergoing a capacity expansion program to 3 Mmt/a. Installation of thin-slab casters was being proposed for TDÇİ's İskenderun mill. Both of TDÇİ's steelworks were undergoing expansion plans (for long products), but with increasing pressures to privatize the mills it was unclear if all of the plans would be realized. The relatively small TDÇİ-Karabük integrated steelworks appeared especially vulnerable in this regard. At least one EAF company, Çukurova, was studying installing thin-slab casting technology.

Although steel exports were at healthy levels in 1993, prices were only moderate owing to regional competition resulting from the breakup of the U.S.S.R. and political changes in Eastern Europe. A flood of inexpensive rebar and other construction steel on both the world and Turkish markets has come from these countries. A large percentage of Turkey's steel exports since 1980 have been to the Middle East, but this market has been severely hurt by the Gulf War and

attendant sanctions against Iraq. Alternative markets, particularly in Asia, have been found but could be short-lived owing to a proliferation of EAF mills in that region. Competition on the domestic market has kept Turkish producers from raising steel prices sufficiently to fully offset the country's high rate of inflation, and profits have suffered accordingly. Further, with the world proliferation of EAF mills, world demand and prices for high-quality scrap steel has risen, and this has increased production costs for Turkish EAF mills. Turkey has been for several years the second largest customer for U.S. scrap exports. Turkey was the third largest customer in 1993, taking 1.31 Mmt of scrap from the United States in 1993, or 13.4% of total U.S. scrap exports. But this was a 40% decline from purchases in 1992 and reflected the fact that Turkey was able to purchase cheaper scrap in Europe.

Industrial Minerals

Cement.—The Turkish cement industry had yet another record output in 1993, again bolstered by strong domestic and export markets and expansion programs at a number of the facilities. Domestic consumption rose 22% during the year. Strong domestic demand in the construction sector has mainly been due to the rapid growth of Turkey's largest cities that resulted from a major population shift in recent years away from the rural areas. There also was continued strong demand for concrete for dam construction. Overall demand for cement was forecasted by the Government to rise by about 1 Mmt/a through the year 2000. At that time Turkey's consumption was projected to be about 34 Mmt/a and production capacity to be slightly in excess of 37 Mmt.

Turkish trade in cement and clinker has traditionally been in response to regional rather than overall supply imbalances. Capacity increases at mills in the high-growth areas have significantly reduced, but not eliminated, the need for imports of cement and clinker. Thus, the 22% growth in domestic consumption

required only a 9% increase in imports (to 431,000 tons), but was the reason for the 38% fall in exports (to 3.2 Mmt).

The cement sector has been to date the most successful part of the Government's privatization program. Whereas the Government, through ÇİTOSAN, directly controlled almost 40% of the country's cement mills and 30% of production capacity in 1991, ÇİTOSAN mills operated only nine plants during 1993. Purchasers of ÇİTOSAN plants have been foreign cement companies and some in the Turkish private sector.

Magnesite.—The Government reiterated its intention to privatize the ÇİTOSAN subsidiary KÜMAŞ Kütahya Manyezit İşletmeleri A.Ş. The facility has been the largest producer of dead-burned magnesite in the country. The most likely purchaser may be the private-sector producer Magnesit A.Ş.

Mineral Fuels

Coal.—Although lignite deposits are found and exploited all over Turkey, hard coal reserves are largely restricted to the area around Zonguldak. The coal seams dip northward, and most of the active operating areas extend under the Black Sea. Mining conditions are difficult. Production has been reduced following a major accident at one of the mines in early 1992, and because of production difficulties at the Karabük integrated steelworks—the primary customer for three of the five mines now working.

Natural Gas.—Only modest amounts of natural gas have been produced in Turkey. Output is primarily from the Hamitabat Field in Thrace, but also from fields near Diyarbakır. Production has been declining for several years. Output and reserves of natural gas, although useful on a local scale, are inadequate to feature significantly in the Government's energy planning. Instead, Turkey has, since 1987, imported large quantities of Russian natural gas via a pipeline through Bulgaria. Some of the gas is used for electricity generation and as feedstock at

a fertilizer plant near İstanbul. Most, however, is used for domestic heating purposes in Ankara and İstanbul, where it has dramatically reduced air pollution produced hitherto from burning lignite and coal for this purpose. The pipeline grid is to be extended through Bursa to Çanakkale and, eventually, south to reach İzmir. Another spur is being constructed from the İzmit area north to Ereğli. Later, it is planned to build pipelines to central and southeast Anatolia.

Russian gas supplies are seen as inadequate to meet Turkey's anticipated needs, unless additional pipelines are constructed. Russia has agreed to supply some natural gas to Romania and Bulgaria from the existing grid. Accordingly, Turkey has sought to diversify its natural gas supplies. A 6-billion-m³/a liquefied natural gas (LNG) offloading, storage, and regassification facility was being constructed at the Sea of Marmara port of Marmaraereğlisi; work on this facility was nearing completion in 1993 and it was expected to open in early 1994. The plant was to take imported LNG, initially from Algeria, and feed gas into the existing natural gas pipeline grid. The first contract with Algeria was for shipments of 2 billion m³/a.

Petroleum.—The largest oil producer in Turkey in 1993 was the parastatal Türkiye Petrolleri Anonim Ortaklığı (TPAO). Production by TPAO fell somewhat during the year, owing to civil unrest in southeast Anatolia, the main producing area. For the same reason, Mobil Oil Corp. was reported to be planning to suspend its production activities near Batman. Civil unrest hampered petroleum exploration in that part of Turkey, but exploration continued elsewhere. A joint venture of TPAO and British Petroleum was actively exploring for oil offshore Samsun in the Black Sea.

Reserves

Turkey's mineral inventory is diverse and is hosted in a very large number of deposits, many of which are small by world standards. This is especially true

for metallic mineral ore deposits. This character of the ore bodies has led to the development of mining by a large number of generally small companies or operations, but for some commodities the cumulative production is significant. Resources of metallic commodities minable by large-scale methods are known for bauxite, chromite, copper and copper-zinc, gold, iron, and silver. Turkey is better known for its deposits of industrial minerals, of which its most significant resources are in barite, boron, limestone and marble, magnesite, perlite, pumice, strontium, and trona.

Much of the published data on Turkish ore reserves are not current. Most of the data appear to be simply mineral inventories, not necessarily explored by drilling or subjected to economic evaluation. For this reason, the "reserves" for some deposits or for some mines may represent material that is physically recoverable rather than economically minable. They thus may be best viewed as resources rather than reserves. The most complete summary of Turkish mineral resources is that by MTA.²

There are a number of bauxite and diasporite deposits in Turkey, the best known of which are those mined by Etibank. Reserves, according to the company, at the Milas diasporite mine amount to 23 Mmt grading 58% alumina. This chemical-grade material is mostly exported. The country's sole alumina refinery and reduction plant is fed by the Mortaş and Doğankuzu bauxite mines. These have remaining combined bauxite reserves of about 11.5 Mmt, averaging about 56% alumina. Additional resources are known in the region.

Turkey's chromite reserves are not well defined and are spread out over several hundred deposits, most of which are small. In 1990, there were 101 chromite mining establishments listed as in production. MTA estimates of chromite reserves (all classes) total about 14 Mmt of ore grading 30% to 54% Cr₂O₃ within a larger inventory of lower grade material; this inventory excludes large, low-grade resources at Karsanti, north of Adana.

The Çayeli copper-zinc massive sulfide ore body at yearend 1993 was reported by the company to contain proven plus probable reserves of about 10.6 Mmt grading 4.7% copper, 7.3% zinc, 0.45% lead, 68 g/mt silver, and 1.0 g/mt gold. Etibank's Şirvan-Madenköy massive sulfide deposit, 20 km northeast of Siirt, is reported by MTA to have proven plus probable reserves of 25.4 Mmt grading 2.06% copper. At yearend 1993, the Cerattepe copper deposit was reported by Cominco Ltd. to have indicated reserves of 1.1 Mmt grading 10% copper, plus other resources of lower (copper) grade material including an indicated reserve of 1.6 Mmt grading 5.2 g/mt gold and 200 g/mt silver. Reserves (all classes) claimed by KBI for mines under its control total about 34 Mmt grading 1% to 4% Cu. ÇINKUR reported 0.9 Mmt of reserves (all classes) of oxide ore reserves grading 21% zinc and 5% lead. The company also has sulfide resources of these metals.

MTA lists Turkey's mercury reserves as 5.5 Mmt grading 0.15% to 0.30% mercury, but the deposits were not economic under 1993 market conditions and production for the year was nil.

Proven plus probable minable reserves as of yearend 1993 for the Ovacık (Dikili) gold deposit were reported by the venture's majority shareholder to be, for the open pit portion, 843,000 tons grading 8.3 g/mt gold, and for the underground portion, 325,000 tons grading 19.4 g/mt gold. Tüprag's Küçükdere deposit has proven reserves, according to the company, of 1.5 Mmt grading 5.2 g/mt gold. Most Turkish copper deposits contain 1 to 2 g/mt of gold in the ore.

According to TDÇİ and MTA, iron ore reserves at TDÇİ's Divriği Mine amount to about 100 Mmt of mostly magnetite ore grading 54% to 58% iron. At the company's Hekimhan (Deveci) mines, there are reserves of about 90 Mmt of siderite ore grading 40% to 50% iron and 3% to 5.7% manganese, and about 5 Mmt of limonite ore reportedly of similar grades. Numerous other iron deposits are known in Turkey, but most are small and of low grade.

Etibank's Aktepe silver mine near

Gümüşköy had original reserves, according to the company, of 19.2 Mmt grading 194 g/mt silver. Since commencing operations in 1987, exploration work by the company added about 1.5 Mmt of ore, grading 245 g/mt silver, to this inventory.

Turkey has significant reserves of a number of industrial minerals. Although they are not well defined, Turkey's reserves of boron minerals (colemanite, tincal, ulexite) are believed to be the largest in the world. MTA estimated (district-wide) reserves of 2.45 billion tons. Turkey's magnesite deposits are numerous; the largest are in Eskişehir, Kütahya, and Konya Provinces. Their combined inventories exceed 200 Mmt. Turkey has immense deposits of marble; total resources have not been defined for the country. Similarly, Turkey's limestone resources are immense but not well defined. Perlite and pumice resources have not been fully measured, but many millions of tons of each are known. Etibank lists its perlite reserves at about 8 Mmt. Etibank's Mazıdağı phosphate deposit, near Mardin, is reported to have proven reserves of 62 Mmt. The Beypazarı soda ash (trona) deposit, according to Etibank, has reserves of 178 Mmt grading 45.5% Na₂CO₃. Barit Maden Türk A.Ş. claims proven reserves of 2 Mmt for its celestite (strontium) deposit near Sivas.

The Government has speculated that the country's ultimate recoverable petroleum reserves may amount to about 2 billion bbl, but are likely to be contained in a large number of small fields. Production of both petroleum and natural gas has, in recent years, exceeded replacement of reserves. Reserves for yearend 1993 were not available but Petrol İşleri reported recoverable petroleum reserves at yearend 1992 of 281 Mbbl, down 5.5% from yearend 1991. Recoverable natural gas reserves at yearend 1992 were 11.06 billion m³, down 38% from those of the previous year. Turkey has large lignite reserves, contained within more than 130 deposits; MTA and Türkiye Kömür İşletmeleri Kurumu estimate that these total more than 7 billion tons. Hard coal reserves,

most of which are near Zonguldak, are given by MTA as 1.2 billion tons (all classes). However, rapidly escalating labor and other mining costs, and the very difficult mining conditions in the Zonguldak Basin, likely make much of this inventory uneconomic.

INFRASTRUCTURE

Turkey has an extensive road and railroad infrastructure, and both are heavily used for the transport of mineral commodities. Turkey's road network totals about 50,000 km, about 55% of which is paved. Turkey has 8,401 km of railroads, all 1.435-m standard gauge. In 1993, Turkish trains carried about 15.8 Mmt of freight, including about 8.9 Mmt of ores and mine supplies, about 1.7 Mbbl of refined petroleum products, and 524,400 tons of fertilizers.

Turkey has 2,092 km of crude petroleum and 2,321 km of refined petroleum products pipelines. The longest stretch of pipeline is the 641-km twin line connecting Iraq with the Turkish oil-shipping facility at Yumurtalık. This facility is also the terminus for a 447-km pipeline from the refinery in Kırıkkale. The oil port at Dörtyol, 28 km north of İskenderun, is the terminus of a 494-km pipeline from the oil refinery at Batman, with shorter spurs from this line to the oilfields near Batman (Şelmo) and around Adıyaman. The Dörtyol-Batman/Şelmo and Yumurtalık-Kırıkkale pipelines carried a total of 47.3 Mbbl of crude petroleum in 1992, the latest data-year available. The Yumurtalık-Iraq pipeline remained full in 1993, but has transported no crude petroleum since the imposition of UN sanctions against Iraq in 1990. In 1990, prior to the sanctions, the pipeline carried about 340 Mbbl, and in 1989 the pipeline carried about 618 Mbbl.

Turkey has about 900 km of natural gas pipeline, which is used to import natural gas from Russia. The pipeline extends from the Bulgarian border to Ankara via İstanbul and Bursa. In 1992, the latest data year, the pipeline grid carried 4.437 billion m³ of Russian natural gas as well as Turkey's own output.

Turkey has many ports capable of handling mineral commodity shipments. Refined petroleum products are handled at several ports, but crude petroleum is handled primarily at Aliğa north of İzmir and at Dörtyol and Yumurtalık—both of these ports are between Adana and İskenderun. Major coal-importing ports include İskenderun and Ereğli. Chromite is shipped from various Anatolian ports on the Marmara coast, as well as from Antalya and İskenderun; the latter two ports handle all of Turkey's ferrochrome exports. Steel, steel scrap, and iron ore imports also are handled at many ports, particularly Aliğa, Ereğli, İskenderun, Mersin, and various ports in the İstanbul-İzmit area. Turkey's boron minerals and chemicals are exported from Bandırma. Copper ore and blister are shipped from Hopa near Artvin, from Samsun, and from İskenderun.

In 1993, Turkish ports handled about 120 Mmt of cargo. Although detailed data were unavailable, this traffic included about 42 Mmt (294 Mbbl) of crude and refined petroleum, 10 Mmt of coal, 8 Mmt of other crude minerals, and 25 Mmt of construction materials.

Turkish electrical output totaled 73,768 GW•h in 1993, of which 54% was from thermal plants and the rest from hydroelectric facilities. This output was 9.5% higher than that in 1992 because of a 28% increase in hydroelectricity production; thermal output fell 2%. Of the thermal powerplant output in 1993, lignite-fired plants accounted for 55%; natural gas, 27%; fuel oil, 13%; and hard coal, 5%. In 1992, the latest year for which data were available, the major industrial electricity consumers were the iron and steel industry, which consumed 5,982 GW•h (9% of total output); the chemical industry, with 3,458 GW•h; the ceramics and cement industries, which consumed a total of 4,733 GW•h; and the nonferrous basic metals industries, with 2,631 GW•h. The coal and lignite mines consumed 731 GW•h and the other mines a total of 501 GW•h.

Total electrical generating capacity in 1992 was 18,714 MW, of which about 55% was installed in thermal plants and

almost all the remainder in hydroelectric plants. Turkey is in the process of greatly expanding its electrical generating capacity, mostly through the construction of new hydroelectric plants. The Southeast Anatolian Project (GAP), involving 21 dams and 17 hydroelectric plants, will add about 8,000 MW of capacity and is the most ambitious of the new projects. The Atatürk Dam and powerplant on the Euphrates River, scheduled for completion in 1994, is the largest of the GAP facilities and will have a capacity of 2,400 MW, installed in eight turbines, when completed. The powerplant began generating electricity in 1992 and was operating at about one-third of capacity in 1993. Completion was scheduled for 1994. Several new lignite and/or hard coal-burning plants have been planned but have faced delays stemming from growing public opposition to the expected air pollution. Some of the new plants could instead be designed for natural gas, but such use would require a significant expansion of the country's natural gas distribution network. In 1993, the Government continued to study the construction of one or more nuclear powerplants.

OUTLOOK

Much of Turkey's economic growth since 1980 has been through massive public spending and export-incentive-induced capacity expansion programs in many of the country's industrial sectors. Servicing of the high levels of public and private debt incurred thereby is anticipated to be a significant burden to future economic growth. Increasing wage and other production costs and low world commodity prices have forced the closure of a number of mines. It appears unlikely that commodity prices will improve sufficiently to allow all of the closed mines to reopen.

Turkey is actively pursuing trade and other investment opportunities in the nearby Turkic republics and throughout the Middle East. A number of agreements have been signed in this regard but it is as yet unclear how successful these ventures will be. Political instability and

severe fiscal and infrastructural problems throughout the region make some of the ventures uncertain, at least in the short term.

The Government is progressing with its privatization program. The remaining state cement mills are expected to be sold soon, followed by state holdings in the steel and mineral fuels sectors. Privatization of the more purely mining parastatals is less certain, given the perception that many of the operations therein are uneconomic. The entire privatization program can be expected to face political and labor union opposition, both of which have resulted in court challenges in the past.

Prospects for growth in the mineral commodities sector remain greatest in the value-added industries. However, expected severe competition on the export market augurs for a decline in the rate of expansion of the Turkish steel sector. The cement sector appears destined for further growth in both the domestic and export markets. Output of most primary minerals will continue to be largely export-driven and will depend on world demand. The Turkish chromite mining and ferrochromium industry, especially in light of expected increases in production in South Africa, would appear especially vulnerable in this regard. In the short term, copper and zinc ore production are likely to increase as at least one new major mine comes on-stream. Anticipated growth of the domestic and export glass and ceramics markets should allow growth in production of a number of industrial minerals, particularly clays and feldspar. Gold production is poised to increase significantly, pending issuance of environmental permits to mine at three locations in western Anatolia. Environmental considerations are expected to become a major cost factor in the growth of mining in Turkey and threatens the survival of some facilities. Lignite mines are particularly vulnerable in this regard.

¹Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL10,985=US\$1.00. The average exchange rate in 1992

was TL6,872=US\$1.00.

²Ereçen, N. Known Ore and Mineral Resources of Turkey. MTA Bull. 185, 1989, 108 pp.

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Publications

Etibank Annual Report.
General Directorate of Petroleum Works:
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TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992 ^a	1993 ^a	Annual capacity ^a (Jan. 1, 1994)
METALS						
Aluminum:						
Bauxite ²	534,273	772,673	488,640	419,872	³ 459,367	600,000
Alumina:						
Gross weight	200,560	177,144	159,091	156,474	³ 169,195	² 200,000
Al content	104,552	92,746	83,290	81,570	³ 88,195	104,000
Metal, smelter	61,776	60,903	55,821	58,550	³ 58,503	³ 60,000
Antimony:						
Ore, mine output:						
Gross weight	30,023	8,997	5,565	5,065	² 2,100	5,000
Sb content	1,471	5,552	370	309	³ 116	310
Concentrates:						
Gross weight	1,607	613	394	² 218	³ 93	350
Sb content	1,035	367	² 236	¹ 131	³ 61	200
Regulus	5	84	—	—	—	100
Cadmium	54	46	22	23	³ 31	³ 125
Chromite:						
Gross weight (34% to 43% chromic oxide)	1,608,043	1,204,691	1,381,633	758,732	³ 706,250	1,500,000
Salable product	1,076,834	835,704	² 940,000	531,112	³ 532,964	1,000,000
Copper:						
Mine output (exclusive of pyrite):						
Gross weight	3,468,288	4,018,506	3,942,254	3,158,674	³ 3,958,000	4,000,000
Cu content of ore	38,151	39,825	⁴ 40,000	³ 32,000	45,000	45,000
Cu content of pyrite ^a	2,360	1,000	920	620	500	1,000
Concentrates (exclusive of pyrite):						
Gross weight	166,833	179,429	178,719	143,196	140,000	150,000
Cu content	30,364	33,499	³ 33,100	² 26,500	² 22,900	28,000
Metal:						
Smelter output						
Refined ^a	25,015	25,167	32,401	31,568	³ 35,600	66,000
	86,400	84,200	80,800	93,500	³ 104,200	125,000
Gold, byproduct of base metals refining ^{a 4} kilograms	1,040	1,010	970	1,120	1,250	1,500
Iron and steel:						
Iron ore:						
Gross weight thousand tons	4,518	4,925	5,335	5,917	³ 5,070	6,500
Fe content ^a do.	² 2,453	² 2,689	2,900	3,200	2,800	3,500
Metal:						
Pig iron and ferroalloys:						
Ferrochromium	59,715	62,040	² 84,651	85,755	³ 90,030	³ 161,000
Ferrosilicon	4,970	5,225	1,736	1,250	³ 4,700	7,000
Pig iron and other ferroalloys thousand tons	3,523	4,827	4,594	4,508	³ 4,350	5,000
Steel, crude including castings do.	7,934	9,322	9,335	10,253	³ 11,414	³ 13,400
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight	345,051	397,765	323,164	233,944	² 236,000	300,000
Pb content	14,147	18,371	15,317	¹ 10,800	11,000	15,000

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992 ²	1993 ³	Annual capacity ⁴ (Jan. 1, 1994)
METALS—Continued						
Lead—Continued:						
Concentrates:						
Gross weight	43,721	34,153	*40,000	*28,000	30,000	45,000
Pb content	10,591	10,678	*10,000	*7,000	7,100	11,000
Metal, refined ⁵	7,000	9,000	8,500	9,000	5,000	10,000
Manganese ore, gross weight ⁵	—	—	500	*500	750	750
Mercury kilograms	197,364	59,650	25,119	*5,000	—	150,000
Silver, mine output, ⁶ Ag content ⁶ do.	49,400	52,500	63,800	103,000	103,000	115,000
Tungsten, W content of concentrate	—	—	—	—	—	—
Zinc:						
Mine output, Zn and Pb-Zn ore:						
Gross weight	446,616	450,185	367,163	*306,960	*236,000	400,000
Zn content	39,412	39,066	32,546	*32,514	25,000	35,000
Concentrates:						
Gross weight	69,856	41,650	*40,000	*37,000	30,000	50,000
Zn content	18,707	15,717	*13,000	*13,000	10,000	17,000
Metal, smelter, primary	24,170	20,063	17,370	18,770	*16,960	*33,650
INDUSTRIAL MINERALS						
Abrasives, natural: Emery	11,299	10,828	24,018	41,474	45,000	45,000
Asbestos:						
Run of mine	—	—	—	—	—	—
Fiber	—	—	—	—	—	—
Barite, run of mine	425,519	366,995	250,579	311,335	*110,000	450,000
Boron minerals:						
Run of mine	1,983,050	2,062,758	*1,814,205	*1,796,100	1,800,000	2,000,000
Concentrates	1,174,520	1,252,591	*1,209,887	1,058,885	*1,124,484	1,250,000
Cement, hydraulic thousand tons	23,796	24,416	26,091	28,607	*31,4003	37,500
Clays:						
Bentonite	93,256	97,464	123,928	123,516	*382,312	125,000
Kaolin	238,251	251,182	186,517	134,416	*138,989	250,000
Other	379,311	463,560	*750,000	*750,000	750,000	750,000
Feldspar, run of mine	84,932	182,266	229,543	464,736	*519,762	500,000
Fluorspar ⁷	13,000	10,000	5,000	*3,074	4,000	10,000
Glass, crude thousand tons	986	1,156	1,127	1,171	1,300	1,500
Graphite, run of mine	11,873	18,712	25,867	20,978	20,000	25,000
Gypsum, other than that for cement	213,731	171,518	307,246	278,402	*541,000	550,000
Lime ⁷ thousand tons	1,432	1,407	1,581	1,582	1,700	2,000
Magnesite, run of mine	1,343,893	845,124	1,365,287	1,224,900	*628,762	1,350,000
Meerschaum ⁸ kilograms	10,350	4,000	2,800	1,050	6,000	10,000
Nitrogen: N content of ammonia	379,697	373,287	356,574	*344,275	*325,800	380,000
Perlite, run of mine	132,941	138,510	87,994	280,883	*213,000	300,000
Phosphate rock (salable product)	84,810	86,788	3,630	*64,803	65,000	125,000
Pumice ⁹	753,745	438,276	447,476	736,316	*1,045,500	1,500,000

See footnotes at end of table.

TABLE I—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992 ^a	1993 ^a	Annual capacity ^a (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued						
Pyrites, cupreous, gross weight	214,434	145,510	133,600	89,000	50,000	150,000
Salt, NaCl, all types thousand tons	1,739	1,889	1,440	1,418	¹ 1,426	2,000
Silica sand, washed product do.	495	469	² 358	⁵ 510	520	550
Sodium compounds, n.e.s.:						
Soda ash (trona) ^a do.	381	385	385	385	385	385
Sulfate, concentrates	68,183	110,273	¹ 115,000	75,058	⁷ 76,450	115,000
Stone:						
Dolomite	323,136	184,155	288,728	255,310	250,000	900,000
Limestone, other than for cement thousand tons	3,742	4,221	3,940	6,937	6,000	7,000
Marble ^a do.	195	170	300	550	585	600
Quartzite	571,980	996,680	¹ 1,000,000	1,310,259	¹ 1,667,177	1,300,000
Strontium minerals: Celestite:						
Run of mine	137,000	117,000	105,000	59,000	68,000	150,000
Concentrates	86,375	73,790	70,000	37,940	43,700	100,000
Sulfates, n.e.s.: Aluminum sulfate (alunite)	3,919	14,077	19,826	9,278	9,000	20,000
Sulfur:						
Native, other than Frasch	22,960	19,550	22,300	² 22,700	20,000	55,000
S content of pyrites	95,852	64,643	⁹ 9,000	40,000	33,000	66,000
Byproduct:						
Petroleum	13,166	3,547	16,910	16,861	45,000	23,000
Other ^a	49,000	7,000	5,000	5,000	5,000	50,000
Total ^a	180,978	104,740	103,210	84,561	103,000	194,000
Talc	6,280	5,557	6,122	3,918	4,000	6,000
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural	415,456	270,238	² 260,000	249,535	50,000	400,000
Carbon black ^a	32,000	25,000	30,000	35,000	35,000	40,000
Coal:						
Hard coal, run of mine thousand tons	6,259	5,629	5,209	5,225	4,000	5,000
Lignite, run of mine do.	52,567	46,892	49,727	50,439	³ 47,827	60,000
Coke and semicoke do.	3,039	3,435	3,381	3,257	³ 3,140	3,450
Gas:						
Natural, marketed thousand cubic meters	173,822	212,488	202,713	197,796	190,000	200,000
Coal, manufactured do.	71,565	39,644	43,046	38,789	35,000	100,000
Petroleum:						
Crude ¹⁰ thousand 42-gallon barrels	20,596	26,614	31,875	30,656	² 27,971	32,000
Refinery products:						
Liquefied petroleum gas do.	7,770	7,845	7,742	7,755	⁸ 8,282	8,000
Gasoline do.	19,869	22,291	22,466	23,846	² 29,725	25,000
Naphtha do.	13,185	12,455	9,497	10,588	¹ 10,311	15,000
Jet fuel do.	4,373	4,951	4,431	5,495	⁶ 6,216	6,000
Kerosene do.	2,691	1,293	1,137	1,125	¹ 1,333	2,700
Distillate fuel oil ¹¹ do.	46,167	49,071	47,717	49,570	⁵ 52,697	50,000
Lubricants do.	1,833	1,976	1,803	1,985	2,000	2,000
Residual fuel oil do.	54,483	56,516	56,920	57,705	⁶ 61,399	60,000

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992 ²	1993 ³	Annual capacity ⁴ (Jan. 1, 1994)	
MINERAL FUELS AND RELATED MATERIALS—Continued							
Petroleum—Continued:							
Refinery products—Continued:							
Asphalt	thousand 42-gallon barrels	2,583	4,368	5,280	5,657	6,000	6,000
Refinery fuel and losses	do.	5,072	4,814	4,912	5,686	5,700	5,700
Unspecified	do.	1,054	961	505	1,321	1,000	1,300
Total	do.	159,080	166,541	162,410	170,733	184,663	181,700

⁴Estimated. ²Preliminary. ³Revised.

¹Table includes data available through Aug. 18, 1994. Large quantities of construction materials (clay, sand and gravel) are quarried, as are limestone and gypsum for cement manufacture; however, information is inadequate to make accurate estimates of output levels.

²Data are for public sector only. Data for private-sector production are not available, but production is believed to be about 30,000 mt/a only.

³Reported figure.

⁴Data are estimated content of Turkish copper refinery tankhouse slimes.

⁵Does not include manganiferous iron ore from the Deveci Mine, production of which amounts to several hundred thousand tons annually and has a manganese content of 3% to 5%.

⁶Includes estimated content of base metals refinery tankhouse slimes.

⁷Data are lime produced for steel production and do not include the widespread artisanal production of lime for whitewash and for sanitation purposes.

⁸Data are based on reported units of 50-kilogram boxes.

⁹Turkish pumice production is officially reported in cubic meters and has a density reported to range from 0.5 to 1.0 ton per cubic meter. Values in this table have been converted using 1 cubic meter=0.75 ton.

¹⁰Data are reported in metric tons and have been converted to barrels using 7.161 bbl/mt.

¹¹Diesel fuel and special heating oil.

TABLE 2
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners ^{1 2}	Location of main facilities	Annual capacity
Aluminum and bauxite	Etibank Milas Boksit İşletmeleri Müdürlüğü (Etibank, 100%)	Open pit mine at Milas, 127 kilometers southwest of Denizli	150 diaspore.
Do.	Etibank Seydişehir Alüminyum Tesisleri Müessesesi Müdürlüğü (Etibank, 100%)	Doğankuzu and Mortaş bauxite mines at Madenli, 25 kilometers south of Seydişehir	450 bauxite.
Do.	do.	Alumina refinery and aluminum smelter at Seydişehir	200 alumina, 60 aluminum.
Barite	Barit Maden Türk A.Ş.	Mines near Sivas and Adana	220 ground barite.
Do.	Baser Maden Sanayi ve Ticaret A.Ş.	Mines at Isparta and Konya	90 ground barite
Do.	Emas Endüstri Mineralleri A.Ş.	Mine at Muş	100 ground barite
Do.	Etibank Beyşehir Barit İşletmesi (Etibank, 100%)	Mine at Beyşehir, 72 kilometers southwest of Konya	70 barite ore.
Do.	Etibank Antalya Elektrometalurji Sanayi İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Grinding plant at Antalya	100 ground barite.
Do.	Polbar Barit Endüstrisi A.Ş.	Mine near Antalya	120 ground barite.
Boron minerals	Etibank Bigadiç Madencilik İşletmeleri (Etibank, 100%)	Bigadiç, 38 kilometers southeast of Balıkesir	200 colemanite concentrate, 115 ulexite concentrate.
Do.	Etibank Emet Kolemanit İşletmeleri (Etibank, 100%)	Espey and Hisarcık Mines near Emet, 62 kilometers west-southwest of Kütahya	500 colemanite concentrate.
Do.	Etibank Kestelek Kolemanit İşletmeleri (Etibank, 100%)	Kestelek, 80 kilometers west southwest of Bursa	100 colemanite concentrate.
Do.	Etibank Kırka Boraks İşletmeleri Müessesesi Müdürlüğü (Etibank, 100%)	Kırka, 61 kilometers north of Afyon	500 tincal concentrate.
Cement	Adana Çimento Sanayii T.A.Ş. (Army Mutual Fund), 48.74%, other Government, ³ 47.28%)	12 kilometers east of Adana	1,850 cement.
Do.	Akçimento Ticaret A.Ş.	Büyüçekmece, 30 kilometers west of İstanbul	2,750 cement.
Do.	Aslan Çimento A.Ş. (LaFarge Coppée, France, 32%; Asland SA, Spain, 32%; Aurelius Bouwstoffen NV, Netherlands, 32%)	Darıca, 40 kilometers southeast of İstanbul	1,300 cement.
Do.	Baştaş Başkent Çimento Sanayii ve Tic. A.Ş.	Elmadag, 35 kilometers east of Ankara	1,320 cement.
Do.	Batı Anadolu Çimento Sanayii A.Ş.	Bornova, 10 kilometers northeast of İzmir	2,550 cement.
Do.	Çanakkale Çimento Sanayi A.Ş.	Near Ezine, 40 kilometers south of Çanakkale	2,000 cement.
Do.	Lafarge Coppée-Yibitaş Holdings JV (50% each)	Çorum Sivas and Yozgat plants	1,785.
Do.	Modern Çimento	Denizli plant	945.
Do.	Rumeli Çimento Sanayi ve Tic. A.Ş.	Bartın, Gaziantep, Trabzon, and Şanlıurfa plants	2,215.
Do.	Sabancı Group	İskenderun, Mersin and Niğde plants	2,500.
Do.	Set Group Holding (Soc. des Ciments Français, France, 100%)	6 plants in Marmara and Aegean coast regions	3,500 cement.
Do.	Türkiye Çimento ve Toprak Sanayii T.A.Ş. (ÇİTOSAN) (Government, ⁴ 100%)	9 plants	5,015 cement.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners ^{1 2}	Location of main facilities	Annual capacity
Chromium:			
Chromite ores and concentrates	Etibank Şark Kromları İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Mines at Güleman, 40 kilometers southeast of Elazığ	150 lump ore, 70 concentrate.
Do.	Etibank Üçköprü Maden İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	8 mines in Göcek District, west of Fethiye	15 lump ore, 30 concentrate.
Do.	Birlik Madencilik Ticaret ve Sanayi A.Ş.	Mines in Kayseri, Erzurum, and Erzincan Provinces	240 lump ore.
Do.	Akpaş Madencilik ve Paz. ve Ticaret A.Ş.	Mines in Erzurum, Erzincan, and Kayseri Provinces	200 lump ore, 70 concentrate.
Do.	Bilfer Madencilik A.Ş.	Mines in Kayseri and Sivas Provinces	100 lump ore, 45 concentrate. ⁵
Do.	Türk Madin Şirketi (AŞ)	Mines at Köyceğiz, 56 kilometers northwest of Fethiye, and at Eskişehir	24 lump ore, 88 concentrate.
Do.	Dedeman Madencilik Turizm Sanayi ve Ticaret A.Ş.	Kayseri Province	56 lump ore.
Do.	Egemetal Madencilik A.Ş.	Mines in Bursa, Mersin, Eskişehir, and Erzurum Provinces	35 lump ore, 40 concentrate.
Do.	Pinar Madencilik ve Turizm A.Ş.	Mines in Kayseri and Adana Provinces	25 lump ore, 14 concentrate.
Do.	Akdeniz Madencilik Ticaret ve Sanayi A.Ş.	Adana	25 lump ore.*
Do.	Other (9) private producers	Mines in Köyceğiz, Bursa, Adana, İskenderun, and Eskişehir Provinces	114 lump ore, 12 concentrate.
Ferrochrome	Etibank Elazığ Ferrokrom İşletmesi (Etibank, 100%)	Ferrochrome plant, 50 kilometers east of Elazığ	150 high-carbon ferrochrome.
Do.	Etibank Antalya Elektrometalurji Sanayi İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Ferrochrome plant at Antalya	11 low-carbon ferrochrome.
Coal:			
Hard coal	Türkiye Taşkömürü Kurumu Genel Müdürlüğü (TTK) (Government, 100%)	Mines on 5 coalfields near Zonguldak	7,000.*
Lignite	Türkiye Kömür İşletmeleri Kurumu (TKİ) (Government, 100%)	38 mines throughout Turkey	45,000.*
Do.	Private-sector producers	About 200 small mines throughout Turkey	8,000.*
Copper	Etibank Küre Bakırlı Pirit İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Open pit copper and pyrite mine at Küre, 14 kilometers south of İnebolu	90 copper concentrate, 460 pyrite concentrate.
Do.	Etibank Ergani Bakır İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Open pit mine and smelter at Ergani, 59 kilometers southeast of Elazığ	16 blister copper. ⁵
Do.	Karadeniz Bakır İşletmeleri A.Ş. (Etibank, 99.91%)	Mine and concentrator at Murgul near Artvin; mines at Sürmene and Espiye near Trabzon	175 copper concentrate,* 20 blister copper.* ⁵
Do.	do.	Open pit Kutlular Mine near Trabzon	15 copper concentrate.*
Do.	do.	Underground mine near Küre	95 ore.*
Do.	do.	Smelter and acid plant at Samsun	38 blister copper.
Do.	Rabak Elektrolitik Bakır ve Mam. A.Ş.	İstanbul	35 refined copper.
Do.	Sarkuysan Elektrolitik Bakır Sanayii ve Ticaret A.Ş.	Gebze, 40 kilometers west of İzmit	70 refined copper.
Do.	Er-Bakır Elektrolitik Bakır Mam. A.Ş.	Denizli	18 refined copper.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners ^{1 2}	Location of main facilities	Annual capacity
Iron and steel:			
Iron ore	Türkiye Demir ve Çelik İşletmeleri Genel Müdürlüğü (TDÇİ) (Government, 100%)	Divriği Mines, 115 kilometers northwest of Elazığ	3,000 run of mine ore;* 1,100 pellets; 600 concentrate; 500 lump ore.
Do.	do.	Deveci Mine at Hekimhan, 112 kilometers west of Elazığ	750 ore.*
Do.	Bilfer Madencilik A.Ş.	Mines near Divriği	1,500.
Steel	do.	İskenderun	2,200 crude steel.
Do.	do.	Karabük	680 crude steel.
Do.	Makina ve Kimya Endüstrisi Kurumu (MKEK) (Government, 100%)	Kırıkkale, 62 kilometers east of Ankara	60 crude steel.
Do.	Ereğli Demir ve Çelik Fabrikaları T.A.Ş. (Erdemir) (Government, ³ 46.53%, others, 53.47%)	Ereğli	2,000 crude steel.
Do.	Çolakoğlu Metalurji A.Ş.	Gebze, 40 kilometers west of İzmit	650 crude steel, 1,050 semifinished steel.
Do.	Çukurova Çelik Endüstrisi A.Ş.	Aliağa, 40 kilometers north-northeast of İzmir	2,000 semifinished steel.
Do.	Diler Demir Çelik Endüstri ve Ticaret A.Ş.	İzmit	310 semifinished steel.
Do.	Ekinciler Demir ve Çelik Sanayi A.Ş.	Arc furnace and 1 rolling mill at İskenderun. Rolling mills at Adana, Karabük, and near İskenderun (Payas)	600 semifinished steel.
Do.	Habaş Sınai ve Tibbi Gazlar İstihsal Endüstrisi A.Ş.	Aliağa	600 semifinished steel.
Do.	İzmir Demir Çelik Sanayi A.Ş. (İDÇ) (İs-Bakansi, 60%, others, 30%)	do.	550 semifinished steel.
Do.	Kroman Çelik Sanayii A.Ş.	Gebze, 40 kilometers west of İzmit	420 semifinished steel.
Do.	Metaş İzmir Metalurji Fabrikası T.A.Ş.	İzmir	450 special and semifinished steel.
Do.	Sivas Demir-Çelik İşletmeleri A.Ş.	Sivas	450 semifinished steel.
Do.	Other (8) private-sector companies.	Plants near Bursa, İzmir, and İstanbul	1,448 semifinished steel.
Magnesite	ÇİTOSAN Konya Krom Magnezit Tuğla Sanayii A.Ş. (Government, 100%)	Konya	40 dead-burned magnesite, 38 bricks, 12 mortar.
Do.	ÇİTOSAN Kümaş Kütahya Manyezit İşletmeleri A.Ş. (Government, 100%)	Kütahya	144 dead-burned magnesite, 46 bricks.
Do.	Comag Continental Madencilik Sanayii Tic. A.Ş.	Mines at Tavşanlı, 40 kilometers northwest of Kütahya, and near Bursa	40 dead-burned magnesite.
Do.	Magnesit A.Ş. (Veitscher Magnesitwerke AG, Austria)	Mine at Margı, 50 kilometers northeast of Eskişehir	60 dead-burned magnesite.
Mercury	metric tons Etibank Haliköy Maden İşletmesi (Etibank, 100%)	Mine near Ödemiş, about 70 kilometers southeast of İzmir	190 mercury. ⁵
Do.	do. Etibank Konya Çıva İşletmesi (Etibank, 100%)	Mine at Sarayönü, 47 kilometers north of Konya	100 mercury. ⁵

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners ^{1 2}	Location of main facilities	Annual capacity
Petroleum and natural gas:				
Crude petroleum thousand 42-gallon barrels		Türkiye Petrolleri Anonim Ortaklığı (TPAO) (Government, 100%)	Production from 34 fields, mostly in Diyarbakır, Gaziantep, and Siirt Provinces	25,000.*
Do.	do.	N.V. Turkse Shell (Royal Dutch/Shell)	Production from 20 fields, all in Diyarbakır and Siirt Provinces	5,000.*
Do.	do.	Other producers (private sector and in joint venture with TPAO)	Production from 9 fields, mostly in Diyarbakır, Gaziantep and Siirt Provinces	3,500.*
Refined petroleum	do.	Türkiye Petrol Rafinerileri A.Ş. (TÜPRAŞ) (Government, ³ 100%)	Refinery at Batman	7,700 crude input.
Do.	do.	do.	Refinery at Aliğa	70,000 crude input.
Do.	do.	do.	Refinery at İzmit	91,000 crude input.
Do.	do.	do.	OAR refinery at Kırıkkale	35,000 crude input.
Do.	do.	Anadolu Tasfiyehanesi A.Ş. (ATAŞ)	Refinery at Mersin	30,800 crude input.
Natural gas thousand cubic meters		Türkiye Petrolleri A.O. (TPAO) (Government, 100%)	Çamurlu Field, Siirt Province	800.*
Do.	do.	do.	Hamitabat Field in Thrace	205,000.*
Do.	do.	do.	Umurca Field in Thrace	10.*
Phosphate rock		Etibank Güneydoğu Anadolu Fosfatları İşletmesi (Etibank, 100%)	Open pit mine at Mazıdağı, 30 kilometers northwest of Mardin	125 concentrate.
Silver	kilograms	Etibank 100. Yıl Gümüş Madeni İşletmeleri Müessesesi Müdürlüğü (Etibank, 100%)	Aktepe Mine near Gümüşköy, 20 kilometers west-northwest of Kütahya	75,000.*
Strontium		Barit Maden Türk A.Ş.	Mine at Akkaya, 25 kilometers south of Sivas	100 celestite concentrate.*
Sulfur		Keçiborlu Kükürt İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Mine at Keçiborlu, 30 kilometers northwest of Isparta	55.
Do.		Türkiye Petrol Rafinerileri A.Ş. (TÜPRAŞ) (Government, ³ 100%)	Recovery plants at company oil refineries	23.
Zinc, smelter		Çinko Kurşun Metal Sanayii A.Ş. (ÇINKUR) (Etibank, 99.91%)	Zinc-lead smelter at Kayseri	34 zinc, 125 tons cadmium.

*Estimated.

¹Turkish private-sector ownership unless otherwise noted.

²Etibank refers to the 100% Government-owned group administered by Etibank Genel Müdürlüğü.

³Shares are held by the Public Participation Fund Administration (PPFA) for eventual privatization.

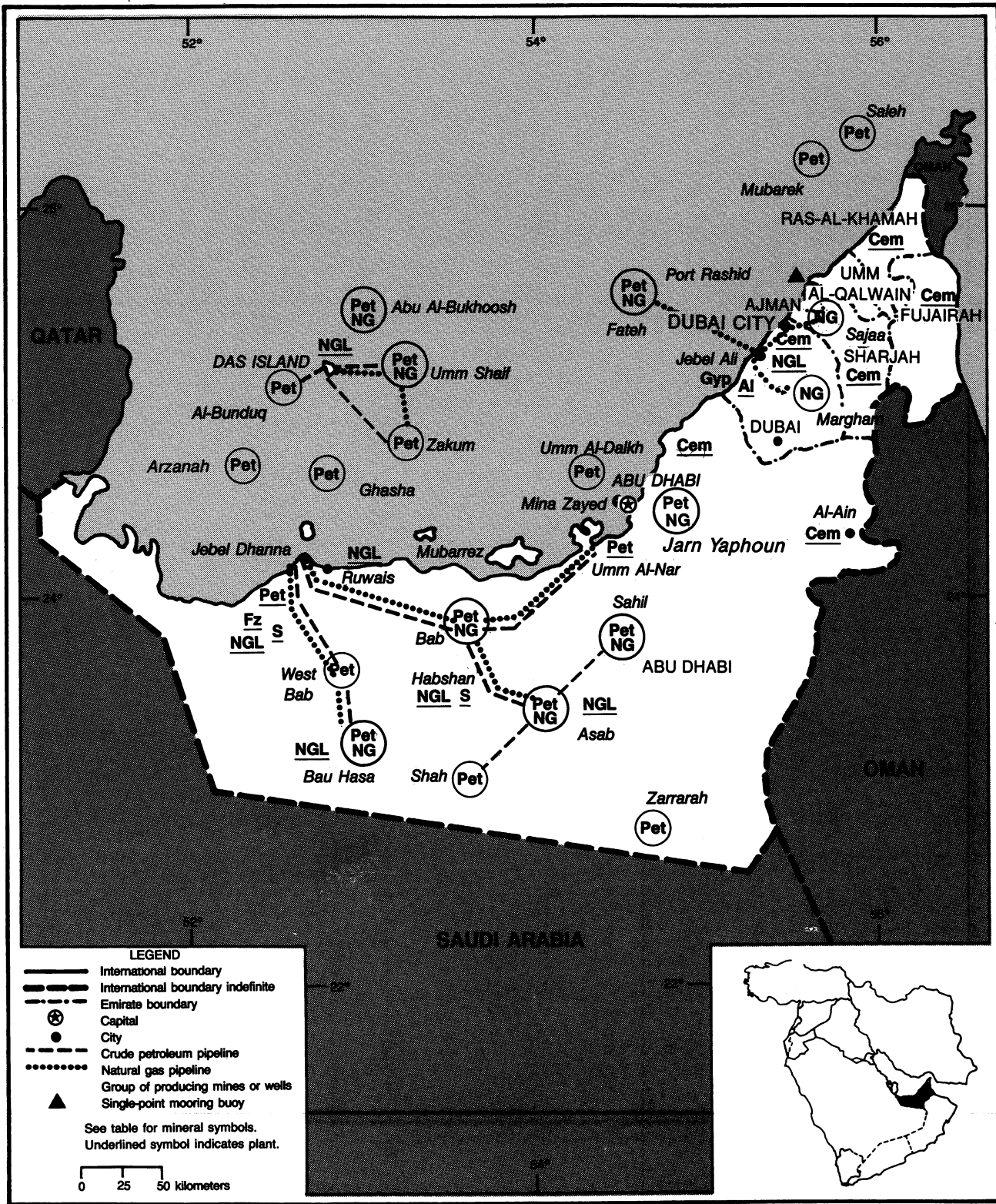
⁴ÇİTOSAN operated all plants in 1993, but five were held by the PPFA for privatization.

⁵Facilities were idle in 1993.

UNITED ARAB EMIRATES

AREA 75,581 km²

POPULATION 2.7 million



THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES¹

By Philip M. Mobbs

The production of crude petroleum and natural gas was the most important facet of both the United Arab Emirates' (UAE²) mineral industry and the country's economy in 1993. Crude petroleum and natural gas accounted for slightly less than 40% of the country's 1993 gross domestic product (GDP) of \$35.6 billion.³ Aluminum metal, ammonia, and cement were also significant in terms of production volume and export earnings. However, other mineral extraction contributed only \$101 million to the nation's economy.⁴

Steel and cement prices had increased dramatically in the UAE in 1992 and 1993, due in part to the demands of the general post-1991 Gulf War construction boom. However, the latter tapered off during 1993. The fall of oil prices during 1993 resulted in reduced oil revenues for the country, which in turn adversely affected large construction project outlays.

GOVERNMENT POLICIES AND PROGRAMS

All mineral resources are owned and controlled by the individual Emirates and only loosely administered by the Federal Government. The Ministry of Petroleum and Mineral Resources coordinates Federal UAE activities with the international community. During the year, the Government continued to encourage the expansion of the country's crude petroleum and natural gas production capacity.

ENVIRONMENTAL ISSUES

The new Federal Environment Authority (FEA) was organized under Federal law No. 7 of 1993. The FEA is

responsible for combatting pollution in the UAE and is authorized to license activities potentially harmful to the environment.

PRODUCTION

The 1992 average crude oil production of about 2.3 Mbb/d, primarily from Abu Dhabi, had settled back to 2.2 Mbb/d during 1993. Additional petroleum and gas production was from Dubai, Sharjah, and Ras Al-Khaimah. However, Dubai's oil production declined dramatically during the year. Additional gas-injection facilities were planned for Dubai to augment the current water-injection program. Although the variety and output of minerals produced was small, demand for domestic industrial minerals continued to grow. (See table 1.)

TRADE

Crude oil and refined petroleum products were the principal mineral products exported, accounting for approximately 60% of the country's total exports of \$23.2 billion in 1993. Preliminary data from the Ministry of Planning indicated that 1993 oil revenues had dropped 3.3% to \$13.99 billion from \$14.47 billion registered in 1992.⁵ The United Nation's trade embargo against Iraq, initiated in late 1990, had resulted in an unfulfilled international petroleum demand that allowed the UAE to increase production and exports.

Japan was the primary customer for UAE petroleum and natural gas, taking almost 50% of produced petroleum, all of Abu Dhabi Gas Liquefaction Co.'s (ADGAS) liquefied natural gas (LNG), and most of its liquefied petroleum gas (LPG). During October, ADGAS and

Tokyo Electric Power Co. signed a 25-year contract doubling the volume of gas exports slated for Japan under the previous contract.

Aluminum was exported to 21 countries in 1992, the last year for which data were available. Japan received 42.5% of the exports, the Republic of Korea, 21%; and Taiwan, 12%. Dubai was also a significant gold bullion and jewelry trading center.

STRUCTURE OF THE MINERAL INDUSTRY

The Government was heavily involved in the mineral industry. (See table 2.) Nonetheless, private participation continued to grow with the emphasis on expansion of the nonfuel sector. International petroleum companies were heavily involved in crude oil and natural gas development and infrastructure projects in Abu Dhabi. Expatriates made up a significant portion of the labor force.

COMMODITY REVIEW

Metals

The Dubai Aluminum Co. Ltd. (Dubal) smelter received ISO 9002 certification, an international quality management designation, during 1993. Aluminum output dropped from the 1992 record production owing to an explosion and fire in the Dubal power station on October 27, 1993.

The Chromite Mining Joint Venture, owned by Derwent Mining Ltd. of Ireland and Portman Mining Ltd. of Australia, began production from reserves of 200,000 tons of 48% Cr₂O₃ ore in Fujairah.⁶

Other metal operations included the

Ahli Steel Co., which had a 70,000-mt/a steel plant for production of deformed reinforcing bar near Dubai; Solo Industries Ltd. Sharjah, which operated a 800-mt/a lead refinery for scrap recycling; and Lucky Recycling Ltd. Dubai, which remelted copper scrap.

Industrial Minerals

Heavy demand for cement for construction and refurbishing projects in the UAE led to higher prices. The price situation was worsened by maintenance problems at domestic plants, in addition to unavailability of domestic production that had been contracted for export.

Ruwais Fertilizer Industries continued to expand fertilizer exports. Smaller fertilizer plants included a 219,000-mt/a plant at Ajman and the 6,000-mt/a Union Kemira plant at Jebel Ali, Dubai. Abu Dhabi National Oil Co.'s (ADNOC) subsidiary, National Chlorine Industries, produced salt, chlorine, and caustic soda at its plant in Umm Al-Nar, Abu Dhabi. ADGAS' Das Island Sulfur Project was completed in June 1993 when a load of liquid sulfur was shipped to Ruwais for pelletization.

Mineral Fuels

A third liquefaction train, which would double the LNG output capacity to nearly 5 Mmt/a, was being constructed on Das Island for ADGAS. The Bechtel Corp.-Technip joint venture was contracted to expand the gas processing facilities at Habshan. This \$1.3 billion onshore gas development project for ADNOC will enhance development of the Thamama B, C, and F sour gas reservoirs. A projected natural gas flow of 42 Mm³/d is to be treated to recover condensate and sulfur. Construction of storage tanks at Ruwais and a 245-km pipeline are also included in the contract.⁷

By yearend 1993, the capacity of the Bab Oilfield was increased from 36.5 to 91.3 Mbbl/a and the development of Jarn Yaphur Field, a 3.7 Mbbl/a condensate operation, was completed. Amoco Sharjah Oil Co. drilled two successful delineation wells on its onshore Kahaif

concession in Sharjah and was expanding the capacity of the Sajaa gas plant from 12.4 Mm³/d to 19.8 Mm³/d.

During December 1993, after the West Jiri-IX well was abandoned as a dry hole, International Petroleum Corp. of Canada terminated operations on its Ras Al-Khaimah concession. ADNOC commissioned additional three-dimensional (3D) land and marine seismic surveys in Abu Dhabi.

Reserves

The country had estimated proven petroleum reserves of 98 billion bbl. Proven natural gas reserves were estimated to be 5.26 trillion m³. The bulk of the UAE's hydrocarbon reserves were in Abu Dhabi.

INFRASTRUCTURE

The nation's four governmental power organizations had a total installed electricity generating capacity of 5,500 MW. A number of new power and desalinization plants were under construction.

The nation had an extensive crude oil and natural gas pipeline network. There were seven coastal petroleum terminals, located at Ruwais, Jebel Dhanna, Port Zayed, and Umm Al-Nar in Abu Dhabi; Jebel Ali and Port Rashid in Dubai; and in Sharjah. Island or mooring buoy loading facilities were at Abu Al-Bukhoosh, Das Island, Delma Island, Mubarraz, and Zirku Island in Abu Dhabi; Fateh, Dubai; and Mubarak, Sharjah. A 212,000-ton bunker-fuel storage facility was constructed at Metro Oil's new distribution terminal at Fujairah, which was the UAE's third largest container port after Dubai Port Authority's Port Rashid and Jebel Ali Port. Metro Oil, a Greek company, also planned to reconstruct a previously owned 35,000-bbl/d oil refinery that was being imported from the United States.⁸

The country's port facilities and merchandising capabilities are expected to attract additional precious metal and stone consolidation and transshipment commerce, especially with the

liberalization of trade policies in nearby India.

OUTLOOK

Privatization and expanding economic interests should ensure growth for the mineral industry. Revenues from mineral fuels should continue to be reinvested in diversification projects and downstream processing of higher valued materials.

¹Text prepared June 1994.

²Includes the following seven Emirates: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al-Khaimah, Sharjah, and Umm al-Qaywayn.

³Where necessary, values have been converted from Emirian dirhams (Dh) to U.S. dollars at the rate of Dh3.67=US\$1.00.

⁴Middle East Economic Digest. Edging Away From Oil Dependency. V. 38, No. 14, May 6, 1994, pp. 33-36.

⁵Arab Oil & Gas Directory 1994, Arab Petroleum Research Center, Paris, France, 1994, 616 pp.

⁶Metal Bulletin. Portman May Invest in Ukraine Mn Mine. No. 7698, July 16, 1992, p. 9.

⁷Oil & Gas Journal. Abu Dhabi Sets Upgrade/Expansion of Gas Facilities. V. 91, No. 14, Apr. 5, 1994, p. 25.

⁸Work cited in footnote 5.

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Agencies

Abu Dhabi National Oil Company (ADNOC)
P.O. Box 898
Abu Dhabi, United Arab Emirates
Telephone: (971) (2) 666-000
Facsimile: (971) (2) 602-3389
Abu Dhabi Gas Liquefaction Company (ADGAS)
P.O. Box 3500
Abu Dhabi, United Arab Emirates
Telephone: (971) (2) 333-888
Facsimile: (971) (2) 606-5456

Publication

Arab Oil & Gas Directory 1994, Arab Petroleum Research Center, Paris, France, 1994, 616 pp.

TABLE 1
UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1989	1990	1991	1992	1993 [*]	Annual capacity [*] (Jan. 1, 1994)
Aluminum, metal, primary ingot	168,250	174,251	[†] 239,030	[†] 244,605	242,264	250,000
Cement, hydraulic ³ thousand tons	3,387	3,264	3,473	[†] 3,800	3,500	3,800
Chromite	—	—	—	—	10,000	25,000
Fertilizer materials:						
Ammonia:						
Gross weight	394,000	358,000	347,600	[†] 332,000	350,000	400,000
N content	324,000	294,500	286,100	[†] 275,000	287,700	328,800
Urea:						
Gross weight	579,000	496,000	517,000	[†] 506,000	520,000	590,000
N content	270,000	231,000	241,000	[†] 236,000	242,600	275,235
Gas, natural:						
Gross million cubic meters	30,837	30,925	[†] 32,940	[†] 36,670	37,000	37,000
Dry do.	22,993	23,786	[†] 25,940	[†] 28,960	28,000	29,000
Gypsum [*] thousand tons	87	89	95	95	95	95
Lime [*] do.	45	45	45	45	45	45
Natural gas plant liquids [*] thousand 42-gallon barrels	47,450	58,400	60,000	60,000	60,000	60,000
Petroleum:						
Crude ⁴ do.	715,400	772,700	889,505	[†] 835,804	800,000	900,000
Refinery products do.	67,890	[†] 71,200	[†] 71,200	[†] 76,700	76,700	77,000
Sulfur, byproduct:[*]						
From petroleum refining	10,000	10,000	10,000	[†] 20,000	24,000	34,000
From natural gas processing	70,000	80,000	64,000	[†] 100,000	122,000	292,000
Total	80,000	90,000	74,000	[†] 120,000	146,000	326,000

^{*}Estimated. [†]Revised.

¹Table includes data available through June 28, 1994.

²In addition to the commodities listed, crude industrial minerals such as common clays, diabase, limestone, marble, shale, other construction stone, and sand and gravel presumably are produced, but output is not reported, and general information is inadequate to make reliable estimates of output levels.

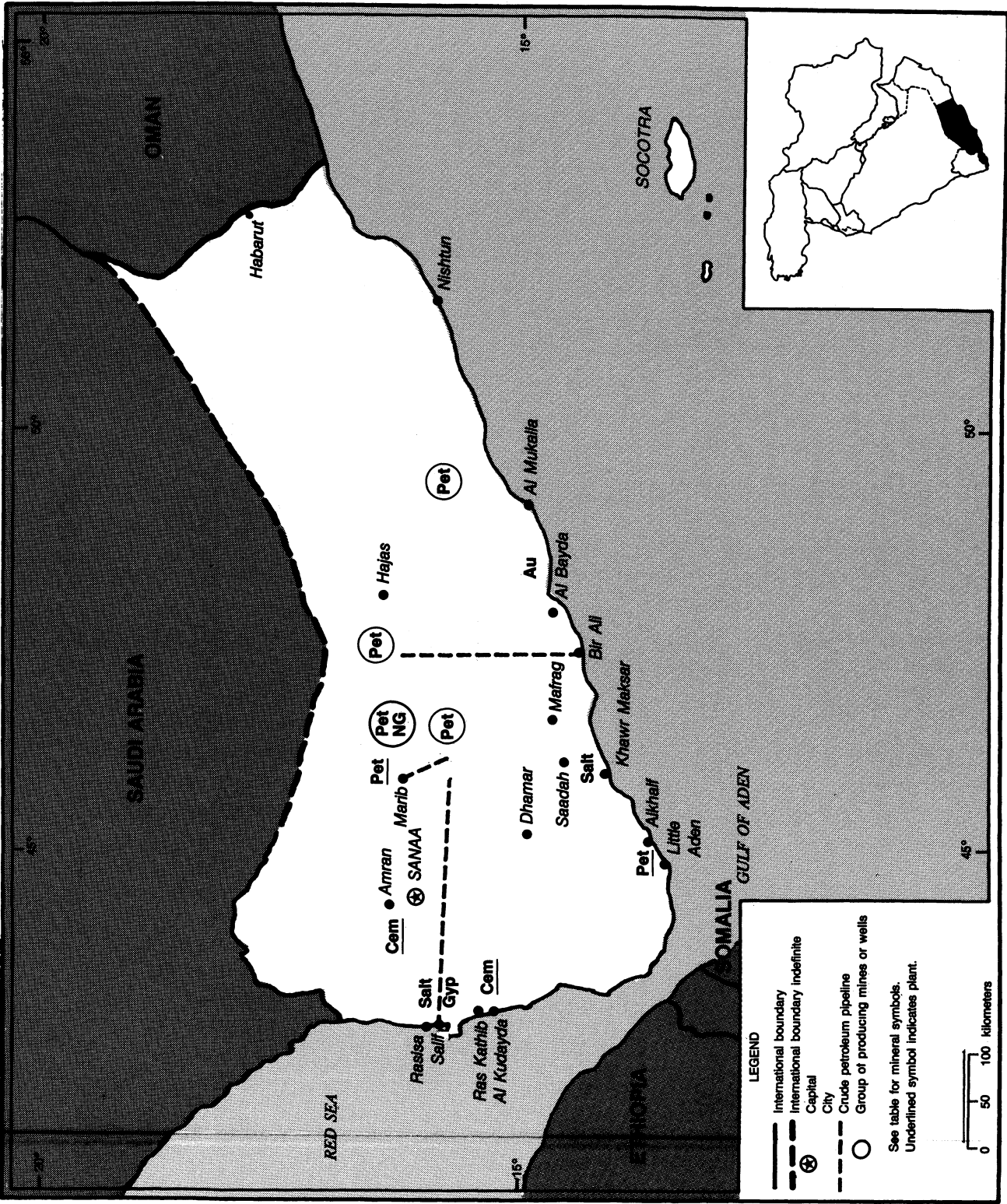
³Includes white cement.

⁴Includes lease condensate.

REPUBLIC OF YEMEN

AREA 527,970 km²

POPULATION 10.7 million



THE MINERAL INDUSTRY OF REPUBLIC OF YEMEN¹

By Bernadette Michalski

The nation's mineral industry activity is dominated by crude oil production. Other mineral output includes cement, dimension stone, gypsum, and salt. The nation's gross domestic product was estimated at more than \$5 billion. The minerals industry accounted for more than \$2 billion, most of which was attributed to petroleum. Recent commercial discoveries resulted in heightened petroleum exploration activity. In 1993, at least 21 concessions were active covering nearly one-half of the nation's land mass.

GOVERNMENT POLICIES AND PROGRAMS

The Government of Yemen abstained from voting on the United Nation's sanctions during the 1990-91 Gulf crisis, resulting in the loss of aid from the Gulf nations and the United States and consequently placing the future of a number of development projects in question. Furthermore, the impact of the return of 800,000 Yemeni expatriates from Saudi Arabia created a huge population increase on a much lower foreign exchange base as the remittances from these very expatriates accounted for 20% of Yemen's foreign exchange earnings.

Originally scheduled for 1992, the unified republic's first general election was held on April 27, 1993. This election named members to the 301-seat Parliament. Election results inflamed political and tribal rivalries to the point of civil disruption.

PRODUCTION

Crude oil production averaged 240,000 bbl/d in 1993. The increased output, for

the most part, was derived from the South Masila fields where production commenced in July at 40,000 bbl/d, increasing to more than 135,000 bbl/d in the last 2 months of 1993. Production from the Marib fields increased by 25,000 bbl/d to nearly 200,000 bbl/d with the completion of new facilities. Production from the Shabwa fields was virtually constant for the year at 5,000 bbl/d. (See table 1.)

TRADE

The Government has liberalized import regulations for a number of commodities related to the construction and agricultural industries. These include cement, iron and steel manufactures, and fertilizers. Importers with sufficient financial resources are now permitted to bring these commodities into the country. Individual import licenses have the following ceilings: 15,000 tons for cement, \$600,000 for iron products, \$350,000 for fertilizers.

Petroleum accounted for more than three-quarters of Yemen's total export earnings. An additional source of revenue was realized when the Masila fields came on-stream in the third quarter, augmenting crude oil exports by approximately 10 Mbbl for a total of more than 64 Mbbl exported in 1993. However, the value of imported raw materials and consumer goods continued to exceed export earnings. Although most of the petroleum exports were destined for the Asian markets, the United States imported a total of 2.3 Mbbl of unfinished oils, residual fuel oil, and naphtha in 1993.

Total petroleum exports in 1994 are expected to average 275,000 bbl/d. The increased export volume should, for the

most part, reflect a full year's production from the newly developed Masila fields.

STRUCTURE OF THE MINERAL INDUSTRY

The Republic of Yemen has passed mining legislation guaranteeing the rights of private property except in the mining of precious stones and the extraction of hydrocarbons. The royalty rate due to the Government in any mining operation is 5% on precious metals and 3% on all other minerals. The precious stone and hydrocarbon industries remain the exclusive domain of the Government. In an effort to accelerate exploration and development, the Government has entered into multiple-exploration and production-sharing agreements with private companies that can offer both expertise and capital.

COMMODITY REVIEW

Exploration for commercial metallic mineral deposits was encouraged by the Government. Two mineral prospecting permits were awarded to Cluff Abela Minerals (Yemen) Ltd. The first covers 3,100 km² in the northern region near Sadah where previous prospecting has outlined several near-surface gold occurrences. The second covers 5,500 km² in the south near Tabaq and Awdah where lead, zinc, and silver in carbonate terrain are under investigation.

The Madden gold deposit 50 km west of Al Mukalla is being further defined as to structure, grade, thickness, and gold distribution of the ore zone to develop a mining plan. Under exploration carried out by the U.S.S.R. in the mid-1980's, estimated reserves-resources were at 23 tons of gold to a depth of 550 m at an

average mineralized grade of 11 to 12 g/mt.

The Yemen Corp. for the Production and Marketing of Cement awarded a design and construction supervision contract for the turnkey Al Buh cementworks near Mafrag. The 500,000-mt/a-capacity cement plant was financed by Japan's Overseas Economic Cooperation Fund at \$145 million. Completion of this project should bring the nation's total annual cement production capacity to 1.25 Mmt. Existing plants, the Japanese built 500,000-mt/a-capacity Amran plant and the 300,000-mt/a-capacity Bajil plant, were being considered for modernization and expansion.

The U.S. Enron Corp. and the Yemen Exploration and Production Co. (YEPC), a joint venture of Hunt Oil Co. and Exxon Corp., each entered bids to develop natural gas resources. Plans include the construction of a natural gas liquefaction plant with the capacity to produce 5 Mmt/a of liquefied natural gas (LNG) as part of an integrated gas export project, estimated to cost \$5.4 billion. Contractors for front-end engineering work and the turnkey contract were to be selected in mid-1994.

YEPC produced about 195,000 bbl/d of 40.4° API gravity crude oil from the Marib al-Jawf region. Associated natural gas is separated and stripped of natural gas liquids. The remaining gas is reinjected at the rate of 18 Mm³/d. The price of Marib oil remained at \$0.40 above the price of Brent crude. The highest price level for the year was in March, averaging \$19.14/bbl for the month, compared with an average price for the year of \$17.35/bbl. Production from the Canadian Occidental Petroleum's Masila concession fields, Camaal, Hejjah, and Sunah, commenced in the third quarter, bringing an average price of \$13.10/bbl. By early 1994, Masila production reached 140,000 bbl/d of 30.5° API gravity crude oil.

The Aden refinery is scheduled to undergo a modernization program, including the installation of new processing units and storage facilities. However, the Government has not yet

succeeded in assembling finance to overhaul the Aden Refinery, which now operates at less than 40% of its 160,000-bbl/d capacity.

The Marib topping plant is to double its capacity to 20,000 bbl/d before the close of the decade. The Government is considering building the nation's third petroleum refining facility at Mukalla. The Masila fields would supply the feedstock for a 100,000-bbl/d-capacity refinery.

Reserves

The combined estimated proven crude oil reserves of the Republic of Yemen were 4 billion bbl. Natural gas reserves were reported at 565 billion m³, of which 200 billion m³ is proven reserves in the Marib al-Jawf region.

INFRASTRUCTURE

Three pipelines now service the petroleum industry bringing export crude to the Red Sea and to the Gulf of Aden. A 438-km pipeline brings crude from the Marib oilfields to the floating oil export terminal at Ras Isa on the Red Sea. A 204-km pipeline connects the Shabwa fields to Al-Huwaymi terminal on the Gulf of Aden. A third export pipeline, opened in September 1993, brings crude oil a distance of 150 km from the Masila fields to the export terminal near Ash Shir.

OUTLOOK

The prospect of increased petroleum output during the coming years should lead to a steady growth in export earnings if prices are sustained or improved. Liberalized exploration laws and investment regulations have attracted not only foreign oil companies with development financing but metallic mineral exploration groups as well. The prospect of further commercial finds is a realistic one. However, full-scale commercial production of hydrocarbons and other minerals are at best 5 years in the future, pending the continued existence of an uncontested line of

governmental authority

In the short term, Yemen's outlook is less favorable. Relationships between the two leaders collapsed after the state's first multiparty elections when the former Peoples' Democratic Republic of Yemen (PDRY), sometimes called South Yemen, saw itself as politically marginalized, thus contributing to a rapid disintegration of the 3-year-long unity. New economic policies inflamed by old tribal rivalries brought the country on the brink of a civil war as the Vice President of the Republic abandoned the unified republic's capital of Sanaa for Aden, the former capital of PDRY, in August. A reconciliation agreement was signed 5 months later in Amman, Jordan, on February 20, 1994. The agreement provided for an extensive decentralization of the country, which was to be divided into provinces enjoying considerable autonomy in the management of their respective economic and social affairs. In addition, it provided for petroleum revenues to be managed jointly. Herein seems to be the major point of contention as the rapid rise in crude oil production in the Masila fields (in the former PDRY) is expected to surpass the output from the Marib fields (in the former Yemen Arab Republic, YAR) in the near future. The southern faction, the former PDRY, seeks to exclusively appropriate the oil wealth of the Masila region. In addition, the construction of a 5-Mmt/a-capacity natural gas liquefaction facility is under consideration. Enron Corp. of the United States and Total of France propose the plant site and export terminal location at Ras Omran on the Arabian Sea. However, the bulk of the natural gas reserves was discovered within the acreage allotted to the Marib region consortium of Hunt and Exxon, both of the United States, and Yukong of the Republic of Korea, which proposes project site location on the Red Sea. The site location for the LNG project further inflames the conflict between the northern and southern Yemeni factions. As hostilities between the northern and southern factions mounted in the spring of 1994, most operators carrying out exploration work pulled out their

nonessential staff. Unless an agreement is reached to share in hydrocarbon revenues as a republic, economic development will be in jeopardy.

Negotiations continued with Saudi Arabia as to mutual boundary delineation, principally involving the Provinces of Asir, Jahran, and Jizan. In 1993, Saudi Arabia addressed letters, as it had done a year earlier, to companies operating in the region informing them of the existing territorial dispute. British Petroleum and Petro-Canada did not renew their respective licenses in the spring of 1993 while Phillips Petroleum relinquished its

license that October. Resolution of this territorial claim is imperative to establish legal ownership and thus permitting uncontested mineral exploration and development in the area.

On the more positive side, relations appear to have improved with the signing of the onshore border agreement with Oman signaling an end to decades of hostilities and encouraging economic bilateral activity.

The proposed development of a free-zone Port of Aden came closer to reality in October 1993 when an agreement was signed in Paris providing \$5.6 billion

over 25 years that would pay for new harbor facilities, extension of the airport, a new gas turbine power station, and construction of the industrial zone itself.

¹Text prepared Apr. 1994.

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Agencies

The Petroleum and Mineral Resource Ministry
Sanaa, Republic of Yemen
The Ministry of Economy, Supply, and Trade
Sanaa, Republic of Yemen

TABLE I
REPUBLIC OF YEMEN: PRODUCTION OF MINERAL COMMODITIES¹

Commodity	1989	1990	1991	1992	1993*	Annual capacity* (Jan. 1, 1994)
Cement thousand metric tons	700	² 828	850	800	800	900
Gypsum metric tons	63,000	66,000	100,000	80,000	80,000	100,000
Natural gas:						
Gross* million cubic meters	10,000	20,000	50,000	80,000	100,000	125,000
Liquids thousand 42-gallon barrels	4	9	25	40	100	110
Petroleum:						
Crude do.	66,500	73,000	² 72,060	64,600	87,600	125,000
Refinery products:						
Gasoline do.	2,900	2,900	6,000	9,600	10,000	12,000
Kerosene do.	1,300	1,300	2,000	4,900	5,000	6,000
Distillate fuel oil do.	9,535	9,535	9,000	9,500	9,500	10,000
Residual fuel oil do.	10,310	10,400	10,400	10,500	10,500	13,000
Other* do.	3,100	3,100	2,500	2,500	2,000	4,000
Total do.	27,145	27,235	29,900	37,000	37,000	45,000
Salt* metric tons	230,000	220,000	250,000	280,000	280,000	300,000
Stone: Dimension* cubic meters	350,000	² 410,000	410,000	410,000	410,000	425,000

*Estimated. *Revised.

¹Table includes data available through May 15, 1994.

²Reported figure.

MAP SYMBOLS

Commodity

Symbol

Alunite	Alu
Alumina	<u>Al</u>
Aluminum	<u>AL</u>
Andalusite	And
Antimony	Sb
Arsenic	As
Asbestos	Asb
Asphalt	Asp
Barite	Ba
Bauxite	Bx
Bentonite	Bent
Beryllium/beryl	Be
Bismuth	Bi
Bitumen (natural)	Bit
Boron	B
Bromine	Br
Cadmium	Cd
Calcium/calcite	Ca
Carbon black	<u>CBl</u>
Cement	<u>Cem</u>
Cesium	Cs
Chromite	Cr
Clays	Clay
Coal	C
Cobalt	Co
Columbium (niobium)	Cb
Copper	Cu
Corundum	Cn
Cryolite	Cry
Diamond	Dm
Diatomite	Dia
Dolomite	Ds
Emerald	Em
Emery	E
Feldspar	Feld
Ferroalloys	<u>FA</u>
Ferrochrome	<u>FeCr</u>
Ferromanganese	<u>FeMn</u>
Ferronickel	<u>FeNi</u>
Ferrosilicon	<u>FeSi</u>
Fertilizer	<u>Fz</u>
Fluorspar	F
Gallium	Ga
Garnet	Gt
Gemstones	Gm
Germanium	Ge
Gold	Au
Graphite	Gr
Gypsum	Gyp
Indium	In
Iron and steel	<u>Fe</u>

Iron ore	Fe
Jade	J
Kaolin	Kao
Kyanite	Ky
Lapis lazuli	Laz
Lead	Pb
Lignite	Lig
Lime	<u>Lime</u>
Limestone	Ls
Liquefied natural gas	<u>LNG</u>
Liquefied petroleum gas	<u>LPG</u>
Lithium	Li
Magnesite	Mag
Magnesium	<u>Mg</u>
Manganese	Mn
Marble and alabaster	Marb
Marl	Ma
Mercury	Hg
Mica	M
Molybdenum	Mo
Natural gas	NG
Natural gas liquids	<u>NGL</u>
Nepheline syenite	Neph
Nickel	Ni
Nitrates	Nit
Nitrogen (ammonia plants)	<u>N</u>
Ochre	Oc
Oil sands	OSs
Oil shale	OSh
Olivine	OI
Opal	Opal
Peat	Peat
Perlite	Per
Petroleum, crude	Pet
Petroleum refinery products	<u>Pet</u>
Phosphate	P
Pig iron	<u>Pig</u>
Pigments, iron	Pigm
Platinum-group metals	PGM
Potash	K
Pozzolana	Pz
Pumice	Pum
Pyrite	Py
Pyrophyllite	Pyp
Quartz or quartzite	Qtz
Rare earths	RE
Rhenium	Re
Salt	Salt
Sand and gravel	S/Gvl
Sandstone	Ss
Selenium	Se
Sepiolite, meerschaum	Sep
Serpentine	Serp
Shale	Sh
Silicon	<u>Si</u>

Sillimanite	Slm
Silver	Ag
Soapstone	So
Soda ash, trona	NaAsh
Sodium sulfate	NaSO ₄
Stone	St
Strontium	Sr
Sulfur	S
Talc	Tc
Tantalum	Ta
Tellurium	Te
Thorium	Th
Tin	Sn
Titanium (rutile or ilmenite)	Ti
Titanium dioxide (processed)	<u>TiO₂</u>
Tungsten	W
Umber	Um
Uranium	U
Vanadium	V
Vermiculite	Vm
Wollastonite	Wo
Yttrium	Y
Zinc	Zn
Zircon	Zr

MAP LEGEND

Symbol = Mine, including beneficiation plants, well

Circled Symbol = Group of producing mines or wells

Underlined Symbol = Processing plant or oil refinery, including smelters and metal refineries

(Symbol) = Undeveloped significant resource

**UNITS OF MEASURE
AND ABBREVIATIONS**

Unit of Measure	Symbol		
		gross domestic product	GDP
		gross national product	GNP
		liquefied natural gas (methane)	LNG
		liquefied petroleum gas (propane-butane)	LPG
year	a	Organization for Economic Cooperation and Development	OECD
American Petroleum Institute	•API	Organization of Petroleum Exporting Countries	OPEC
gravity	•API	United Nations	UN
barrel(s)	bbl	United Nations Development Program	UNDP
calorie(s)	cal		
centi (prefix)	c		
centimeter(s)	cm		
cubic meter(s)	m ³		
day(s)	d		
ton(s), deadweight	dwt		
giga (prefix)	G		
gigawatt(s)	GW		
gigawatt hours(s)	GW•h		
gram(s)	g		
gram(s) per metric ton	g/mt		
hectare(s)	ha		
thousand	k		
kilocalorie(s)	kcal		
kilogram(s)	kg		
kiloliter(s)	kL		
kilometer(s)	km		
square kilometer(s)	km ²		
thousand metric ton(s)	kmt		
kilovolt(s)	kV		
kilowatt(s)	kW		
kilowatt hour(s)	kW•h		
liter(s)	L		
mega (prefix)	M		
megawatt(s)	MW		
megawatt hour(s)	MW•h		
meter(s)	m		
million	M		
million metric ton(s)	Mmt		
square meter(s)	m ²		
ton(s), metric	mt		
standard coal equivalent	SCE		
volt	V		
watt	W		
watt hour	W•h		

Name of Term Abbreviation

African Development Bank	ADB
American Petroleum Institute	API
European Community	EC
European Free Trade Association	EFTA
Free Trade Agreement	FTA
General Agreement on Tariffs and Trade	GATT

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