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Bureau of Mines

Washington, D. C.: Bureau of Mines : United States Government Printing Office, 1992

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MINERAL INDUSTRIES OF

THE MIDDLE EAST



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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.

Preface

This edition of the Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1992 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on advanced materials, nonrenewable organic materials, and nonferrous metals recycling also were added to the Minerals Yearbook series beginning with the 1989, 1990, and 1991 volumes, respectively. A new chapter on materials recycling has been initiated in this 1992 volume. 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, Minerals Yearbook—International Review; Contains the latest available mineral data on more than 175 foreign countries and discusses the importance of minerals to the economies of these nations. Since with the 1989 the international review, this volume has been presented as six reports: Mineral Industries of the Middle East, 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, and Minerals in the World Economy. The reports incorporate location maps, industry structure tables, and an outlook section previously incorporated in our Mineral Perspectives Series quinquennial regional books, which are being discontinued.

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 will be welcomed.

Acknowledgments

The U.S. Bureau of Mines, in preparing these Volume III Minerals Yearbook Reports—International Review reports, 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 was also 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 U.S. Department of State located in U.S. American Embassies worldwide. Their contributions are sincerely appreciated.

The text and production, structure of the mineral industry, and reserve tables of this volume were prepared by the respective country authors on the staff of the Division of International Minerals, Information and Analysis Directorate. The mineral export and import trade tables were prepared by the International Data Section of the Division of Statistics and Information Services, Information and Analysis Directorate.

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 MIDDLE EAST

By Staff, Branch of Africa and the Middle East

INTRODUCTION

The production and processing of crude petroleum and natural gas are the dominant economic sectors of the Middle East, providing more than 80% of the region's foreign exchange. In 1992, the 15 countries that constituted the region accounted for 29.5% of world crude petroleum output, 20% of world natural gas plant liquid production, and 5% of world dry natural gas production. Only Cyprus and Lebanon were not crude petroleum producers.

A fairly wide range of nonfuel minerals is also produced in the region. The most significant are boron minerals, bromine, chromite, gypsum, phosphate rock, potash, strontium, and sulfur. However, the variety of minerals produced, output levels, and the size of the overall nonfuel mineral economy of the region is dominated by Iran and Turkey. Turkey, with a diverse mineral production and strategically situated between Europe and the Middle East, was first in world production of run-of-mine boron minerals, second in strontium behind Mexico, and fourth in pumice. It was also a significant world producer of chromite, magnesium compounds, mercury, and sodium sulfate. Turkey was also the Middle East's largest cement and steel producer. Iran continued to expand output of most mineral commodities following the war with Iraq from 1980 to 1988. It was a significant world producer of gypsum and strontium and on its way to becoming a major iron and steel producer in the region. Despite a very small domestic mineral industry, Israel was second in world production of bromine and a significant producer of phosphate rock and potash. In terms of processed minerals, Israel was a major

world diamond cutting center and exporter of cut diamond. Jordan ranked sixth in world production of phosphate rock. Saudi Arabia was eighth in world production of sulfur.

Nonfuel mineral output from the Middle East supplied primarily local markets, India, Japan, and the European Community. The observed surge in cement and steel production was primarily to satisfy post Iran-Iraq and Gulf War demand for construction materials. Production of nonfuel minerals as shown in tables 1 and 2 generally represented a small percentage of total world production. The most significant in 1992 were gypsum at 10.5%, phosphate rock at 7.2%, and potash at 8.4% of world output. Despite a 40% drop in tonnage from 1991, the Middle East accounted for 7% of the world total of mined chromite in 1992.

Significant new mine development projects and exploration programs continued in both Saudi Arabia and Turkey. Downstream mineral-based industries were expanding, encouraged by the availability of low-cost fuel in the form of the region's abundant associated natural gas. Bahrain, Iran, Turkey, and the United Arab Emirates accounted for nearly 4% of the world's output of aluminum. During 1992, aluminum production capacity was expanded to 460,000 tons in Bahrain and construction of new aluminum facilities in Iran, Qatar, and Saudi Arabia were under consideration.

Mineral fuels output increased by more than 521 Mbbbl compared with the volume produced in 1991. Resumed output from Kuwait, which had been suspended owing to war damage, accounted for approximately 59% of this increase. The war and subsequent United Nations trade

embargo resulted in Iraq registering as the seventh largest producer of crude petroleum in the Middle East. Prior to the war, Iraq had been the region's fourth largest producer of crude petroleum. Iraqi crude oil and natural gas facilities damaged during the Gulf War appeared to have been restored to at least 50% of pre-war capacity. There were indications that other significantly damaged segments of the Iraqi mineral industry, such as cement, construction material, petroleum-chemical products, phosphate, and sulfur, were nearly completely repaired. Only domestic sales officially took place, as Iraq's mineral exports were embargoed. The United Nations trade embargo also affected mineral products traditionally transhipped to Iraq through Jordan, Saudi Arabia, and Turkey.

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, although most of the Governments, especially Turkey's, continued to promote privatization of the sector.

United States imports of mineral-based materials from the region were primarily energy products. In 1992, the Middle East provided 22% of total U.S. net oil imports or about 652 Mbbl of crude petroleum, natural gas liquids, and petroleum refinery products. Nonfuel minerals, for which the Middle East was considered 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. Turkey was the second leading consumer of American exported iron and steel scrap. American companies active in the Middle East included Chase Manhattan Bank for an aluminum expansion project in Bahrain; Bechtel Corp., for transportation infrastructure development in Lebanon, Turkey, and the United Arab Emirates, and petroleum infrastructure reconstruction in Kuwait; Universal Oil Products for powerplant conversion in Syria; and Ralph M. Parsons Co. for sulfur plant rehabilitation and expansion in the United Arab Emirates.

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. Development of value-adding downstream facilities for the processing of petroleum and natural gas, to produce such products as petrochemicals and fertilizers, and for

producing energy-intensive metals, such as aluminum, can be expected to continue. Earnings from the petroleum industry are also 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. Mechanisms for this include arranging loans through the Islamic Development Bank and the Arab Bank for Economic Development in Africa, as well as direct bilateral arrangements. Several countries in the region, such as Kuwait and Saudi Arabia, have developed significant international petroleum refining and distribution capabilities.

Water resources are a critical issue in the Middle East. The world's largest desalinization plants are operating in the region to supply potable water to countries such as Kuwait and Saudi Arabia. Water resources for human consumption and for agriculture and industry, including mineral extraction and processing, in Iraq, Syria, and Turkey are from the Tigris and Euphrates Rivers that arise in Turkey. Expansion of the economies of these countries has placed heavy demand on traditional water supplies and has increased downstream countries' concern about sustained water flow.

The region covers about 6.2 Mkm² or about 66% of the U.S. land area. The total population of the region was approximately 200 million in 1992 compared with 255 million for the United States. Expatriate labor was an important factor in the economies of some of the countries of the Middle East.

All tons are metric in this report unless otherwise specified.

SELECTED GENERAL SOURCES OF REGIONAL INFORMATION

American Petroleum Institute, Washington, DC: Basic Petroleum Data Book, annual.
Arab Petroleum Research Center, Paris: Arab Oil and Gas Directory, annual.
British Sulphur Corp. Ltd., London: Nitrogen, bimonthly.
Phosphorus and Potassium, bimonthly.

Sulphur, bimonthly.
Bureau de Recherches Géologiques et Minières, Paris: Chronique de la Recherche Minière, quarterly.
International Lead and Zinc Study Group, London.
International Monetary Fund, Washington, DC: International Financial Statistics, monthly and annual yearbook.
Middle East Economic Digest, London.
Miller Freeman Publications, San Francisco: World Mining, monthly.
World Mining, yearbook.
Mining Journal Ltd., London: Mining Magazine, monthly.
Mining Journal, weekly.
Mining Annual Review, July.
Organization of Petroleum Exporting Countries, Vienna, Austria: Annual Report.
Annual Statistical Bulletin.
PennWell Publishing Co., Tulsa, OK: International Petroleum Encyclopedia.
International Energy Statistics Sourcebook.
United Nations Statistical Office, New York: U.N. 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.
U.S. Department of Energy, Office of International Affairs: Energy Industries Abroad, DOE/IA-0012.
U.S. Department of Energy, Energy Information Administration: International Energy Annual, DOE/EIA-0219.
Annual Energy Outlook, DOE/EIA-0383.
Annual Energy Review, DOE/EIA-0384.
U.S. Department of the Interior, Bureau of Mines: Mineral Commodity Summaries.
Minerals Yearbook, v. I, Metals and Minerals.
U.S. Department of State: Various economic and mineral industry reports from American Embassies in the region.
U.S. Joint Publications Research Service, Arlington, VA: 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, 1992

(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 equivalent	Salt	Steel, crude	Sulfur
Bahrain	292	150	—	—	2,000	4,015	325	15,500	—	—	—	—	48
Cyprus	—	1,131	—	35	—	—	—	—	—	—	—	—	—
Iran	92	18,000	130	8,716	20,000	32,000	657	1,300,000	—	—	1,108	2,917	750
Iraq	—	10,000	—	380	2,200	1,000	200	146,000	900	—	250	—	600
Israel	—	3,500	—	26	—	32	34	80	3,595	1,300	1,100	160	60
Jordan	—	2,733	—	83	—	—	—	50	4,296	794	56	244	—
Kuwait	—	500	—	—	—	—	140	375,600	—	—	—	—	75
Lebanon	—	1,000	—	2	—	—	—	—	—	—	3	—	—
Oman	—	970	2	—	2300	3,110	—	266,225	—	—	—	—	70
Qatar	—	544	—	—	50,000	7,100	622	137,900	—	—	—	588	52
Saudi Arabia	—	15,300	—	375	262,800	33,000	904	3,075,100	—	—	—	1,900	2,000
Syria	—	3,700	—	175	1,800	2,800	105	193,600	1,266	—	127	70	30
Turkey	59	28,607	758	278	—	198	375	30,656	30	—	1,418	10,253	43
United Arab Emirates	240	3,700	—	95	60,000	25,550	290	850,000	—	—	—	—	75
Yemen	—	800	—	80	25	—	—	64,600	—	—	280	—	—
Total Middle East	683	90,635	890	10,245	401,100	108,805	3,652	6,455,231	10,087	2,094	4,342	16,132	3,803
Share of world total, %	3.9	7.3	7	10.5	20.1	5	3.9	29.5	7.2	8.4	2.3	2.3	7.2
United States total	4,000	70,760	—	14,790	611,980	536,470	13,150	2,602,270	47,000	1,760	36,380	84,000	10,600

*Estimated.

TABLE 2
MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES, 1991^r

(Thousand metric tons unless otherwise specified)

	Aluminum, 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 equivalent	Salt	Steel, crude	Sulfur
Bahrain	227	150	—	—	2,576	5,522	325	15,434	—	—	—	—	48
Cyprus	—	1,134	—	37	—	—	—	—	—	—	—	—	—
Iran	80	15,000	90	8,050	18,250	29,450	468	1216,910	—	—	901	2,203	700
Iraq	—	5,000	—	190	1,600	630	40	109,000	400	—	120	—	300
Israel	—	3,550	—	26	—	32	34	82	3,370	1,320	1,115	160	66
Jordan	—	1,754	—	55	—	—	—	50	4,433	805	57	200	—
Kuwait	—	300	—	—	—	—	—	68,255	—	—	—	—	—
Lebanon	—	900	—	2	—	—	—	—	—	—	3	—	—
Oman	—	995	—	—	2,200	3,025	—	258,500	—	—	—	—	70
Qatar	—	527	—	—	13,140	7,100	569	137,970	—	—	—	561	52
Saudi Arabia	—	11,371	—	375	258,400	31,500	827	2,963,000	—	—	—	1,850	2,000
Syria	—	3,500	—	175	800	1,400	105	171,500	1,359	—	127	70	30
Turkey	56	26,091	1,382	307	—	203	357	31,875	3	—	1,140	9,335	103
United Arab Emirates	239	3,473	—	95	60,000	24,500	286	889,505	—	—	—	—	74
Yemen	—	850	—	100	25	—	—	71,900	—	—	250	—	—
Total Middle East	602	74,595	1,472	9,412	356,991	103,362	3,011	5,934,031	9,565	2,125	3,713	14,379	3,443
Share of world total, %	3.3	6.3	11.1	10	20.6	4.8	3.2	27.1	6.5	8.2	2	2	6.2
United States total	4,121	66,230	—	14,020	604,287	527,178	12,800	2,686,765	48,096	1,749	35,902	79,700	10,820

^rRevised.

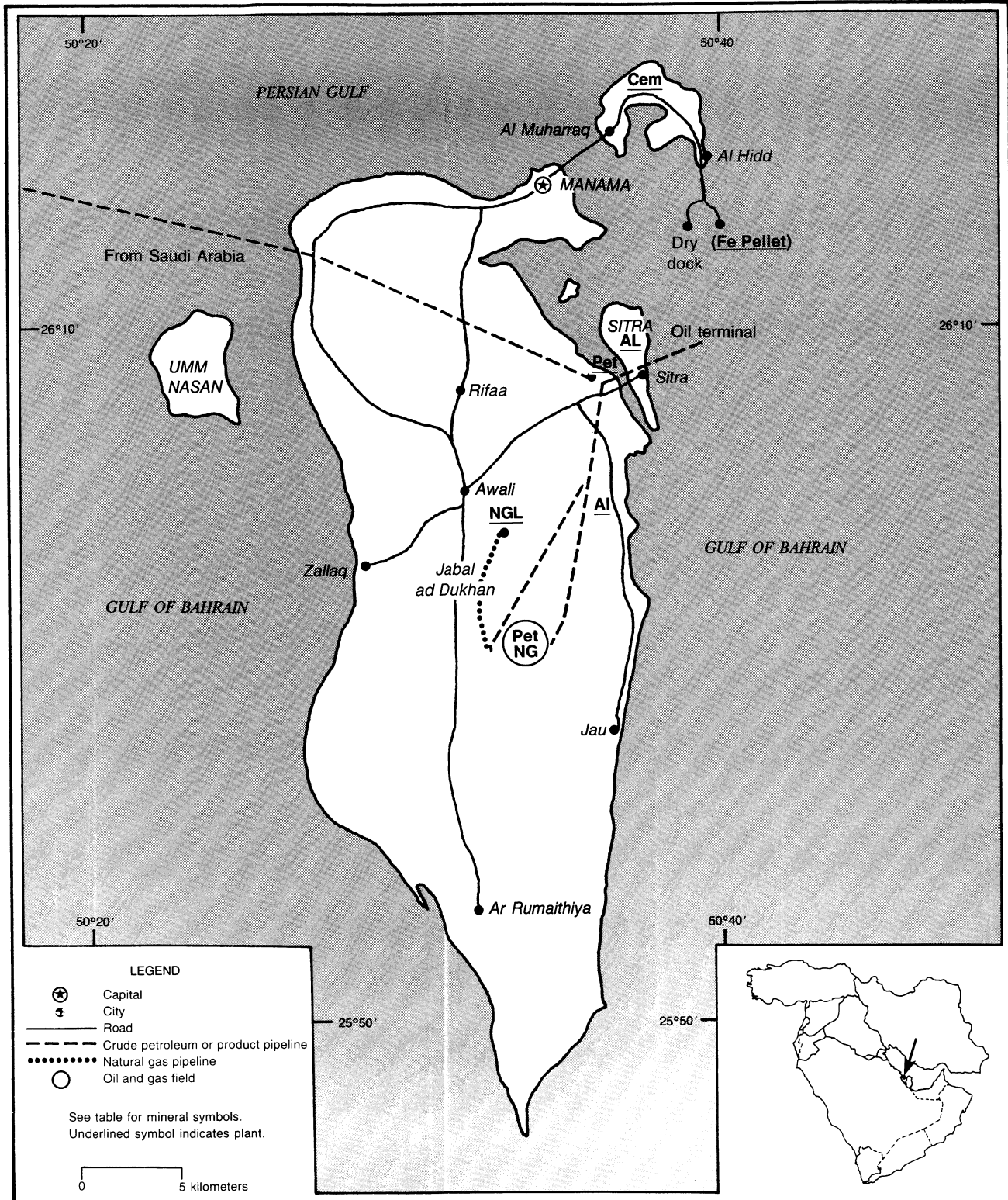


The Arab Shipbuilding & Repairyard Co. (ASRY) operations at Hidd, Bahrain. The drydock, in operation since 1977, can service ships up to 500,000 dwt. The two floating docks (far right) were purchased from Jacksonville Shipyards, a subsidiary of Fruehauf Trailer Corp. of the United States. The floating docks were placed in service in 1992 to accommodate ships up to 180,000 dwt.

BAHRAIN

AREA 620 km²

POPULATION 551,600



THE MINERAL INDUSTRY OF

BAHRAIN

By Bernadette Michalski

The mineral industry, particularly hydrocarbons and aluminum, supplied more than 90% of Government revenues and export earnings and accounted for 30% of the GDP. In 1992, petroleum and natural gas revenues alone were estimated at \$930 million accounting for 65% of Government revenues.¹

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 by late 1992, making the Aluminum Bahrain (Alba) smelter the largest in the Middle East. Other mineral industry and related diversification efforts included iron ore pelletization, petrochemicals, and a major tanker repair shipyard.

GOVERNMENT POLICIES AND PROGRAMS

The Bahraini Government encourages private ownership of industry. The Government has proposed to offer another 20% to 30% of Bahrain Aluminium Extrusion Co. (Balexco) to the private sector. This offering could raise private ownership of the company to one-half. This company was the first state-owned company offered for privatization. Before the Gulf War, 20.72% of Balexco was sold to buyers in Bahrain, Saudi Arabia, and the United Arab Emirates.

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

PRODUCTION

While aluminum capacity virtually doubled by yearend, the production of the nation's mineral commodities has for the most part stabilized. Output of crude petroleum has been maintained at 15 Mbbbl or more with the aid of natural gas reinjection and is expected to continue at this level throughout the decade. The Alba aluminum smelter's capacity was increased to 460,000 mt/a in November 1992. It is expected to operate at capacity levels in 1993 and throughout the decade. Downstream manufacturing facilities are under expansion to take advantage of the availability of greater quantities of local aluminum. (See table 1.)

TRADE

Feedstock for the aluminum plant was imported with about 75% of the alumina supply obtained from Alcoa of Australia.

Aluminum exports were estimated at 150,000 tons in 1992, accounting for more than 10% of all exports. Almost 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 to only 30,000 tons in 1992.

Refined petroleum product exports from domestic and imported crude oil were about 250,000 bbl/d in 1992. More than one-half 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 about 850,000 tons in 1992. 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.

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. (See table 2.)

COMMODITY REVIEW

Metals

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. Financing for the project was secured principally through the Gulf Investment Corp., the Arab Banking Corp., and the Chase Investment Bank of the United States. Export credits were arranged with Belgium, France, Italy, the Netherlands, and the United Kingdom. Bahraini downstream manufacturing groups planned to expand their operations as well.

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. 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 mm 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%. Although the company's principal market is in the Gulf area, sales to the Pacific region have increased in 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 under way 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 has formed a joint venture with BBS Kraftfahrzeugtechnik of Germany and Al Zayani Investments of Bahrain to produce wheel castings for auto manufacturers and suppliers in Europe.

Balxco 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. The next stage of the company's privatization will take place in 1993. An additional 20% to 30% of equity will be offered to private investors, reducing Government ownership to 50% or 60%. The company is expected to be completely privatized in 3 to 5 years.

Mineral Fuels

Natural Gas.—Almost one-third of natural gas production is reinjected for enhanced recovery operations necessary to maintain petroleum production at approximately 15 Mbbl/a. The remaining production is utilized in the production of electric power and petrochemical feedstock. Increased revenues were realized at the Bahrain National Gas Co. owing to the commissioning of the \$74 million central-gas-plant capacity

expansion from 4.8 Mm³/d to 7.1 Mm³/d.

Petrochemicals.—The Gulf Petrochemical Industries Co., a joint venture between Bahrain and Kuwait, operated an ammonia and methanol plant at Sitra. Nonassociated Khuff gas was used as feedstock. The petrochemical use of natural gas was approximately 1.2 billion m³ in 1992. The company is considering a \$140 million project directed toward the expansion of urea production to 1,700 mt/d. A 3-year feasibility study was undertaken.

The construction of an \$18.5 million sulfur derivatives plant with an annual capacity of 9,000 tons of sodium sulfur and 6,000 tons of metabisulfite is proposed on Sitra. National Chemical Industries Corp. has 55% of the equity. Other principal shareholders are Qatar Industrial Manufacturing Co. with 15%, Arabian industry Development Co. of Saudi Arabia with 10%, and the United Group for the Development of Riyadh with 5%. Sulfur is to be supplied by the Bahrain Petroleum Corp.

The Gulf Petrochemical Industries Co. has announced plans for the construction of a \$140 million, 1,700-mt/d-capacity urea plant, consuming 80% of GPIC's ammonia output.

Petroleum.—In March 1992, the Harken Energy Co. announced that the offshore Jarim 2 well was capped as dry after penetrating a depth of 4,354 m. For the foreseeable future Bahraini production appears stabilized at about 42,000 bbl/d, entirely derived from the Awali Field.

Through a 1972 revenue-sharing agreement signed with Saudi Arabia, Bahrain receives a 50% share of revenues from the Abu Saafa offshore field situated between the two countries.

The 250,000-bbl/d-capacity refinery at Sitra has consistently operated at or above capacity level. About 83% of the refinery's throughput was delivered by pipeline from Saudi Arabia and the remainder from the Awali Field and from stocks. The refinery is scheduled to undergo an expansion and revamping over the next 4 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 has stabilized at a little more than 8,500 bbl/d, with the remaining output, eventually reaching 350,000 bbl/d, destined for the export market.

Reserves

Recoverable petroleum reserves were estimated by the Bahrain National Oil Co. at between 150 Mbbl and 200 Mbbl and proven nonassociated natural gas reserves at 183 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 Riffa. Their combined capacity is 992 MW. In 1993, a link will be completed, bringing an extra 200 MW to the national grid system from Alba's 800-MW powerplant. 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. 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 November 1991, a \$30 million loan was secured through Bahraini and Kuwaiti banks to finance two floating drydocks purchased

from Jacksonville Shipyards of the United States. The docks were operational in 1992 accommodating vessels of up to 125,000 dwt.

OUTLOOK

The state revenues from the petroleum industry enabled the Government to accelerate social and economic development and establish new energy-intensive industries. The Government is focusing on three sectors in the hope of expanding Bahrain's existing industrial base and attracting new ventures. This involves expanding the local aluminum, petrochemical, and steel industries.

The lifting of restrictions that limited foreign company holdings to 49% in favor of allowing fully foreign-owned companies to register in Bahrain should substantially increase foreign investment and benefit the economy. 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, which came on-stream in late 1992, is the largest in the Middle East and will foster new downstream industries and increase employment. The German car industry may be a promising market as the car manufacturers are looking for cheaper alternatives to domestic aluminum fabricating sources. The contract to produce pieces for the rear axle may be the first step in entering a huge market. Aluminum marketing is also promising in view of the rising demand from new building projects in Saudi Arabia, Bahrain, Kuwait, and the United Arab Emirates. Bahrain is considering the construction of an alumina plant on Qesham Island in joint venture with Iran.

The development of a container port and industrial center at Al Hidd could have a significant impact on the economy. Plans include a power station, desalination plant, and a causeway linking the area to the main island. The Al Hidd project would be another welcome boost

to the construction industry.

Bahrain has invested in a new international commercial exhibition center that opened in November 1991. It should bring considerable business to the region and facilitate market expansion.

¹Where necessary, values have been converted from Bahraini dinars (BD) to U.S. dollars at the rate of BD0.377=\$US1.00.

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.
P.O. Box 29099
Rifaa, Bahrain
Telephone: (973) 756 222
Fax: (973) 756 991
Caltex Bahrain
P.O. Box 25125
Awali, Bahrain
Telephone: (973) 753 134
Fax: (973) 753 122
Harken Bahrain Oil
P.O. Box 11715
Manama, Bahrain
Telephone: (973) 531 735
Fax: (973) 536 592
Aluminium Bahrain (Alba)
P.O. Box 570
Manama, Bahrain
Telephone: (973) 661 751
Arab Shipbuilding and Repair Yard Co.
P.O. Box 50110 Al Hadd
(ASRY), Bahrain
Telephone: (973) 671 111
Fax: (973) 670 236

Publications

Bahrain National Oil Co. (BANOCO),
annual report.
Bahrain National Gas Co. (BANAGAS),
annual report.

TABLE 1
BAHRAIN: PRODUCTION OF MINERAL COMMODITIES¹

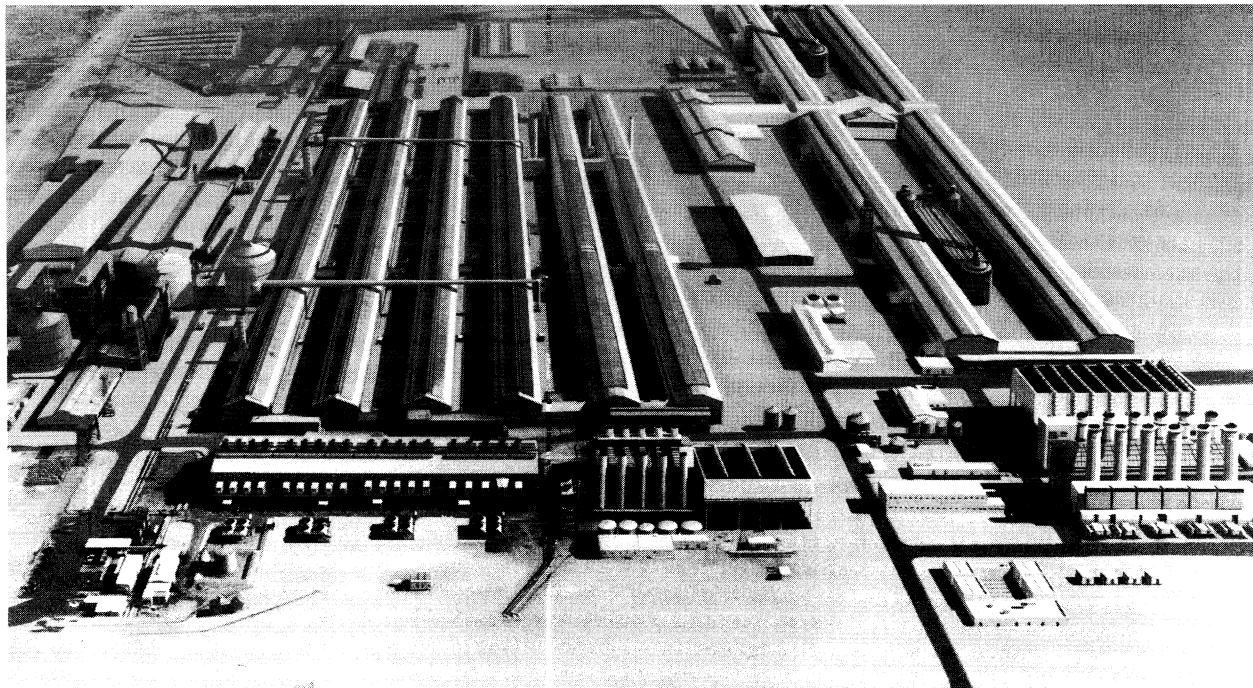
(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992*	
Aluminum, smelter output, primary metal	182,804	186,889	212,505	215,000	250,000	
Cement	158,000	158,000	148,000	150,000	150,000	
Gas, natural:						
Gross	million cubic meters	7,524	7,733	8,110	8,087	7,900
Dry	do.	5,720	5,947	6,000	5,522	² 4,015
Natural gas plant liquids:						
Butane	thousand 42-gallon barrels	897	917	975	1,102	1,000
Propane	do.	880	890	1,150	1,474	1,000
Nitrogen, N content of ammonia		296,400	319,400	325,000	325,000	325,000
Petroleum:						
Crude	thousand barrels	15,671	15,595	15,875	15,434	15,123
Refinery products:						
Gasoline	do.	5,449	6,931	7,500	7,840	7,900
Jet fuel	do.	10,081	8,419	9,000	7,477	7,500
Kerosene	do.	6,286	7,359	7,500	10,427	10,500
Distillate fuel oil	do.	27,562	28,698	28,500	28,110	28,000
Residual fuel oil	do.	22,268	21,983	22,500	23,570	23,500
Other	do.	17,200	16,285	16,300	16,300	16,300
Total	do.	88,846	89,675	91,300	93,724	93,700
Sulfur, byproduct of petroleum		48,000	48,000	48,000	48,000	48,000

*Estimated.

¹Table includes data available through July 1, 1993.

²Reported figure.

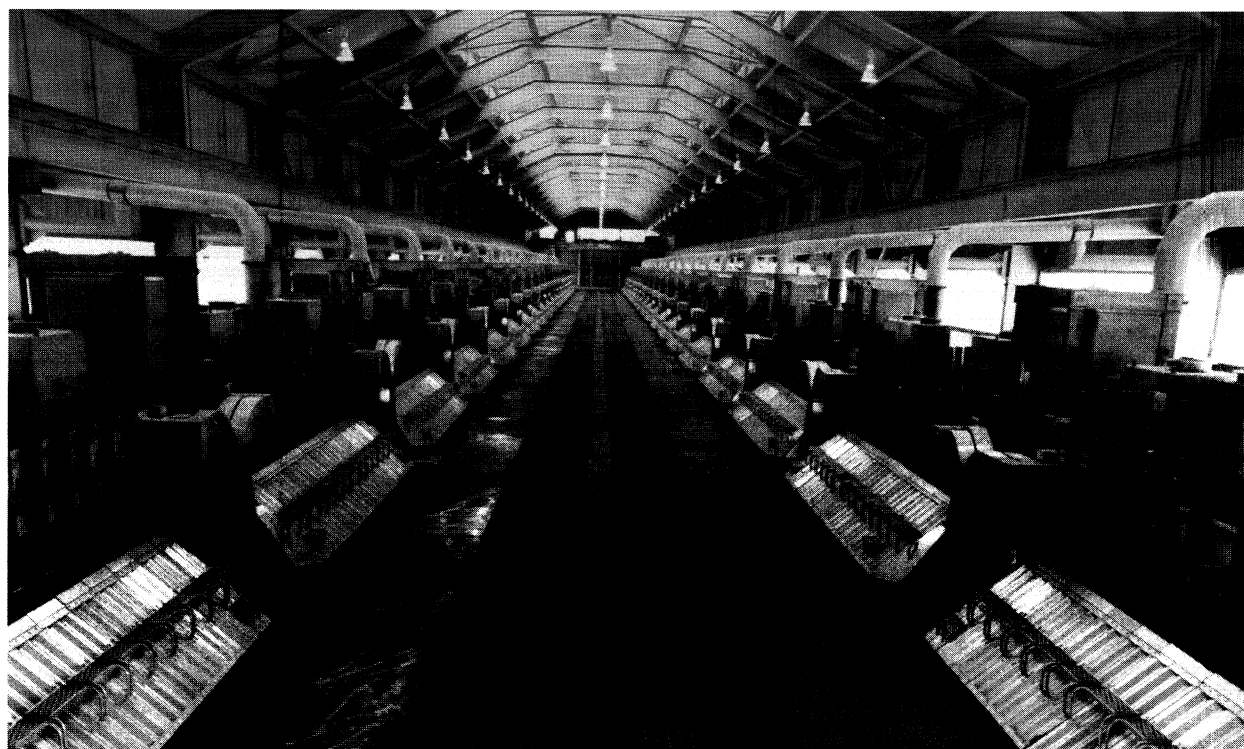


Model of Aluminium Bahrain's operations including the fourth reduction cell line (far right), which commenced production in 1992 raising primary aluminum capacity to 460,000 mt/a.

TABLE 2
BAHRAIN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Aluminum Bahrain Co., (Alba) (Government, 74.9%; Saudi Arabia, 20%; Breton Investments, 5.1%)	Sitra	460
Aluminum products	Bahrain Aluminum Extrusion Co. (Government, 74%; private, 26%)	do.	6
Do.	Middle East Aluminum Cables Ltd. (Al-Zayani Investments of Bahrain, 50%; Saudi Cable Co., 50%)	do.	50
Do.	Gulf Aluminum Rolling Mill Co. (Government, 25.47%; Sabic, 20.75%; Industrial Bank of Kuwait, 16.99%; Gulf Investment Corp., 14.15%; Iraq, 11.32%; Qatar, 5.66%; Oman, 5.66%)	do.	60
Cement	Hundai Cement Co. (Government, 100%)	Al Muharraq Island	450
Iron oxide pellets	Gulf Industrial Investment Co. (Kuwait Petroleum Corp., 100%)	do.	2,000
Natural gas	Bahrain National Gas Co. (Government, 100%)		
Natural gas liquids: thousand barrels			
Propane	do.	Jabal ad Dukhan	1,400
Butane	do.	do.	1,100
Naphtha	do.	do.	1,500
Petrochemicals:			
Ammonia	Gulf Petrochemical Industries Corp. (Bahrain National Oil Co., 33.33%; Saudi Basic Industries Corp., 33.33%; Petrochemical Industries Co., 33.33%)		425
Methanol	do.		425
Petroleum, crude	Bahrain National Oil Co. (Government, 100%)	South of Awali	16,000
Petroleum products	Bapco BSC (Bahrain National Oil Co., 60%; Caltex, 40%)	Sitra	91,500
Sulfur	do.	do.	150

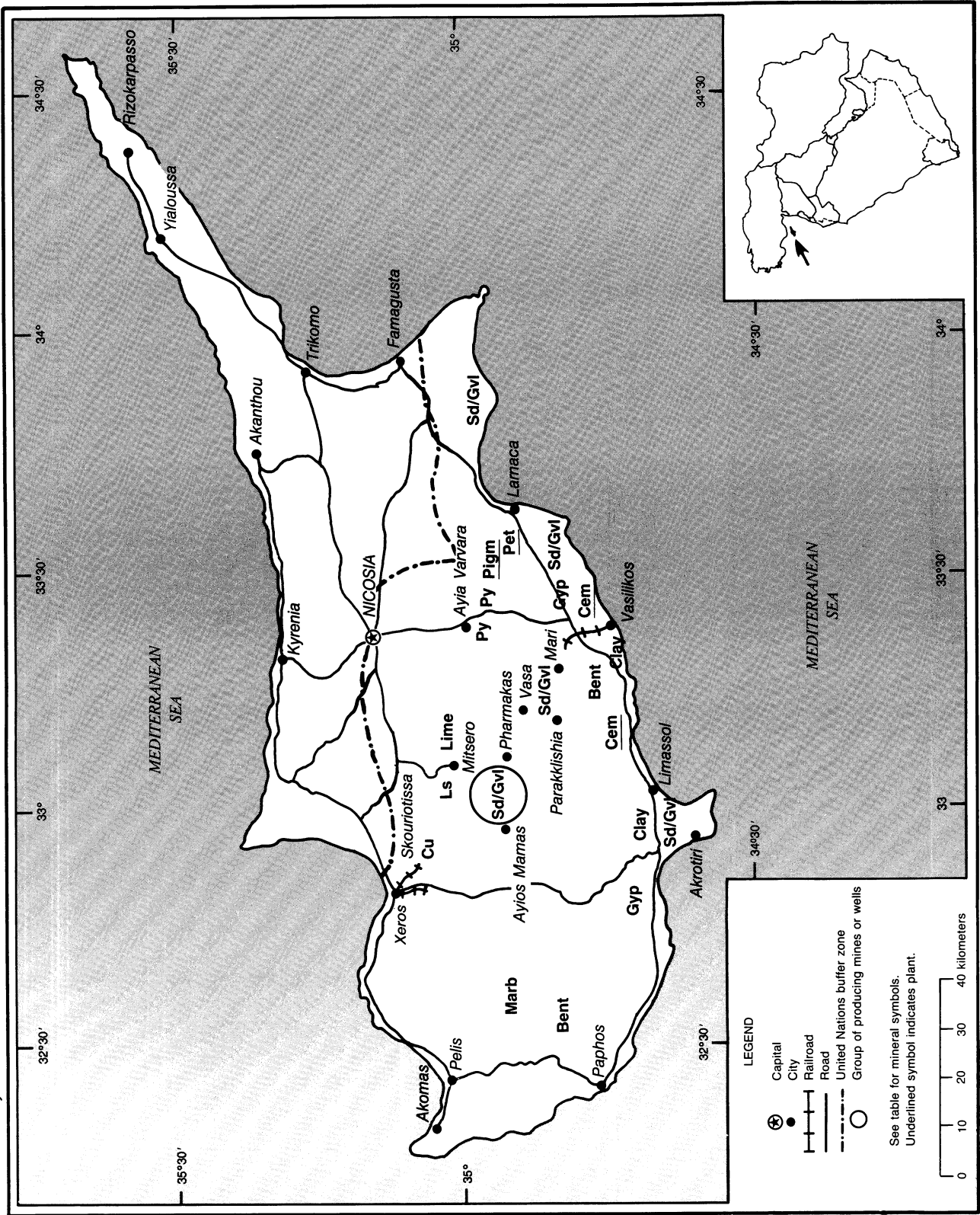


Interior view of Aluminium Bahrain (ALBA)'s third reduction cell line.

CYPRUS

AREA 9,000 km²

POPULATION 716,000



THE MINERAL INDUSTRY OF

CYPRUS

By Philip M. Mobbs

The Cypriot mineral industry continued a recent trend toward lower mineral production and exports. Over the past few years, operations in Cyprus¹ historically important export commodities, asbestos, chromite, iron pyrite, copper concentrate, and celestite, have effectively ceased. Although the value of the mineral industry's output, excluding revenues from the petroleum refinery, rose by about 4%, from \$105.8 million² in 1991 to \$110.5 million in 1992, the volume of most mineral commodities mined or produced actually declined. Hydraulic cement production accounted for approximately one-half of the total value of Cyprus' mineral industry output.

Cyprus has been geopolitically divided since 1974, when Turkish troops took control of 37% of the land area in the northern region of the island. The southern Greek-administered area was separated from the northern Turkish-administered area by a narrow UN buffer zone. The expansion of Cyprus' economy slowed in 1991, the last year for which there were data, when the 4.5% growth rate resulted in a GDP of approximately \$5,863 million. In 1990, the latest year that data were available, the GDP of the Turkish-occupied territory was \$600 million.

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.

During 1992, the mining and quarrying sector, including cement production, kept pace with Cyprus' economy, accounting for approximately

1.5% of the nation's GDP. Production was done mainly by small companies working small deposits. (See table 1.)

In January 1988, Cyprus began a 15-year program to abolish all trade barriers with the European Community (EC). In recent years, trade with the EC has become increasingly important to Cyprus' economy, while the country's volume of trade with the Middle East has steadily declined. Once again, the value of sand and gravel and other construction materials produced for domestic consumption increased in relative importance to mineral exports. Sales volumes were down for most of Cyprus' exported mineral commodities during the year. However, the total value of mineral exports increased slightly in 1992 to \$3.9 million, from about \$3.7 million in 1991. The rise was attributed to the increased value of bentonite and amber exports.

Mining operations on the island have been privately owned and operated 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. Prospecting also was carried out by foreign and domestic mining companies and by the research agencies of foreign countries. The Environmental Service was responsible for coordinating the environmental efforts of the Government departments.

During 1992, Hellenic Mining Co. continued its solvent extraction and bioleaching studies and copper cement operations at the Skouriotissa Mine.

The island's electrical generating

capacity furnished by the Dhekelia and Moni thermal power stations was increased to 540 MW. An additional 120 MW of generating capacity was expected to be commissioned at Dhekelia during March 1993.

The Cypriot mining industry, which has been in a steady decline for more than a decade, appears to have bottomed out. Most of the country's traditional mineral enterprises were either shut down or were operating at a small fraction of past production levels. The domestic copper industry was suffering from the depletion of its richer copper ores. Because of the country's experience in copper processing, it could continue producing minor quantities of cement copper from mine and waste drainage and concentrates from lower grade ore.

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.

Industrial mineral mining and cement production for the domestic construction industry should continue to grow in importance to the nation's economy. The economic decline in Europe, however, could hurt the country's fortunes, which are tied to tourism and foreign trade.

¹Unless specifically stated, all data in this chapter are concerned with the southern Greek-administered area because data related to the Turkish Cypriot area are sparse or unavailable.

²Where necessary, values have been converted from Cypriot pounds (£) to U.S. dollars at the rate of £0.45=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Department of Statistics and Research
Republic of Cyprus
Nicosia, Cyprus

Mines Service
Republic of Cyprus
Nicosia, Cyprus

Publications

Ministry of Commerce and Industry, Mines
Service, Republic of Cyprus, Nicosia:
Annual Report of the Mines Service,
annual report.

Ministry of Finance, Department of Statistics
and Research, Republic of Cyprus, Nicosia:
Economic Report, annual report.

Ministry of Finance, Department of Statistics
and Research, Republic of Cyprus, Nicosia:
Industrial Statistics, annual report.

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

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992
METALS					
Copper:					
Cupreous pyrite concentrate:					
Gross weight	—	1,752	—	—	—
Cu content	—	251	—	—	—
Cement copper:					
Gross weight	765	1,080	1,032	535	473
Cu content	315	465	472	226	172
INDUSTRIAL MINERALS					
Asbestos, fiber produced	14,585	—	—	—	—
Cement, hydraulic	868	1,042	1,133	1,134	1,131
Clays, crude:					
Bentonite	<u>90,300</u>	<u>59,744</u>	<u>82,000</u>	<u>58,500</u>	<u>58,840</u>
Other:					
For brick and tile manufacture	357	390	400	440	463
For cement manufacture ³	250	330	300	300	346
Total	<u>607</u>	<u>720</u>	<u>700</u>	<u>740</u>	<u>809</u>
Gypsum:					
Crude	32,710	*34,000	37,000	*37,000	35,470
Calcined	3,975	*4,000	4,600	6,200	6,150
Lime, hydrated	6,810	7,060	7,326	6,566	5,540
Pigments, mineral: Umber	10,060	8,534	7,700	5,800	5,000
Stone, sand, and gravel:					
Limestone, crushed (Havara)	2,450	2,580	2,700	2,700	2,800
Marble	78	96	82	74	58
Marl, for cement production	*565	692	700	1,400	*1,400
Sand and gravel ³	4,400	4,850	5,250	5,450	5,750
Unspecified building stone	300	166	200	200	*250
Sulfur:					
Pyrite, gross weight	113,145	57,455	—	—	—
S content	<u>50,916</u>	<u>25,855</u>	<u>—</u>	<u>—</u>	<u>—</u>
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Liquefied petroleum gas	342	301	*300	315	*300
Gasoline	1,224	1,191	*1,100	1,032	*1,000
Kerosene and jet fuel	375	232	*300	301	*300
Distillate fuel oil	1,489	1,451	*1,500	2,076	*2,000
Residual fuel oil	1,506	1,268	*1,300	1,574	*1,500
Asphalt	246	266	*300	171	*200
Refinery fuel and losses	222	198	*200	*208	*200
Total	<u>5,404</u>	<u>4,907</u>	<u>*5,000</u>	<u>5,677</u>	<u>*5,500</u>

¹Estimated.

²Table includes data available through July 11, 1993.

³Mineral production data from the northern Turkish-occupied section of the country is not included in this table, as available information is inadequate to make reliable estimates of output levels.

³Includes crushed aggregate.

TABLE 2
CYPRUS: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	Destinations	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys:			
Scrap	1,731	—	Greece 715; Netherlands 627; Italy 134.
Unwrought	2	—	All to Jordan.
Semimanufactures	374	—	United Kingdom 123; Netherlands 79; Italy 68.
Copper:			
Matte and speiss including cement copper	500	—	All to Germany.
Metal including alloys:			
Scrap	value, thousands	\$1,793	— Greece \$934; United Kingdom \$388.
Semimanufactures	8	—	Lebanon 5; Jordan 3.
Iron and steel: Metal:			
Scrap	12,961	—	Greece 12,889.
Ferrous alloys: Ferromanganese	21	—	All to Netherlands.
Steel, primary forms	18	—	All to Saudi Arabia.
Semimanufactures:			
Flat-rolled products: Of iron or nonalloy steel, not clad, plated, coated	20	—	Lebanon 19; Syria 1.
Bars, rods, angles, shapes, sections	92	—	Germany 49; Greece 20; Jordan 12.
Rails and accessories	14	—	All to Netherlands.
Wire	49	—	United Arab Emirates 19; Greece 16; United Kingdom 13.
Tubes, pipes, fittings	133	—	Libya 41; Lebanon 32; Yemen 16.
Lead: Metal including alloys, scrap	1,032	—	All to Greece.
Titanium: Oxides	1	—	All to Lebanon.
Zinc:			
Oxides	4	—	All to Greece.
Metal including alloys:			
Scrap	16	—	All to India.
Semimanufactures	83	—	All to Italy.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	value, thousands	\$10	— Jordan \$7; Libya \$2; Oman \$1.
Clays, crude: Bentonite	12,088	—	United Kingdom 11,676; Germany 252.
Diamond, natural: Gem, not set or strung	value, thousands	\$2,662	— Mainly to Switzerland.
Fertilizer materials: Manufactured, unspecified and mixed	do.	\$3	— All to Greece.
Gypsum and plaster	12,092	—	Lebanon 7,325; Italy 4,600.
Lime	value, thousands	\$3	— Israel \$2; Syria \$1.
Magnesium compounds: Oxides and hydroxides	5	—	All to Belgium-Luxembourg.
Precious and semiprecious stones other than diamond: Natural	value, thousands	\$2	— All to United Kingdom.
Sodium compounds, n.e.s.: Soda ash, manufactured	2	NA	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	438	—	Italy 137; United Kingdom 67; Netherlands 62.
Worked	value, thousands	\$324	NA NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1991	Destinations	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Stone, sand and gravel—Continued:			
Gravel and crushed rock	2	—	All to Bahrain.
Sulfur: Elemental: Crude including native and byproduct	141	—	All to Israel.
Vermiculite, perlite, etc.	60	—	All to Jordan.
Other: Crude	8	3	Lebanon 3; United Kingdom 1.
MINERAL FUELS AND RELATED MATERIALS			
Peat including briquets and litter	9	—	All to Lebanon.
Petroleum refinery products:			
Mineral jelly and wax	42-gallon barrels	4,777	— Saudi Arabia 4,683; Sierra Leone 94.
Distillate fuel oil	do.	24	— All to Greece.

NA Not available.

¹Comparable data are not available for 1990. Table prepared by Virginia A. Woodson.

TABLE 3
CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	Sources	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	3	—	Denmark 1; Germany 1.
Metal including alloys:			
Scrap	2	—	All from Israel.
Unwrought	4,841	—	Canada 2,787; Greece 1,364; Norway 681.
Semimanufactures	2,076	8	Greece 839; United Kingdom 348; Italy 266.
Antimony: Metal including alloys, all forms	3	—	Mainly from China.
Bismuth: Metal including alloys, all forms	value, thousands	\$2	— All from Belgium-Luxembourg.
Chromium:			
Oxides and hydroxides	1	—	All from United Kingdom.
Metal including alloys, all forms	value, thousands	\$2	— All from Germany.
Cobalt: Metal including alloys, all forms	do.	\$7	\$5 Mainly from Germany.
Copper: Metal including alloys:			
Unwrought	do.	\$359	\$9 United Kingdom \$295; Germany \$26; Italy \$26.
Semimanufactures	2,004	69	United Kingdom 703; Bulgaria 282; Greece 219.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	2,505	1 Germany 1,221; United Kingdom 1,155.
Iron and steel: Metal:			
Scrap	80	—	Egypt 58; United Kingdom 21.
Pig iron, cast iron, related materials	219	—	United Kingdom 49; Poland 29; unspecified 108.
Ferroalloys: Ferromanganese	20	—	All from France.
Steel, primary forms	111	—	United Kingdom 108; Japan 3.

See footnotes at end of table.

TABLE 3—Continued
CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	Sources	
		United States	Other (principal)
METALS—Continued			
Iron and steel: Metal—Continued:			
Semimanufactures:			
Flat-rolled products:			
Of iron or nonalloy steel:			
Not clad, plated, coated	18,037	—	United Kingdom 4,692; Czechoslovakia 3,666; Greece 2,772.
Clad, plated, coated	21,600	—	Greece 10,109; Germany 2,600; Italy 2,462.
Of alloy steel	1,009	1	Spain 194; Germany 137; France 121.
Bars, rods, angles, shapes, sections	138,789	1	Poland 51,942; Czechoslovakia 24,438; Greece 20,391.
Rails and accessories	650	—	Switzerland 590; Austria 21.
Wire	2,664	1	Hungary 641; United Kingdom 624; Greece 421.
Tubes, pipes, fittings	12,861	19	Greece 4,884; Egypt 1,881; Hungary 1,304.
Lead:			
Oxides	303	—	United Kingdom 302; Germany 1.
Metal including alloys:			
Scrap	25	—	Germany 20; Denmark 5.
Unwrought	1,173	(²)	United Kingdom 384; Italy 344; Lebanon 280.
Semimanufactures	208	—	Lebanon 171; United Kingdom 23.
Manganese:			
Oxides	34	—	All from Belgium-Luxembourg.
Metal including alloys, all forms	value, thousands	\$1	— All from Italy.
Mercury	do.	\$3	— Germany \$2; United Kingdom \$1.
Nickel:			
Matte and speiss	do.	\$4	— Israel \$3; Spain \$1.
Metal including alloys:			
Scrap		1	— All from Italy.
Unwrought	value, thousands	\$5	— Germany \$2; Greece \$1; Italy \$1.
Semimanufactures		8	— United Kingdom 5; Austria 1; Italy 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought			
	value, thousands	\$232	\$20 Germany \$184; United Kingdom \$18.
Selenium, elemental, phosphorus, etc.	do.	\$6	— United Arab Emirates \$5; United Kingdom \$1.
Silver: Metal including alloys, unwrought and partly wrought			
	do.	\$2,124	\$59 Germany \$1,292; United Kingdom \$350; Greece \$308.
Tin: Metal including alloys:			
Unwrought	do.	\$2	— Germany \$1; United Kingdom \$1.
Semimanufactures		2	(²) Mainly from United Kingdom.
Titanium:			
Oxides		349	67 Finland 86; United Kingdom 78; Netherlands 46.
Metal including alloys: Semimanufactures	value, thousands	\$2	— All from Italy.
Tungsten: Metal including alloys, semimanufactures			
	do.	\$1	— All from United Kingdom.
Uranium: Metal including alloys, all forms			
	do.	\$50	\$1 United Kingdom \$35; Israel \$10.
Zinc:			
Oxides		55	— Germany 46; Belgium-Luxembourg 7.
Blue powder		2	— Mainly from Norway.

See footnotes at end of table.

TABLE 3—Continued
CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	Sources	
		United States	Other (principal)
METALS—Continued			
Zinc—Continued:			
Metal including alloys:			
Unwrought	372	—	Belgium-Luxembourg 212; Netherlands 143.
Semimanufactures	value, thousands \$4	—	Greece \$2; United Kingdom \$2.
Other: Oxides and hydroxides	3	—	United Kingdom 2; Norway 1.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	3,628	—	Greece 3,605.
Artificial: Corundum	value, thousands \$3	—	Germany \$1; Switzerland \$1.
Grinding and polishing wheels and stones	do. \$955	\$14	Italy \$409; Germany \$144; Greece \$84.
Asbestos, crude	215	—	Brazil 160; Republic of South Africa 36.
Barite and witherite	10	NA	Germany 6.
Boron materials: Oxides and acids	5	—	Greece 4.
Bromine ³	3	2	Mainly from Switzerland.
Cement	842	—	Greece 750; France 63.
Chalk	454	—	France 265; United Kingdom 181.
Clays, crude:			
Bentonite	86	—	United Kingdom 79; France 6.
Kaolin	17,850	—	Greece 17,428; United Kingdom 249.
Unspecified	428	—	United Kingdom 144; Greece 141; Germany 117.
Diamond, natural: Gem, not set or strung	value, thousands \$8,167	—	U.S.S.R. \$5,042; Belgium-Luxembourg \$1,455; Israel \$862.
Diatomite and other infusorial earth	176	95	Germany 43; Greece 21; Netherlands 16.
Fertilizer materials:			
Crude, n.e.s.	23	4	France 14; United Kingdom 3.
Manufactured:			
Ammonia	16	—	Netherlands 6; Germany 4; United Kingdom 4.
Nitrogenous	22,396	—	Romania 12,219; Bulgaria 9,157.
Phosphatic	1,482	—	Lebanon 1,000; Romania 420.
Potassic	332	—	Israel 325; Germany 6.
Unspecified and mixed	48,741	88	Romania 16,969; Greece 14,468; Yugoslavia 14,222.
Gypsum and plaster	57	4	Greece 27; United Kingdom 24.
Lime	value, thousands \$1	—	All from Romania.
Magnesium compounds: Oxides and hydroxides	67	—	Netherlands 30; United Kingdom 25; Greece 5.
Mica:			
Crude including splittings and waste	17	4	United Kingdom 11; Norway 2.
Worked including agglomerated splittings	value, thousands \$3	—	United Kingdom \$2; Italy \$1.
Nitrates, crude	21	—	Netherlands 20; United Kingdom 1.
Pigments, mineral: Iron oxides and hydroxides processed	58	—	Belgium-Luxembourg 14; Germany 10.
Precious and semiprecious stones other than diamond:			
Natural	value, thousands \$425	\$1	United Kingdom \$112; Germany \$65; India \$62.
Synthetic	do. \$299	—	Switzerland \$104; Austria \$63; Thailand \$34.
Salt and brine	6,642	—	Israel 3,275; Greece 1,312; Tunisia 950.
Sodium compounds, n.e.s.:			
Soda ash, manufactured	499	—	United Kingdom 323; Italy 144; France 25.
Sulfate, manufactured	2,331	—	Austria 1,263; Germany 930.

See footnotes at end of table.

TABLE 3—Continued
CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1991	Sources	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	23,102	1	Italy 14,647; Greece 8,344.
Worked	value, thousands \$3,767	\$4	Italy \$2,429; Greece \$1,196.
Dolomite, chiefly refractory-grade	6,879	—	Greece 6,781; Norway 98.
Gravel and crushed rock	3,756	—	Italy 2,341; Greece 1,336.
Quartz and quartzite	15	—	Netherlands 7; Italy 6.
Sand other than metal-bearing	value, thousands \$157	\$1	Belgium-Luxembourg \$46; Germany \$41; Netherlands \$21.
Sulfur:			
Elemental: Crude including native and byproduct	1,356	—	Saudi Arabia 640; Lebanon 616; Egypt 100.
Dioxide	138	—	All from Greece.
Sulfuric acid	367	(²)	Greece 341; Germany 25.
Talc, steatite, soapstone, pyrophyllite	515	—	Greece 258; Norway 144; Italy 40.
Vermiculite and perlite, etc.	402	—	Greece 401; Italy 1.
Other: Crude	3	—	Netherlands 1; unspecified 2.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	10	—	Saudi Arabia 7; United Kingdom 2.
Carbon black	5	2	Germany 2; Belgium-Luxembourg 1.
Coal:			
Anthracite	72,175	60,697	Italy 11,455.
Briquets of anthracite and bituminous coal	54	—	All from Australia.
Lignite including briquets	294,258	NA	Germany 294,100.
Coke and semicoke	419	—	Belgium-Luxembourg 342; Germany 61; United Kingdom 16.
Peat including briquets and litter	4,844	—	Germany 2,499; Netherlands 992; Ireland 970.
Petroleum:			
Crude	thousand 42-gallon barrels 5,691	—	U.S.S.R. 3,816; Algeria 1,401; Saudi Arabia 318.
Refinery products:			
Liquefied petroleum gas	do. 190	(²)	Greece 92; Italy 60; Saudi Arabia 7.
Mineral jelly and wax	do. 6	(²)	Germany 4; Greece 1.
Bitumen and other residues	do. 213	—	Italy 107; Greece 105.
Bituminous mixtures	do. 2	—	Mainly from United Kingdom.

NA Not available.

¹Comparable data are not available for 1990. Table prepared by Virginia A. Woodson.

²Less than 1/2 unit.

³May include iodine and fluorine.

TABLE 4
CYPRUS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	Hellenic Mining Co. Ltd. ²	Skouriotissa	1.1 cement copper.*
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	Hellenic Mining Co. Ltd. ²	Mitsero	8 hydrated lime.*
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	700.*
Petroleum, refined thousand barrels	Cyprus Petroleum Refinery Ltd. (private, ¹ 100%)	Larnaca	5,850.
Pyrite	Hellenic Mining Co. Ltd. ²	2 mines 20 kilometers south of Nicosia	146.
Sand	do.	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%)	Parakklishia	270.*
Do.	Eskal Ltd. (private, ¹ 100%)	Ayios Mamas	175.*
Do.	Skyropiia "Leonik" Ltd. (private, ¹ 100%)	Mitsero area	135.*
Sand and gravel	Neeffa 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%)	do.	2.
Do.	Umber Corporation of Larnaca Ltd. (private, ¹ 100%)	Surface workings, 20 kilometers northwest of Larnaca	13.*

*Estimated.

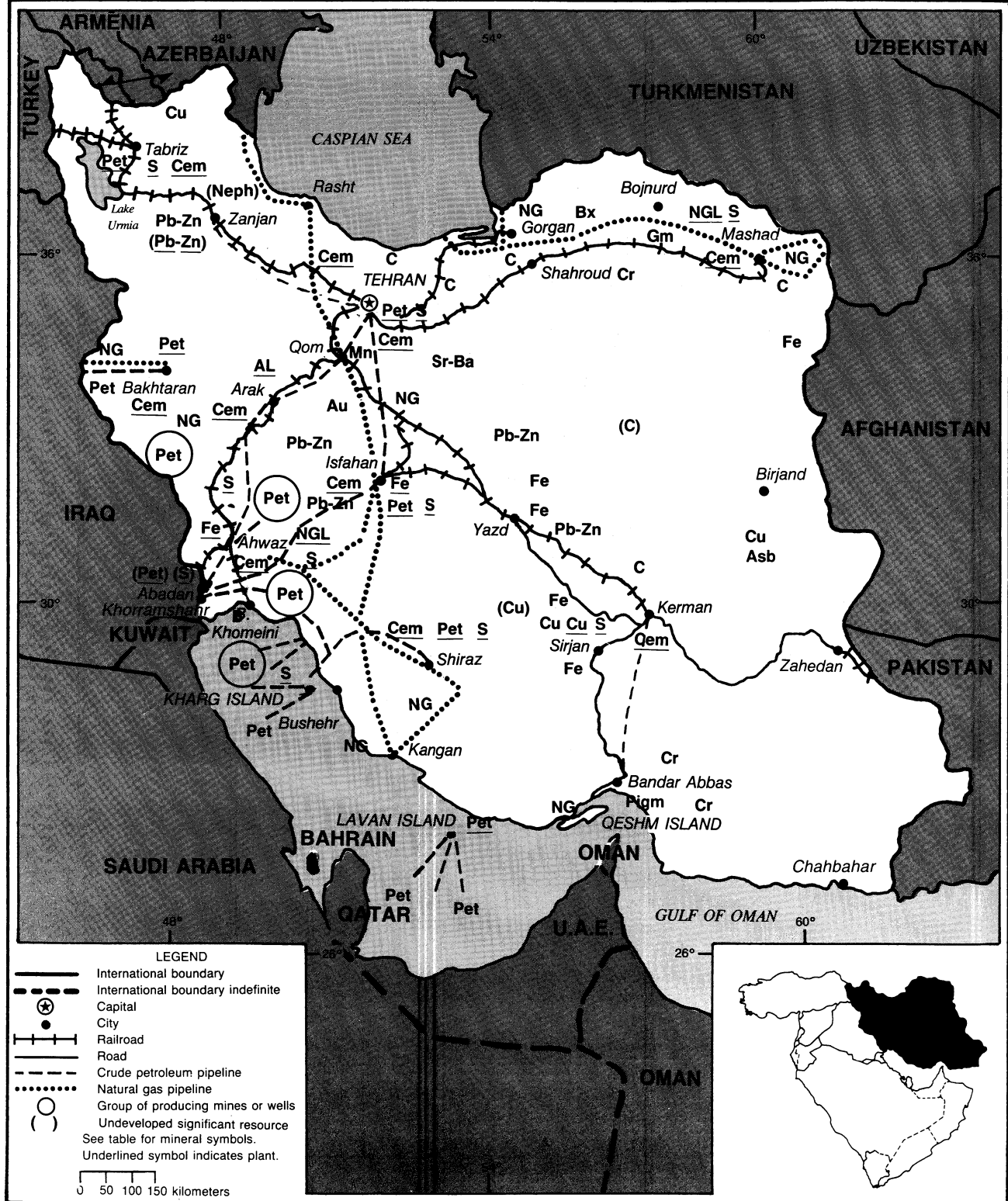
¹Ownership by individual citizens of Cyprus and/or individual foreign investors.

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 61 million



THE MINERAL INDUSTRY OF

IRAN

By Michael Mir Heydari

The mineral industry, dominated by the crude petroleum and natural gas sectors, continued to play a prominent role in Iran's economy in 1992. Oil and gas provided about 82% of the country's foreign exchange. Iran was the world's fourth largest petroleum producer, with a production level averaging about 3.5 Mbbbl/d.¹ Its petroleum reserves were among the top five. Iran was among the top 10 producers of natural gas, with reserves second only to Russia. In addition, about 60 Mmt of other mineral products, ranging from iron ore to base metals, coal, industrial minerals, and dimension stone, were produced in 1992.

The Government placed a high priority on developing its mineral resources as evidenced by its earmarking one-quarter of its \$20 billion investment budget under the current 5-year development plan, which runs until March 1995, to the metals and minerals sector.²

In 1992, GDP grew at about 10% and reached \$30.72 billion. The nonpetroleum mining sector's contribution to GDP was about 3.4%. The Government's target is to increase the latter to 10% by the year 2000. The value of nonpetroleum raw minerals produced in 1992 was \$252 million.

GOVERNMENT POLICIES AND PROGRAMS

The Government undertook economic reforms to reduce the state influence in Iran's economy, privatize state companies, promote the stock exchange, and encourage foreign and domestic private investment. As most subsidies disappeared, prices increased markedly to free market levels.

Foreign investment was invited in most sectors, especially mining. The 49%

ceiling on foreign ownership was lifted as the Government indicated its willingness to consider foreign majority ownership on a case-by-case basis. Several large contracts were signed with European and Japanese companies for the construction or expansion of mine, processing, smelting, and refining facilities throughout the country.

PRODUCTION

A total of 43 different minerals was produced by 1,314 active mines. According to official Ministry of Mines and Metals figures, Iran possesses 1,919 mines at the prospecting and production stages. The majority of these mines are small-scale quarries. In 1992, 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. In 1992, the Ministry of Mines and Metals pursued plans for major increases in steel production. Steel output was to increase from 3 Mmt/a to 5.5 Mmt/a by 1994 and to 7 Mmt/a a few years later. Output rates in nonferrous metals were also to grow. Copper was to increase to 120,000 mt/a by 1993 and 200,000 mt/a by 1995. Aluminum output from the Arak plant was to increase to 150,000 mt/a in 1993 and to more than 300,000 mt/a by 1995. Additionally, 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 1992, total exports amounted to about \$20 billion, of which oil and gas exports accounted for about \$17 billion.

Total imports amounted to about \$21.5 billion, 17% less than those in 1991. The five leading suppliers of goods and services to Iran were, in order of importance, Germany with about \$5 billion worth of exports to Iran; Japan with \$3 billion; Italy with about \$2 billion; the United Arab Emirates with more than \$1 billion, particularly of luxuries and consumer goods; and the United Kingdom with \$1 billion. Dubai's free port and its proximity to Iran have made it a busy reexport point for goods destined for Iran.

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. In 1992, while U.S. exports to Iran soared to \$780 million—almost equal to France's export to Iran—from \$527 million in 1991, imports from Iran were a mere \$0.8 million compared with \$230 million in 1991. The high 1991 import figure was due to oil purchased under a special agreement that allowed the proceeds to

pay for settlement of claims brought by U.S. firms as a result of losses incurred during the 1979 Iranian revolution. Major U.S. exports to Iran included oil drilling and engineering equipment, chemicals, gas turbines, medical equipment, and spare parts for machinery.

Iran's postwar import spree brought about a minidebt crisis in 1992, 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 \$2 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. In 1990 and 1991, the Government both increased imports to revive industry and allowed the local banks greater leeway in issuing letters of credit. As a result, imports soared to nearly \$50 billion over the 2 years, while export revenues remained less than \$40 billion.

Iran has announced its intention to develop several islands in the Persian Gulf as free trade and industrial zones. Substantial funds have been devoted to beginning this program on Qeshm and Kish. The former, a large island in the Strait of Hormuz, will be a free trade and industrial zone; the latter, a small 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. Iran has also expressed interest in joining the General Agreement on Tariffs and Trade (GATT) to integrate its economy with that of the world.

Export earnings from non-oil and gas minerals amounted to \$368 million in 1992 and were expected to reach \$1 billion by the mid-1990's. The most significant minerals exported were chromite, lead, and zinc. 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. In 1992, Iran imported 470,000 tons of phosphate rock from Senegal, up from 375,000 tons in 1991.

STRUCTURE OF THE MINERAL INDUSTRY

Most of the principal mineral commodity production facilities were under Government control in 1992 through more than 30 parastatal companies administered by the Ministry of Mines and Metals (MMM) and the Ministry of Petroleum. The Government continued to emphasize privatization of mining industry. This included all mining operations except 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.

The Geological Survey of Iran (GSI) undertook collaborative detailed geological mapping programs on a 1:100,000 scale with technical assistance from Australia, Azerbaijan, China, Czechoslovakia, and Germany. GSI is modernizing its laboratories with state-of-the-art equipment.

COMMODITY REVIEW

Metals

Aluminum.—The aluminum production from the reconstructed Arak plant reached 105,000 tons in 1992. The Arak expansion project increased the 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 progressing on schedule. Switzerland's ABB Process Automation, a subsidiary of the Zurich-based ABB Asea Brown

Boveri, won a \$130 million contract to supply electrical equipment for the smelter. The smelter is expected to commence production in 1994 at an initial rate of 220,000 mt/a, with a subsequent expansion to 330,000 mt/a of aluminum. 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 Iran's MMM and 40% by the Dubai-based International Development Corp., a partnership of Arab, United Kingdom, and Swiss investors and traders.

Technical assistance is 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 is due to become operational in 1995, will feed the aluminum smelters at Arak and Bandar Abbas. The ore will be supplied by bauxite deposits near Jajroum having estimated reserves of 22 Mmt averaging 48% Al₂O₃. Lack of hard currency may, however, postpone implementation of this project.

In northwestern Iran at Sarab, about 120 km east of Tabriz, a large nepheline syenite deposit could be mined for alumina using technology developed by Russia to exploit a similar deposit in the Kola Peninsula.

The Government is seeking partners to develop a 2-Mmt/a-capacity aluminum refinery on Qeshm Island that would serve the needs of all of the Persian Gulf region's aluminum producers. Alternatively, the possibility of financing a refinery in Guinea, in western Africa, is being considered. Iran signed an agreement with Tajikistan to import 400,000 tons of aluminum ingots.

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 the 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, were approved by the Government for implementation.

Copper.—Expansion of the Sar Cheshmeh copper mine-concentrator-smelter-refinery complex of the National Iranian Copper Industries Co. (NICICO), about 150 km southwest of Kerman, continued in 1992. NICICO awarded a \$23.4 million contract to a consortium of contractors, Kloeckner INA Industrials Plants Ltd., and consultants, Techpro Mining and Metallurgy, for the design, supply, construction, supervision, and commissioning of a heap-leach solvent extraction-electrowinning plant at Sar Cheshmeh. The company ultimately plans to produce 200,000 mt/a of copper, doubling current production volumes. 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 Klockner Industrie-Analgen are already working together on studies for the expansion of the main smelter and associated sulfur fixation plant.

An underground copper mine and concentrator, Qal'eh Zari, about 150 km south of Birjand, was also 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. Outomec, a subsidiary of Finland's Outokumpu, is carrying out a feasibility study for the

development of the Meiduk ore body, including the construction of an on-site concentrator. Economic reserves of the deposit vary from 50 Mmt to 100 Mmt, depending upon copper prices under consideration. Mining at Meiduk, which has been described as "a mini Sar Cheshmeh," will most likely be by open pit. The concentrator will treat 3 Mmt/a to 5 Mmt/a of ore grading about 1% Cu. Capital costs are projected at \$300 million for the open pit mine and concentrate.

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, 300 km southeast of Tehran. 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. Iranian General Mine Co. is developing a mine at the largest deposit, Chahar-khaton, which accounts for about 50% of total area resources. Mining will be by open pit. Construction of surface facilities and infrastructure, premining activities, and a 1-kg/d gold refinery plant have been completed with assistance from Broken Hill Pty. Ltd. of Australia (BHP). The operation is due to start up 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. Iron ore output was estimated at about 6 Mmt in 1992. Steel production increased by more than 33%. Sponge iron produced by direct reduction plants was up by more than 50%.

Iran has four main iron mines: Chadormalu, 125 km northeast of Yazd; Choghart in Bafq, 130 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 are being developed or expanded. In 1992, most of the iron production came from the Choghart and Golgohar Mines.

The Government-owned National Iranian Steel Co. (NISCO), under the direction of the MMM, owned and operated all major iron mines and steel plants. 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. 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 the ASCO's Ahwaz steel complex was planned to commence in 1993 from its first Mexican HYL module. Total DRI capacity from

ASCO's three HYL units is targeted at 1.1 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. The other three are scheduled to be commissioned in 1993. 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 the 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 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 a ceiling of 25% in a hot-briquetted iron (HBI) plant on Qeshm island. The Qeshm HBI plant is to be built by Qeshm Iron Co., a joint venture set up in June 1992 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 1994, rising to 5 Mmt/a in five stages.

Germany's Mannesmann Demag Huttentechnik continued work on construction of a ferrosilicon plant in Semnan, 200 km east of Tehran, under a contract with the Iran Ferrosilice Co. The project, described as the largest private-sector project since the 1979 revolution, was being appraised by IFC for possible participation. The plant is scheduled to start producing 25,000 mt/a of FeSi-75 in late 1993.

An international consortium consisting of Mitsubishi Corp. of Japan and Danieli & Co. of Italy won the \$550 million turnkey contract to build a new alloy and specialty steels plant near Yazd. Initial capacity was to be 140,000 mt/a at the 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, Anguran, Douna, Emarat, Irankouh, Kushk, Nakhlak, and Ravanj. The deposits have a wide regional distribution but the major mines are centered near Yazd and Isfahan. A new 40,000-mt/a-capacity lead smelter came on-stream in late October 1992 at the Angouran Mine, near Zanjan. Angouran is 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. Companhia Mercantil e Industrial Inga of Brazil has signed an \$11.35 million contract with the Government, under which it will transfer technology for the production of zinc ingots from zinc silicate ore based on Inga's own patented process.

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, 5-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 Hegmatan 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 5-stage preheater with a calciner supplied by Humboldt Wedag of Germany.

Dimension Stone.—The Government made efforts to promote expansion of the production of decorative stone from the extensive deposits in Iran. An international exhibition of decorative stones and production machinery, held in April 1992 in Isfahan, attracted more than 130 exhibitors. In addition to marketing quantities of marble, onyx, and travertine, Iran is actively seeking export markets for its substantial range of granites. Several modern stone processing plants have been purchased, particularly by the companies related to MMM, with investment of about \$900 million, during the past 4 years.

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.—In 1992, about one-half of the coking coal for use in Iran's steel industry was produced at the Babnizou and Pabedana coal mines near Kerman and other mines around Shahroud, all operated by NISCO. The remaining coking coal requirements were met by imports. 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 would also 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. British, Canadian, and German firms are assisting with the feasibility studies and preengineering work. The project still needs the Government's final approval. 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, that produce a total of about 260,000 mt/a of coking and heating coal for local demand.

Petroleum and Natural Gas.—In spite of OPEC's lower ceiling for Iran, petroleum production averaged about 3.5 Mbbbl/d in 1992. 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 2.8 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 1,089,300 bbl/d of crude oil. The four major refineries at Isfahan, Abadan, Tehran, and Arak treated 281,000 bbl/d; 254,600 bbl/d; 224,700 bbl/d; and 150,000 bbl/d of crude,

respectively. Domestic consumption of oil totaled 975,000 bbl/d.

Projects for rehabilitation of the Adaban refinery were completed, and construction of new refineries at Arak and 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, neared completion.

Reserves for 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, were estimated at 3 trillion m³ of gas and 2.5 billion bbl of natural gas liquids. National Iranian Gas Co. and Gas de France signed an agreement to set up a joint company to study opportunities for exporting Iranian gas, by pipeline and gas tanker, to Central, Eastern, and Western Europe.

The production of petrochemical products totaled about 5.4 Mmt in 1992. 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 will have doubled. 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. Isfahan has also 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 was also planned in the northeast from Mashad into the 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 vessels of up to 2,500 tons. 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.

The 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 hot-briquetted iron 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 the Qeshm Island to the mainland. The project is estimated to cost about \$100 million.

Electricity generated by the country's powerplants totaled about 48,000 GW•h in the first 9 months of 1992, an increase of 5.7% over the corresponding period in 1991. Thermoelectric plants accounted for about 85% of power generation. An ambitious electric power generation and distribution program was under way in 1992 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 powerplant. 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.

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

²In 1992, the open market exchange rate averaged Iranian Rials (IR) to U.S. dollars at the rate of IR1,530=US\$1.00. As 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 IR1,538=US\$1.00 and keeping the old official rate of IR70=US\$1.00 for \$3,800 million worth of essential imports. The floating rate dropped to IR1,640=US\$1.00 in Apr. 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

Publications

Iran Yearbook
M&B Publishing Co. Ltd.
P.O. Box 200949
5300 Bonn 2, Germany

TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992*
METALS					
Aluminum: Metal, primary ingot*	40,000	54,000	60,000	80,000	92,000
Arsenic: Orpiment and realgar, concentrates	417	1,039	382	552	600
Chromium: Chromite, mine output, concentrate (46% to 52% Cr ₂ O ₃):					
Gross weight	60,289	72,628	77,189	90,119	90,000
Cr ₂ O ₃ content*	30,000	35,000	38,000	44,000	44,000
Copper: ²					
Mine output, concentrate (29% to 32% Cu):					
Gross weight	170,722	171,477	219,728	289,621	³ 303,987
Cu content*	51,000	68,000	60,300	80,700	³ 91,561
Metal:					
Smelter output, blister/anode	⁵ 2,000	⁷ 6,000	54,800	55,200	³ 128,047
Refinery output, cathode	³ 2,000	⁴ 0,000	43,255	77,900	³ 86,363
Gold: Mine output, Au content* kilograms	400	400	500	800	1,000
Iron and steel:					
Ore and concentrate:					
Gross weight thousand tons	2,005	2,296	3,240	4,890	6,000
Fe content* do.	1,100	1,300	1,800	2,700	3,600
Metal:					
Pig iron do.	² 50	² 50	1,267	1,952	³ 2,053
Direct-reduced iron do.	—	⁴ 0	² 64	⁴ 70	³ 709
Steel, crude (ingots and castings) do.	978	1,081	1,425	2,203	³ 2,937
Lead:					
Mine output, concentrate *(56% to 60% Pb):					
Gross weight	18,510	21,866	19,310	27,468	50,000
Pb content*	11,000	13,000	11,000	16,000	25,000
Refinery output, secondary*	10,000	9,000	10,000	12,000	12,000
Manganese, mine output, *(30% to 35% Mn):					
Gross weight	74,630	80,953	54,404	48,422	50,000
Mn content*	23,000	24,000	18,000	16,000	16,000
Molybdenum, mine output, concentrate (55% to 57% Mo):					
Gross weight	1,181	1,305	889	707	³ 2,350
Mo content*	700	750	500	400	1,300
Silver: Mine output, Ag content*	30	41	38	40	50
Zinc, mine output, concentrate *(50% to 55% Zn):					
Gross weight	29,015	54,995	54,762	135,180	140,000
Zn content*	15,000	29,000	29,000	70,000	75,000
INDUSTRIAL MINERALS					
Asbestos:					
Concentrate, (3% to 8% marketable fiber)	68,202	65,000	51,467	62,032	70,000
Marketable fiber*	³ 3,410	3,300	2,800	3,000	3,000
Barite	44,309	59,660	77,423	191,238	200,000
Boron: Borax	1,720	466	1,818	1,030	1,200
Cement, hydraulic* thousand tons	³ 12,202	12,500	13,000	15,000	18,000
Clays:					
Bauxite and refractory clays	92,536	74,097	92,509	98,425	100,000
Bentonite	37,028	31,547	51,096	40,452	45,000

See footnotes at end of table.

TABLE 1—Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992*
INDUSTRIAL MINERALS—Continued					
Clays—Continued:					
Other:					
Industrial clays ^o	344,350	299,000	² 213,181	² 216,710	250,000
Kaolin ^o	150,000	150,000	150,000	³ 150,473	150,000
Total⁴	494,348	448,980	¹ 363,200	367,183	400,000
Diatomite	32	—	2,152	90	100
Feldspar	14,781	20,458	32,071	64,754	65,000
Fluorspar: Fluorite	6,483	⁶ 6,000	4,767	12,260	12,000
Gemstones: Turquoise kilograms	23,838	17,408	24,855	² 20,000	20,000
Gypsum thousand tons	7,648	7,858	7,724	8,050	8,000
Industrial sand and gravel (quartzite and silica)	829,121	822,853	⁸ 70,000	832,441	850,000
Lime ^o thousand tons	650	650	650	650	650
Magnesium compounds: Magnesite and huntite ⁵	2,777	6,967	1,405	29,291	30,000
Mica	1,167	2,294	1,352	4,135	4,000
Nitrogen: Ammonia, N content	145,500	336,000	420,000	467,700	³ 656,600
Perlite	¹ 1,260	2,240	2,266	6,275	6,000
Pigments, mineral, natural iron oxide	3,700	4,869	3,720	3,753	3,800
Pumice and related volcanic materials	¹ 190,000	212,442	237,868	215,149	202,000
Salt	814,842	989,932	848,098	900,965	900,000
Sodium compound: Caustic soda ^a	12,000	12,000	15,000	15,000	15,000
Stone:					
Construction and building, crushed, n.e.s. thousand tons	2,741	3,086	3,515	3,073	3,500
Dimension and decorative: Marble, travertine, granite.⁶					
Blocks and slabs ^o thousand tons	3,700	4,450	³ 4,800	³ 4,940	5,000
Crushed ^o do.	410	500	³ 669	³ 555	500
Total⁴ do.	4,107	4,947	5,469	5,495	5,500
Dolomite do.	72	77	71	105	100
Limestone do.	17,420	17,527	20,546	24,180	25,000
Seashell do.	⁸ 85	85	81	73	80
Strontium: Celestite	39,194	56,849	34,140	28,500	30,000
Sulfates, natural:					
Aluminum potassium sulfate (alum) ^o	12,000	12,000	12,000	12,000	12,000
Sodium sulfate	213,521	184,848	176,951	144,204	150,000
Sulfur:^o					
Byproduct of petroleum and natural gas	206,000	460,000	635,000	650,000	700,000
Byproduct of metallurgical processing, S content of acid	25,000	40,000	45,000	50,000	50,000
Total	231,000	500,000	680,000	700,000	750,000
Talc	29,261	11,039	31,087	6,676	10,000
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	1,625	1,457	1,435	1,480	1,600
Coke ^o do.	400	400	400	400	400
Gas, natural:					
Gross million cubic meters	40,500	43,600	⁴ 46,500	⁵ 50,000	54,000
Dry ⁷ do.	20,000	22,200	² 23,800	² 29,450	32,000
Natural gas plant liquids thousand 42-gallon barrels	7,300	9,900	¹ 12,775	¹ 18,250	20,000

See footnotes at end of table.

TABLE 1—CONTINUED
IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992 [*]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	<u>817,600</u>	<u>1,025,650</u>	<u>1,127,120</u>	<u>1,216,910</u>	<u>1,300,000</u>
Refinery products:						
Motor gasoline	do.	33,580	39,055	^r 43,800	[*] 44,895	49,640
Jet fuel	do.	2,555	2,920	^r 3,650	[*] 4,015	4,745
Kerosene	do.	22,995	24,820	^r 31,025	^r 31,755	35,040
Distillate fuel oil	do.	62,050	75,555	^r 94,900	^r 96,725	100,000
Residual fuel oil	do.	76,650	83,220	^r 109,500	^r 110,960	114,975
Liquefied petroleum gas	do.	6,935	8,760	^r 9,855	[*] 11,680	13,140
Lubricants (including greases)	do.	3,285	3,285	4,015	[*] 4,380	4,745
Other ⁸	do.	^r 10,950	^r 10,585	^r 20,805	^r 24,090	27,740
Total ⁹	do.	219,000	248,200	^r 317,550	^r 328,500	350,000

^{*}Estimated. ^rRevised.

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 May 21, 1993.

²Copper metal production figures include output smelted and refined from copper scrap, estimated at about 5% of total output.

³Reported figure.

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

⁵Figures for 1988-90 is for magnesite; the 1991 figure includes 3,336 tons of huntite ("white clay"), Mg₃Ca(Co₃)₄.

⁶For 1991, blocks and slabs production totals for marble, travertine, and granite, respectively, in thousand tons, were: 4,468; 463; and 9. Crushed production totals were 498; 56; and 2, respectively.

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

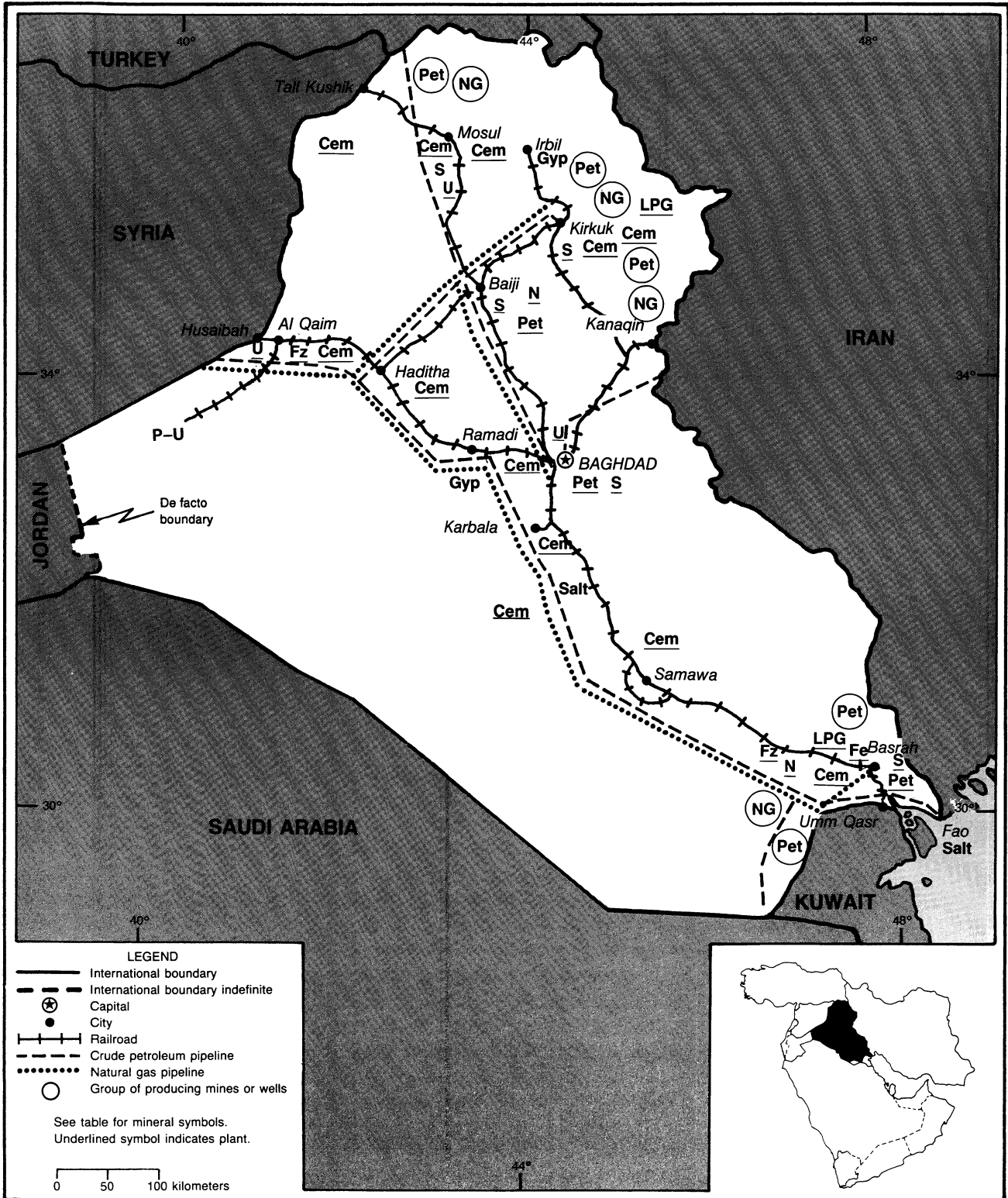
⁸Includes asphalt, coke, aviation gasoline, naphthas, paraffin wax, petrochemical feedstocks, unfinished oils, white spirits, and blending components.

⁹Refinery fuel and losses are included in output of individual products; totals are as follows, in thousand 42-gallon barrels: 1988—10,585; 1989—9,490; 1990—12,045; 1991—13,140 (estimated); 1992—14,600 (estimated).

IRAQ

AREA 434,920 km²

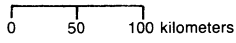
POPULATION 18.4 million



LEGEND

- International boundary
- - - International boundary indefinite
- ⊙ Capital
- City
- +—+— Railroad
- - - - - Crude petroleum pipeline
- Natural gas pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.



THE MINERAL INDUSTRY OF

IRAQ

By Lloyd E. Antonides

Minerals, particularly oil, were a major factor in Iraq's economy. For some time Iraq ranked among the world's 10 largest oil producers and 12 largest sulfur producers. In the Middle East it was a significant producer of cement, phosphate, and urea. However, the

economy, and especially the oil and other mineral sectors, was greatly affected by the Gulf War that began when Iraq invaded Kuwait in August 1990 and was particularly affected by the UN's retaliatory trade embargo that continued into 1993. Production of mineral

commodities in excess of domestic consumption apparently led to stockpiling.

Reports of infrastructure and industry damage sustained in the Gulf War remained inconsistent and inconclusive. Information indicated that some facilities

TABLE 1
IRAQ: ESTIMATED PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	1988	1989	1990	1991	1992
METALS					
Iron and steel:					
Pig iron (direct reduced sponge)	20	200	170	—	—
Steel, crude	50	300	150	20	100
INDUSTRIAL MINERALS					
Cement, hydraulic	³ 10,500	12,500	10,000	5,000	10,000
Gypsum ⁴	350	450	380	190	380
Nitrogen: N content of ammonia	313	474	240	40	200
Phosphate rock:					
Beneficiated (³ 30% P ₂ O ₅) ⁵	1,270	1,140	900	400	900
P ₂ O ₅ content	381	342	270	120	270
Salt	³ 300	300	² 250	¹ 120	250
Sulfur, elemental:					
Native, Frasch	³ 958	960	800	250	500
Byproduct ⁶	³ 227	370	³ 380	⁵ 50	100
Total	1,185	1,330	¹1,180	³300	600
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross	14,160	14,400	⁹ 9,090	¹ 1,400	2,000
Dry	2,800	3,100	⁴ 1,190	⁶ 30	1,000
Natural gas plant liquids	7,300	19,700	11,000	1,600	2,200
Petroleum:					
Crude (including lease condensate)	980,000	1,057,000	745,000	¹ 109,000	146,000
Refinery products	146,000	160,000	¹ 164,000	² 24,000	32,000

¹Revised.

²Includes data available through May 1, 1993.

³In addition to commodities listed, the following were also 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.

⁴Reported figure.

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.

⁶Crude rock reported only for 1988 as 3.5 Mmt estimated to contain 22% P₂O₅.

⁷Presumably from petroleum and natural gas processing.

had been rapidly repaired or reconstructed.

The trade embargo imposed by the UN member countries covered essentially everything except food and medicine. In the absence of oil sales, which normally generated about 95% of foreign exchange and most of the Government's revenue, the country reported having difficulty purchasing even what was allowed. Iraq

continued to refuse the UN conditions that would allow limited sale of crude oil to buy vital civilian needs. Jordan was the main conduit for food and medicine, and some smuggling was reported across most borders. The Kurdish self-controlled area along the northern border appeared to be surviving with its own economy.

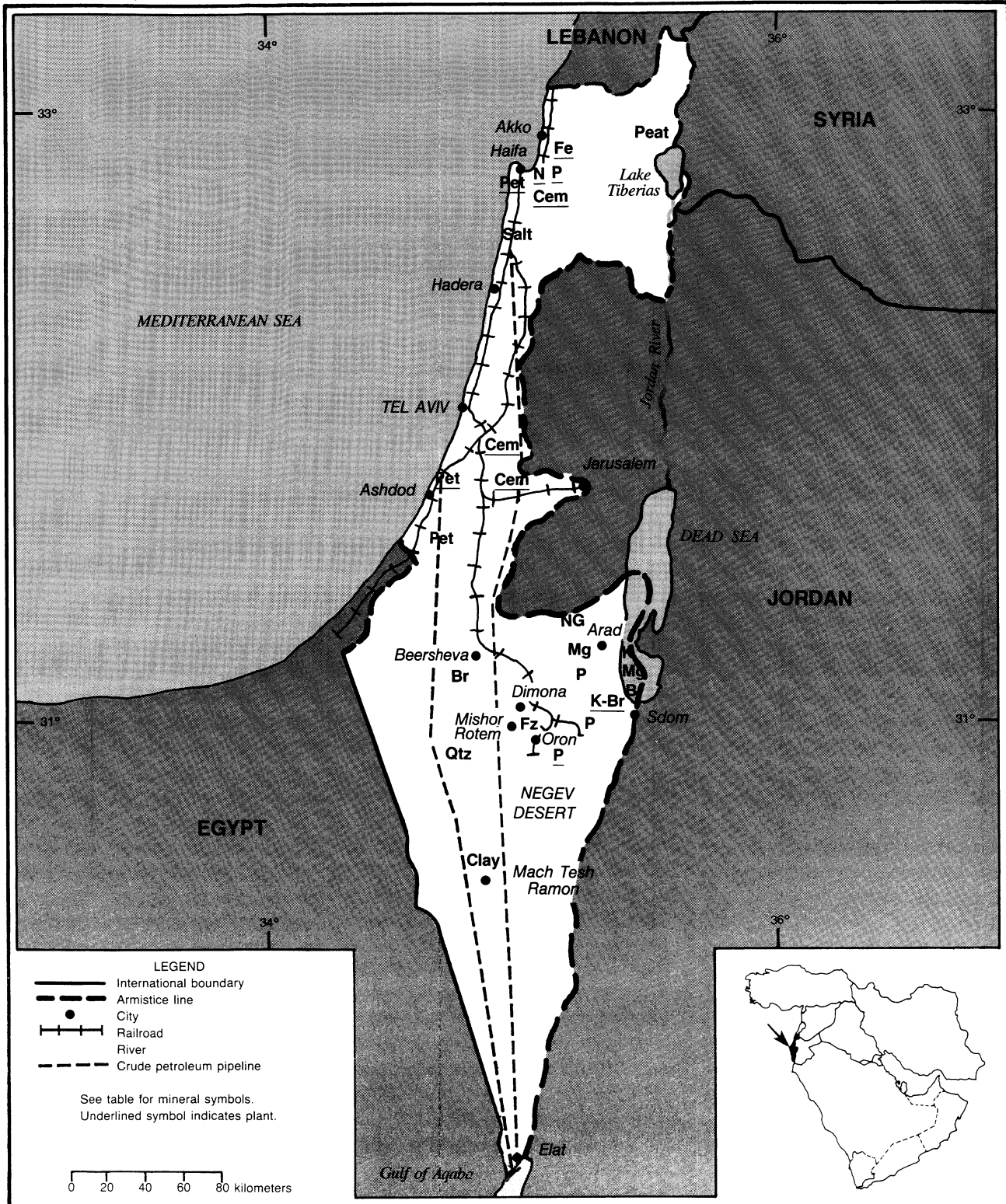
The foreign investment law of 1988 limited private and foreign participation

to Arab capital. In mid-1989, some consideration was being given to other sources on a case-by-case basis. And in 1992, despite the trade embargo, several foreign companies entered agreements or developed understandings with the Government regarding oil and possibly other ventures after sanctions were lifted.

ISRAEL

AREA 21,000 km²

POPULATION 4.7 million



THE MINERAL INDUSTRY OF

ISRAEL

By David Izon

The mineral industry of Israel in 1992 concentrated 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's role as the seventh largest producer of phosphate rock in the world was maintained in 1992 and accounted for 2% of world production. Israel also has the world's second largest production of bromine and bromine compounds, which was more than 31% of total world production in 1992. As the third largest producer of potash, Israel's output was about 5% of the world's production. The country accounted for about 1% of the world's refractory-grade magnesia, produced from Dead Sea brine.

The mineral industry contributed very little to Israel's overall economy, accounting for only about 2% of gross domestic products in 1992. However, the mineral industry was relatively important to Israel's trade because more than 90% of the country's mineral production was exported. Israel has a capable high-tech industry that processes a significant number of imported raw materials for reexport. Such processed products included cut diamond, polished gemstones, fertilizer, petroleum products, inorganic chemicals, and primary metal products, some of which are processed for domestic consumption. 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. During 1992, Israel Chemicals Ltd. signed a joint-venture agreement with India to supply India with

a total of 500,000 tons of potassium and phosphate. Also, Israel and China signed an agreement to operate regular flights between the two countries. Trade agreements also were signed with Russia.

GOVERNMENT POLICIES AND PROGRAMS

In 1992, the net inflow of new immigrants was 75,000, and creating jobs for these immigrants from the former U.S.S.R. was the main priority of Israel's economic policy. The Government consequently slacked back its housing investment program, and this in turn slowed the growth in aggregate demand. Despite the Government's best efforts, unemployment averaged 11.2% in 1992. Unemployment is expected to reach 13% by 1995. Most of the jobs created were in the public sector, though the public sector accounts for only 30% of employment.

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. Job creation continued under the "Package Deal" of 1991, which was to create about 36,000 new jobs and invest about \$800 million in infrastructure projects. Most of the new jobs were expected to be in the construction sector. The industrial sector accounted for 21% of employment and other sectors such as agriculture, 4%; commerce/services, 39%; and construction, 6%. Apart from the Government's plan to train and employ 1,000 more engineers, the industrial sector would absorb about 150,000 workers over a 4-year period.

Foreign exchange for authorized

imports was granted upon presentation of relevant documents, and advanced payments from imports to be supplied within 1 year were permitted in July 1992. 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. Residents may not keep bank accounts abroad. Exporters are permitted to deposit 10% of their foreign currency earnings in foreign banks for up to 1 year. As of April 1992, Israeli residents were allowed to own and engage in trade of gold ingots or coins.

Although the Government remained committed to freeing up the economy, it has been slow to implement proposed privatization reforms. At yearend 1992, the Government sector still monopolized Israel's aviation, oil refining, transport, and telecommunications sectors. The banking sector was reorganized with Israel selling 16.5% of Government shares in Bank Hapoalim, the country's largest bank. Still, privatization of many of the country's parastatal firms, including some of the major companies involved in the minerals industry, was being planned.

PRODUCTION

During 1992, the production of locally consumed mineral products generally increased, while the production of mineral products for export decreased slightly. The production of mineral products for use in the construction industry, such as cement, clays, crushed stone, steel, and sand, increased during the year owing to continued construction of new homes for immigrants.

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 4% to 23% from 1991 levels. Potash production rose slightly in 1992 despite a decrease in exports because Dead Sea Works Ltd. (DSW) 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 GDP dependent on trade. The major mineral commodities traded are mostly evaporites for chemicals, fertilizers, salt, and cut and polished gemstones, particularly diamond. Israel exported an estimated \$12,444 million worth of merchandise in 1992 and imported about \$18,557 million. Trade data obtained from the U.S. Commerce Department showed Israel's total deficit for 1992 as \$6,113 million.

Although trade with the European Community (EC) was larger overall, the United States remained Israel's single most important trading partner. The EC accounts for about one-half of merchandise imports and one-third of merchandise exports. Together, the EC and the United States account for two-thirds of all exports and imports. The EC exports to Israel rose slightly in 1992 by about 1.5 percentage points. During 1992, the rate of growth of investment goods imported by Israel declined, reflecting the decline in construction activity, while imports of consumer goods continued to rise. Growth of export goods, excluding diamond, have been mainly in the industrial sector and accounted for 70% of total exports. Diamonds accounted for 25% of total exports in 1992.

U.S. exports to Israel consisted mainly of machinery and military equipment, agricultural products, vehicles and transport equipment, optical and

measuring instruments, chemicals, rough diamonds and precious stones, cardboard, and paper. The United States' main imports from Israel included polished diamonds and gemstones; machinery and mechanical instruments; medical, optical, and measuring instruments; vehicles and transport equipment; chemicals; textiles and clothing; and metals.

A trade agreement, signed in 1985, would eliminate custom duties between the United States and Israel by 1995. Israel had Generalized System of Preferences-type trade agreements with Australia, Austria, Canada, Finland, Japan, New Zealand, Norway, Sweden, and Switzerland.

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. (See table 2.)

COMMODITY REVIEW

Industrial Minerals

Cement.—Cement output increased from 3.4 Mmt in 1991 to 4 Mmt in 1992, although clinker production remained at 1.8 Mmt. The country's cement imports declined to 38,000 tons in 1992 compared with 48,000 tons in 1991. All cement produced in 1992 was for domestic consumption. The main cement producer, Neshar Israel Cement Enterprises Ltd. (Neshar), anticipated a demand level of about 38,000 tons for 1993. In April 1992, the first stage of work by Neshar began on a 1-Mmt/a clinker line at the Ramala plant that would be commissioned by July 1994. The project cost was estimated at \$135 million, and 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 one of Neshar's plants during 1992 and a second one is planned for completion in 1993. Also, a pair of pellitizers was installed at the Haifa and Har-Tuv plants in 1992.

Completion of the finish mill at the Ramala plant, being converted from open to close circuit with a high-efficiency classifier, would enhance productivity. The other project at the Har-Tuv plant involves the installation of dedusting equipment on the grate preheater system.

Clays.—Israel's Negev Ceramic Materials Ltd. (NCM) produced ceramic, refractory, and other unspecified clays, mainly from a clay deposit at Mach Tesh Ramon in southern Israel. The company had a production capacity of 60,000 mt/a and supplied the ceramic and chemical industries roughly equal proportions of plastic clay. A magnetic separator at the mine site was used to reduce the Fe₂O₃ content to less than 1.0% for certain product grades. NCM also had the capacity to calcine about 12,000 mt/a of flint clay for use in refractories. The alumina content of the flint clays ranged from 35% to 55% depending on the amount of boehmite or diasporite contained. Total value of clay minerals produced in 1992 was about \$1.2 million.

Diamond.—Israel is not a diamond producer but cuts and polishes imported rough diamonds and gemstones. There was slight growth of about 7% in polished exports in the first 5 months of 1992. Although exports to the Pacific countries increased significantly to about 24% in the first 5 months, the average export figures for the year experienced an increase of 23% above 1991 levels. In 1992, jewelry exports sales amounted to about \$400 million, and net polished exports amounted to about \$3,380 million. The diamond trade employed about 9,000 workers and accounted for about 16% of the total value of Israel's imports and about 26% of the value of total exports. In 1992, imports of rough and semifinished stones amounted to about \$2,460 million. The Russian

Diamond Mining and Manufacturing Branch opened offices in the newly established Free Trade Zone for rough diamonds at the Ramat Gam diamond complex. New policies have been designed to increase the rough diamond trade by about \$500 million within a few years.

Fertilizer.—Rotem Amfert Negev Ltd. (RAN), a product of the merger of Negev Phosphate Ltd. and Rotem Amfert Ltd., has played a major role in the integration of Israel's raw materials producers and the downstream fertilizer industry. RAN planned investment was a total of \$120 million for the construction of a 55,000-mt/a monopotassium phosphate (KH_2PO_4) plant. A completion date for the plant was scheduled for July 1993. The \$42 million KH_2PO_4 plant at Mishor Rotem is based on the use of more economic reaction materials such as phosphate rock, sulfuric acid, and muratte of potash. A strategic marketing study showed that Rotem could market up to 50,000 mt/a in a competitive market structure. Three other major projects planned include the construction of a flash phosphate rock calcination plant, a beneficiation plant for white phosphate rock, and an expansion of the company's phosphoric acid production capacity.

Periclase.—In 1992, work began on the \$23 million, 13,000-mt/a Tateho Dead Sea Fused Magnesia Co.'s plant. The plant is scheduled for completion in December 1993, when the first shipments of products to refractory brick manufacturers are expected. Tateho Dead Sea Fused Magnesia Co. (TDF) was a partnership of Dead Sea Periclase Ltd. (DSP) and Japan's Tateho Chemical Industries Co. Ltd. The plant is intended to produce refractory-grade fused magnesia from a new plant to be sited at DSP's existing location at Mishor Rotem in the Negev Desert. The plans required TDF's product to be used as a raw material in advanced refractory products, thereby not competing with DSP's other mainstream grade of fused magnesia.

Salt.—DSW, a subsidiary of Israel Chemicals Ltd., planned to invest about \$40 million in the construction of a 700,000-mt/a solar evaporating salt facility at Sdom on the shores of the Dead Sea. The construction, which commenced in 1992, is expected to be completed in early 1994. The new facility is intended to use a unique solar energy process to produce salt, developed by DSW, that should equal the standards of vacuum salt. This process is expected to be cost-effective and environmentally favorable because it would not use fuel energy.

The facility is scheduled to produce different grades of salt, including common table salt, salt for chemical industries, chloralkaline production, road deicing, and for general industries such as animal feed, fisheries, tanneries, and water softeners. DSW was one of the leading producers of bromine, magnesium chloride, and potassium chloride.

Reserves

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 Haifa, Ashdod, and Elat. 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 could be attributed to its ability to utilize its abundant work force. Expansion programs in the cement, fertilizer, gem cutting, and salt industries, as well as positive developments in the political field, should translate into increased jobs. Israel's mineral industry is expected to remain export-oriented and continue to fluctuate with world commodity prices. Israel's economic growth could increase the domestic consumption of mineral commodities.

The dividends of a peaceful resolution of the Arab-Israeli conflict could be a boost in regional development and mutual benefits to both the Arabs and the Israelis in terms of technical expertise and energy needs, respectively. The age old water problems also could be resolved within a positive political framework. Trends to export higher valued mineral products such as custom fertilizers, technical-grade chemicals, and other high-tech specialty items should continue.

Israel's present industrial structure, though advanced for the area and by world standards, lacks the diversity of foreign companies operating in the country. The apparent political instabilities in the region could be one of the reasons why there is inadequate representation of foreign-owned firms or businesses in the country. Israel has started investing in long-term peace and the fruits could be exposure to the world's markets and influx of international investment. This could benefit the country's expanded work force as employment is generated by the investing foreign firms for those who have the skills. All of the Government's programs designed to entice foreign investment would not be successful if

Israel is perceived as being too unpredictable. The Middle East peace negotiations, if successful, could mean the best path to peace, and peace in the region would translate to industrial growth.

¹Where necessary, values have been converted from new Israeli shekels (NIS) to U.S. dollars at the rate of NIS2.40=US\$1.00.

OTHER SOURCES OF INFORMATION

Central Bureau of Statistics, Tel Aviv:
Monthly Bulletin of Statistics.
Israel Economist International Enterprises,
Jerusalem: The Israel Economist, monthly.

TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1988	1989	1990	1991	1992
METALS					
Iron and steel: Steel, crude ³	120,000	118,000	144,000	160,000	160,000
INDUSTRIAL MINERALS					
Bromine:					
Elemental	118,000	¹ 134,725	130,000	135,000	135,000
Compounds	² 86,700	¹ 102,300	120,000	125,000	125,000
Cement, hydraulic	thousand tons 2,326	2,289	2,868	³ 3,550	3,500
Clays:					
Bentonite	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Flint clays	6,020	¹ 7,598	13,955	30,000	30,000
Kaolin	30,600	¹ 31,245	42,212	53,000	53,000
Other	11,739	¹ 17,369	¹ 6,800	3,000	3,000
Fertilizer materials, manufactured:					
Nitrogenous: N content of ammonia and urea	¹ 47,758	¹ 47,650	¹ 42,030	33,835	33,800
Phosphatic: P content	36,737	29,685	25,831	23,462	23,400
Potassic: K content	22,638	18,203	20,938	18,612	18,600
Gypsum ⁴	¹ 31,181	31,000	38,000	² 25,570	25,500
Lime	130,000	¹ 180,000	230,000	208,000	208,000
Magnesia, Mg content	³ 30,159	³ 34,261	³ 38,600	38,600	38,600
Phosphate rock:					
Beneficiated	thousand tons 3,479	3,922	3,516	3,370	³ 3,595
P ₂ O ₅ content	do. 1,092	1,231	1,104	1,070	1,125
Potash, K ₂ O equivalent	do. ¹ 1,244	¹ 1,273	¹ 1,311	1,320	1,300
Salt, marketed (mainly marine)	do. 361	475	426	1,115	1,100
Sand:					
Glass sand	59,520	65,300	84,759	60,000	60,000
Other ⁴	thousand tons 4,500	4,500	⁴ 4,616	⁴ 6,408	6,400
Sodium and potassium compounds: Caustic soda ⁴	29,727	30,897	³ 31,575	³ 32,180	32,200
Stone:⁴					
Crushed	thousand tons 13,000	13,000	⁴ 16,372	⁴ 17,094	17,100
Dimension, marble	10,000	10,000	⁴ 8,000	⁴ 12,000	12,000
Sulfur:					
Byproduct from petroleum ⁴	thousand tons ¹ 68	¹ 68	¹ 64	66	60
Sulfuric acid	do. 163	161	154	136	130
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:⁴					
Gross	million cubic meters ¹ 44,706	¹ 44,406	¹ 39,920	32,295	32,300
Dry	do. ¹ 44,706	¹ 44,406	¹ 39,920	32,295	32,300
Peat	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)
Petroleum:					
Crude	thousand 42-gallon barrels <u>¹131</u>	<u>¹117</u>	<u>¹94</u>	<u>82</u>	<u>80</u>
Refinery products:					
Gasoline	do. 10,950	11,600	12,200	12,700	12,700
Kerosene and jet fuel	do. 5,500	5,800	6,100	6,400	6,400
Distillate fuel oil	do. 14,700	15,600	16,400	17,100	17,100
Residual fuel oil	do. 13,500	13,700	14,400	15,000	15,000
Other	do. 5,200	4,400	4,600	4,800	4,800
Refinery fuel and losses ⁴	do. 1,800	1,800	1,900	2,000	2,000
Total	do. 51,650	52,900	55,600	58,000	58,000

⁴Estimated. ¹Revised.

²Table includes data available through Nov. 8, 1993.

³In 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.

⁴Revised to zero.

⁵Reported figure.

TABLE 2
ISRAEL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bromine	Dead Sea Bromine Co. Ltd. [Israel Chemicals Ltd. (ICL), ¹ 90%; private, 10%]	Sdom	200 bromine and bromine compounds.
Do.	Bromine Compounds Ltd. (ICL, 90%; private, 10%)	Romat industrial park: two plants near Beersheva	60 bromine compounds.
Cement	Nesher Israel Cement Enterprises Ltd. (CLAL Industries Ltd., 50%; Coor Industries Ltd., 50%)	Haifa	1,236.
Do.	do.	Beit Shemesh, 30 kilometers west of Jerusalem	1,144.
Do.	do.	Ramla, 25 kilometers southeast of Tel Aviv	1,359.
Chlorine	Dead Sea Bromine Co. Ltd. (ICL, 90%; private, 10%)	Sdom	75.
Clay	Negev Ceramic Materials Ltd. (ICL, 100%)	Machtsh Ramon	60.
Fertilizer	Rotem Amfert Negev Ltd. (ICL, 100%)	Mishor Rotem	600 mixed fertilizers.*
Magnesia	Dead Sea Periclase Ltd. (ICL, 50%; Austrian-American Magnesite Co., 50%)	do.	70.
Do.	Tateho Dead Sea Fused Magnesia Co. (Tateho Chemical Industries Co., 50%; ICL, 25%; Austrian-American Magnesite Co., 25%)	do.	13
Magnesium chloride	Dead Sea Works Ltd. (ICL, 90%; private, 10%)	Sdom	75.
Nitrogen	Fertilizers and Chemicals Ltd. (ICL, 76%; private, 24%)	Mishor Rotem	180 ammonium sulfate.
Petroleum, refined million barrels	Oil Refineries Ltd. (Government, 100%)	Haifa	43.8.
Do.	do.	Ashdod	25.5.
Phosphate rock	Rotem Amfert Negev Ltd. (ICL, 100%)	Arad, Zin, Oron southwest of Sdom	4,000.
Phosphoric acid	do.	Mishor Rotem	200.
Do.	do.	Near Oron	30.
Potash	Dead Sea Works Ltd. (ICL, 90%; private, 10%)	Sdom	2,200.
Potassium nitrate	Haifa Chemicals Ltd. (private, 100%)	Haifa	300.
Iron	United Steel Mills Ltd. (Koor Industries Ltd., 100%)	Near Haifa	130.
Sulfuric acid	Rotem Amfert Negev Ltd. (ICL, 100%)	Mishor Rotem	500.
Do.	Fertilizers and Chemical Ltd. (ICL, 76%; private, 24%)	Haifa	220.

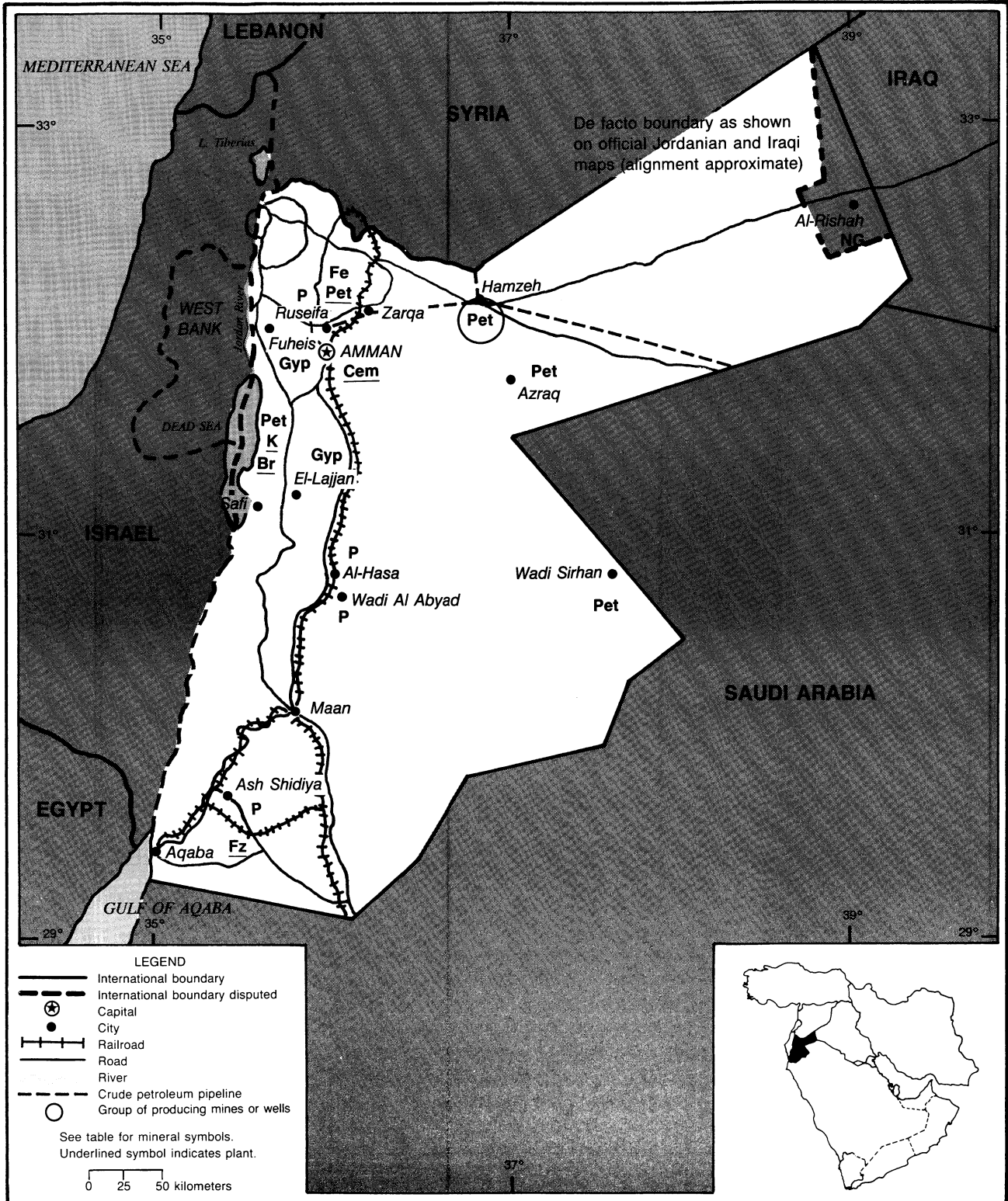
*Estimated.

¹ICL is 100% Government owned.

JORDAN

AREA 91,880 km²

POPULATION 3,557,304



THE MINERAL INDUSTRY OF

JORDAN

By Thomas P. Dolley

Economic recovery in 1992, following the conclusion of the Persian Gulf War, has proceeded adequately in the Hashemite Kingdom of Jordan, despite the return of 300,000 Palestinian workers from the Gulf states. The otherwise poor economic situation has been helped primarily by the large repatriation to Jordanian banks of workers' savings, totaling \$3.2 billion¹ by midyear. Jordan's 1992 GDP was \$3.98 billion.

The minerals sector continues to play an important role in the Jordanian economy. In 1992, Jordan remained the third largest exporter of and the fourth largest producer of phosphate rock in the world. Despite this statistic, Jordanian phosphate exports have fallen approximately 33% since 1989, due in part to a loss of markets, along with a concomitant loss of profits for the Jordan Phosphate Mines Co. (JPMC). JPMC's profits have dropped from \$160 million in 1989 to about \$49 million¹ in 1991, the latest year for which data are available. JPMC's economic situation reflects the fact that global phosphate exports also have declined by 29% since 1989.

GOVERNMENT POLICIES AND PROGRAMS

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

PRODUCTION

Industrial minerals are the primary component of the Jordanian mineral industry. Despite phosphate production

that has not returned to pre-Gulf War levels, JPMC's export marketing has salvaged some of the company's profits. The Jordanian phosphate sector was not spared the global phosphate market downturn. However, traditional Eastern European customers that have been lost are being replaced by Asian markets. The Arab Potash Co. (APC) continued to be profitable in 1992 and is proceeding with expansion along with JPMC. Basalt, calcium carbonate, glass sand, granite, limestone, and volcanic tuff are produced from 230 quarries throughout Jordan. Salt is produced for the domestic market. (See table 1.)

TRADE

Owing to the reduced transit cargo through the Port of Aqaba and the cost of ship inspections under the UN trade embargo with Iraq, Jordan has lost nearly \$570 million in revenue since 1990. Commodity transshipments through Aqaba to Iraq have dropped 66% since the Gulf crisis, and the port is operating at only 60% of capacity. Before the onset of hostilities, improvements at the port included a new oil terminal, seven added berths, and a \$3 million communications center.

JPMC is the largest exporter in Jordan. Eastern European countries were responsible for purchasing about 30% of Jordanian phosphate exports in the late 1980's. Due to political upheaval and concomitant governmental financial austerity measures, these countries are no longer reliable purchasers of Jordanian phosphate. In 1989, the phosphate exports bound for Eastern Europe totaled 2.3 Mmt only to be truncated to 0.58 Mmt in 1991. JPMC's total exports for 1989 were 6.4 Mmt, dropping to 4.2 Mmt in

1991, the latest data available.

Newer Asian markets have helped to fill the trade voids left with the decline of Eastern Europe. However, this has not completely solved the problem as total phosphate exports were only 3.12 Mmt in the first 9 months of 1992. Since 1991, India has been the largest importer of Jordanian phosphate. A total of 1.3 Mmt of Jordanian phosphate was imported by India in 1991 and contracts for 1.6 Mmt in 1992 have been signed. JPMC also is cultivating newer markets in Australia and New Zealand.

APC is Jordan's second biggest exporter and has benefited from a global demand for potash. This increased demand is primarily from Asia, particularly China, which raised its demand in 1991 for Jordanian potash by 47%. (See tables 2 and 3.)

STRUCTURE OF THE MINERAL INDUSTRY

The Jordanian Natural Resources Authority (NRA) is the governmental agency responsible for all activities relating to exploration and development of minerals and mineral fuels. NRA's operational budget for 1991 was approximately \$14 million. About \$9.5 million of this total was for petroleum exploration. In the past 2 years, the NRA also conducted general prospecting for clay, kaolin, tripoli, and alternative quarry sites. The NRA has indicated that current budgetary constraints could adversely affect future exploration activities. The exploitation of the major mineral commodities of Jordan—cement, kaolin, phosphates, potash, and rock wool—are all controlled by parastatals that are public shareholding mining companies. Aggregates, basalt, calcium

carbonate, dimensional stone, glass sand, and natural sand are produced by private-sector firms. (See table 4.)

COMMODITY REVIEW

Metals

Hyundai Corp. of the Republic of Korea signed a \$4 million contract during the year to erect, install, and commission a hot-rolling mill for the newly chartered Middle East Steel Industries Co. Due for completion in 1993, this plant will be the first of its kind in Jordan and will be between Zarqa and Mafraq. Production capacity at the facility will be 30,000 mt/a of steel angles, T-bars, squares, and other parts. Products will be aimed at the thriving local market, with eventual export to neighboring countries. Hyundai Corp. also will provide technical support for the plant.

Industrial Minerals

Cement.—Cement production within Jordan is primarily for domestic consumption, with some available for export to neighboring countries such as Egypt. The Jordan Cement Factories Co. (JCFC) is the primary cement producer in Jordan. JCFC reported that local demand for cement had doubled in 1992 from that of the previous year. JCFC reported selling 190,000 tons of cement in April 1992 and was flooding the market with 10,000 mt/d of cement to curb rising prices. Cement production has been driven by a construction boom valued at \$870 million with additional Government construction contracts worth about \$580 million.

Phosphate Rock.—JPMC mines phosphate rock from three mines: the Al-Hasa Mine, Wadi Al Abyad, and the newer Ash Shidiya Mine. Despite falling production and profits, JPMC is proceeding with a number of joint ventures. By yearend 1991, JPMC had signed a \$100 million agreement with India's Southern Petrochemicals Corp. (SPC) for a new processing plant to

produce 200,000 tons of phosphoric acid for the Indian market. SPC will have equity ownership of 60% of the venture and JPMC will have 40%. The plant at Ash Shidiya will be completed by 1995. In 1992, a consortium of four Japanese companies led by Mitsubishi Corp. took a 60% share in a planned \$360 million compound fertilizer plant with JPMC and APC. To be located at Aqaba, the plant is to produce 300,000 mt/a of fertilizer for Japan, equivalent to 10% of Japan's consumption. The plant is slated for completion in 1995. Both of the latter joint ventures are to be constructed in new duty-free zones. This offers investors tax exemption on profits, duty exemption on imported machinery, and absolution from property tax for up to 12 years. An additional joint-venture project between JPMC and a Pakistani company indicates an annual income of \$61 million when it is completed. JPMC has indicated that most of the countries that it markets to prefer to import finished fertilizers rather than bulk phosphate rock. The cost is lower, and there is less damage to the environment.

By yearend 1992, JPMC had to pay an additional \$10 million in higher sulfur prices since the UN-imposed trade embargo of August 6, 1990. JPMC utilizes between 300,000 and 350,000 mt/a of sulfur for phosphoric acid production at its Aqaba fertilizer plant. In September 1992 JPMC purchased 100,000 tons of sulfur at a rate of \$66.75 per ton c.i.f. at Aqaba. Preembargo prices were \$55 per ton c.i.f. for sulfur, transported by truck from Iraq to JPMC's warehouses. Sulfur is purchased by commodity dealers, but the origin of the product is not reported. Saudi Arabia was probably the likely vendor because it was the only significant sulfur producer in the region. Despite lower sulfur prices offered by more distant nations, the higher freight costs make those offers prohibitive.

Potash.—APC produces potassium chloride from brines at its Dead Sea facility. APC is the fourth largest shareholding company and a major export revenue earner in Jordan, employing

approximately 1,630 people. APC has survived the political and economic shocks that have affected commerce in the area. APC's sales rose to \$150 million in 1991, a \$20 million increase over profits in 1990. Additionally, APC owns a 20% share of the future JPMC-Mitsubishi consortium fertilizer complex.

APC has gradually increased production capacity at its Dead Sea facility since 1982. The increase in production capacity has been the result of engineering changes such as the installation of a dike across the pan to facilitate brine flow to the precarnallite pan; the alteration of the brine flow in the carnallite pan to enhance carnallite deposition; and nonengineering changes as a result of the descent of the level of the Dead Sea at a rate of 85 cm/a causing a more concentrated brine feed. The pumping station has been modified to accommodate the falling water level of the Dead Sea. APC's current potash production capacity is 1.4 Mmt/a.

Mineral Fuels

Petroleum exploration has been an intermittent enterprise in Jordan since the 1930's. Lacking any significant domestic hydrocarbon sources, Jordan continued to import most of its energy needs. The NRA reported a total of 667,980 bbl of crude oil produced from the Hamza field since production commenced in 1985. Additionally, the NRA reported that natural gas production from the Al-Rishah field totaled 155 Mm³ for 1991. Petro-Canada International Assistance Corp. provides technical aid to the NRA at the Al-Rishah field.

Since 1985, Amoco Corp. and Hunt Oil Co. of the United States, Belgium's Petrofina, the Japan National Oil Corp., and Austria's OMV have all had exploration programs within Jordan. Unsuccessful results have caused these companies to withdraw. In 1992 Hanbo Corp. of the Republic of Korea was negotiating a production-sharing agreement with Jordan for the exploration of oil and natural gas. Hanbo Corp. was interested in outlaying \$8 million for the exploration program.

Reserves

The NRA estimated Jordanian phosphate reserves at 1 billion tons. Of this total, 790 Mmt of Jordan's phosphate rock reserves are found at the Ash Shidiya Mine. Potash was obtained primarily from Dead Sea brines. Geological surveys had shown that Jordan had additional unexploited mineral resources of bromine, dolomite, glass sands, gypsum, iron, lead, oil shale, pyrite, tin, travertine, and tripoli.

INFRASTRUCTURE

Railroads within Jordan consisted of 619 km of 1.05-m-gauge single track. Highways totaled 7,500 km, of which 5,500 km was asphalt paved, with the remaining 2,000 km composed of crushed stone and gravel. Crude oil pipelines within the country totaled 209 km. Electrical generation capacity within the country was estimated at 981,000 kW.

By yearend, 23 companies and joint ventures had submitted bids to the Jordan Valley Authority for the Karameh dam project. Conceived in the 1980's, the \$91 million project is to dam the Wadi Mallaha tributary of the Jordan River to help irrigate more than 3,000 ha of land. The earthfill dam would be 45 m high and have a capacity of 55 Mm³ of water. Upon awarding of the contract, construction should take 3 years. The Karameh dam project is one of four such proposed dam projects in Jordan with a total estimated cost of \$230 million.

OUTLOOK

Underemployed workers within Jordan combined with reduced trade through the Port of Aqaba, and marginal energy resources, will plague Jordan's economy into the next century. Sound fiscal management and lasting cooperation with neighboring countries could ameliorate the situation.

JPMC has projected its phosphate production to rise to 9.6 Mmt by the year 2000. Additionally, APC has commenced a two-phase plan to raise potash production from the current average of

1.4 Mmt/a to 2.2 Mmt/a by the year 2000.

¹Where necessary, values have been converted from Jordanian dinars (JD) to U.S. dollars at the rate of JD0.68=US\$1.00.

OTHER SOURCES OF INFORMATION

Agency

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

Publication

Natural Resources In Jordan, published by the Jordan Natural Resources Authority, December 1988.

TABLE 1
JORDAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992*
Cement, hydraulic thousand tons	1,828	1,930	1,820	1,754	² 2,733
Clays	23,452	38,600	38,800	46,200	² 34,446
Gypsum	84,866	132,400	92,700	55,300	² 83,038
Iron and steel: Steel, crude	^r 200,000	176,500	179,100	200,300	² 243,700
Lime	2,461	3,100	5,400	4,600	² 7,115
Petroleum:					
Crude* thousand 42-gallon barrels	200	110	116	50	50
Refinery products:					
Gasoline do.	2,368	2,514	3,396	3,300	3,300
Jet fuel do.	100	85	115	110	110
Kerosene do.	1,398	1,179	1,584	1,500	1,500
Distillate fuel oil do.	5,104	4,845	5,556	5,500	5,500
Residual fuel oil do.	4,462	4,887	5,140	5,100	5,100
Liquefied petroleum gas do.	640	670	1,185	1,100	1,100
Other do.	⁸ 800	2,500	2,103	2,100	2,100
Total do.	14,872	16,680	19,079	18,710	18,710
Phosphate:					
Mine output:					
Gross weight thousand tons	6,611	6,900	6,082	4,433	² 4,296
P ₂ O ₅ content* do.	2,182	2,277	2,007	1,458	1,409
Phosphatic fertilizers	615,000	602,000	596,000	599,700	² 570,001
Potash:					
Crude salts	1,309,000	1,320,000	1,402,700	1,364,000	² 1,346,020
K ₂ O equivalent	785,000	792,000	841,000	805,000	794,152
Salt	38,000	57,000	55,000	57,000	² 56,000
Stone:					
Limestone* do.	² 3,642	3,600	3,600	136,000	² 115,397
Marble	322,800	333,560	484,200	180,000	² 200,000

*Estimated. ^rRevised.

¹Table includes data available through Aug. 1993.

²Reported figure.

TABLE 2
JORDAN: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	—	117	NA	United Arab Emirates 100; unspecified 17.
Oxides and hydroxides	3,700	3,811	—	All to Iran.
Metal including alloys:				
Scrap	1,207	1,298	—	Japan 725; Germany 233; Netherlands 213.
Semimanufactures	248	250	NA	United Arab Emirates 60; unspecified 181.
Copper:				
Ore and concentrate	—	644	—	Germany 578; India 66.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
METALS—Continued				
Copper—Continued:				
Metal including alloys:				
Scrap	1,733	4,937	—	Netherlands 1,522; Germany 1,167; Japan 873.
Semimanufactures	128	123	NA	Germany 40; Japan 20; unspecified 27.
Gold: Metal including alloys, unwrought and partly wrought	147	—		
				kilograms
Iron and steel: Metal:				
Scrap	693	535	—	Syria 361; United Arab Emirates 91; Saudi Arabia 23.
Steel, primary forms	195	756	NA	Syria 32; unspecified 724.
Semimanufactures:				
Flat-rolled products: Of iron or nonalloy steel, clad, plated, coated	—	1,114	NA	NA.
Bars, rods, angles, shapes, sections	3,114	1,396	NA	Sudan 100; Saudi Arabia 73; unspecified 1,209.
Wire	556	379	NA	Sudan 72; unspecified 284.
Tubes, pipes, fittings	4,298	3,788	NA	Syria 1,867; United Arab Emirates 188; unspecified 1,474.
Unspecified	5,464	—		
Lead: Metal including alloys:				
Unwrought	1,315	67	—	Syria 44; Lebanon 23.
Semimanufactures	508	—		
Nickel: Metal including alloys, semimanufactures	80	—		
Titanium: Oxides	10	20	—	All to United Arab Emirates.
Zinc: Metal including alloys, scrap	—	221	—	India 162; Republic of Korea 20; Netherlands 20.
Other: Ores and concentrates	—	21	—	All to India.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	15	7	—	Yemen 6; United Kingdom 1.
Grinding and polishing wheels and stones	74	20	NA	NA.
Cement	thousand tons	1,410	1,265	— Thailand 609; Sri Lanka 172; Singapore 136.
Clays, crude:				
Kaolin	462	—		
Unspecified	85	—		
Feldspar, fluorspar, related materials	392	—		
Fertilizer materials: Manufactured:				
Nitrogenous	value, thousands	—	\$126,650	NA India \$54,260; Iran \$43,849.
Phosphatic	—	2	—	All to Lebanon.
Potassic	—	570	—	Syria 220; Egypt 200; Saudi Arabia 150.
Unspecified and mixed	720	314	—	Saudi Arabia 84; United Arab Emirates 64; Libya 56.
Graphite, natural	—	6	—	All to Yemen.
Gypsum and plaster	—	1,046	—	Yemen 1,000; Syria 25.
Lime	1,162	25	—	All to Syria.
Phosphates, crude	value, thousands	\$92,022	\$180,716	— India \$60,668; Indonesia \$26,430; Turkey \$14,184.
Potassium salts, crude	do.	\$58,746	\$142,064	— China \$46,707; India \$45,674; Republic of Korea \$8,797.
Salt and brine	12,009	8,650	53	Iraq 8,321; unspecified 160.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Sodium compounds, n.e.s.: Soda ash, manufactured	30	598	NA	NA.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	3,601	4,139	—	Lebanon 3,001; United Arab Emirates 833.
Worked	64,003	7,237	—	United Arab Emirates 5,906; Lebanon 553; Qatar 440.
Gravel and crushed rock	6,508	68	NA	Lebanon 43; unspecified 25.
Sand other than metal-bearing	831	—		
Sulfur: Sulfuric acid	2,218	56	NA	Iran 20; United Arab Emirates 5; unspecified 30.
Talc, steatite, soapstone, pyrophyllite	1,178	249	NA	Saudi Arabia 229; unspecified 20.
Other:				
Crude	—	4	NA	Yemen 3; unspecified 1.
Slag and dross, not metal-bearing	—	174	—	India 104; Japan 40; Lebanon 30.
MINERAL FUELS AND RELATED MATERIALS				
Coal: Briquets of anthracite and bituminous coal	—	50	—	All to Yemen.
Petroleum refinery products:				
Mineral jelly and wax	42-gallon barrels	—	315	NA NA.
Lubricants	do.	987	1,288	— Lebanon 630; Iraq 147; Syria 42.
Residual fuel oil	do.	—	206	— All to Lebanon.
Bitumen and other residues	do.	—	6	— All to Iraq.

NA Not available.

¹Table prepared by Virginia A. Woodson.

TABLE 3
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	—	2,247	NA	NA.
Oxides and hydroxides	22,871	31,501	—	Australia 31,350; Germany 124.
Metal including alloys:				
Scrap	1,588	1,009	—	Egypt 500; Yemen 229; Saudi Arabia 156.
Unwrought	3,588	4,799	—	Egypt 3,500; Lebanon 702; Bahrain 499.
Semimanufactures	1,367	1,815	(²)	Italy 456; Turkey 376; Venezuela 275.
Cadmium: Metal including alloys, all forms	—	\$1	—	NA.
	value, thousands			
Chromium: Oxides and hydroxides	41	5	(²)	Germany 3; United Kingdom 1.
Cobalt: Oxides and hydroxides	2	6	—	Germany 4; Netherlands 2.
Copper: Metal including alloys:				
Ore and concentrate	—	1,050	NA	NA.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS—Continued				
Copper: Metal including alloys—Continued:				
Metal including alloys:				
Scrap	1,107	328	NA	Turkey 77; France 38; United Kingdom 37.
Unwrought	—	154	—	United Kingdom 81; Germany 48; Turkey 25.
Semimanufactures	4,491	2,700	26	Saudi Arabia 2,000; Turkey 164; Netherlands 110.
Gold:				
Waste and sweepings kilograms	—	11	8	Italy 3.
Metal including alloys, unwrought and partly wrought do.	1,201	433	41	Switzerland 165; Italy 96.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	100	—		
Metal:				
Scrap	9,961	4,948	—	Lebanon 4,203; Japan 356.
Pig iron, cast iron, related materials	405	154	—	Italy 74; France 34; China 25.
Ferroalloys:				
Ferromanganese	525	—		
Unspecified	—	149	—	All from China.
Steel, primary forms	192,958	193,945	5	Zimbabwe 140,040; U.S.S.R. 24,139; Norway 14,935.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel, clad, plated, coated	NA	47,022	282	Germany 6,236; Czechoslovakia 6,220; Libya 5,119.
Of alloy steel	NA	26,488	65	Zimbabwe 7,451; Yugoslavia 4,554; Hungary 3,003.
Bars, rods, angles, shapes, sections	37,376	34,210	61	Saudi Arabia 4,045; Czechoslovakia 3,670; Lebanon 3,664.
Rails and accessories	2	147	—	China 143; Austria 3.
Wire	6,659	8,458	—	Czechoslovakia 1,980; Lebanon 1,361; Germany 866.
Tubes, pipes, fittings	12,426	12,668	333	Turkey 4,286; Italy 1,316; Mexico 1,166.
Unspecified	40,229	—		
Lead:				
Oxides	127	175	—	United Kingdom 153; Netherlands 22.
Metal including alloys:				
Scrap	—	115	NA	United Kingdom 2; unspecified 112.
Unwrought	922	2,015	—	Saudi Arabia 984; Yemen 500.
Semimanufactures	6	17	—	Belgium-Luxembourg 10; Sweden 5.
Magnesium: Metal including alloys, unwrought	15	12	—	All from Yugoslavia.
Manganese: Oxides value, thousands	\$8	\$2	—	All from Germany.
Mercury	—	34	—	Mainly from United Kingdom.
Nickel:				
Matte and speiss	5	5	—	Belgium-Luxembourg 3; Canada 2.
Metal including alloys:				
Unwrought	13	—		
Semimanufactures	3	—		
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	\$12	\$11	—	Switzerland \$6; Germany \$5.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991		
			United States	Other (principal)	
METALS—Continued					
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	—	\$53	—	Switzerland \$15; Italy \$20; Thailand \$7.
Tin: Metal including alloys:					
Scrap	10	6	—	Belgium-Luxembourg 2; Netherlands 2.	
Unwrought	1	—			
Semimanufactures	4	6	—	Singapore 5; United Kingdom 1.	
Titanium: Oxides	1,449	1,968	327	France 480; Belgium-Luxembourg 202; Italy 180.	
Tungsten: Metal including alloys, unwrought	value, thousands	—	\$1	— All from France.	
Zinc:					
Oxides	75	11	—	Germany 7; France 4.	
Metal including alloys:					
Scrap	100	868	—	Belgium-Luxembourg 768; Bulgaria 99.	
Unwrought	1,121	—			
Semimanufactures	4	6	—	Mainly from Belgium-Luxembourg.	
Other:					
Ores and concentrates	263	1,461	—	Belgium-Luxembourg 200; Morocco 12; unspecified 1,249.	
Base metals including alloys, all forms	—	22	(?)	Netherlands 10; Turkey 10.	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.	—	241	—	United Kingdom 103; Turkey 96.	
Artificial: Corundum	66	—			
Grinding and polishing wheels and stones	449	224	—	Italy 117; Germany 44; Netherlands 20.	
Barite and witherite	—	224	—	Thailand 160; Turkey 46; Germany 18.	
Boron materials:					
Crude natural borates	11	50	—	All from Saudi Arabia.	
Oxides and acids	8	11	—	Germany 9; United Kingdom 2.	
Cement	930	40	—	All from France.	
Chalk	903	504	—	France 420; United Kingdom 84.	
Clays, crude:					
Bentonite	—	2,904	45	Turkey 2,205; United Kingdom 476; Cyprus 160.	
Kaolin	507	850	—	United Kingdom 740; Turkey 50; Italy 40.	
Unspecified	1,454	—			
Cryolite and chiolite	—	721	—	Turkey 511; China 160.	
Diamond, natural:					
Gem, not set or strung	value, thousands	—	\$373	— Ireland \$338; Belgium-Luxembourg \$35.	
Industrial stones	kilograms	5	—		
Diatomite and other infusorial earth	21	30	—	All from Germany.	
Feldspar, fluorspar, related materials:					
Feldspar	—	189	—	All from Syria.	
Unspecified	669	—			
Fertilizer materials:					
Crude, n.e.s.	231	92	63	NA.	

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Fertilizer materials—Continued:				
Manufactured:				
Ammonia	125,903	180,565	—	Bahrain 94,381; U.S.S.R. 56,192; Qatar 29,785.
Nitrogenous	5,282	39,356	—	Bulgaria 5,896; Italy 4,995; unspecified 25,844.
Phosphatic	2,488	947	27	Italy 780; Lebanon 100; Canada 35.
Potassic	300	1,968	184	Germany 384; Netherlands 380; Italy 326.
Unspecified and mixed	24,608	—		
Graphite, natural	44	—		
Gypsum and plaster	2,524	3,221	4	Germany 23; unspecified 3,180.
Magnesium compounds: Oxides and hydroxides	735	—		
Mica:				
Crude including splittings and waste	—	2	—	All from Norway.
Worked including agglomerated splittings	1	14	—	Mainly from India.
Nitrates, crude	2,517	—		
Pigments, mineral:				
Natural, crude	170	—		
Iron oxides and hydroxides, processed	193	264	—	India 83; Spain 80; Belgium-Luxembourg 42.
Precious and semiprecious stones other than diamond:				
Natural kilograms	3	—		
Synthetic value, thousands	\$21	\$61	—	Republic of Korea \$60; Italy \$1.
Salt and brine	184	286	—	Tunisia 160; Netherlands 65.
Sodium compounds, n.e.s.: Soda ash, manufactured	8,139	—		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	5,955	10,026	—	Italy 8,687; U.S.S.R. 268.
Worked	776	18	—	Saudi Arabia 15; Syria 3.
Dolomite, chiefly refractory-grade	—	22	—	All from Norway.
Gravel and crushed rock	2,953	2,546	—	Italy 1,454; United Kingdom 516.
Quartz and quartzite	31	—		
Sand other than metal-bearing	1,282	406	3	United Kingdom 36; unspecified 291.
Sulfur:				
Elemental:				
Crude including native and byproduct	38,410	281,154	—	Iran 54,630; unspecified 225,790.
Colloidal, precipitated, sublimed	62,444	22,720	—	Iran 22,050; Egypt 66.
Sulfuric acid	320	597	—	Turkey 253; Netherlands 40; unspecified 301.
Talc, steatite, soapstone, pyrophyllite	1,105	940	—	China 425; Norway 206; Austria 182.
Other: Crude	30	645	—	Greece 500; Italy 100; Egypt 40.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	43	14	—	Germany 12; Netherlands 2.
Coal:				
Briquets of anthracite and bituminous coal	—	173	—	Egypt 125; Germany 48.
Unspecified	184	—		
Coke and semicoke	269	562	—	China 370; Portugal 143; Egypt 49.
Peat including briquets and litter	2,050	1,740	—	Germany 1,132; Finland 255; Netherlands 178.

See footnotes at end of table.

TABLE 3—Continued
JORDAN: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991		
			United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued					
Petroleum:					
Crude	thousand 42-gallon barrels	19,993	17,247	—	Iraq 14,244; Syria 1,211; Yemen 1,198.
Refinery products:					
Liquefied petroleum gas	do.	—	486	—	Turkey 127; Lebanon 112; Syria 100.
Gasoline	do.	—	266	—	Syria 261; Iraq 4.
Mineral jelly and wax	do.	2	2	(²)	Mainly from China.
Distillate fuel oil	do.	5,686	—		
Lubricants	do.	139	80	9	France 38; United Arab Emirates 11.
Residual fuel oil	do.	—	4,320	—	Iraq 3,734; Syria 586.
Bituminous mixtures	do.	2	(²)	(²)	Mainly from Iraq.
Petroleum coke	do.	—	1	—	Mainly from Germany.

NA Not available.

¹Table prepared by Virginia A. Woodson.

²Less than 1/2 unit.

³Unreported quantity valued at \$4,000.

TABLE 4
JORDAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

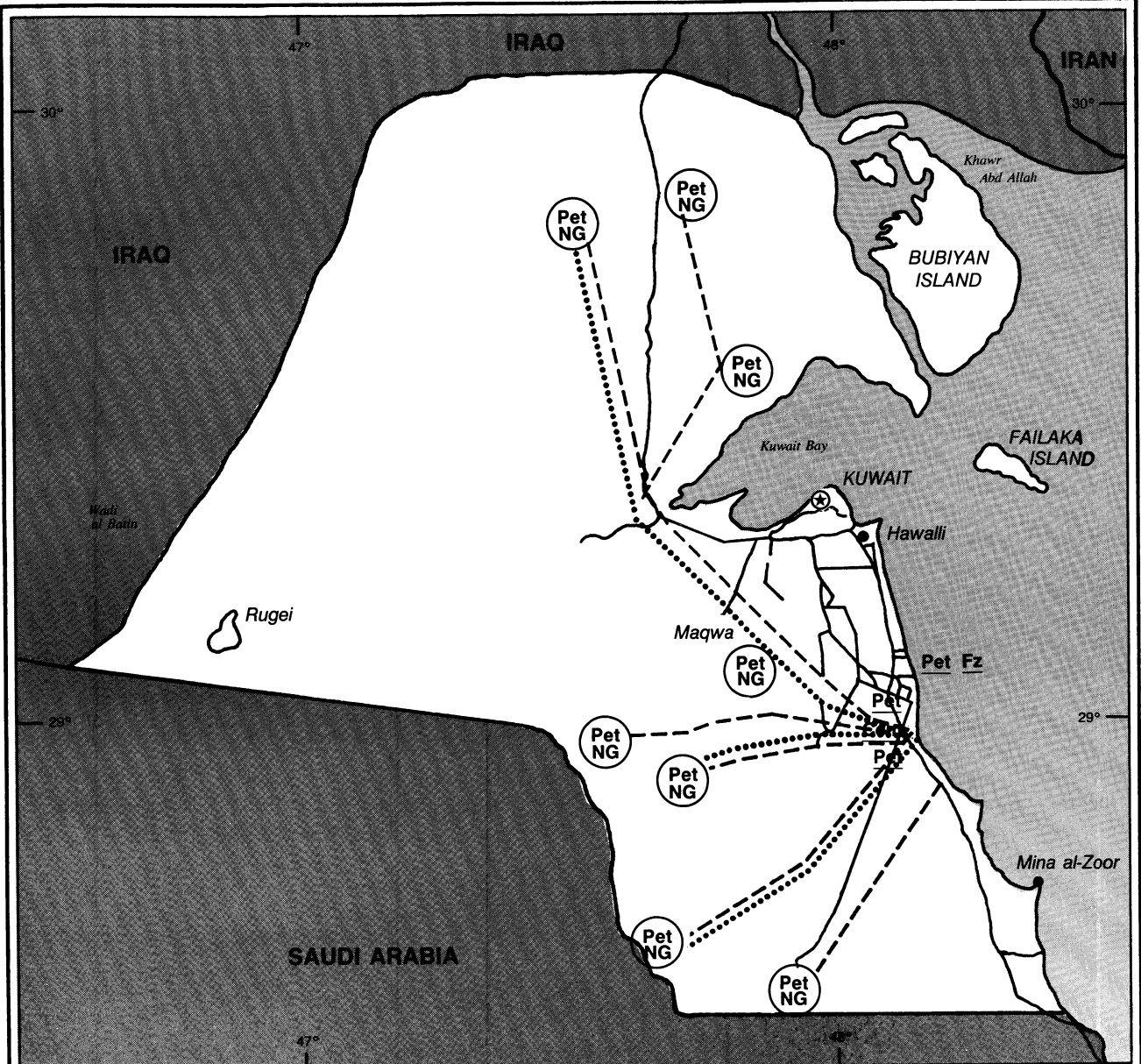
Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Jordan Cement Factories Co. (Government, 49%; private shareholdings, 51%)	Fuheis	1,300
Fertilizer		Jordan Fertilizer Industry Co. (Government, 26%; JPMC, 25%; private Jordanian interests, 19.875%; Arab Mining Co., 10%; Arab Petroleum Investments Corp., 10%; International Finance Corp., 5%; Islamic Development Bank, 4.125%)	Aqaba	*600
Petroleum, crude	thousand barrels	National Resources Authority (Government, 100%)	Northeast of Azraq, Azraq	*116
Petroleum, products	million barrels	Jordan Petroleum Refinery Inc. (Government, 100%)	Zarqa	22
Phosphate rock		Jordan Phosphate Mines Co. (Government, 82%; private shareholdings, 12%)	El Hasa	3,300
Do.		do.	Wadi El Abyad	*3,000
Do.		do.	Ash Shidiya	*1,500
Potash		Arab Potash Co. (Government, 56.659%; Arab Mining Co., 22.826%; Government of Kuwait, 4.348%; Islamic Development Bank, 5.521%; Government of Libya, 4.348%; Government of Iraq, 5.187%; Government of Saudi Arabia, 0.345%; private shareholders, 0.766%)	Safi, Dead Sea	*1,400
Steel		Jordan Iron and Steel Co. (private shareholders, 100%)	Zarqa	50

*Estimated.

KUWAIT

AREA 17,820 km²

POPULATION 1.38 million

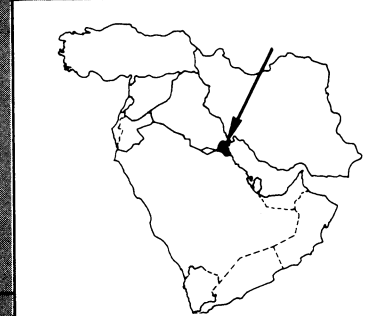


LEGEND

- International boundary
- ⊙ Capital
- City
- Crude petroleum pipeline
- ⋯ Natural gas pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.

0 5 10 15 20 25 kilometers



THE MINERAL INDUSTRY OF

KUWAIT

By Bernadette Michalski

The production and refining of crude oil recovered sufficiently to provide the bulk of Government revenues as well as about 30% of the GDP in 1992. GDP for 1992 was estimated at \$15 billion, compared with \$8.75 billion in 1991. Total exports for 1992 were estimated at \$5.06 billion and total imports at \$6.5 billion. Government revenue for 1992 was \$5.5 billion while expenditure was \$12 billion with a resulting deficit of \$6.5 billion.

Oil revenues, as estimated by the National Bank of Kuwait, were placed at \$2.4 billion for fiscal year 1991-92. Crude oil production was restored to nearly the levels attained just before the country was occupied by Iraq in 1990 by the close of 1992. Revenues, therefore, are expected to increase to \$6.9 billion in fiscal year 1992-93.

During the Iraqi occupation, which lasted almost 7 months, the infrastructure was destroyed and industrial facilities were rendered inoperative as sophisticated equipment was dismantled and transported out of Kuwait. The state-of-the-art hydrocarbon processing units, petrochemical facilities, cement plants, and desalination plants were particularly vulnerable.

Reconstruction followed the extinguishing of 749 burning wells by November 1991.

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 that accumulated more assets than debts prior to the invasion.

In the interest of preserving profitable assets while meeting debt obligations to UN coalition allies as well as reconstruction costs, Kuwait obtained a \$5.5 billion syndicated loan through J.P. Morgan Banking.

The full restoration of crude oil production and exports was recognized by the Government as the key element in financing reconstruction. The Kuwaiti Government abandoned its ambitions for a nonoil industrial and manufacturing sector of the economy.

Although the invasion's impact on the economy was profound, it also focused the attention of Kuwaitis on the restoration of a democratic parliament. National assembly elections took place in October 1992. Kuwait is a constitutional monarchy with a modern economy.

The Bechtel Group of the United States was awarded the overall reconstruction contract that extended through March 1993. Bechtel handled repairs to quickly restore petroleum production and transit.

Reconstruction costs were estimated at about \$20 to \$25 billion during the first 5 years following liberation. The U.S. share of reconstruction contracting was \$2 billion in 1991 and \$3 billion in 1992. This confirms the Kuwaiti Government's commitment that American firms would win a significant share of reconstruction work.

Crude oil purchase contracts have been restored with most of Kuwait's traditional customers. Further spending of up to \$6 billion is expected over the next 5 years to rebuild oilfield installations and refineries.

Defense pacts have now been signed

with France, the United Kingdom and the United States underlining the Gulf War allies' continued commitment to Kuwait's security. Baghdad has not renounced its claim to Kuwait.

PRODUCTION

Government ambitions for a significant nonoil industrial and manufacturing sector of the economy were dismissed in postoccupation Kuwait. The restoration of mineral production was focused on petroleum extraction and to a lesser extent processing. These sectors of the mineral industry were recognized as the most expeditious means of replenishing depleted cash reserves.

By early 1992, crude oil output rose to 550,000 bbl/d. Production rose to 680,000 bbl/d by early March. A month later output rose to 860,000 bbl/d, consisting of 708,000 bbl/d from Kuwait and 152,000 bbl/d from the divided zone. By midyear, output reached 1.1 Mbbbl/d and approached 1.9 Mbbbl/d by early 1993. (See table 1.)

TRADE

Total exports for 1992 were estimated at \$5.06 billion and total imports at \$6.5 billion. Petroleum accounted for the bulk of exports. Petroleum exports to the United States in 1992 were 14.2 Mbbbl of crude oil and 4.6 Mbbbl of products, one-half of which was unfinished oils.

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 Government control of the Kuwait Oil Co. (KOC) and the Kuwait National Petroleum Co. (KNPC) was in effect since 1975.

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. (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 not reached the preinvasion level by the close of 1992 largely due to delayed housing projects.

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 obliterated any export plans for the near future.

Fertilizers.—The Petrochemical Industries Co. (PIC) operated the Shuaybah 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, limited production was restored by the close of 1992.

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 where possible to supplement fuel oil for natural gas as the source of power.

The gas system had not as yet attained preinvasion capacities as of early 1993. However, when fully restored, the gas system will be able to handle associated gas from as much as 3 Mbb/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 Shuaybah. 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 Shuaybah. 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 Shuaybah for fractionation. Although the Burgan and Maqwa Fields were partially restored in late 1991, the natural gas-gathering and processing system was not yet fully restored, and the associated gas recovered from these fields was of necessity flared. By yearend, only 6 of the nation's 26 gathering centers were restored.

Two LPG plants adjacent to Mina Al Ahmadi are functional but not operating at capacity. They each can process 16 Mm³/d of wet gas.

The serious damage inflicted to Kuwait's hydrocarbon reservoirs and

production, processing, storage, and transportation facilities underlined the necessity for establishing a regional natural gas grid linking the six member states of the Gulf Cooperation Council. The main source of natural gas for this grid would be Qatar's North Field.

Petroleum.—Production.—About 10% of all the Kuwaiti wells was damaged beyond economic repair and was plugged and abandoned. At the close of 1992 more than 350 wells were in production. Field reconstruction has brought Kuwait's production, including output from its share in the Divided Zone, close to 1.9 Mbb/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 Mbb/d by the first quarter of 1993. Of an estimated 30 Mbb of crude oil spilled onto the ground forming oil lakes in Kuwait, about 20 Mbb is considered recoverable. About 35% to 40% of the recoverable amount has been gathered by vacuum trucks that carry it to treatment facilities in Kuwait's two operating refineries or to special tanks for sale as weathered crude. Most of Kuwait's 1992 production was derived from the Burgan complex, which includes the Magwa and Ahmadi Fields. The KOC reported that since early in 1992 about 30 to 40 wells have been worked over monthly. Workover operations are expected to be completed by mid-1993.

In the Divided Zone near the Kuwaiti border, production from the less severely damaged Arabian Oil Co. (AOC)'s offshore Khafji Field was restored to near prewar levels of 175,000 bbl/d by yearend 1991. However, it was not until March 3, 1992, that limited production resumed from the severely damaged onshore fields of Wafra, South Fuwaris, and South Umm Gudair operated jointly by Saudi Texaco and the KOC. Initial restored output was 40,000 bbl/d, rising to 90,000 by the close of 1992. Of the 365 wells producing oil in the Divided Zone's onshore area, nearly 300 wells were set ablaze. About 95 of the 365 wells were producing oil by the close of 1992. It is estimated to take another 2

years to restore the Divided Zone's onshore fields to full production, 165,000 bbl/d.

Refining.—Overall damage to the Mina al Ahmadi refinery was relatively light while the Mina Abdullah and Shuaybah refineries were subjected to extensive damage. By the close of 1992, the Mina Abdullah refining capacity was restored to 230,000 bbl/d, although not all internal processing units were back on-stream, and the Mina al Ahmadi refining was restored to 185,000 bbl/d. Their combined capacity represents just over one-half of the total capacity, 770,000 bbl/d, reported by the KNPC after completion of an 8-year, multibillion dollar refinery expansion and modernization program just before the Iraqi invasion.

The Mina al Ahmadi refinery had a capacity of 415,000 bbl/d before the Iraqi invasion. Its capacity after reconstruction is scheduled to be 290,000 bbl/d because KNPC plans not to restore an older 125,000-bbl/d unit. The 30,000-bbl/d fluid catalytic cracker at Mina al Ahmadi resumed operations in December 1992, handling vacuum gas oil from the Mina Abdullah refinery. KNPC hopes to complete restoration of the Mina al Ahmadi refinery by October 1993.

Restoration of the central control room at Mina Abdullah is expected in 1994, until which time the refinery is operated from local control rooms. The refinery has a 160,000-bbl/d crude unit and an older, 70,000-bbl/d unit, both back in operation. The refinery includes two vacuum units, each with a capacity of 64,500 bbl/d. As of early 1993, only one was in operation. A kerosene desulfurization unit and diesel desulfurization unit, each with capacity of 35,000 bbl/d, have resumed operation. By mid-1993, all of Mina Abdullah's processing units should be back on-stream.

Reconstruction efforts are then expected to shift to the 195,000-bbl/d-capacity Shuaybah refinery, which sustained major damage to its crude unit, most of it in the preflash section. The vacuum section had moderate damage,

the atmospheric section light damage. Also damaged were the main pipe rack in the process units, the second stage of the hydrocracker, tanks, and export oil pier. The refinery is scheduled to return to operation at a crude throughput rate of as much as 130,000 bbl/d. This represents 65,000 bbl/d less than the preinvasion capacity because the badly damaged preflash section of the crude unit and part of the hydrocracker are scheduled to remain off-stream.

Foster Wheeler Corp. of the United States was awarded the \$47 million project management contract on the refineries restoration program in the spring of 1992.

KNPC has two refinery modernization and expansion studies in progress. One is considering modifications necessary to adapt existing facilities to product specification changes, such as reductions in gasoline, benzene, and diesel sulfur content, expected to be imposed by 1996. The other study is examining modernization of Shuaybah. KNPC is also studying the feasibility of an acid gas removal plant at the Mina al Ahmadi LPG plant.

The Kuwaiti market absorbs 28,000 to 30,000 bbl/d of gasoline from its refineries. Powerplants consume about 70,000 bbl/d of fuel oil during winter and as much as 115,000 bbl/d in summer. Local diesel demand averages less than 5,000 bbl/d, kerosene demand about 1,000 bbl/d.

A refinery reconstruction program was underway at the beginning of 1992 to boost refining capacity to 630,000 bbl/d by 1993, still far below the preinvasion capacity of 770,000 bbl/d. The more sophisticated processing units will be restored or replaced last, limiting the range of product availability. Until restoration is completed, Kuwaiti product exports will be predominantly fuel oil.

Petrochemicals.—The nation's principal petrochemical complex is in Shuaybah and is operated by PIC, a wholly owned subsidiary of the Kuwait Petrochemical Co. Initially commissioned in 1966, the complex has steadily expanded, including a fertilizer complex

and salt and chlorine plants. Repairs costing \$200 million were under way in the fertilizer plants, and limited production resumed in 1992. Capacity will be cut to 450,000 mt/a of urea from the preinvasion capacity of 800,000 mt/a.

In March 1990, KPC announced approval for the construction of a \$3 billion ethylene-based petrochemicals complex at Shuaybah. With reconstruction efforts centered on restoring crude oil production and in view of the extensive damage suffered at the existing Shuaybah Industrial Complex, the proposed petrochemical complex has been scaled down and put on hold pending finding a joint-venture partner willing to contribute marketing and technology expertise as well as capital. Plans now call for a plant based on ethane-rich gas from the Mina al Ahmadi LPG plant. The ethane cracker in the plant will produce 650,000 mt/a of ethylene, which is to be converted into 450,000 mt/a of high-density polyethylene and linear low-density polyethylene and 350,000 mt/a of ethylene glycol.

Reserves

Kuwait's proven reserves of crude oil were officially estimated at 97.1 billion bbl before the invasion. The extent of reservoir damage due to blowouts and fires has reduced reserves by an estimated 2%.

Natural gas reserves were estimated at 1,400 billion m³ before the invasion. As most of the reserve base was associated gas produced in conjunction with petroleum, a reassessment of the natural gas reserve base after the occupation should prove appreciably lower.

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. Because 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 partially restored by the close of 1992. The natural gas-gathering facilities had not as yet been restored.

OUTLOOK

Significant tasks had been effected in 1992, including the reconvening of the Parliament, reordering development priorities in the light of the experience of the crisis, and restoring petroleum production capacity. In the oil industry alone, reconstructions have thus far totaled about \$2.5 billion with another \$7.5 billion in costs anticipated before all of the industry's fields, refineries, and export facilities are fully restored. It is estimated that it will take another 2 years to restore the Divided Zone's onshore fields to full production.

The economy's non-oil sectors, however, are suffering from weak demand, delays in capital spending on projects started before the invasion, and the limited injection of liquidity by the public sector.

With lower refining capacity planned domestically, KPC is allotting \$300 million for expanding refining and marketing ventures elsewhere, particularly East Europe. Restoration priority will be given to the wealth-creating sectors of the economy, petroleum production and downstream processing. When petroleum production is resumed, Kuwait will undoubtedly produce at the optimum rate to finance reconstruction. This may eventually require higher quotas from OPEC, which before the invasion were 1.5 Mbbl/d.

In addition to emergency reconstruction work, previous Government policies are under reassessment and could involve authorizing total privatization of utilities.

Although the recovery in Kuwait should be stronger in 1993, with the GDP increasing to \$20,000 million largely on the strength of increased oil production, the economy will not yet be fully returned to prewar levels.

The Government's new demographic

policy has limited the foreign population of Kuwait, which once accounted for two-thirds of all residents and 85% of all workers. This has put increased pressure on wage rates and per unit labor costs throughout the economy. The Government has begun to look seriously at the possibility of privatizing and liberalizing economic activities in Kuwait, while restricting its own intervention within the commercial economy. The Government has formed a national committee on privatization and selected its first few targets: telecommunications and the KNPC retail service stations. The Government has begun to reduce some of the barriers to foreign investment, which have long isolated Kuwait from the worldwide flow of capital. The Petrochemical Industries Co. has already announced that it will seek foreign partners for its proposed \$2 billion petrochemical complex south of Kuwait City, and the Ministry of Finance has under review those restrictions that allow foreign companies only a minority stake in joint ventures. Simple uncertainties regarding the long-term political situation in Kuwait and the region may continue to depress investment interest. Further growth after 1993 will depend upon the world oil market and the progress the Government is able to make in privatizing and liberalizing its economy.

OTHER SOURCES OF INFORMATION

Kuwait Petroleum Corp. (KPC)
P.O. Box 26565
Safat, 13126, Kuwait
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TABLE 1
KUWAIT: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991 ^a	1992 ^a
Chlorine	24,700	23,610	19,000	—	—
Cement thousand tons	888	1,110	900	300	500
Clay products, nonrefractory: Sand lime bricks cubic meters	300,100	354,800	300,000	100,000	100,000
Lime: Hydrated and quicklime	65,000	65,000	50,000	5,000	5,000
Natural gas: ²					
Gross million cubic meters	8,980	11,100	7,070	1,000	—
Dry do.	6,490	8,160	5,230	—	—
Natural gas liquids thousand 42-gallon barrels	34,000	38,500	30,500	—	—
Nitrogen:					
N content of ammonia	497,500	664,600	292,100	—	³ 140,100
Urea	379,000	371,700	203,700	—	³ 118,400
Petroleum:					
Crude ² thousand 42-gallon barrels	<u>546,000</u>	<u>657,700</u>	<u>427,780</u>	<u>68,255</u>	<u>³375,600</u>
Refinery products: ^a					
Gasoline, motor do.	16,425	22,265	14,000	NA	NA
Jet fuel do.	12,775	19,690	12,000	NA	NA
Kerosene do.	14,600	22,200	14,000	NA	NA
Distillate fuel oil do.	60,225	71,200	46,000	NA	NA
Residual fuel oil do.	93,075	99,350	70,000	NA	NA
Other do.	41,610	44,700	28,000	NA	NA
Total do.	<u>238,710</u>	<u>279,405</u>	<u>184,000</u>	<u>³17,000</u>	<u>100,000</u>
Salt	39,500	31,950	30,000	—	—
Sodium and potassium compounds: Caustic soda	16,100	15,700	12,000	—	—
Sulfur:					
Elemental, petroleum byproduct	360,000	375,000	300,000	30,000	150,000
Sulfuric acid	4,500	5,000	4,000	—	—

^aEstimated. ^rRevised. NA Not available.

¹Table includes data available through May 31, 1993.

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

³Reported figure.

TABLE 2
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	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. (Texaco 50%; Kuwait Oil Co. 50%)	Wafra	35.	
Do.	do.	South Fuwaris	2.	
Do.	do.	South Umm Gudair	10.	
Do.	Arabian Oil Co. (Japanese Petroleum Trading Co., 80%; Saudi Arabia, 10%; Kuwait, 10%)	Khafji	65.	
Do.	do.	Hout	10.	
Petroleum, products	million 42-gallon barrels	Kuwait National Petroleum Co. (Government 100%)	Mina al Ahmadi	100.
Do.	do.	Shuaybah	—	
Do.	do.	Mina Abdulah	35.	



Oman Mining Co.'s AARJA Copper Mine in Aarja, the Sultanate of Oman.

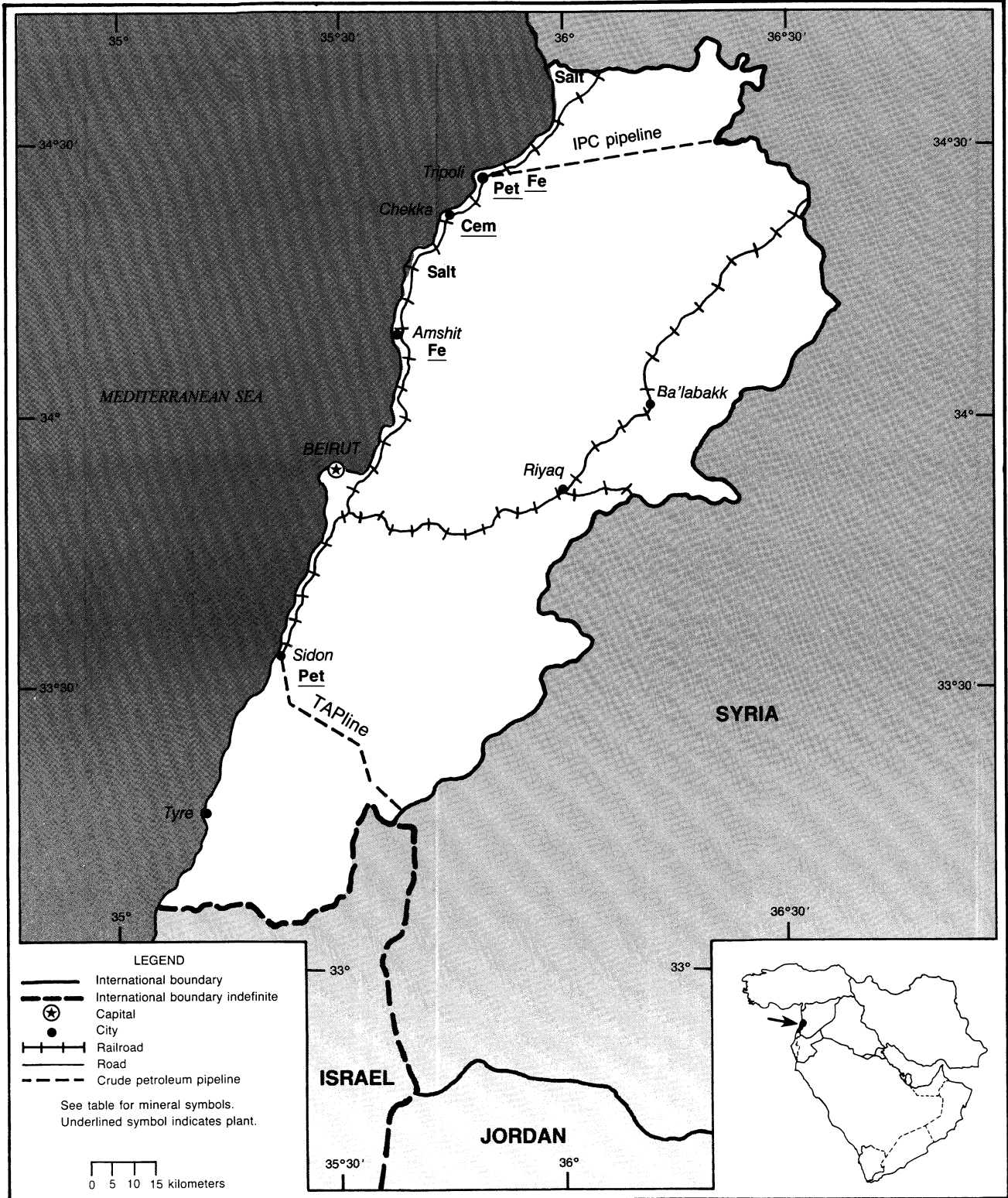


Oman Chromite Co.'s Ghashabi Mine in the Sultanate of Oman.

LEBANON

AREA 10,400 km²

POPULATION 3.4 million



THE MINERAL INDUSTRY OF

LEBANON

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 relative political and military calm since the Taif Agreement resulted in the influx of loans and aid to rebuild the nation's infrastructure while providing stimulus to the economy. A loan of \$500 million was made available from Italy and Arab agencies. 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 in early 1993. The loan funds were allocated to power, water, education, housing, and technical assistance programs. High priority was given to the restoration of the 600-MW Zouk power station and the 24-MW Jiyeh plant.

The Ministry of Electricity and Water Resources reported the nation's 1992 electric power capacity at approximately 1,400 MW.

Mineral production 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 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. With the return of a centralized Government, the import of crude oil and products was reestablished under the sole authority of the Government. Since 1991, the official prices of petroleum products were set weekly on the basis of world market prices and the value of the Lebanese pound. As of December 31, 1992, the price of 20 L of gasoline was \$5.45.

The tentative peace established in 1991 has enabled the central Government to restore control in Beirut, collect taxes, and regain access to key port facilities. By early 1992, the port of Beirut was bustling with activity, with nearly 400,000 tons of merchandise unloaded every month. Revenues were reported at \$533 million compared with just \$2.5 million in 1990. Although political instability precluded any mineral exploration activities for more than a decade, in mid-March the Industry and Petroleum Ministry issued an international tender inviting bids for offshore and onshore areas in the hope of developing a local source of energy.

Lebanon's domestic debt at the beginning of 1992 stood at about \$3.37 billion and external debt at \$600 million. The country's three principal creditors are France, Italy, and the United States.

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, the latter now closed, are controlled by the Lebanon Ministry of Petroleum. The Tripoli refinery with its postcivil war capacity of about 20,000 bbl/d is under consideration for expansion to an estimated 85,000-bbl/d capacity.

About 20,000 bbl/d of Syrian crude oil is delivered to the refinery via a 530-km-long spur line connecting the main Iraq Petroleum Co. (IPC) pipeline to the refinery at the 825-km point.

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 inherit with the civil war and 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.

The private sector is in a favorable position to contribute to the estimated \$18 billion reconstruction cost. Private funds totaling \$3 billion are deposited in Lebanese banks, and about \$12 billion is deposited in banks abroad.

The country should enjoy a high rate of economic growth in 1993 as a result of the economic stimulus encouraged by the newly available finance. The GDP in 1992 grew by 4.2% in real terms. To maintain or improve the growth rate, Government policies must focus on a comprehensive fiscal adjustment program.

OTHER SOURCES OF INFORMATION

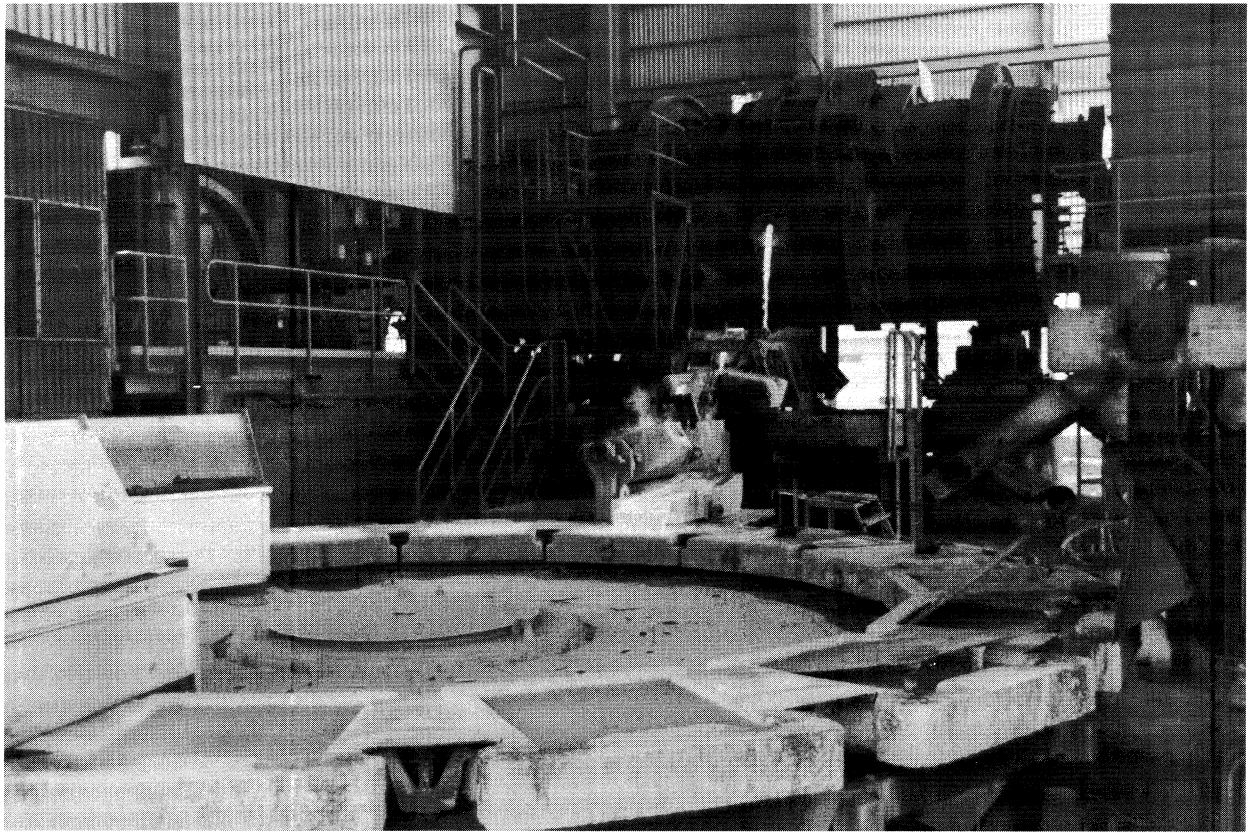
United States Embassy
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TABLE 1
LEBANON: PRODUCTION OF MINERAL COMMODITIES¹

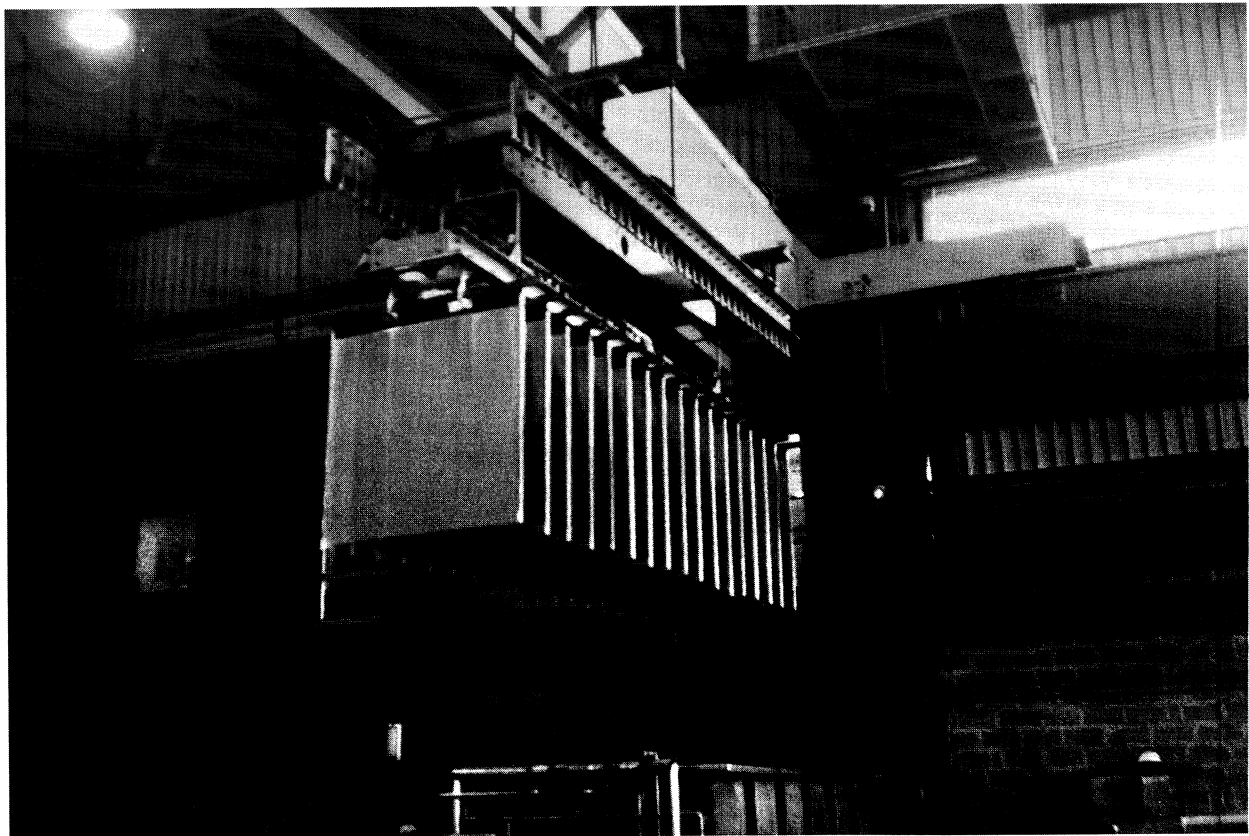
Commodity		1988	1989	1990	1991	1992*
Cement, hydraulic*	thousand metric tons	900	900	900	900	1,000
Gypsum*	metric tons	2,000	2,000	2,000	2,000	2,000
Iron and steel: Metal, semimanufactures*	do.	80,000	75,000	75,000	75,000	80,000
Lime*	do.	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>15,000</u>
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	140	125	102	100	100
Gasoline	do.	2,015	1,800	2,093	2,000	2,000
Jet fuel	do.	90	90	—	—	—
Kerosene	do.	150	130	70	180	180
Distillate fuel oil	do.	1,725	1,600	2,877	2,000	2,000
Residual fuel oil	do.	3,400	3,400	3,805	3,500	3,500
Other	do.	40	35	40	100	100
Total	do.	<u>7,560</u>	<u>7,180</u>	<u>8,987</u>	<u>7,880</u>	<u>7,880</u>
Salt*	thousand metric tons	3	3	3	3	3

*Estimated.

¹Table includes data available through May 1, 1993.



Pouring blister copper anodes at the Oman Mining Co.'s smelter near Sohar, the Sultanate of Oman.

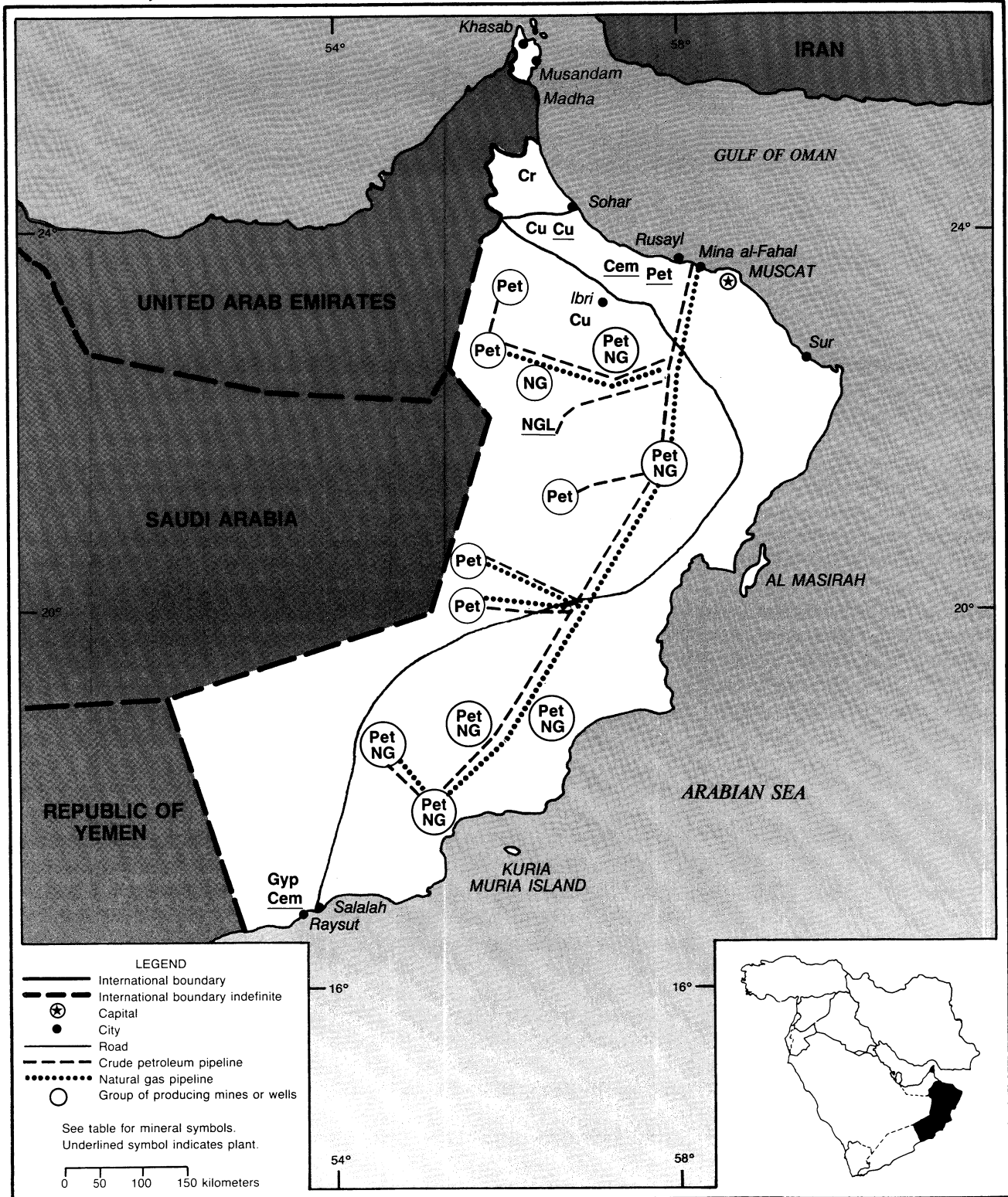


Finished electrolytic copper cathodes Oman Mining Co.

OMAN

AREA 212,460 km²

POPULATION 1.6 million



THE MINERAL INDUSTRY OF

OMAN

By Bernadette Michalski

For the present and foreseeable future petroleum and natural gas will continue to underwrite Oman's developing economy, providing more than 80% of Government revenues. Commercial solid mineral ventures include the mining and refining of copper with gold and silver as byproducts, the return of chromite mining, 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. All but the copper and chromite operations produce primarily for the domestic market.

The GDP grew by 9% in 1992, reaching \$11,142 million.¹ The oil and gas sector accounted for 42% of the GDP or \$4,670 million.

GOVERNMENT POLICIES AND PROGRAMS

Although not a member of the Organization of Petroleum Exporting Countries (OPEC), Oman plays a prominent role in the Independent Petroleum Exporting Countries group, often acting as a liaison between that group and OPEC. Oman has on several occasions announced oil production cuts in support of OPEC, most recently in December 1992.

The Government-owned Oman Oil Co.'s successful mediation between the Kazakhstan Government and Chevron U.S.A., Inc. resulted in the latter's contract as operator for the giant Tengiz Field. Oman has also organized and is participating in a pipeline venture to transport the oil from that field and others to the Black Sea.

The Government also has promoted a \$9 billion natural gas liquefaction project

that will go on-stream in 1999. To implement this project a joint-venture company with 49% foreign ownership was established in early 1993.

PRODUCTION

Crude oil production increased to record levels as development activity and enhanced recovery operations continued. Omani crude oil production averaged nearly 730,000 bbl/d for 1992 but reached sustained production levels of 750,000 bbl/d in the second half of the year. Oman does not have large reservoirs of easily recoverable crude oil. Because of its complex geology, relatively small fields, low pressure, and the need for enhanced recovery techniques in many fields, production costs of Omani crude were \$3 to \$5 per bbl. The average price of Omani crude was \$18 per bbl in 1992 compared with an average of \$17.46 in the previous year.

Chromite production was reinitiated in the last half of the year. Output is entirely destined for export markets. (See table 1.)

TRADE

About 95% of all export earnings in 1992 were derived from petroleum. More than 250 Mbbl was exported. The East Asian nations were the destination for 93% of Oman's petroleum exports. Japan alone received more than 100 Mbbl. Other importers, by order of magnitude, included Korea, Singapore, China, Thailand, and India. The United States imported 686,000 bbl of unfinished oils from Oman in 1992.

Copper exports were estimated about 10% below the level of the previous year

due to lower ore grades and conversion from surface to underground mining.

STRUCTURE OF THE MINERAL INDUSTRY

The Government maintains a majority interest in most companies; however, foreign partnerships are encouraged. The newly formed Oman Chrome Co. had limited Government participation with major equities held by private companies and private share distributions. (See table 2.)

COMMODITY REVIEW

Metals

Chromite.—The Minister of Petroleum and Minerals announced plans to reopen chromite mines in late 1992. To this end, the Oman Chrome Co. was formed, capitalized at \$7.8 million with 15% Government ownership, 45% allocated to local companies, and the remainder floated on the stock exchange. The company's objective is to develop the chromite reserves across the country. As many as 600 sites have been identified, two of which are scheduled for immediate exploitation. The newly formed company contracted the parastatal Oman Mining Co. to begin mining in midyear. After fulfilling its contract for the production of 12,000 tons of chromite ore and concentrates, personnel of the Oman Mining Co. were transferred to the Oman Chrome Co., which is expected to continue as owner and operator. The chromite averaged 42% Cr₂O₃, 22% Al₂O₃, 15% FeO, 0.17% CaO, 18% MgO, and 1.49% SiO₂.

Copper.—Oman's copper production

was for the most part extracted from the Lasail and Aarja Mines with minor input from the Bayda Mine, where reserves are near exhaustion. The blended ore from the three 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 gold, extending mining activity by another 14 years.

Industrial Minerals

The Ministry of Petroleum and Minerals announced the discovery of a gypsum deposit in Shuwaymiyah, about 100 km east of Marmul, with estimated reserves in excess of 100 Mmt.

Mineral Fuels

Coal.—The United Nations' Department of Technical Cooperation and Development conducted a feasibility study on the exploitation of 22 Mmt of recoverable coal in the Sultanate. Of particular interest is the high-sulfur coal basin at Al-Kamil, near the Port of Sur, in eastern Oman. Under consideration is the commercial use of coalbed methane and the technical and economic viability of extracting the coal.

Natural Gas.—About 90% of all natural gas production is utilized. Field operations, including reinjection, absorbed about one-half of the natural gas produced. More than one-third of production is distributed by the Government Gas System network.

About 7 Mm³ of natural gas was produced daily from the Yibal Field while the Fahud and Sayh Nuhaidah Fields each accounted for almost 1 Mm³/d. In early 1992, the Government signed an agreement with Royal Dutch/Shell, Total CFP, Mitsubishi Corp., Mitsui & Co.,

Partex, and C Itoh & Co. forming a consortium responsible for liquefaction, shipping, and marketing Oman's natural gas. The group's proposed \$9 billion natural gas liquefaction project should yield 5 Mmt/a of liquefied natural gas (LNG) annually and come on-stream by 1999. The LNG project will utilize recent natural gas discoveries that have nearly doubled the nation's reserve estimates over the past 2 years.

The offshore Bukha natural gas field is expected to begin commercial production by August 1993. 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. Product yield should include 5,500 bbl/d of natural gas liquids and 1.1 Mm³/d of dry natural gas.

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 Nuhaidah gas treatment plant, and the Yibal gas processing plant with capacity now under expansion to 16.6 Mm³/d by 1993. The Government gas system received more than one-third of production, which is primarily used as fuel for electric power generation. It is also 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 desalinization and powerplant near Muscat and to the Rusayl Industrial Estate. A pipeline also extends south from Sayh Nuhaidah to Zufar, which transports gas for use in the southern oilfields.

Petroleum.—Production over the past decade maintained a constant growth spiral. The Petroleum Development Oman Co. (PDO) accounted for most of this output, contributing 94% of the nation's total petroleum production in 1992. By the second half of 1992, Oman's daily output reached 750,000 bbl/d, largely because of the increased output from the Lekhwair Field in northwest Oman as well as the completion of more than 90 horizontal

wells. These horizontal wells have made petroleum recovery possible from structures not previously thought to have commercial possibilities. PDO has reported two more oil discoveries in 1992. Located in South Oman, Tharish I and Marmul NW3 are slated for development.

Development continued on the Tarkep Al Barakan Field about 40 km southeast of the Safah Field in Occidental Oman's Sumeimah concession. When the field is brought on-stream in late 1993, it should add 12,000 bbl/d, raising Occidental Oman Co.'s total output to about 40,000 bbl/d.

Oman projects a sustained level of production at about 750,000 bbl/d for the remainder of the decade. All of Oman's oil, both from the heavier crudes of the south to the lighter crudes of the north, is gathered and blended into Omani Export Blend through a single pipeline to the country's refinery and export terminal at Muscat. Less than 10% is refined domestically. The bulk of crude oil output is exported, mostly to Asian markets. Japan has been a traditional market for Omani crude oil, purchasing 40% to 50% of all exports for the past decade.

Petroleum Development Oman has proposed the construction of a butane plant in Yibal with a capacity of 2.4 Mbbbl/a. Construction cost is estimated at \$18 million.

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 300,000 bbl/d, rising eventually to 1.5 Mbbbl/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.

Reserves

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 billion bbls at yearend 1992. Reportedly, at least an additional 1.5 billion bbls could be recovered through steam soak, polymer and steam flooding, hotwater 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

The Omani highway system totals 26,000 km, of which only 23% is bituminous surfaced.

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 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. The construction of new quays at Mina Qaboos was under way to accommodate new-generation container ships. 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. The Government is also proposing new port complexes near Sohar and Bimmah. These proposals have been referred to the Development Council, which oversees all major projects in Oman.

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. Although petroleum output is modest, reserves continue to outpace reservoir withdrawals, affording a substantial economic base for at least the next 15 years at the current rate of production. Oil output rose to 750,000 bbl/d in 1992 and should maintain that level through this decade unless static petroleum prices prompt Oman to push production to 800,000 bbl/d as the Government looks to increase revenues to sustain new development projects.

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 sincerity in its policy of encouraging private involvement in major mineral industries.

Although Oman may face difficulties in locating needed financing, the port construction program is well under way in support of the Government's plan to create an entrepot for shipping in the Gulf region.

Increasing overseas investments should place Oman in a more secure position when its own hydrocarbon reserves are depleted.

¹Values were converted from Omani rial (RO) to U.S. dollars at the rate of RO0.3845=US\$1.00, a fixed rate since 1986.

OTHER SOURCES OF INFORMATION

Ministry of Petroleum and Minerals
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TABLE 1
OMAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Country and commodity	1988	1989	1990	1991	1992
Cement, hydraulic	864,915	947,672	999,887	995,000	970,000
Chromite, gross weight	—	12,810	—	—	1,764
Copper:					
Mine output, Cu content	17,065	*16,600	*14,000	14,000	*13,600
Metal:					
Smelter	16,500	15,200	12,100	12,200	14,973
Refinery	16,473	15,080	12,010	12,000	11,383
Gas, natural:					
Gross million cubic meters	6,088	4,850	² 5,290	5,292	5,313
Dry do.	2,449	2,682	² 3,007	3,025	3,110
Gold* kilograms	22	22	20	20	20
Natural gas liquids: Butane and propane thousand 42-gallon barrels	2,130	2,135	2,129	2,200	2,300
Petroleum:					
Crude do.	226,600	233,800	² 249,300	258,500	266,225
Refinery products:					
Gasoline do.	3,431	3,848	4,056	4,077	4,440
Jet fuel do.	948	1,116	2,170	2,380	2,370
Kerosene do.	80	80	85	85	80
Distillate fuel oil do.	4,459	4,406	4,565	4,565	4,582
Residual fuel oil do.	7,800	9,174	11,317	11,317	12,070
Other do.	1,000	780	800	800	850
Total do.	17,718	19,404	22,993	23,224	24,392
Sand and gravel thousand tons	4,719	5,539	5,899	5,900	6,536
Silver* kilograms	2,650	2,650	2,600	2,600	2,668
Stone:					
Marble do.	41	33	35	35	54
Other do.	1,335	1,396	1,973	2,000	2,000
Sulfur: ²					
Hydrocarbons	17,000	25,000	30,000	40,000	40,000

*Estimated. ²Revised.

¹Table includes data available through May 31, 1993.

²Reported figure.

TABLE 2
OMAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Oman Cement Co. (Government, 100%)	Rusayl	625.
Do.		Salalah Cement Works (Raysut Cement Co., 80%; Government, 20%)	Salalah	210.
Chromite		Oman Chrome Co. (Government, 15%; Oman Mining Co., 10%; Omninvest, 5%; Dhofar International Development and Investment Co., 5%; Royal Oman Police Pension Fund, 5%; Petroleum Development Oman, 2.5%; Oman Refinery Co. Pension Fund, 2.5%; Public Share Issue 40%)	30 kilometers northwest of Sohar	15.
Copper		Oman Mining Co. (Government, 100%)	Mine at Sohar	1,500 ore.
Do.		do.	Smelter at Sohar	20 blister.
Natural gas	million cubic meters	Petroleum Development Oman (Government, 60%; Royal Dutch/Shell, 34%; Compagnie Francais des Petroles, 4%; Partex-Portgual, 2%)	Yibal, Fahud, Saih Nihayda, and others	7,000.
Petroleum, crude	thousand barrels	Petroleum Development Oman (Government, 60%; Royal Dutch/Shell, 34%; Compagnie Francais des Petroles, 4%; Partex-Portgual, 2%)	Yibal-Shuayba, Fahud, and Rima	275,000.
Do.		Occidental Group. (Occidental Petroleum Corp., 65%; Neste 35%)	Sahfah Field	9,500.
Do.		Elf-Aquitaine Oman Ltd. (Elf-Aquitaine, 48%; Sumitomo Petroleum Development Co. 32%; Wintershall AG, 20%)	Sahmah Field	2,200.
Do.		Japex	Dalil Field	3,000.
Petroleum products		Oman Refinery Co. (Government, 100%)	Mina al Fahal	30,000.

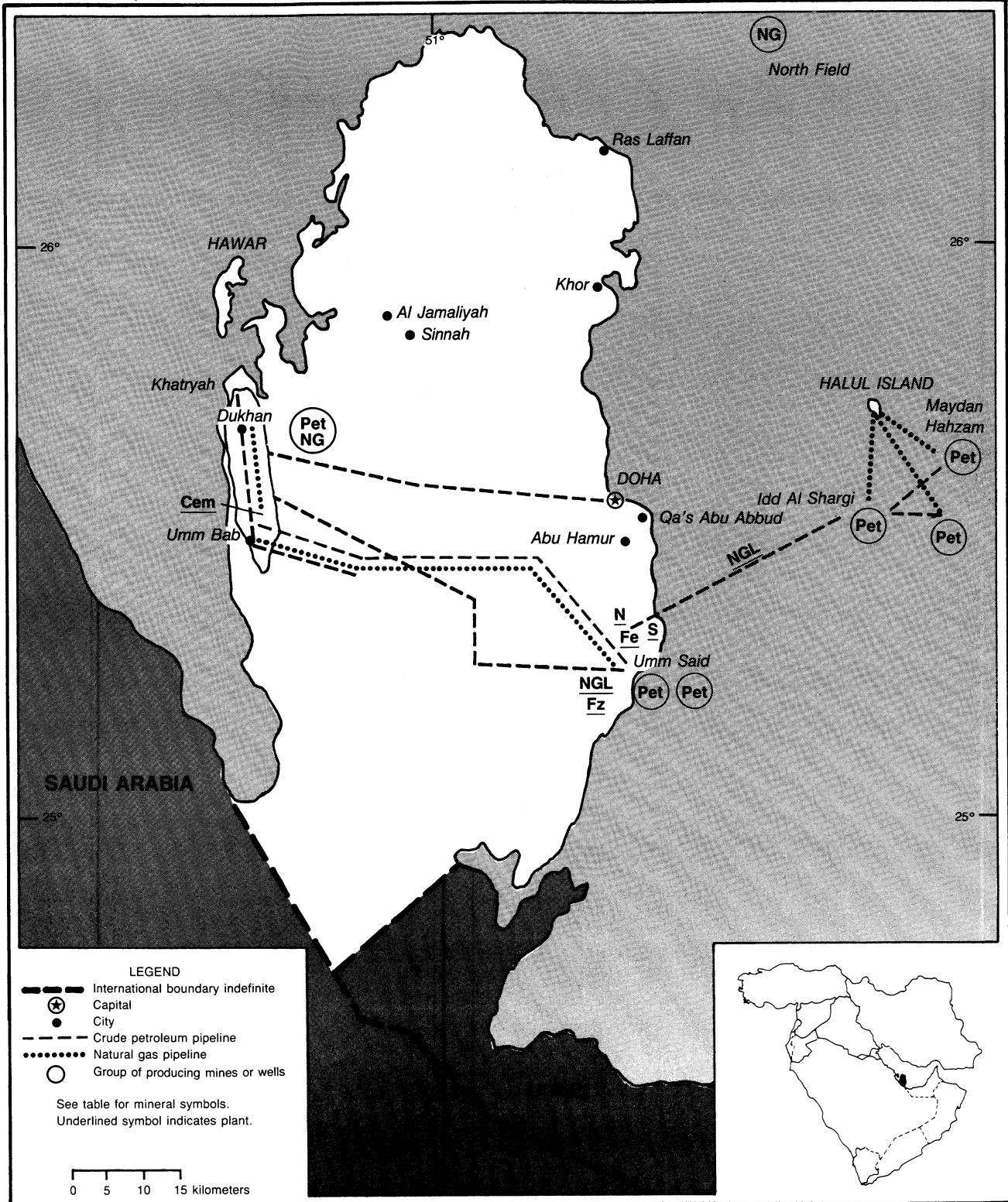


Omani owned and operated chromite mine near Sohar, the first privatized mining operation in the Sultanate of Oman.

QATAR

AREA 11,000 km²

POPULATION 0.49 million



THE MINERAL INDUSTRY OF

QATAR

By David Izon

Qatar's oil production was less than 1% of world output in 1992 and was inconsequential to world or OPEC production. However, the development of the North Field's phase 1 and phase 2 gas projects would supply domestic and external demands. The huge nonassociated gas reserves of the North Field have constituted the beginning of an era of continued industrial development in the country. Qatar's economy has continued to be largely dependent on the oil sector, as the oil industry accounted for about 28% of a GDP of about \$7.5 billion¹ in 1992. Oil exports dominated the external trade sector and generated about 90% of Government revenues and 95% of mineral export.

The Government established a shipping company in the second half of 1992 to boost the country's capacity to handle its shipping needs. The planned goals of the shipping company included transportation from Qatar of locally made petrochemicals, fertilizers, and steel bars. Other objectives were to provide commercial cargo services among the Gulf Cooperative Council (GCC) states, as well as ports in the Red Sea and Indian Ocean; to transport the country's liquefied natural gas (LNG) and petroleum products to overseas markets; and to transport Qatar's cargo imports, including iron ore and other bulk commodities from overseas countries.

The Government is keen for foreign and local investors to play an enhanced role 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

A major Cabinet reshuffle in 1992 included the creation of three new ministries, among which were the Ministry of Energy and Industry and the Ministry of Finance, Economy and Trade. The new Ministry of Energy and Industry became responsible for the former Public Works and Industry, and Petroleum. In 1992, Government policy was geared toward the development of industrial sites at Ras Laffan based on gas as the main energy source and feedstock, and expansion of facilities at Umm Said. Also, the Government signed several contracts and agreements on the LNG and petrochemical projects.

Among major contracts signed was the joint-venture agreement of July 8, 1992, among Qatar General Petroleum Corp. (QGPC), Elf Aquitaine Co. of France, and Sumitomo Corp. of Japan on the integrated LNG plant at Ras Laffan. Others included the Eurogas joint venture among QGPC (65%), Snamprogetti Co. (Snam) (30%) of Italy, and Nelson Bunker Hunt Co. of the United States (5%). This \$500 to \$600 million project is expected to involve building an LNG regasification plant also in Italy and receipt of passage rights through the Suez Canal. It is expected that an agreement with Egyptian authorities on canal transit charges could be critical in determining the viability of exports of LNG to Italy and Europe as a whole. On December 6, 1992, Societa Italiana per Condotte d'Acqua agreed to extend \$100 million in export credits to finance the proposed methanol and methyl tertiary butyl ether plant. Qatar's Chamber of Commerce and Industry established a standing committee to act as intermediary between

Government and business to promote the role of the private sector in industry and boost economic activity.

PRODUCTION

In 1992, 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 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. The value of nonfuel minerals produced was estimated at about \$430 million. (See table 1.)

TRADE

Qatar's mineral economy has continued to be largely dependent on the oil sector. Oil exports accounted for about 90% of Government revenue and about 95% of export earnings. In 1992, 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 in other commodities such as cement, fertilizer, and iron and steel to neighboring gulf countries. Estimates of the value of mineral exports to the United States amounted to about \$10 million in 1992.

Qatar imported pelletized iron ore from Bahrain and machines 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 bars, rods, angles, plates etc., zinc and zinc alloys, vehicles and heavy machinery. Estimates of the value of major mineral imports from the United States in 1992 were about \$160 million.

STRUCTURE OF THE MINERAL INDUSTRY

Qatar's mineral industry continued to be dominated by the oil and gas sector. In 1992, about 25% of the labor force of about 1,700 was employed in oil-related industries. The 300,000-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. This was a new project to be completed in 1993. (See table 2.)

COMMODITY REVIEW

Metals

Qatar Steel Co. (QASCO) saw a remarkable turnaround in the past 4 years (1989-92). Its board of directors approved a planned expansion project in mid-1992 that may double the production capacity at QASCO. QASCO experienced losses in the neighborhood of \$157 million in its first decade of operations, 1978-88. The board of directors was changed at the end of 1988; QASCO took over management from Kobe Steel of Japan and also took over marketing responsibilities from Tokyo Boeki in May 1992. The administration is comprised of 100% Qatari nationals. A cost-cutting program accompanied by profit-sharing and productivity bonuses helped to improve the overall efficiency leading to

profits in 1992. Output has been above design capacity by about 80%. Annual profit was \$3 million from 1989 to 1992. Improved product quality and efficient delivery system were cited among other reasons for the turnaround. All but 10% of QASCO's output is exported, mainly to GCC customers and to international markets. The expansion is expected to start in parallel with Qatar Electricity and Water Co.'s increase in local generating capacity.

QASCO, which lost a cumulative total of about \$100 million in the 1980's, is to award a \$275 million contract that may double its production capacity in anticipation of exporting to Far Eastern markets. Construction is expected to start before the end of 1993. The expansion project would include building a new plant that could raise present capacity (560,000 tonnes) of reinforced steel bars by between 300,000 and 500,000 tonnes. Qatar anticipates utilizing a lot of the less expensive gas from its North Field. In 1992, the company made a \$40 million profit from sales to neighboring countries such as Algeria, Egypt, and Iran at a total value of \$192 million. Completion of repayment of loans acquired to build the existing plant is expected by 1994.

Industrial Minerals

Fertilizer.—Qatar Fertilizer Co. (QAFCO) was the country's sole fertilizer producer. The status of the third plant to supplement QAFCO's fertilizer production was in the construction bidding stage in 1992. The estimated cost for the new complex was about \$500 million. The planned completion period was 3 to 4 years. Companies that have been prequalified to submit bids for turnkey lumpsum contracts were the M. W. Kellogg Co. of the United States, Chiyoda Corp. and Mitsubishi Heavy Industries of Japan, a French/Japanese consortium of Technip Corp., Samprogetti Co. of Italy, and a German company known only as Uhde. Planned output for the new plant was 1,000-mt/d of ammonia and 2,000-mt/d of urea. In July 1992, QAFCO signed a contract with India's Southern Petrochemical

Industrial Corp. to supply 100,000 mt/a of ammonia to the Indian company. The contract's initial life was 3 years.

Sulfur.—Sulfur production from phase 1 of Qatar General Petroleum Corp.'s North Field sour gas project started in October 1992. Output is expected to reach 80,000 mt/a in 1993, and similar additions to production are expected when phases 2 and 3 are completed in the future. The oil refinery at Umm Said produced about 52,000 in 1991, but an upgrade program in 1992 is expected to boost recovery capacity by about 48,000 mt/a, bringing total capacity to about 100,000 mt/a. The expansion of sulfur storage and loading facilities at Umm Said is scheduled to be completed in March 1993. At completion, storage capacity would increase to 200,000 mt/a and this was further scheduled to be expanded by another 140,000 mt/a to cope with increasing sulfur output.

Mineral Fuels

Natural Gas.—A 25-year sales and purchase agreement was signed between Qatar Liquefied Gas Co. (Qatargas) and Chubu Electrical Power Co. of Japan in May 1992. The agreement covered the sale of 4 Mmt/a of LNG to Chubu. The cost of the engineering design, procurement, and construction for the complex at Las Laffan was estimated at \$2 billion. The \$17 million contract for the initial phase of engineering design for the complex was awarded to M. W. Kellogg of the United States. The contract included designs and drawing up of tender documents for the construction of the production facility.

These designs are expected to be completed in 12 months. No decisions have been made by Qatargas for the production process to be used. Qatargas is expected to announce in early 1993 tenders for the supply of seven LNG carriers, each with a minimum capacity of 135,000 m³. Delivery of the vessels is expected between 1996 and the year 2000 at cost of \$285 million each, but it was not clear whether Qatargas was going to own or charter the vessels. It was

anticipated that Qatargas would favor a consortium of shipyards to bid for building the ships because of the size of the contracts. Several companies in Germany, Japan, and the Republic of Korea were already forming such consortiums in readiness for the bids.

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 would take a 30% share in a new venture with QGPC to start production of 10 Mmt/a of LNG after 1998.

QGPC started to export NGL in 1992. Production from the fully commissioned phase 1 of the North Field was estimated at 50,000 bbl/d. Major operating companies included Caltex Petroleum Co. of the United States and Nippon Mining Co. of Japan.

Petroleum.—In 1992, the country's continued exploration program yielded new commercial discoveries offshore by Societe Nationale Elf Aquitaine of France. Maersk Oil Co. of Qatar, a local affiliate of Denmark's Maersk Oil and Gas Co., also discovered some oil in its concessions offshore. Reserves, according to Elf's discovery, were estimated at about 80 Mbbl. The three major areas QGPC focused on were to boost exploration, develop proven reserves, and upgrade production facilities. QGPC's intention was to fully develop all concessions where there were known oil deposits and to actually increase output. However, output for 1992 remained at 1991 levels. QGPC was confident that production levels in onshore fields were stable and would remain that way for the next 20 to 25 years.

Development of the Diyab Field near Dukhan continued on schedule and was expected to raise onshore production capacity by 50,000 bbl/d to 280,000 bbl/d. The \$95 million project involved drilling 19 production wells and building a 24-km pipeline; also included was the expansion of the Jaleha production plant. Advanced oil recovery methods were being implemented to help the existing oil fields maintain their current levels of

production. QGPC would spend close to \$300 million for these reservoir upgrade programs.

Reserves

Qatar was estimated to have among the world's largest nonassociated gas reserves in the North Field. The North Field's recoverable gas reserves were put at 5 trillion m³. The country's recoverable oil reserves were believed to be about 2.5 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 were exported 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 expected to continue to be given top priority because of abundance of natural gas and the expected growth in demand worldwide for the next 20 years. World LNG trade is expected to rise to about 80 Mmt by the year 2000 from present levels of 52 Mmt and is forecasted to top 100 Mmt by the year 2010. Therefore, the 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 positive effect on the environment. Resulting industrial developments from completion of the first and second phase of the North Field and downstream projects should increase job opportunities for Qatar's 35,000 citizens and its foreign residents.

The addition of Mobil Oil Corp. to the LNG project would provide necessary balance of influence on other European shareholders in the project. Mobil's extensive experience in LNG operations should prove beneficial to Qatargas. Agreement on the passage of LNG tankers through the Suez Canal would determine the viability of the Eurogas project. Agreements with Enel would open the way for mobilization of Italian Government credits and commercial loans. Natural gas should continue to provide cheap energy for Qatar's domestic industries, including aluminum, fertilizer, ferroalloys, petrochemicals, and steel. The completion of several natural gas projects with their long-term subcontracts for LNG may provide additional economic stability.

¹Where necessary, values have been converted from Qatari riyals (QRs) to U.S. dollars at the rate of QR13.64=US\$1.00 in 1991.

OTHER SOURCES OF INFORMATION

Qatar General Petroleum Corp.
Doha, Qatar
National Oil Distribution Co.
Doha, Qatar

TABLE 1
QATAR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1988	1989	1990	1991	1992 [*]
Cement, hydraulic	*300,000	300,000	267,000	526,527	³ 544,348
Gas, natural:					
Gross million cubic meters	6,490	7,270	7,820	8,100	8,100
Dry do.	⁵ 5,860	⁶ 6,200	6,720	7,100	7,100
Iron and steel: Metal:					
Direct-reduced iron thousand tons	443	531	530	530	
Steel, crude do.	527	550	580	561	⁵ 588
Semimanufactures do.	505	530	540	540	540
Natural gas liquids thousand 42-gallon barrels [*]	15,000	³ 13,231	13,200	³ 13,140	50,000
Nitrogen: N content of ammonia	199,870	235,620	250,000	228,416	³ 249,572
Petroleum:					
Crude thousand 42-gallon barrels	<u>116,581</u>	<u>117,214</u>	<u>140,525</u>	<u>³137,970</u>	<u>137,900</u>
Refinery products:					
Gasoline do.	2,920	3,650	4,750	4,750	4,750
Jet fuel do.	2,336	2,920	3,800	3,800	3,800
Kerosene do.	1,054	1,310	1,710	1,710	1,700
Distillate fuel oil do.	4,526	4,745	6,175	6,170	6,100
Residual fuel oil do.	4,526	5,840	7,595	7,500	7,500
Other ⁴ do.	438	1,825	1,800	2,000	2,000
Total do.	15,800	20,290	25,830	25,930	25,850
Stone: Limestone [*] thousand tons	900	900	³ 810	850	900
Sulfur	⁵ 55,000	52,000	52,000	52,000	52,000

^{*}Estimated.

¹Table includes data available through Feb. 26, 1993.

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.

TABLE 2
QATAR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

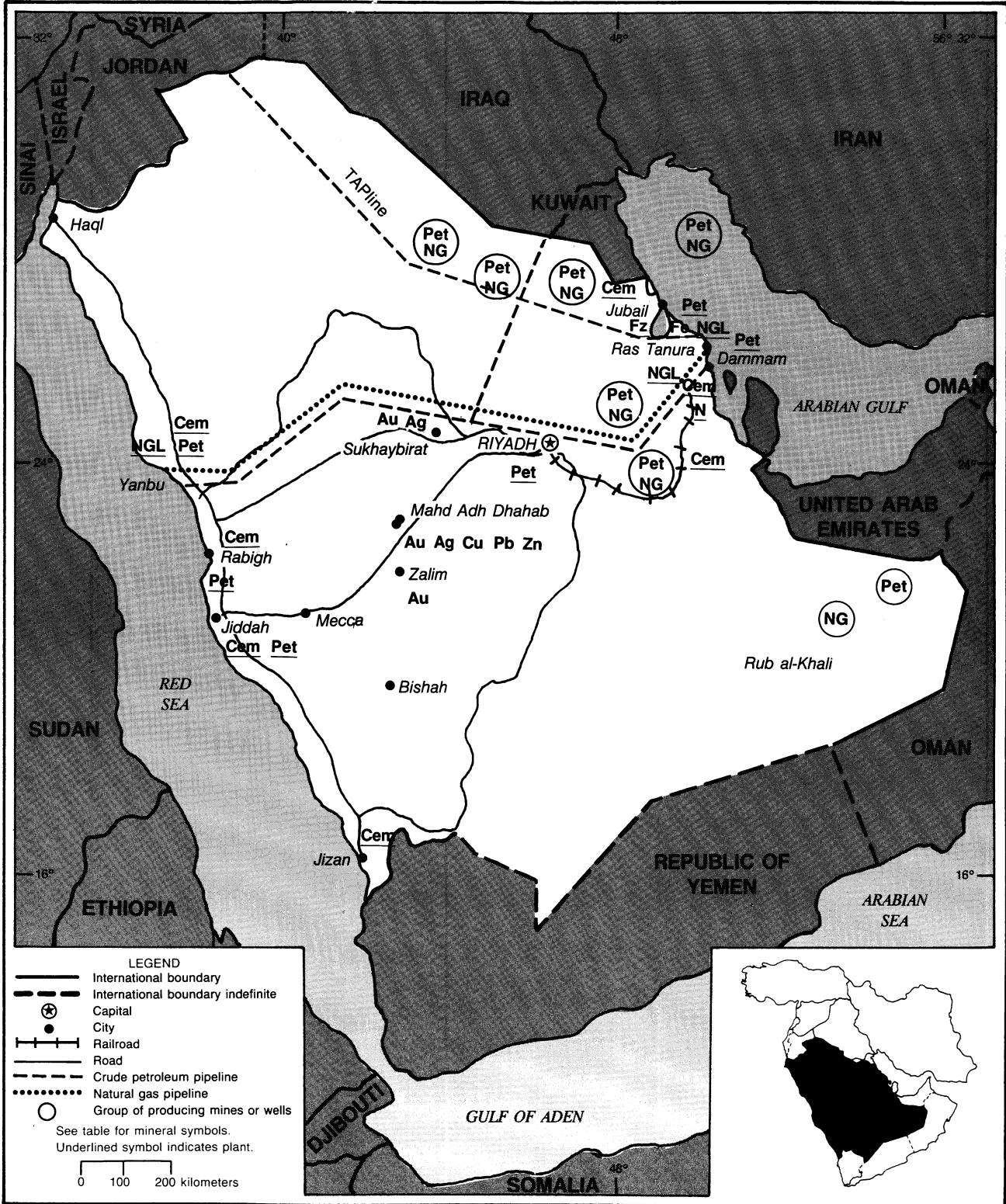
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
Cement	Qatar National Cement Co. (Government, 43 %; private, 57 %)	Umm Bab	550.	
Fertilizer	Qatar Fertilizer Co. (QAFCO) (Government, 75 %; Norsk Hydro AS Norway, 25 %)	Umm Said	540, N content of ammonia, 350, N content of urea.	
Natural gas, liquefied	thousand barrels	Qatar General Petroleum Co. (QGPC) (Government, 100 %)	do.	250,000.
Petroleum, crude	do.	do.	Dukhan	146,000.
Petroleum, refinery products	do.	QGPC; National Oil Distribution Co. (Government, 100 %)	Umm Said	22,630.
Iron and steel	Qatar Steel Co. (QASCO) (Government, 70 %; Kobe Steel Ltd. of Japan, 20 %; Tokyo Bocki Ltd. of Japan, 10 %)	do.	400.	
Sulfur	Qatar Petrochemical Co. (QAPCO) (QGPC, 84 %; Charbonnages de France-Chemie, 16 %)	do.	52.	

SAUDI ARABIA

AREA 2.0 million km²

POPULATION 17.1 million



THE MINERAL INDUSTRY OF SAUDI ARABIA

By Bernadette Michalski

Although Saudi Arabia has achieved a significant diversity in its mineral industry sector through the Kingdom's copper and gold mining operations and cement and steel manufacturing facilities, it remains the world's largest producer of crude oil and the third largest producer of natural gas. The oil and gas industries, including the ever growing downstream refining and petrochemical industries, generate the Kingdom's finances for public expenditures and social and economic development. Saudi Aramco, the national oil company, has accelerated its expansion program for production and downstream refining, marketing, and distribution facilities to meet anticipated long-term market demand.

The expanded oil production and downstream processing programs continued to support strong economic growth in 1992 as in the previous 2 years. Gross domestic product (GDP) was \$110,200 million.¹ Nominal GDP growth was reported at 5% in 1992. The oil sector accounted for 36.6% of GDP, 75% of Government revenues, and 85% of total exports in 1992. The Gulf War debts were repaid by early 1992, resulting in an accounts deficit of only \$8 billion—appreciably down from the \$25 billion accounts deficit of just a year before.

The Saudi Government has 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 focused on the diversification and expansion of the economic base while securing a more balanced allocation of resources between the different regions of the country. An improvement in the balance of payments was encouraged by the substitution of local production for foreign imports. Additional emphasis was placed on encouraging private capital to participate in the Kingdom's economic development. The plan calls for the construction of 300 factories and proposed industrial investments of \$5 billion, with about \$3.5 billion in capital and commercial financing from the private sector.

In February 1992, the rules for the national consultative council and the draft rules for regional government were outlined. Final rules for the Provincial system, which calls for the establishment of councils in the Kingdom's 13 regions, were published later in the year. These actions provide a format in which the Saudi Arabian citizen will have a greater voice in government.

In mid-1993, the council of ministers announced the merger of Samarec with 12,000 employees into Saudi Aramco with 47,000 employees, resulting in that entity becoming the world's largest integrated petroleum company and the third largest refining company behind Exxon and Royal Dutch/Shell, moving up from seventh place.

PRODUCTION

Crude oil production, the Kingdom's principal mineral commodity, averaged more than 8.4 Mbbbl/d in 1992. Updated

assays of the two crudes marketed as Arabian Medium were produced in 1992. Production from the offshore Zuluf and Marjan Fields has dropped in gravity from 31.1° API to 28.8° API, while onshore crude from the Khursaniyah and Abu Saafa Fields has dropped from 30.9° API gravity to 28.5° API gravity. The first stage of the 5-year expansion project is scheduled to come 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 is anticipated by the end of 1993. Additional capacity is scheduled to be 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 is expected to reach sustainable capacity of 10 Mbbbl/d by the close of 1993, well ahead of the 1995 target date. (See table 1.)

TRADE

Saudi Arabia's major export markets are Asia, including Japan, which accounts for 34% of total exports; North America, 24%; Western Europe, 21%; and the countries of the Cooperation Council for the Arab States of the Gulf (GCC), 6.7%.

Saudi Arabian exports are dominated by hydrocarbon products and derivatives. Crude oil exports, about 6.4 Mbbbl/d, were valued in excess of \$43 billion in 1992. Spot prices for Saudi Arabian crude oils ranged from a low of \$15.90 per bbl for 34° Arabian Light and \$12.70 per bbl for 27° Arabian Heavy in January to a high in June of \$19.79 per bbl and \$17.19 per bbl, respectively.

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; about 25% went to Europe, and less than 10% to North America. In 1992, about 30% of crude oil shipments was directed to North America, 30% to the Far East, and 25% to Europe. Petroleum imports by the United States totaled 1.7 Mbb/d, including 122,000 bbl/d of petroleum products, mostly unfinished oils and gasoline. Saudi Arabia is the leading supplier to the United States, accounting for 22% of U.S. petroleum imports in 1992. Near the close of 1992, petroleum product exports from Saudi Arabia had to be reduced to accommodate domestic demand when refinery throughput was temporarily reduced due to maintenance work at several facilities.

The value of non-oil exports has increased rapidly over the past decade. In 1982, they were valued at about \$1 billion rising to \$5 billion in 1992. 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.

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 was second with 13.7% of the market share, while the United Kingdom was 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. (See table 2.)

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 3.)

COMMODITY REVIEW

Metals

Ferrous Alloys.—The Bahraini-based United Gulf Industries Corp. has confirmed the viability of constructing a ferroalloy complex at Jubail, a location that will enjoy the advantage of the availability of high-quality quartz and inexpensive energy. The complex will include a 25,000-mt/a-capacity ferrosilicon plant, a 7,000-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 as domestic needs do not exceed 3,000 mt/a. Silicon metal, silicomanganese, and ferromanganese production is intended for local consumption.

Gold.—Although several commercially significant gold deposits have been discovered in the Arabian Shield, at present, the Mahd Adh Dhahab deposit, 275 km northeast of Jiddah, offers the most favorable recovery with a minable reserve of 1.14 Mmt. Output in 1992 was reported at 4,330 kg combined in concentrate and doré bullion, from 159,500 tons of ore with gold content between 24 to 28 g/mt.

The Saudi Co. for Precious Metals, a joint venture between Petromin of Saudi Arabia and Boliden International Mining of Sweden, continued development of the Sukhaybirat gold deposit, about 480 km northwest of Riyadh, where reserves were reported at 8.4 Mmt of ore yielding an average gold content of 2.5 g/mt.

Sukhaybirat production in 1992 was reported at 1,776 kilograms. Near yearend, the open pit was at a level of 35 m below surface. The Saudi Co. for Precious Metals, which owns and operates the mine, reports having to pump about 5 m³/hr of water. Gold is recovered in a standard carbon-in-leach circuit. The doré assays at 80% to 90% gold with the balance in silver and a few trace elements. Actual gold recovery from the ore is expected to be maintained at about 88.7%. Precious metals recovered from the mine were to be sold by competitive tendering to refineries in Europe and the Far East.

Other gold deposits are under consideration for commercial exploitation. The U.S. Geological Survey continued exploration in the Hamdah area and commenced exploration in the Amayir al Madan area in 1992.

Iron and Steel.—The first of a planned three-stage expansion at the Saudi Iron and Steel Co.'s (Hadeed) complex at Jubail was completed with the startup of a direct reduction plant capable of producing 650,000 mt/a of sponge iron. The second stage is an expansion of the basic steel plant, including modification of the existing electric arc furnaces, and the installation of two ladle furnaces. The third stage is the expansion of the rolling mill. These projects will increase the plant's annual capacity to 2.15 Mmt/a and should be completed by the close of 1993. Hadeed is also considering the development of a flat products complex for which it has commissioned a preliminary feasibility study. The Saudi market for flat products is projected at 800,000 tons by mid-decade.

Magnesium.—Consideration was given to the construction of a 10,000-mt/a-capacity magnesium plant using the salt water method to produce magnesium.

Silver.—Production in conjunction with gold mining operations at Mahd Adh Dhahab yielded 13,130 kg in concentrate and 3,280 kg in doré bullion. At Sukhaybirat, the yield was 133 kg of silver.

Industrial Minerals

Cement.—The Saudi Consolidated Cement Co., with an annual capacity of 3.4 Mmt, accounted for more than 25% 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. on the first day of 1992.

Saudi Arabian cement demand has been forecast to rise to 18 to 20 Mmt in 1993 as a result of the current construction boom. Consequently, the expansion of the domestic cement industry has accelerated as six plants are either implementing or planning expansion programs. Projects under consideration include increasing the capacity at Saudi 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 where net profits were reported at \$68 million compared with \$23 million in 1991; and increasing capacity by at least 1 Mmt at Southern Province Cement Co. where local sales were reported at 2.15 Mmt or 7% above those of 1991. 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 Qassim Cement Co.'s 1.4-Mmt/a-capacity plant in Buraidah, and the addition of 2.5 Mmt/a of capacity at Yanbu Cement Co. was under way. The Tabuk Cement Co. was established in 1992 to operate a cement plant at Duba on the Red Sea coast. Investment requirement is projected at \$240 million.

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 Jubail. Total project cost was estimated at \$240 million. The Arabian Mining and Manufacturing Co. (AMAM) has been set up as a Saudi Joint Stock Co. 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 located between Riyadh and Oman. The current domestic market, principally the glass industry and water-treatment industry, consumes about 100,000 mt/a, and consumption is expected to rise to 120,000 by 1995. The remaining production is slated for export to other Gulf nations.

Titanium Dioxide.—The National Titanium Dioxide Co. (Crystal) has inaugurated its 51,500-mt/a-capacity TiO₂ plant at Yanbu. Although most of the production is to service the domestic market, 5,000 tons is to be exported to the Asian market. 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, Crystal has formed a joint-venture company, Arabian Chlorine Industries, with Basic Chemical Industries.

Mineral Fuels

Natural Gas.—Most of the Kingdom's natural gas was produced in association with crude petroleum. The natural gas utilization rate peaked at 64.4% in 1988. The gas gathering systems were not in place at all fields when crude oil production capacity was restored during the Gulf War. Consequently, Saudi Aramco flared or reinjected substantial quantities of gas during the recent periods of peak production. The utilization rate was reduced to less than one-half of total production in 1992. However, the production of natural gas liquids (NGL) has substantially increased during the past few years with output approaching 200 Mbbl/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.

Saudi Aramco has discovered nonassociated gas in the central region of the peninsula in the past 2 years and at least one gas discovery on the northern Red Sea coast. Near yearend, a major gas find was reported at Madyan on the

northwest coast of the peninsula. The reservoirs have not been delineated as of this writing.

Petrochemicals.—The state-owned Saudi Basic Industries Corp. (Sabic) ranks as the world's third largest producer of petrochemicals. Most of its output is delivered to world markets. Output amounted to 15.7 Mmt in 1992, of which 13 Mmt was exported. The principal markets for these products were the Far East, Western Europe, and Southeast Asia. Lower international petrochemical prices hit the profits of Sabic for the second year running. Profits fell by 14% to \$524 million from \$612 million in 1991.

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

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 investors.

Petroleum.—Production.—Saudi Arabia attained an average production level exceeding 8.4 Mbbl/d in 1992. The Wafra Field in the Saudi-Kuwaiti Partitioned Zone, under joint operation by Saudi Arabian Texaco and the Kuwait Oil Co., was brought back into production only in March 1992. Production in the Partitioned Zone had not recovered to the levels prevailing before the Gulf War, but output approached full capacity rate by mid-1992.

Saudi Aramco is the only company authorized to engage in oil exploration and development in Saudi Arabia. It has transferred the focus of its work away from the traditional oil-producing zones in the east of the country and in the Gulf and concentrated its exploration efforts increasingly in the central area south of Riyadh, in the northwest, and in the southwest. Eight seismic crews were operating in these zones in 1992.

Saudi Aramco launched a 5-year, \$16

billion program to raise sustainable capacity to 10.87 Mbb/d by 1995. The program includes the development of the Haradh area of the Ghawar Field and the Najd area light crude oilfields in central Saudi Arabia. In addition, the production facilities are to be expanded and upgraded at the Qatif, Safaniya, Zuluf, Marjan, and Manifa Fields. The largest single capacity expansion is slated for the Ghawar Field where capacity will be expanded from 4.7 Mbb/d to 5.3 Mbb/d at a cost of \$2.5 billion. Most of the increased output was derived from the southern fields that produce light and medium crudes. 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 1.5 Mbb/d of Arabian Heavy.

The majority of Saudi Aramco's expansion projects are 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 affording 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 Yanbbu on the Red Sea.

Refining.—Including two refineries in the Partitioned Zone, Saudi Arabian total refining capacity is 1.94 Mbb/d. Saudi Arabia has announced its objective to refine one-half of its crude oil production within its own refinery network by the end of the decade. To this end, master contracts have been awarded for the upgrade and expansion of the seven refineries within the Kingdom itself. The expansion and modernization plans will be divided into three phases. The first expansion phase will focus on refineries

at Jeddah, Riyadh, and Yanbu with the objective of increasing output of higher value products, particularly high-octane unleaded gasolines, for export. A range of new units is planned, including vacuum distillation, isomerization, fluid catalytic cracking, and distillate desulfurization. The program's objectives are threefold: to make Saudi Arabia the world's leading exporter of unleaded gasoline; to meet rising domestic demand through modernization; and to increase revenues by the production of higher quality products. As a result of this program, domestic production of gasoline should exceed domestic requirements by about 175,000 bbl/d by 1995. Foster Wheeler of the United States is responsible for the project management and engineering of the first phase. Phase 2 of the refinery expansion program, scheduled for completion in 1995-96, would involve upgrading units at the Ras Tanura and Rabigh refineries. The third phase calls for enhancement of facilities at two joint-venture refineries--the 300,000-bbl/d SAMAREC-Mobil Yanbu refinery and 284,000-bbl/d SAMAREC-Shell refinery at Jubail--along with upgrades at Jeddah and Ras Tanura and extension of the pipeline from Abqaiq to the 134,000-bbl/d Riyadh refinery. The third phase timeframe is 1995-2000.

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 bought into the South Korean refining sector and concluded an agreement for a refining venture in Japan. Negotiations for positions in China, France, Indonesia, and Italy continued. Direct investment in foreign refining, marketing, and distribution operations established 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. The bulk of its 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, 17 billion bbl; Berri, 11 billion bbl; Manifa, 11 billion bbl; Zuluf, 8 billion bbl; Shayba, 7 billion bbl; Abu Saafa, 6 billion bbl; and Khursaniya, 3.5 billion bbl. Saudi Arabia's proven oil reserves were reported at 260.3 billion bbl at the close of 1992, representing more than 26% of total world proven reserves. This current figure does not take full account of the central oilfields because no definitive evaluation of their reserves has been made. At the present accelerated rate of output, Saudi Arabia enjoys a reserve-production ratio sufficient to last 86 years at current production levels.

Natural gas reserves were reported at 5.2 trillion m³. This figure does not include the 1989-91 discoveries as they have not been delineated. Most of the Kingdom's natural gas 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 about 35% of total gas reserves. (See table 4.)

INFRASTRUCTURE

The Kingdom's basic infrastructure is in place with highways totaling 74,000 km, of which 35,000 km was bituminous surfaced and 39,000 km was gravel and improved earth. Railroad lines total 886 km of 1.435-m standard gauge.

Further expansion of the East-West pipeline was under way. Petroline, which runs from Abqaiq in the Arabian Gulf to Yanbu on the Red Sea, was undergoing an expansion to a capacity of 5 Mbb/d through the installation of additional pumps and turbines at the 11 pumping stations now 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 under way.

OUTLOOK

Saudi Arabia has emerged from the Gulf War not only in a strong political position but also with a strong private sector and renewed prominence as the world's largest oil 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.

The merger of Samarec into Saudi Aramco should cut overlapping jobs, providing the Kingdom opportunities to reduce the number of foreign nationals while providing more opportunities for Saudi Arabians. The merger should result in productivity and marketing enhancement. 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 outlets for its crude in markets close to the consumers. Aramco has been involved in a joint venture with Texaco in the United States for 4 years. It also has a refining venture with Sangyong in the Republic of Korea. The purpose of these overseas purchases is to acquire more refining and distribution facilities in the major oil-consuming countries, which will give Saudi Aramco secure outlets for a significant part of Saudi Arabia's crude oil production. By the close of 1992, it was negotiating agreements with China, Italy, and Japan.

Saudi Arabia is embroiled in border disputes with some of its neighbors. In the south, it is in conflict with 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. A dispute flared with Qatar at the end of September 1992 over a shooting incident at the Al-Khafous border post, but a new accord was signed between them on December 20, 1992, that confirmed the 1965 border.

An industrial conference between the GCC and the EC convened in October 1992 at Doha, Qatar, to discuss tariffs

imposed on petrochemicals and other imports into the EC and the proposed EC energy/carbon tax. Trade with the EC is sizable, in excess of \$35 billion. Discussions and negotiations could save and expand a major market for the Kingdom's already substantial and still growing petrochemical exports.

The less than total defeat of the Iraqi army in the Gulf War has not enhanced Saudi Arabia's sense of security, and it continues to build up its armed forces by purchasing the most advanced military hardware available. The Kingdom is perceived by the rest of the world as a bastion of stability in a particularly turbulent region. This image has been reinforced by Saudi Arabia's policy of economic aid and early establishment of diplomatic relations with Uzbekistan, Tajikistan, Turkmenistan, and Azerbaijan, matching Iranian influence in the new republics.

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

- Ministry of Petroleum and Mineral Resources
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- Directorate General of Mineral Resources
Jiddah, Saudi Arabia
- General Organization for Petroleum and Mineral Resources (PETROMIN)
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Fax: [966] (1) 464-1992

Publications

- Kingdom of Saudi Arabia, Ministry of Finance and National Economy, Central Department of Statistics, Statistical Yearbook, annual.
- Saudi Arabian Monetary Agency, Research and Statistics Department, Statistical Summary, annual.
- Kingdom of Saudi Arabia, Ministry of Planning, Fifth Development Plan 1990-1995.

TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992*
Copper: Cu content of concentrate and bullion ²	*300	765	895	900	850
Cement, hydraulic thousand tons	10,951	11,442	11,983	11,371	15,300
Gold:					
Mine output, gross weight:					
Ore	*40,000	100,000	146,000	450,000	806,000
Concentrate ²	2,800	6,977	7,000	7,800	8,000
Bullion, crude, gross weight kilograms	*1,500	3,642	5,630	6,400	9,500
Au content of concentrate and bullion do.	*1,000	2,900	3,536	4,300	5,626
Gas, natural:³					
Gross million cubic meters	41,050	46,400	51,265	52,000	65,000
Dry do.	29,150	29,900	30,800	31,500	33,000
Gypsum*	375,000	375,000	375,000	375,000	375,000
Iron and steel:					
Iron, direct reduced thousand tons	1,080	1,205	1,085	1,117	1,610
Metal, steel, crude do.	1,614	1,810	1,833	1,850	1,900
Lead: Pb content of concentrate ²	65	205	250	250	250
Lime*	12,000	12,000	12,000	12,000	12,000
Natural gas liquids, all forms thousand 42-gallon barrels	149,145	153,645	194,630	*258,400	262,800
Nitrogen: N content of ammonia thousand tons	867	863	942	827	*904
Petroleum:³					
Crude thousand 42-gallon barrels	<u>1,890,100</u>	<u>1,848,500</u>	<u>*2,353,900</u>	<u>2,963,000</u>	<u>3,075,100</u>
Refinery products:					
Liquefied petroleum gas do.	9,559	7,909	*7,320	*8,380	12,000
Gasoline and naphtha do.	130,539	124,104	*135,991	*128,594	170,000
Jet fuel do.	15,822	18,214	*37,800	39,900	60,000
Kerosene do.	30,917	29,918	51,866	42,000	65,000
Distillate fuel oil do.	161,590	145,670	*124,200	112,500	170,500
Residual fuel oil do.	164,282	148,348	*183,863	*161,700	176,000
Unspecified do.	13,084	13,437	*18,033	*22,501	35,071
Total do.	<u>525,793</u>	<u>487,600</u>	<u>*561,236</u>	<u>*517,256</u>	<u>*688,571</u>
Silver: Ag content of concentrate and bullion ² kilograms	*3,600	13,321	16,237	15,000	*4,350
Sulfur: Byproduct, hydrocarbons thousand tons	1,378	1,423	1,435	*2,000	2,000
Urea do.	500	500	568	598	*644
Zinc: Zn content of concentrate ²	*700	2,580	2,472	2,475	2,475

*Estimated. *Revised.

¹Table includes data available through July 31, 1993.

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 Sukhaybirat surface mine included since 1991.

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

*Reported figure.

TABLE 2
SAUDI ARABIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	United States	Sources
			Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	85	—	Switzerland 40; United Kingdom 21; unspecified 24.
Metal including alloys:			
Scrap	22,641	46	Bahrain 13,710; United Arab Emirates 2,787; Oman 1,582.
Unwrought	22,657	26	Bahrain 21,385; United Kingdom 280.
Semimanufactures	52,840	16,387	West Germany 10,599; United Kingdom 7,349; Japan 6,289.
Chromium: Oxides and hydroxides	2,293	30	Japan 427; West Germany 423; France 282.
Cobalt: Oxides and hydroxides	1,502	307	Ireland 467; West Germany 296; Belgium-Luxembourg 193.
Columbium and tantalum: Tantalum metal including alloys, all forms	274	271	United Kingdom 2.
Copper:			
Ore and concentrate	2,297	NA	Netherlands 2,217; United Kingdom 32.
Matte and speiss including cement copper	50,153	492	Zambia 31,560; Poland 4,752; U.S.S.R. 2,893.
Metal including alloys:			
Scrap	719	15	West Germany 149; United Kingdom 142; Oman 120.
Unwrought	10,846	254	Oman 4,329; Turkey 1,497; Italy 959.
Semimanufactures	4,955	1,179	Japan 1,091; Belgium-Luxembourg 510; Spain 304.
Gold: Waste and sweepings	value, thousands \$39,372	\$151	Italy \$13,815; United Arab Emirates \$8,899; Singapore \$6,818.
Iron and steel:			
Iron ore and concentrate including roasted pyrite	thousand tons 1,668	(^c)	Brazil 1,226; Australia 110; Sweden 106.
Metal: Semimanufactures:			
Rails and accessories	312	55	China 68; West Germany 54; Hong Kong 51.
Tubes, pipes, fittings	360,260	283,047	Turkey 32,886; Canada 27,216.
Lead:			
Oxides	106	NA	West Germany 11; Canada 5; unspecified 90.
Metal including alloys:			
Scrap	65	NA	Belgium-Luxembourg 20; Singapore 20; West Germany 7.
Semimanufactures	117	NA	West Germany 66; unspecified 50.
Magnesium: Metal including alloys, semimanufactures	389	211	United Kingdom 27; Spain 20.
Manganese:			
Ore and concentrate: Metallurgical grade	345	NA	Thailand 202; United Kingdom 82; unspecified 61.
Oxides	1,901	425	Japan 439; West Germany 176; United Kingdom 107.
Nickel:			
Ore and concentrate	3,349	1,060	United Kingdom 1,900; Sweden 189.
Metal including alloys:			
Scrap	66	1	Japan 48; United Kingdom 14.
Unwrought	53	NA	China 40; unspecified 13.
Semimanufactures	252	50	Italy 109; Spain 33; West Germany 25.
Platinum-group metals: Waste and sweepings	value, thousands \$1,801	NA	United Arab Emirates \$741; Singapore \$368; Thailand \$109.
Silver: Metal including alloys, unwrought and partly wrought	13	NA	Greece 3; India 1; unspecified 8.

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	United States	Sources
			Other (principal)
METALS—Continued			
Tin: Metal including alloys:			
Scrap	145	34	West Germany 72; Malaysia 18; Italy 14.
Unwrought	50	NA	Malaysia 17; United Arab Emirates 8; unspecified 19.
Semimanufactures	413	208	West Germany 47; France 28; Sweden 27.
Tungsten: Metal including alloys, unwrought	25	NA	Japan 8; unspecified 17.
Zinc:			
Oxides	4,744	6	United Arab Emirates 2,366; West Germany 751; Spain 735.
Blue powder	3,932	791	West Germany 763; Czechoslovakia 541; Australia 333.
Metal including alloys:			
Scrap	1,248	NA	Republic of Korea 401; Australia 233; Belgium-Luxembourg 221.
Unwrought	6,765	—	Australia 1,616; Republic of Korea 1,499; Belgium-Luxembourg 904.
Semimanufactures	237	76	Republic of Korea 73; Netherlands 40.
Other: Oxides and hydroxides	7,125	3,537	United Kingdom 1,439; Belgium-Luxembourg 1,039; West Germany 393.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Artificial:			
Corundum	660	NA	Canada 371; Netherlands 100; France 47.
Silicon carbide	43	NA	West Germany 41.
Dust and powder of precious and semiprecious stones including diamond	4	1	Switzerland 2; United Kingdom 1.
Grinding and polishing wheels and stones	5,250	5	Italy 3,922; France 262; Spain 211.
Asbestos, crude	2,005	NA	Brazil 1,238; Canada 420.
Barite and witherite	4,829	47	India 4,420; Netherlands 125; United Kingdom 122.
Boron materials:			
Crude natural borates	108	NA	Belgium-Luxembourg 96; unspecified 12.
Oxides and acids	170,612	6	Morocco 169,854.
Bromine, fluorine, iodine	746	NA	Norway 699; Austria 42.
Cement	242,832	187	Denmark 117,103; Iraq 57,529; United Arab Emirates 43,940.
Clays, crude:			
Bentonite	3,785	—	United Kingdom 3,445; Belgium-Luxembourg 235.
Kaolin	31,876	7,270	India 18,880; United Kingdom 1,596.
Cryolite and chiolite	5,227	729	Austria 1,445; Finland 1,764.
Diamond, natural: Gem, not set or strung ²			
value, thousands	\$2,756	NA	Belgium-Luxembourg \$1,712; Switzerland \$450; Thailand \$334.
Diatomite and other infusorial earth	1,190	301	United Kingdom 329; West Germany 214.
Fertilizer materials:			
Crude, n.e.s.			
	4,209	211	West Germany 3,128; Netherlands 366.
Manufactured:			
Ammonia	2,396	102	Netherlands 1,470; United Kingdom 248; West Germany 207.
Nitrogenous	14,590	269	West Germany 4,649; France 2,307; Belgium-Luxembourg 2,164.
Phosphatic	240,535	1,739	Morocco 88,999; France 37,339; Belgium-Luxembourg 32,884.
Potassic	62,154	18,930	Belgium-Luxembourg 31,296; Italy 5,210; United Kingdom 2,668.
Unspecified and mixed	6,965	252	West Germany 3,680; Spain 1,489; Netherlands 539.

See footnotes at end of table.

TABLE 2—Continued
SAUDI ARABIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1990	United States	Sources
			Other (principal)
INDUSTRIAL MINERALS—Continued			
Graphite, natural	259	NA	France 225; unspecified 34.
Gypsum and plaster	51,876	93	Yemen 48,362; France 1,088; West Germany 851.
Lime	920	NA	United Kingdom 200; unspecified 704.
Mica: Worked including agglomerated splittings	161	31	West Germany 55; United Kingdom 38; Yugoslavia 23.
Phosphates, crude	3,878	—	Netherlands 2,850; Belgium-Luxembourg 1,000.
Pigments, mineral: Iron oxides and hydroxides, processed	51	19	Sweden 16; West Germany 6.
Potassium salts, crude	140	NA	Netherlands 128; unspecified 12.
Precious and semiprecious stones other than diamond, natural	value, thousands \$499	\$125	Thailand \$200; India \$59; Italy \$38.
Pyrite, unroasted	1,106	118	Greece 790; France 83.
Salt and brine	16,739	8,486	Belgium-Luxembourg 2,499; West Germany 2,153; Netherlands 1,860.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	13,637	151	Italy 6,909; Brazil 1,517; France 1,154.
Worked	281,526	376	Italy 168,890; Greece 52,128; Spain 13,297.
Dolomite, chiefly refractory-grade	871	19	United Kingdom 495; Thailand 180.
Gravel and crushed rock	15,108	117	Italy 8,062; Greece 714; Syria 4,368.
Quartz and quartzite	345	42	Belgium-Luxembourg 176; unspecified 111.
Sulfur: Elemental, colloidal, precipitated, sublimed	910	43	United Kingdom 582; Netherlands 76.
Talc, steatite, soapstone, pyrophyllite	281	NA	United Kingdom 161; unspecified 120.
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite and bituminous	4,470	286	West Germany 3,280; Indonesia 635.
Briquets of anthracite and bituminous coal	4,816	472	United Kingdom 4,055; Singapore 84.
Lignite including briquets	2,165	NA	Netherlands 2,014; Japan 43.
Peat including briquets and litter	1,284	—	All from West Germany.
Petroleum refinery products:			
Mineral jelly and wax	42-gallon barrels 2,856	—	United Kingdom 1,360; China 228; Kenya 157.
Unspecified	do. 345,345	108,619	Greece 59,381; United Arab Emirates 31,493; Netherlands 23,828.

NA Not available.

¹Comparable data for exports are not available. Table prepared by Virginia A. Woodson.

²Less than 1/2 unit.

³May include industrial stones.

TABLE 3
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Saudi-Bahraini Cement Co. (Saudi Cement Co., 50%; Saudi stockholders 35%; Gulf Enterprises Co. of Bahrain, 15%)	Ayn Dar, 75 kilometers southwest of Dammam	2,000
Do.	Saudi Cement Co. (Government, 100%)	Al-Hufuf	1,350
Do.	Saudi-Kuwait Cement Co. (Saudi Arabia, 55%; Kuwait, 45%)	Al-Kharsaniyah, 64 kilometers northwest of Jubail	3,000
Do.	Arabian Cement Co. Ltd. (Government, 100%)	Rabigh	1,260
Do.	Southern Province Cement Co. (Government, 100%)	Suq al-Ahad, 10 kilometers northeast of Jizan	1,560
Do.	Yanbu Cement Co. (Government, 100%)	Yanbu	1,460
Do.	Yamama Cement Co. (Government, 100%)	Riyad	2,850
Do.	Qasim Cement Co. (Government, 100%)	Buraydah	1,320
Fertilizer:			
Urea	Al-Jubail Fertilizer Co. (Samad) (Sabic, 50%; Taiwan Fertilizer Corp., 50%)	Jubail	632
Amonia			300
Urea	National Chemical Fertilizer Co. (Ibn al-Baytar) (Sabic, 50%; Safco, 50%)	do.	500
Amonia			500
NPK			500
TSP			200
DAP			100
Liquid fertilizer			10
Urea			Saudi Arabian Fertilizer Co. (Safco) (Saudi Arabian private interests, 100%)
Amonia	200		
Sulfuric acid	100		
Melamine	20		
Gold:			
Ore	General Organization for Petroleum and Mineral Resources (Petromin) (Government, 100%)	Mahd Adh Dhahab, 270 kilometers northeast of Jiddah	200
Metal kilograms			4,300
Gold:			
Ore	The Saudi Company for Precious Metals (Petromin, 50%; Boliden International Mining, 50%)	Sukhaybirat, 480 kilometers northwest of Riyadh	600
Metal kilograms			1,800
Natural gas	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	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 Jubail	110
			20
Petrochemicals:			
Ethylene	Saudi Petrochemical Co. (Sadaf) (Sabic, 50%; Pecten Saudi Arabia, 50%)	Jubail	760
Ethylene dichloride			560
Styrene			360
Industrial ethanol			300
Caustic soda			450
Methanol	National Methanol Co. (Ibn Sina) (Sabic, 50%; Celanese Arabian, 25%; Texas Eastern Arabian, 25%)	Jabail	770
Do.	Saudi Methanol Co. (Al-Razi) (Sabic, 50%; Japan Saudi Arabia Methanol Co., 50%)	do.	1,200

See footnotes at end of table.

TABLE 3—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petrochemicals—Continued:				
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%) Arabian Oil Co. (AOC) (Japan Petroleum Trading Co., 80%; Kuwait, 10%; Saudi Arabia, 10%) Texaco Saudia, Inc. (Neutral Zone production shared by Saudi Arabia and Kuwait)	Eastern Province and offshore Khafji Al Hout Wafra South Fawaris South Umm Gudair	2,900 91 20 (²) (²) (²)
Petroleum products		Saudi Aramco (Government, 100%)	Ras Tanura	530
Do.		Rabigh Petroleum Refining Co. (Samarec, 50%; Petrola, 50%)	Rabigh	325
Do.		Jubail Petroleum Refining Co. (Samarec, 50%; Shell, 50%)	Jubail	295
Do.		Yanbu Petroleum Refining Co. (Samarec, 50%; Mobil, 50%)	Yanbu	300
Do.		Riyadh Oil Refinery Co. (Samarec, 100%)	Riyadh	135
Do.		Jiddah Oil Refinery Co. (Samarec, 100)	Jiddah	105
Steel		Saudi Iron and Steel Co. (Hadeed) (Sabic, 95%)	Jubail	1,800
Do.		Jiddah Steel Rolling Mill (Sulb) (Government, 100%)	Jiddah	243
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.

²This field was severely damaged during the Gulf war and production was not resumed until Mar. 1992.

TABLE 4
**SAUDI ARABIA: RESERVES OF
 MAJOR MINERAL COMMODITIES
 FOR 1992**

Commodity	Reserves
Gold, ore	
20 to 30 grams per ton	¹ 2.1
1 to 7 grams per ton	¹ 18.0
Petroleum million 42-gallon barrels	260,300
Natural gas billion cubic meters	6,500

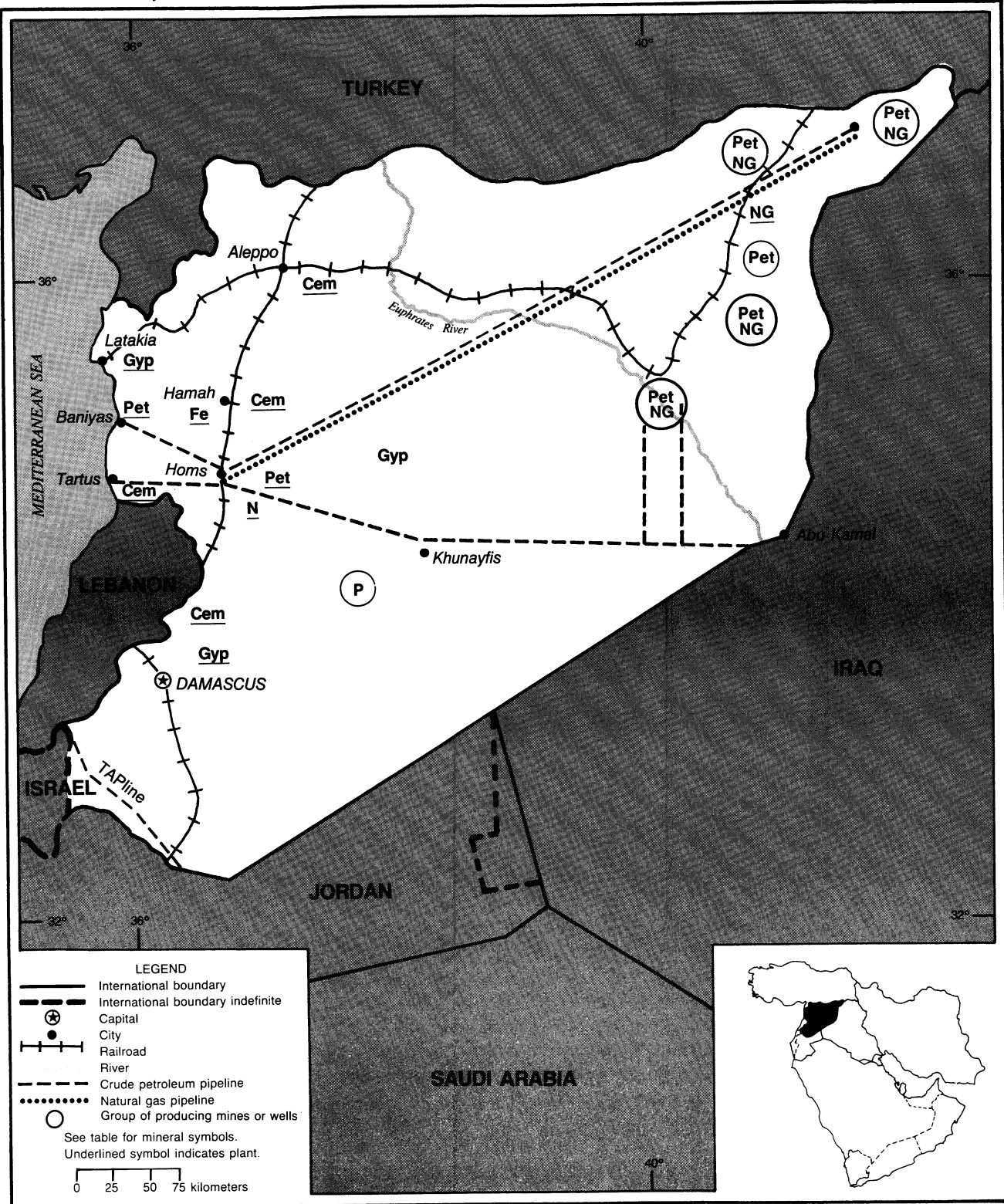
¹Million tons.

Source: Ministry of Petroleum and Mineral Resources.

SYRIA

AREA 185,180 km²

POPULATION 13.7 million



THE MINERAL INDUSTRY OF

SYRIA

By Bernadette Michalski

The mineral industry contributed nearly 20% to the nation's \$30 billion GNP.¹ Oil and natural gas development and marketing increased sharply in recent years, dominating the country's mineral industry. The discovery and development of petroleum fields yielding low-sulfur, light crude oils have improved the balance of payments position. Associated natural gas flaring was reduced to less than one-half of production. The development of nonassociated natural gas deposits in the north and northeast with accompanying gas gathering and processing facilities make it possible to replace fuel oil for the electric power industry, provide a feedstock for the production of ammonia, and eventually to provide natural gas exports to neighboring countries 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

The Ministry of Petroleum and Mineral Resources placed approximately 72,500 km² under exploration and production-sharing agreements with foreign companies. However, the Government controls all mineral exploration and production.

An investment law designed to encourage domestic and foreign private participation by lifting restrictions on foreign-exchange transactions, as well as providing tax and customs concessions, was adopted. Thus, the state should no longer dominate all industry. At present, private investment is for the most part directed toward agricultural and tourism

activities. Early private involvement in the minerals industry can be expected in petrochemicals.

The Government continued to emphasize increasing the utilization of natural gas in domestic energy consumption. This policy will free more oil for export while increasing domestic use of an energy and feedstock source that would be impossible to export beyond neighboring countries without considerable capital investment. Natural gas is expected to account for 30% of total energy consumption in the year 2000. A program for switching power stations and industrial plants to natural gas is well under way. Conversions already completed include the Homs fertilizer plant, which utilizes nearly 300 Mm³/a as feedstock and 157 Mm³/a as fuel, the furnaces at the Homs and Baniyas refineries, and the Tartus cementworks.

PRODUCTION

Crude oil production averaged 530,300 bbl/d in 1992, an increase of more than 60,000 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. Crudes from the northeastern fields, which range between 18° to 25° API gravity, supplied less than one-third of total output.

Production of the nonhydrocarbon minerals has shown 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 between 1989 and 1991. While the revived business activity following the Gulf crisis brought imports to their highest level in 5 years at \$2.77 billion, a trade surplus of \$661 million was reported for the year. All 1991 exports totaled \$3.43 billion, of which \$1.54 billion was derived from crude oil and \$180 million from petroleum products. Total crude oil exports averaged 255,000 bbl/d while product exports averaged 40,000 bbl/d. Shipments to the United States in 1991 totaled 1.59 Mmbl of crude oil. In 1992, shipments were reduced to a total of 1.35 Mmbl of unfinished oils and residual fuel oil. Exports of Syria's other significant mineral, phosphate rock, were reported at 1.17 Mmt in 1992. Europe accounted for 80% of phosphate rock exports.

Presently, Syria imports between 200,000 and 250,000 mt/a of triple super phosphate (TSP). However, the country will become a net exporter of TSP when additional planned capacity is realized. Syria is importing increasing amounts of scrap from neighboring countries for the Hadid Hamah plant's rebar and wire production. Imports in recent years were 35,000 mt/a. Future projections are placed at 50,000 to 65,000 mt/a. Sources for scrap metal, by order of significance, will be Jordan, Lebanon, and Saudi Arabia.

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 Syrian Government. All mining, processing, and distribution companies are Government-operated firms. Hydrocarbon exploration concessions, however, have been granted to foreign companies operating on behalf of the Syrian Government.

The nation's total labor force has been estimated at 2.4 million. The hydrocarbon industry presently employs about 25,000 people.

Law 10, adopted in 1991, provides for mixed private- and public-sector joint ventures that accord the state 25% to 50% ownership, but management is placed in private hands. The objective of Law 10 is to encourage the return of overseas capital for reinvestment. Thus far, only services supporting tourism and to some extent agriculture have been open to private investment. (See table 2.)

COMMODITY REVIEW

Metals

The General Organization of Engineering Industries has awarded a consultancy contract for the construction of an integrated iron and steel plant at Al-Zara near Hamah in east-central Syria. Construction time is projected to take 36 months. 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-mm 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.

Industrial Minerals

Fertilizers.—Contract negotiations for construction of a phosphatic fertilizer

complex at Palmyra were 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 TSP. Arab financing agencies have pledged most of the capital necessary for construction.

The overhauling of the fertilizer complex at Homs was undertaken in 1991 and expected to be completed by 1993. The plans include the conversion of the phosphoric acid and TSP plants to a process that can accommodate low-grade rock. When the Homs complex is overhauled and the Palmyra complex is constructed, Syria will be producing nearly 1 Mmt/a of TSP.

Phosphate Rock.—Production levels have been reduced and surpluses are added to growing stockpiles following 4 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.

Mineral Fuels

Natural Gas.—The Government has put a high priority on increased utilization of natural gas. Production now consists of both associated and nonassociated 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. The Marathon Oil Co.'s discovery of two major natural gas fields in the Palmyra (Tadmur) region, Sharifah (Cherrife) and Ash Shajar (Ash Shaer), with combined reserves of 85 billion m³, encouraged this increased reliance on natural gas.

Universal Oil Products (UOP) of the United States was selected as the consultant and process engineer to assess prospects for converting Syrian power stations from fuel oil to natural gas. Powerplant consumption of natural gas is anticipated at nearly 18 Mm³/d while

industrial plant consumption is expected to reach nearly 4 Mm³/d by 1993.

At the Umar Field, Brown & Root of the United States built a gas treatment plant with a capacity of 4.5 Mm³/d with eventual expansion to 6.8 Mm³/d. Associated natural gas from the field is to be piped to Homs and Damascus to fuel power stations. The Homs link has been completed and will fuel the Mardikh power station converted to gas by the Forney Co. of the United States.

The Al-Furat Petroleum Co. development plans now under way include construction of a natural gas gathering system encompassing the Umar, North Umar, Shahil, Al Isba, and Tanak Fields. When the Sharifah and Ash Shajar Fields are developed, they may be added to the system. A natural gas liquids plant came on-stream near Umar at yearend providing 3.7 Mm³/d of dry gas, which will be piped to the 400-MW Tishrin power station near Damascus.

The Syrian Petroleum Co. accepted bids for a contract to provide engineering and consultancy services for the development of natural gas fields in the Palmyra area. The contract includes creating detailed designs for the project that will involve production of more than 5 Mm³/d of natural gas. Three fields in the area contain sweet natural gas and require only basic production facilities.

The Jubaisseh gas treatment plant is to have its capacity doubled. The project is financed by the Arabian Petroleum Investment Corp. The extension will have the capacity of 1.7 Mm³/d. Plans include the construction of a booster station and 30 km of pipeline to transport the gas from the Homs pipeline junction to Al-Zarah, near Hamah. The gas is planned for use at the steel plant to be built at Al-Zarah. The gas may also be used in the ammonia/urea fertilizer plant planned to be built in Al-Hasakah.

Several projects are under way, 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. Two cementworks will be gas fueled, and the

construction of a natural gas-base fertilizer plant is planned for Homs. Syria is also considering piping natural gas to Lebanon and Turkey.

Petroleum.—The Syrian Government encourages 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. While most of the new exploration activity was centered in east-central Syria near Dayr az-Zawr, concessions were also 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.

British Petroleum, ARCO British, and Enron Oil did not renew their concession licenses in April 1992. By yearend, Repsol Exploration of Spain did not renew its 3-year exploration agreement covering the Al Andalus concession, northeast of Palmyra. Minor amounts of oil were discovered in one of the two wells drilled in the Repsol concession. Another withdrawal was Atlantic Richfield Co. (ARCO) of the United States, which withdrew from the Palmyra concession it shared with Marathon Oil Co., also of the United States. ARCO's withdrawal was attributed to a lack of exploration success after drilling five wells.

New acreage at East Ash Sham was awarded to Tullow Oil of Ireland in April 1992. Shell took over the license relinquished by British Petroleum covering 3,300 km² at Al Jazira.

Elf Aquitaine brought the North Attala Field on-stream in early 1992. The initial recovery was 10,000 bbl/d. The company also reported a probable commercial discovery of 34° API gravity crude oil at Jafra under the Dayr az-Zawr permit.

Crude oil production averaged 530,300 bbl/d in 1992; the Al-Furat Petroleum Co.'s operations accounted for 75% of the output. Daily production for the entire country exceeded the 580,000-bbl/d level by yearend.

Syrian refining policy has begun 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 fall short of domestic consumption requirements. UOP has been engaged to study the options of building a third refinery instead of, or in addition to, upgrading the existing plants. Two new hydrocrackers, one at each of the refineries, are likely to be the focus of the upgrading plan.

Reserves

The Syrian Ministry of Oil, Electricity and Natural Resources had announced changes in hydrocarbon mineral reserves at yearend. Recoverable natural gas reserves were estimated at 225 billion m³, virtually doubling the 113 billion m³ reserve figure announced in 1989. 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. This field covers a 72-km² area with a 260-m-thick oil layer. 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 pipelines include the Iraq Petroleum Co. (IPC) pipeline traversing Syria from east to west. Relationships with Iraq have deteriorated, and the pipeline has been closed for Iraqi use since 1982. Sections of the pipeline have been converted to domestic use. More than 100 km has been converted into a natural gas transmission pipeline 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 at the T-2 pumping station.

In a wet year, Syria can depend on hydroelectric power generation from dams on the Euphrates River. However, dam construction upstream in Turkey will reduce flow rates through the mid-1990's, requiring thermal generating plants to provide a higher percentage of electric power. 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.

The Al Zara power station project has been allocated \$155 million by the Abu Dhabi Fund for Arab Economic Development.

OUTLOOK

Syria's participation in the Gulf coalition ended years of isolation from the Gulf states, gaining the Government substantial financial resources to undertake a wide array of projects to rehabilitate the country's infrastructure and to revitalize ailing state enterprises. The availability of finance has been the direct consequence of Syria's posture during the Gulf crisis. 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 EC is providing about \$210 million, and smaller amounts were pledged by other nations. This surge in aid from Arab neighbors and the passage of less restrictive investment laws have made Syria one of the more active business locations in the Middle East. Industrial production was improved largely because of availability of foreign exchange for inputs and spare parts. Substantial infrastructure and industrial schemes were being set in motion.

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 private sector should continue to benefit from a series of reforms, including an expansion of the list of items the private sector may import, increased use of the free market rate for the Syrian pound in pricing, incentives for manufacturing for export and for exporting, and industrial investment incentives. The discovery of nonassociated natural gas fields and the increased utilization of associated natural gas has prompted the Government to target this fuel as the source for 30% of Syria's energy consumption by the year 2000, thus reducing the demand for fuel oil and increasing refined product export potential.

Bids on a major industrial plant, the Palmyra fertilizer plant, were over budget by \$100 million and in some cases \$500 million. The project seems destined for negotiation and redesign.

Syria's additional output comes at a time when oil prices are depressed, and the sale of additional output is questionable.

Syria's downstream facilities operate at low levels of efficiency and high levels of pollution. Universal Oil Products of the United States is conducting a feasibility study to determine plans for either upgrading the two existing refineries or building a third one.

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 volume of gas feedstock available and its indigenous reserves of phosphate.

Recent economic indicators have reflected the positive effect of large aid

flows during the Gulf crises and the rapid growth in oil production and export. Aside from the several billion dollars in transfers and development aid pledged by Arab states, Syria benefited from increased oil output. The growth in oil revenues is by far the most positive aspect of the Syrian economy. Revenues will continue to grow as more fields come on-stream. The attraction of strong business interest follows improved economic outlook. Industrial and infrastructure schemes are moving ahead with the backing of Arab financing.

¹Where necessary, values have been converted from Syrian pounds (£Syr) to U.S. dollars at the rate of £Syr11.2=US\$1.00.

OTHER SOURCES OF INFORMATION

General Organization for Engineering Industries

Damascus, Syria

Banias Refining Co.

P.O. Box 26

Banias, Syria

Telephone: 238/307

Telex BANREF 470000 SY

General Company of Homs Refinery

P.O. Box 352

Homs, Syria

Telephone: 22771/22768

Telex HRC 441004 SY

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	1988	1989	1990	1991	1992*
Cement, hydraulic thousand tons	3,330	3,501	3,500	3,500	² 3,700
Gas, natural: ²					
Gross million cubic meters	² 2,695	² 2,822	³ 3,750	⁴ 4,000	4,700
Dry do.	² 885	² 900	¹ 1,200	¹ 1,400	2,800
Gypsum	179,000	180,000	175,451	² 200,000	234,432
Iron and steel: Steel, crude ²	70,000	70,000	70,000	70,000	70,000
Natural gas liquids thousand 42-gallon barrels	600	700	750	800	1,800
Nitrogen: N content of ammonia	78,700	122,500	103,600	105,000	105,000
Petroleum:					
Crude thousand 42-gallon barrels	<u>²96,800</u>	<u>130,000</u>	<u>140,000</u>	<u>171,550</u>	<u>193,600</u>
Refinery products:					
Liquefied petroleum gas do.	1,750	1,825	1,900	1,825	1,825
Gasoline do.	8,570	10,950	11,100	9,600	9,600
Naphtha do.	5,000	5,000	5,000	5,000	5,000
Jet fuel do.	3,125	4,000	4,000	4,200	4,200
Kerosene do.	1,460	1,500	1,500	1,500	1,500
Distillate fuel oil do.	21,535	23,700	24,000	24,800	24,800
Residual fuel oil do.	38,490	35,800	36,000	35,700	35,700
Asphalt do.	1,400	1,400	1,400	1,300	1,300
Other do.	1,800	1,700	1,700	1,700	1,700
Total do.	<u>83,130</u>	<u>85,875</u>	<u>86,600</u>	<u>85,625</u>	<u>85,625</u>
Phosphate rock:					
Gross weight thousand tons	2,186	2,256	1,633	1,359	² 1,266
P ₂ O ₅ content do.	715	² 690	² 511	² 425	² 395
Salt	127,000	137,950	127,172	127,000	127,000
Stone, sand and gravel:					
Stone: Dimension, marble cubic meters	17,804	18,000	18,000	18,000	18,000
Sand and gravel thousand tons	8,000	8,000	8,000	8,000	8,000
Sulfur, byproduct of petroleum and natural gas	² 40,000	40,000	29,652	30,000	30,000

*Estimated. ²Revised.

¹Table includes data available through June 30, 1993.

²Reported figure.

TABLE 2
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

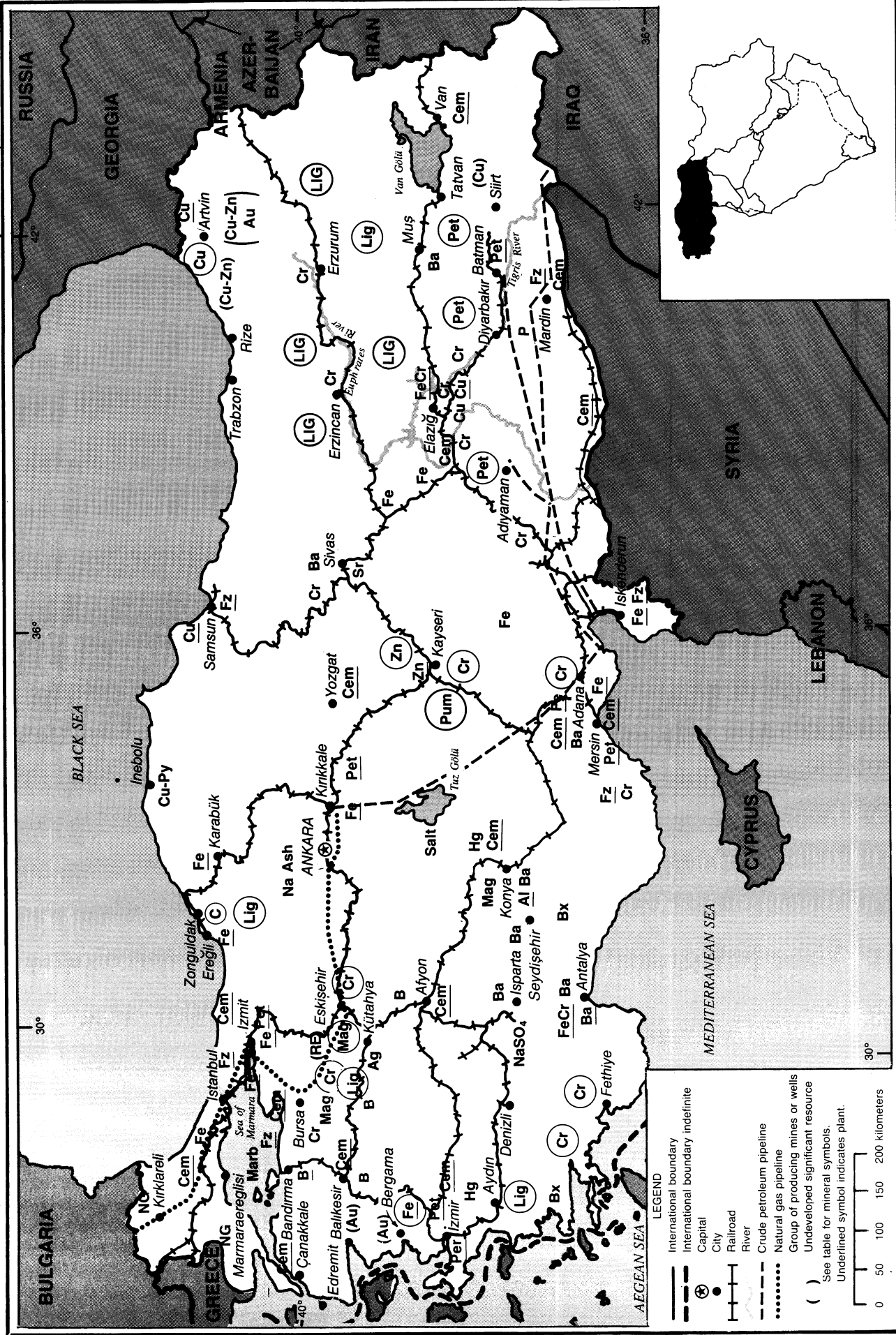
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		General Organization for Cement and Building Materials (Government, 100%)	Tartus	1,655
Do.		do.	Hamah	405
Do.		do.	Musslemieh	300
Do.		do.	Al-Rastan	123
Gypsum		General Organization for Marble and Gypsum (Government, 100%)	Damascus	250
Do.		do.	Latakia	100
Natural gas	million cubic meters	Syrian Petroleum Co. (Government, 100%)	Suwaydiyah plant processing gas from the Karatchuk, Suwaydiyah, and Rumaylah Fields	240
Do.	do.	do.	Jubaisseh plant processing gas from the Jubaisseh, Ghuna, Al-Hol and Markaba Fields	640
Do.	do.	Al-Furat Petroleum Co. (Syrian Petroleum Co., 50%; Shell Pecten Co., 15.625%; Syria Shell Co., 15.625%; and Deminex, 18.75%)	Umar plant processing gas from the Umar, Shahel, Al-Isba, and Tanak Fields	1,565
Petroleum, crude	thousand barrels	Syrian Petroleum Co. (Government, 100%)	Northeastern fields (including Suwaydiyah, Jabisah, Gbebeh, Tichrine, Karatchuk, and Rumaylah)	58,000
Do.	do.	Dayr As-Zawr Petroleum Co. (Syrian Petroleum Co., 50%; Elf Aquitaine, 50%)	North Atalla	5,500
Do.	do.	do.	Mazraa	2,000
Do.	do.	Al-Furat Petroleum Co. (Syrian Petroleum Co., 50%; Shell Pecten Co., 15.625%; Syria Shell Co., 15.625%; and Deminex, 18.75%)	Al-Thayyim, Umar, Al-Ward Maleh, Sijan, Al Isba, Tanak Januf, Younes, Al Ashara, Jido, Al Ahmar, and others	150,000
Petroleum, refined	thousand barrels	Baniyas Refining Co. (Government, 100%)	Baniyas	46,000
Do.	do.	Homs Refining Co. (Government, 100%)	Homs	42,000
Phosphate rock		General Co. for Phosphates and Mines (GECOPHAM)	Khunayfis	400
Do.		do.	Al-Sharqiye Eastern A 20 km south of Khunayfis	600
Do.		do.	Al-Sharqiye Eastern B 26 km southeast of Khunayfis	400
Salt		do.	Dayr az-Zawr	60
Do.		do.	Mine 35 km southeast of Aleppo	100
Steel, rebar and wire		General Co. for Iron and Steel Products (Government, 100%)	Plant 8 km north of Hamah (Hadid Hamah)	130
Sulfur		Baniyas Refining Co. (Government, 100%)	Baniyas	85
Do.		Homs Refining Co. (Government, 100%)	Homs	87
Do.		Syrian Petroleum Co. (Government, 100%)	Suwaydiyah	7
Do.		do.	Jubaisseh	14

TURKEY

AREA 780,580 km²

POPULATION 58.6 million



LEGEND

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

0 50 100 150 200 kilometers

THE MINERAL INDUSTRY OF

TURKEY

By Hendrik G. van Oss

Turkey has a large and diverse mineral industry, much of which was adversely affected in 1992 by the continuing world recession and mineral commodity glut. Primary mineral output and revenues during the year in general were lower than those in 1991, especially in the primary metallic mineral sector. The secondary or value-added mineral commodity sector fared better; this sector has for many years generated far greater revenues than the primary mineral sector. Secondary mineral output in 1992 largely was higher than that in 1991, markedly so in cement and steel. Revenues, however, were mitigated by depressed world prices.

Official Government data for 1992 show a GDP for the country of about \$154.5 billion,¹ about 3% higher than that in 1991. The primary mineral sector ("mining and quarrying") is credited with accounting for just 1.7% of GDP, about the same as in previous years. However, this understates the mineral industry's contribution to the economy because the secondary mineral sector is lumped with the manufacturing sector in terms of basic economic data. Although complete data were unavailable, domestic sales of primary and secondary mineral commodities were estimated at about \$20 billion, equivalent to almost 13% of GDP. Of these sales, refined petroleum products alone are estimated to have amounted to \$12 billion. Total mineral commodity exports amounted to about \$2.7 billion and accounted for about 18% of the country's total exports. Mineral commodity imports are estimated to have been worth about \$8.8 billion in 1992 and accounted for about 40% of total imports.

Turkey produces a wide variety of metallic, nonmetallic, and energy minerals; this diversity reflects the

extreme complexity of the country's geology. The country is best known for its industrial minerals. Turkey has been second only to the United States in boron mineral output and was one of the top producers of strontium minerals and natural abrasives (emery and pumice). The country remained a major producer of barite, feldspar, limestone, magnesite, marble, perlite, and soda ash. Among secondary industrial mineral commodities, Turkey was a major world producer of refined boron chemicals, cement, ceramics, and glass. Although famous in ancient times for its production of metals, notably copper, gold, and mercury, in more recent years the country has been a major world producer only of chromite and mercury. However, although Turkey ranked among the top chromite producers in 1992, it recorded no mercury output for the year. In terms of secondary metallic mineral commodities, Turkey in 1992 was a major regional, and significant world, producer of ferrochromium and steel. Although the country has not been known for its energy minerals, it was in fact a significant producer of lignite.

Data from 1990 suggest that Turkey still had more than 800 mining establishments and about 3,000 mines in 1992, although with depressed markets and inflation-driven production cost increases it is likely that a significant number of these operations were idle during all or part of the year. The overwhelming majority of Turkish mines, including many in the public sector, are small by world standards. Despite this, the cumulative Turkish production of several commodities was significant.

Turkey has extensive primary and secondary mineral trade with many regions of the world. Its once major trade

with the Middle East, particularly Persian Gulf countries, has declined in recent years largely because of the Gulf War and related trade sanctions against Iraq. However, for some commodities, particularly steel, this decline has been offset by large sales to Asia. Turkey is an Associate Member of the EC and has structured many of its trading practices and investment regulations in accord with those of the EC. Import tariff reductions are being implemented to meet the requirements of Turkey's achieving full customs union with the EC in 1995. Turkey has had much trade in recent years with the former U.S.S.R., and much of this continued in 1992—particularly with Russia. Longstanding ethnic and cultural ties to the former Soviet Turkic republics were seen as an advantage to Turkey's establishing close economic links with these new countries, as well as with other countries along the Black Sea. To this end, a Black Sea Economic Cooperation Zone was created in 1991 and at least two meetings were held in 1992 among the member countries (Turkey, Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Russia, Romania, and Ukraine). Apart from trade, Turkish parastatal and private companies were actively pursuing mining investment opportunities in the region.

Capacity expansion projects were under way at many of Turkey's secondary mineral production facilities, particularly those in the private sector. The Government's extensive involvement throughout the country's industrial sector was being reduced through privatization, but progress in this regard was uneven. Complete or partial sales of Government holdings in several cement, petrochemical, and steel companies were made during the year. Government

holdings in the primary mineral sector remained largely unaffected, however.

GOVERNMENT POLICIES AND PROGRAMS

Active Government participation in mining dates to 1935 when Etibank, the first of several large parastatal mineral commodities companies, was formed. Government involvement peaked in the late 1970's when a number of mines, most notably boron, were nationalized. Since then, some properties (but not boron) have been returned to the private sector. 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 in terms of factors such as taxation and access to exploration permits. Expansion and refining of mining regulations was done in the form of a 1991 draft for a new mining law, but this was shelved when the present Government was elected late that year. The new Government appointed its own committee to draft a new mining law, but this work had not been completed by yearend 1992.

Apart from the 1985 mining law, the Government enacted a number of programs during the 1980's to encourage industrial growth and to promote exports. The policies included import tariffs, export incentives, and high levels of Government spending, particularly in the construction sector. These policies largely succeeded, but also led to a high level of inflation and of public debt—problems that have not significantly abated since. One outcome has been a dramatic increase in wages in both the public and private sectors, commonly negotiated only after lengthy work stoppages. The labor cost increases, together with other inflation-related cost rises, have forced many Turkish industries to raise their prices. The effort to contain price increases to maintain export

competitiveness has hurt profits for many industries, in that the price increases have not kept pace with increased costs.

Industrial growth, particularly that of exports, also has been hurt by political changes in the region, most notably the 1990-91 Gulf War. Furthermore, export subsidies and import tariff protection for Turkish producers have been reduced in recent years in response to pressure largely from Turkey's EC trading partners.

A major burden on the Turkish economy has been the high level of Government borrowing and spending to maintain the large parastatal corporations. The societal importance of these parastatals is high, given that they employ a total of about 650,000 workers and support an estimated 1.5 million dependents. Nevertheless, about 70% of these corporations reportedly have become unprofitable and all are considered to be overstaffed. The total parastatal payroll was reported to have been 130% of the companies' net value added in 1991, compared with about 35% in 1988. Public-sector losses in 1991, the most recent year for which data were available, totaled more than \$2.6 billion. Under pressure from international lending institutions, the Government, in 1989, began to institute a privatization program. But, by yearend 1992, 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. Privatization has been conducted through the intermediate transfer of Government shares to the Public Participation Fund Administration (PPFA), which may then sell the shares on the İstanbul stock exchange and/or seek direct purchases by foreign or domestic corporations. Although the İstanbul stock exchange has been one of Europe's most active, demand for shares on the exchange has been erratic, and high share prices for the parastatals have frequently been difficult to sustain. One explanation for the disappointing performance is Turkey's high inflation rate (about 60% in 1992); for many small investors, higher rates of

return (about 5% over inflation) can be obtained from bank deposits.

Turkey's industrial expansion in the 1980's and the rapid growth of some cities had led to a heightened public awareness of environmental issues. Of particular concern has been the severe air pollution resulting from the widespread use of lignite both for domestic heating and for electricity generation. The lack of adequate sewage treatment facilities for several large cities has also been an issue. Although a number of environmental regulations have been passed, the strict enforcement of environmental regulations by the Ministry of the Environment has, until recently, been erratic. 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. Loans have been obtained for sewage-treatment projects.

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, and certain existing plants have even been mooted for closure. To meet the anticipated electricity demands without additional lignite plants, the Government has proceeded with plans to build additional hydroelectric power facilities and also has revived plans to build one or more nuclear powerplants. Loans were being sought to meet the anticipated huge costs of these projects.

Environmental issues were also regional factors in Turkey's foreign economic relations. In the near future, a number of large new natural gas and crude oil fields were expected to be developed in Kazakhstan and other landlocked Turkic republics. The problem has been the choice of routes by which these fuels would be exported. The shortest routes are through Georgia to the Black Sea, or through Iran. Turkey opposes the Georgia-Black Sea option

because it would necessitate transit of the Bosphorus (and the Dardanelles) by supertankers. Both of these passages are extremely narrow, congested, and difficult to navigate, and the Bosphorus is straddled by İstanbul, a historic city of more than 10 million inhabitants. Oil spills or other shipping hazard from major tanker transits pose an unacceptable risk under these conditions. Turkey, instead, proposes an export route for the fuels via pipeline through Azerbaijan and/or Armenia and Iran and thence through Turkey to the Mediterranean port of Yumurtalık. A linkage could be made under this scenario with the existing pipeline from Iraq to this port. 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 route are the initial cost of a longer pipeline and the apparent political instability of the regions to be transited, but the latter could impact negatively the other options as well.

On a more local environmental scale, in 1991 and 1992 there was strong local public opposition to the proposed use of cyanide in the gold-recovery circuits at two advanced gold projects along the Aegean coast. Permitting delays were being experienced in 1992 by both projects, notwithstanding formal approval of the mines' engineering and operating plans by the Ministry of Energy and Natural Resources. There was some speculation that the permitting delays were partly political; a parastatal silver mine that opened in 1987 in the same general region has faced no opposition even though it too uses cyanide. It was hoped that any new mining law would clarify the environmental requirements to obtain mining permits.

PRODUCTION

Turkey produces a wide variety of primary and secondary mineral commodities (*see table 1*). Output of metallic minerals in 1992 was generally lower than that in 1991, especially for minerals destined for export. Chromite

production was especially affected by world oversupply and low prices; ferrochromium output remained well below capacity as well. Antimony production was likewise affected. Turkey's mercury mines closed in 1991 and remained closed throughout 1992, again because of low world prices. Bauxite and alumina production fell, evidently because of adequate stockpiles at the country's sole aluminum smelter; metal output from the latter increased modestly.

Although domestic copper demand was healthy, copper ore production fell significantly, owing to the depletion of ore reserves and declining grades. Blister copper production, which is entirely by parastatal companies and is partly based on imported concentrates, declined only slightly, notwithstanding that only one of the country's three smelters was in operation during the year. Refined copper production, on the other hand, was entirely by private-sector facilities and increased significantly. Output was based on both domestic and imported blister and/or anode and reflected ongoing expansion projects. Most Turkish base metals ores, especially of copper, contain significant gold and silver credits; these are ultimately recovered in Europe from Turkish refinery tankhouse slimes. Output, therefore, largely mirrors that of refined copper and, to a lesser extent, zinc. An estimate of the gold content of Turkish tankhouse slimes is made, for the first time, in table 1. Turkey's output of lead and zinc ores declined owing to depletion of reserves.

Domestic, and to a lesser extent, export demand for steel was strong in 1992. Production of steel rose because of this trend and as a result of ongoing capacity expansion programs at many of the country's steel mills. Iron ore output also increased, but to a lesser extent.

Output of Turkey's major industrial minerals generally showed increases in 1992. Emery output increased significantly, responding to strong export demand. Barite production rebounded somewhat from the low output level of 1991, but still was restrained by poor demand by the domestic and international

petroleum exploration drilling industries. Continued strong domestic and export demand, coupled with facility expansion at several mills, allowed cement production to set another record. Feldspar production increased dramatically, possibly reflecting the attainment of full production capacity at a nephelene syenite mine at Uludağ, near Bursa. The mine had started trial production in 1989. Perlite production rose significantly because of strong demand from the country's building materials sector. Phosphate rock production, which showed a substantial decline in 1991 compared with that of 1990, reportedly rose significantly in 1992 owing to the reorganization of the country's sole phosphate mine. Pumice output returned to 1989 levels, but this evidently reflected new domestic demand in the construction sector. Pumice exports actually fell 5%.

Production of boron minerals declined insignificantly, reflecting stagnant world demand for fiberglass. Although data may be incomplete, there appears to have been a major decline in kaolin production in 1992. This may reflect a reduced level of output of ceramics, as evidenced by a decline in crude glass output, which commonly mirrors ceramic production trends. Magnesite production fell slightly, probably reflecting a decrease in demand for furnace brick on the international rather than the domestic market. Pyrite production, largely associated with copper mining, declined significantly, evidently associated with problems in the copper sector. Also in 1992, competition from Spain caused the reduction of Turkey's export-driven output of strontium (celestite).

With the exception of coal, primary energy mineral production in Turkey declined modestly in 1992. Refined petroleum products output increased, however, owing to capacity expansion projects at the country's refineries.

TRADE

Turkey's trade in mineral commodities has been extensive, reflecting both the needs of the diverse Turkish industrial and agricultural sectors and the fact that

the country has served as an entrepôt for other countries in the region. In 1992, total exports were reported at \$14.8 billion and total imports were worth about \$22.8 billion. Exports of mineral commodities totaled about \$2.7 billion, an increase of about 8% from the level in 1991. Total imports of mineral commodities rose about 10% in 1992 to about \$8.8 billion.

Mineral commodity exports were dominated in value by secondary or value-added products. Highest in value were exports of steel, which increased almost 8% to \$1.56 billion in 1992. The increase was largely the result of very high demand from Taiwan, China, and the Republic of Korea. Sales to East Asia in 1992 more than replaced the lost sales to traditional Middle East customers resulting from the Gulf War. Sales to Iran, traditionally a major customer, declined significantly owing to the growth of the steel industry in that country. Exports of glass and ceramics increased 11% to \$395 million, largely due to increased demand from European customers. Exports of crude oil apparently were nil during the year as a result of decreased production and the increased feed demand of the Turkish refineries. Increased domestic demand for refined petroleum products reduced exports of these commodities by almost 30% to about \$198 million. Cement exports increased 25% in 1992 to \$139 million because of production capacity increases at a number of mills and because of recent sales of parastatal cement plants to European cement companies; 48% of cement exports in 1992 were to European customers.

In contrast to the strong performance of value-added mineral commodities aforementioned, exports of other mineral commodities fared poorly in 1992 compared with exports in 1991. Exports of these commodities declined by an estimated 2.2% to about \$418 million, largely because of the world recession and a glut of many commodities on the world market. The most important decline was in crude borate minerals exports, which fell by 11% to \$121 million. However, the decline may have

been due to increased domestic processing; exports of refined borates increased by 39% to \$58 million and exports of boric acid rose 66% to \$11.6 million. In line with reduced demand by the international oil exploration drilling industry, barite exports in 1992 fell by 73% to \$2.7 million, and bentonite clay exports fell by 12% to \$1.6 million. Celestite (strontium) exports declined by 45% to \$2.7 million, owing to the main customer relying more on its own mine in Spain. The world chromium market remained severely depressed in 1992, both because of modest demand for stainless steel and because of world mine and smelter overcapacity. Turkish chromite exports fell 35% to \$32.6 million, and, although ferrochrome exports increased slightly by weight, in value they fell 6% to \$45.1 million. Magnesite exports fell 7.5% to \$38 million, largely because of reduced demand for furnace brick. Pumice exports declined yet again, by 5% to \$11 million, as a result of a continuing decline in demand for stone-washed clothing.

Most other mineral commodity exports were of relatively low value and of only modest cumulative importance. Of the more significant minerals showing export increases, the most important was marble (block and slab), exports of which increased slightly to \$42 million. Feldspar exports in 1992 rose 21% to \$6.3 million, largely reflecting a large increase in production. Notwithstanding some shortage of local copper ore feed for the country's largest smelter, Turkish exports of copper ores and concentrates increased more than eightfold to \$12 million. Bauxite exports were worth about \$1.9 million, a 23.5% increase. The bauxite was of chemical and/or refractory grade, and its sales were thus unaffected by the world aluminum glut. Exports of clays other than bentonite rose 26% to \$3.8 million. Exports of perlite increased by 38% to \$3 million. Emery exports increased by 89% to \$1.2 million.

Detailed data were unavailable for Turkish mineral commodity imports in 1992, but, compared with 1991 trade, imports appear to have increased overall by about 10% to almost \$9 billion total.

Much of the increase was due to greater imports of crude petroleum. Lower prices mitigated the 9.5% volume increase in crude petroleum imports; the value increased just 7% to \$2.63 billion. Data on total refined petroleum products imports in 1992 varied between \$490 million and \$559 million, or about 15% lower than comparable data for 1991. The data reflected high domestic demand for petroleum products, which was met by the expanded capacity at Turkish refineries through the increased imports of crude petroleum.

Turkey continued to develop its natural gas pipeline grid, and natural gas imports for it in 1992 increased 22% to \$305 million compared with imports in 1991. In contrast, coal imports fell 32% to \$262 million, largely because of an increased use of domestic coking coal by the steel industry. A rising domestic construction market led to a 5% increase in steel imports to \$2.1 billion. Various data sources show that steel scrap imports for the country's expanding steel sector increased about 10%, although estimates of the value of the imports ranged from about \$440 million to almost \$500 million. Imports of iron ore, in contrast, declined by 16% in response to increased domestic production. The imports were worth about \$40 million.

Gold imports continued to respond to liberalized trading laws. Gold imports in 1992 increased by 23% in mass, but declined in value by 17% to about \$1.53 billion because of lower world prices. Most of the gold was fabricated into jewelry, and much of this was exported. Aluminum imports fell 1% in value during the year to \$206 million in response to a decline in the world price and a modest increase in domestic production. Imports of refined copper fell 19% to \$144 million, largely because of increased domestic output. Total metallic ore imports in 1991, including iron ore, fell 28% to \$81 million. Presumably, the increased domestic fertilizer output in 1992 accounted for the reported 15% decline during the year, to \$344 million, of imports of manufactured fertilizers and of ammonia and phosphoric acid. Partly offsetting increased exports, imports of

glass and ceramics increased by 8% to \$196 million. Cement imports declined by almost 16% to \$18 million as a result of a major increase in domestic output.

Few mineral-specific trade data for 1991 or 1992 were available in terms of Turkey's trading partners. Eastern Asia replaced the Middle East as largest destination for Turkish steel. The EC was the other main destination. The United States traditionally has been the largest customer for Turkish ferrochromium, but European and Asian countries purchased most of the chromite. Turkey exported cement mainly to European and other countries rimming the Mediterranean. Glass and ceramics exports were exported mostly to the EC. Boron ores and chemicals traditionally have been exported to a variety of European and North American customers and to Japan.

Saudi Arabia reportedly supplied 56% of Turkey's total crude petroleum imports. Other major suppliers to Turkey were Libya, the United Arab Emirates, and Iran. Turkey was the United States' second largest customer for steel scrap in 1992, taking 22% of total U.S. exports. This material made up almost 45% of total Turkish steel scrap imports in 1992, and the rest was obtained mostly from Europe. Steel imports other than scrap were from various western and eastern European sources and from the United States. Iron ore was imported from a variety of sources, and coal was imported from Australia, the United States, Canada, and the Republic of South Africa. Turkey imported all of its natural gas from Russia, but LPG imports were from a variety of Middle East and north Africa sources.

Traditionally, Turkey has provided transit services for Middle East products, especially petroleum. The volume of this trade declined drastically, largely because of the continued sanctions-related closure of the oil pipeline from Iraq to Yumurtalık, 46 km southeast of Adana. Oil carried by this twin pipeline in 1990 prior to closure was 340 Mbbbl, about 55% of capacity. No oil was carried by this pipeline in 1991 or 1992. Other transit services, largely by truck, also have declined because of continued

instability in the region.

STRUCTURE OF THE MINERAL INDUSTRY

Despite progress in privatization, several sectors of the Turkish minerals industry remained dominated by large, state-owned conglomerates, whereas other sectors were dominated by or had significant private company representation (see table 2). The parastatal corporations tended to have many thousands of employees each and were generally considered to be overstaffed, but the actual operations controlled by the parastatals also included a large number of very small operations. Private companies 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. Commodities particularly affected include antimony, asbestos, 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 (39 private), 22 steel mills, and a number of independent base metals refineries, glass factories, and fertilizer plants.

In the mining sector, the main state-owned corporations in 1992 were Etibank, Türkiye Kömür İşletmeleri (TKİ), Türkiye Taşkömürü Kurumu (TTK), Türkiye Demir ve Çelik İşletmeleri (TDÇİ), and Türkiye Petrolleri Anonim Ortaklığı (TPAO). These, and to a lesser degree a few other parastatals, are major players in the Turkish mineral industry.

The various subsidiaries of Etibank dominate or produce the country's entire output of aluminum, boron minerals and

chemicals, blister copper, ferrochrome, mercury, and zinc. Etibank is the largest chromite producer in Turkey but its output is less than that of the overall private sector. Etibank's sales accounted for about 2% of all mineral commodities sales, 9% of all mineral commodity exports, and almost 70% of primary mineral exports. Turkish hard coal mining is all by TTK, and about 70% of total lignite output is accounted for by TKİ. Using 1990 data, sales by these two corporations were 34% of total Turkish primary minerals sales and about 45% of all parastatal-produced primary mineral sales. 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 41% of total steel output in 1992. About 70% of Turkey's total output crude petroleum, all of its natural gas, and almost all of its refined petroleum products were produced by TPAO. Until recently, cement production had been dominated by the parastatal Türkiye Çimento ve Toprak Sanayii T.A.Ş. (ÇİTOSAN), but by yearend 1992, privatization had reduced its sectoral share to less than 10%.

Although there have been some retrenchments, employment levels in the primary mineral sector in 1992 were probably not very much below 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 1992 were not available but, undoubtedly, wages were higher, perhaps by about 50%, 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. Some of its services have been available for hire to the private sector. Prior to the 1985 mining law, MTA had first refusal rights for all exploration concessions in Turkey, but it now must bid on such concessions on an equal basis with domestic and foreign exploration companies.

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. In 1992, the capacity of the reduction plant was 60,000 mt/a and that of the alumina refinery's capacity about 200,000 mt/a. The excess alumina capacity allows significant production for export. Given the fact that metal output capacity was adequate to meet only about 40% to 45% of Turkish demand, and given the plant's excess alumina and 20,000-mt/a excess rolling capacity, 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. Accordingly, in 1992 Etibank sought a joint-venture partner for the project. If a partner could be found, a final decision on the expansion project was expected late in 1993.

Chromite.—Poor demand and a severe glut of both metallurgical and refractory chromite and ferrochromium on the world market made 1992 a rough year for the Turkish chromite producers. At least one major private-sector producer, Bilfer Madencilik A.Ş., reported that all of its mines were shut during the year, and, reportedly, at least some other private-sector companies may have been in a similar position. Ege Metal Endüstri A.Ş., another major private-sector producer, was reported to have reduced output in 1992 to only 50% of capacity. Several companies, citing dumping of ferrochromium by Russia, Ukraine, and Kazakhstan, reportedly were applying to the Government for assistance, largely through export credits. Overall production of chromite in Turkey fell drastically during the year, and exports fell 32% to 444,000 tons. Exports were entirely by the private sector; Etibank's own production since 1990 has been entirely consumed by its ferrochromium smelters. Turkish consumption of ferrochromium was 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.

Under the prevailing market conditions, plans, announced in 1990, by a joint venture of Ege Metal and several Republic of Korea companies to build a new chromite mine and a ferrochromium smelter in the Bursa region apparently have been temporarily put in abeyance. Instead, toward yearend 1992, the company signed an agreement to supply chromite to the ferrochromium smelter operated by Coleraine Mining Resources Inc. in Canada.

Etibank remained Turkey's largest chromite producer and was the only producer of ferrochromium. Output from the company's new ferrochromium furnaces at Elazığ increased slightly, but was still well-below capacity. Exports of ferrochromium in 1992 increased slightly to 74,156 tons, but the value of these exports fell. The United States continued to be the main customer. Etibank, together with MTA, continued to evaluate

the resources of the Karsanti deposit, a very large, low-grade chromite deposit north of Adana, but little optimism was expressed for the economics of a future mine there.

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. Copper ore output by KBİ in 1992 was 97% of the country's total. KBİ's Samsun smelter was the only operating copper smelter in the country in 1992. This was the result of Etibank's 1991 closure of its own smelter at Ergani owing to depletion of copper ore reserves. Copper concentrate feed for Samsun comes mainly from KBİ mines and concentrators in the Murgul district near Artvin, but 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, some is used to make sulfuric acid for use by the smelter, and the remainder is sold to fertilizer producers for acid production.

Blister copper production is entirely in the public sector but, except for about 4,000-mt/a capacity installed at the parastatal Makina ve Kimya Endüstrisi Kurumu (MKEK), all copper refining is in the private sector. Turkey's total refining capacity in 1992 was 170,000 mt/a. Sarkuysan Elektrotik Bakır Sanayii ve Tic. A.Ş. had 41% of this. Sarkuysan, the country's largest copper refiner, had recently expanded its capacity from 45,000 mt/a to the current 70,000 mt/a. Sarkuysan meets about 60% of its blister or anode requirements through imports; the other companies are almost totally import-dependent for their feed.

Engineering work, including plant site preparation, was under way at the Çayeli copper-zinc-silver deposit, 23 km northeast of Rize. A decision to proceed with development of an underground mine had been made in 1991, and 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%. Lurgi Metallurgie GmbH of Germany has the turnkey contract for the mill, construction of which was to commence in early 1993. Other work planned for 1993 included the ramp decline and the construction of Cu-Zn concentrate shiploading facilities at Rize. 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 possibly be extended through the delineation of additional reserves. At yearend 1992, no decision had yet been made as to where the concentrates would be toll smelted, although there was the possibility that some of the copper concentrates would be smelted at KBI's Samsun facility.

Cominco Resources International Ltd. of Canada was planning a production decision in early 1993 on its Cereteppe copper property in the outskirts of Artvin. The decision would be based on the results of drilling programs in 1991 and 1992; the 1992 drilling program was reported by the company to have increased the reserves by one-third over those at yearend 1991. Environmental and metallurgical studies commenced in 1992. Cominco announced that, late in the year, additional copper mineralization was intercepted by a single drill hole about 500 m north of Cereteppe. The newly discovered area of mineralization, termed the Kardelen zone, was to be further drilled in 1993. The company also was exploring other areas in the region for massive sulfide base metals (and precious metals) deposits.

All of Turkey's slab zinc production is by the Etibank subsidiary Çinko-Kurşun Metal Sanayi A.Ş. (ÇINKUR), which operates an electrolytic plant near Kayseri. The facility also produces lead concentrates and cadmium metal. The plant is set up to handle oxide and carbonate ores only. According to ÇINKUR, ore production capacity in

1992 was about 50,000 mt/a, from 10 mines mostly in the Yahyalı and Niğde areas, about 70 km south and 100 km southwest of Kayseri, respectively. Typically, ÇINKUR also purchases 35,000 to 40,000 mt/a of ore from private-sector mines in the same regions. Although the company claimed more than 10 years of oxide ore reserves, there were reports that much of the better material was running out. Accordingly, the company was evaluating a project to build a concentrator and a lead-zinc smelter to handle its more abundant sulfide resources.

Gold and Silver.—Turkey was a famous producer of gold and silver in ancient times but in recent decades has had only very limited primary gold production, all on an artisanal scale. Formal mine production of silver commenced in 1987. For the past 20 years, however, Turkey has exported tankhouse slimes from base metals refineries for the recovery of precious metals or has received credit for precious metals in smelter products. Turkish copper ores, for example, typically contain 1 to 2 g/mt of gold and 30 g/mt silver, and copper concentrates typically contain twice these values. Given the tenfold to twentyfold increase in the copper grade of concentrate above that in the ore, it is evident that significant precious metals values are being lost in the concentration process. It is possible that the missing precious metals are in pyrite, which is used to make sulfuric acid, but is not smelted in Turkey for its copper content (about 1%). Turkish blister copper typically grades about 12 g/mt gold (range 5 to 20 g/mt) and 230 g/mt silver (range 150 to 300 g/mt); some imported copper anode or blister contains even higher values.

To date, recovery of precious metals from refinery slimes has been done in Europe rather than in Turkey because of the lack of Turkish facilities. However, with the liberalization of Turkish import restrictions on gold, attendant increase 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 were exploring for gold in Turkey during the year, and two prospects were being permitted for mining. Most of the exploration was in the Aegean and southeastern Black Sea coastal regions.

Preliminary site preparation was ongoing at midyear at the Ovacık (Dikili) gold deposit, about 12 km west-southwest of Bergama. The operating company was 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 was to be a combination open pit-underground operation, exploiting two auriferous quartz-adularia-calcite veins. The company envisioned mining at a rate of about 300,000 mt/a and the use of carbon-in-pulp (CIP) processing to produce about 3,100 kg/a of gold in doré. The project received its operating license from the Ministry of Energy and Natural Resources during the year. However, the startup of mining was being delayed by the Ministry of the Environment in response to organized local public opposition to the mine's proposed use of cyanide, notwithstanding the closed-circuit system recovery system.

Similar permitting delays were being experienced by Tüprağ Madencilik Ticaret ve Ltd. Şti., a subsidiary of Gencor of the Republic of South Africa, for its proposed gold mine on 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 and would recover doré with a CIP circuit. Reserves were adequate for 6 to 8 years of ore production to support an annual output of about 3,100 kg/a doré, grading about 33% gold and 67% silver. Tüprağ was actively exploring other properties in the region.

Cominco continued to explore three gold properties about 70 km southwest of Artvin and reported encouraging preliminary results on precious and base metals property southwest of Trabzon.

Except for silver credits in base metals concentrates, smelter, and refinery

products as aforementioned, Turkish silver production in 1992 was all from Etibank's Aktepe (Gümüşköy) Mine, about 20 km west of Kütahya. Run-of-mine ore output was reported as 620,000 tons in 1992 and silver recovered as 77,187 kg; both were about twice the output in 1991.

Iron and Steel.—The Turkish steel industry continued to be one of the most dynamic in the world, recording a 9.6% production increase for the year in 1992—a year in which many steel companies elsewhere recorded output declines. In 1992, Turkey ranked 9th in Europe and 17th in the world in crude steel output. The performance in 1992 was a continuation of the rapid growth seen through much of the 1980's, which was stimulated by the Government's direct export subsidies, preferred rates for electricity, import tariffs, and massive spending on domestic building construction. However, the percentage increase in 1992 was higher than it would have been had there not been an estimated 0.3 Mmt of lost production in 1991 owing to work stoppages. No strikes were experienced in 1992. The effect of labor unrest notwithstanding, total steel output has more than doubled since 1985 and has more than quadrupled since 1980. Although many of the export and electricity subsidies and import tariffs have since been removed, capacity expansion projects completed or ongoing at most of the steel mills have continued to have a positive effect on production levels.

Most of the growth in the Turkish steel sector since 1980 was based on the proliferation and expansion of electric arc steel minimills, virtually all of which are now in the private sector. Expansion projects are ongoing, too, at the country's integrated steel mills, but have yet to have a major effect because of the longer completion times required.

The Turkish steel sector has been more affected by regional political developments than have most other sectors of the economy. With the breakup of the U.S.S.R. and political changes in Eastern Europe, a flood of inexpensive

rebar and other construction steel has been forthcoming from these countries. This material has provided strong competition at times for Turkish steel on both the domestic construction and export markets. 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. The ease of startup of electric arc mills has allowed previous customers such as Iran to rapidly increase their own steel production capacities and so reduce imports from Turkey. Turkish Government export subsidies for steel have attracted increasing complaints from the EC, and the Government has been forced to reduce or eliminate the subsidies to keep the country on track to customs union with the EC in 1995. The export competitiveness of Turkish steel has been further hurt by rapid wage and other cost escalation; costs have increased significantly faster than steel prices. An increasingly important cost factor has been the price of high-quality steel scrap. Turkey produces no direct-reduced iron and, accordingly, all of the electric arc steel production, and 15% to 20% of that from the integrated steelworks, requires scrap feed. But with more electric arc steel mills being established in Europe and elsewhere, competition and hence prices for ferrous scrap have increased. Furthermore, Turkish electric arc producers must pay higher scrap transportation costs than most of their competitors in Europe. Despite these problems, the Turkish steel companies, especially the minimills, were able to take advantage of the rapid growth of the east Asian market, particularly in China, Taiwan, and the Republic of Korea. Sales to this region in 1992 more than made up for reduced exports to the Middle East and the EC.

In 1992, there were 3 integrated steel mills and 19 electric arc minimills in production. Two of the integrated mills, İskenderun and Karabük, were operated by the parastatal TDÇİ, and the third by Erdemir, a partially private company. The integrated plants' performance in 1992 was disappointing. At İskenderun,

output declined slightly to 1.778 Mmt, and at Karabük, production fell by 6% to 0.651 Mmt. Erdemir's production declined by almost 8% to 1.714 Mmt. The decline at Erdemir was especially significant because it is Turkey's only producer of steel flat products.

Rapidly rising costs at TDÇİ's mills and at its Divriği and Hekimhan iron mines forced the company to raise steel prices several times during the year. Despite this and worker retrenchments, the company expected large losses for the year. It was hoped that losses would be reversed with the completion of factory expansion at both of the mills. At İskenderun, it was planned to modernize and/or expand virtually every part of the old Soviet-designed facility. By the end of the 1990's, TDÇİ expected to have increased the hot-metal capacity at İskenderun to 3.5 Mmt/a (3.25 Mmt crude steel) and the rolling mill capacity to 2.6 Mmt/a. A thin slab continuous casting and cold-rolling plant was also being considered. The capacity of the wire rod mill at İskenderun is to be expanded from 500,000 mt/a to 700,000 mt/a. At Karabük, a new casting machine and ladle furnace were to be installed and the blast furnace modernized. Liquid metal capacity was to be increased to 1.1 Mmt/a by 1994. A major cost problem for Karabük continued to be coal. The plant obtained more than 60% of its coking coal requirements from TTK's mines at Zonguldak, but this coal was of relatively poor quality and added to the company's energy costs. The remainder was imported material, railed in at high cost from İskenderun. A Black Sea coal port was planned for the company to reduce coal transport costs.

Erdemir continued to benefit from its position as Turkey's sole producer of flat products and of tinplate, and remained profitable despite its fall in output. Erdemir, too, was in the process of a major modernization and capacity expansion program. Aspects of this process evidently interfered with routine production during the year. The expansion program has involved virtually every facet of Erdemir's production line and port infrastructure. Projected for

completion in 1995, the expansion project should increase the company's output capacity for flats by 50% to 3 Mmt/a. A new basic oxygen furnace will eliminate the current 0.4 Mmt/a excess rolling capacity and should thus obviate the slab imports. Once the current expansion program is completed, Erdemir was planning a feasibility study for a second expansion program to further double capacity.

In contrast to the decline in integrated steel mill output, total production by the electric arc minimills increased in 1992 by 22% to 6.11 Mmt. Only one plant recorded a production decrease for the year. Most of the increase in output was attributed to the recent and ongoing facility expansion programs at many of the minimills. But 1992 also saw the return to production, albeit late in the year, and only of 136,000 tons, of Metaş İzmir Metalurji Fabrikası T.A.Ş., a plant that had been idle since 1990 for financial reasons. However, its rolling mill did resume production for a brief period in 1991. The new 450,000-mt/a-capacity furnace for Sivas Demir-Çelik İşletmeleri A.Ş. came on-stream in 1992, several months late. The company had hitherto only operated its 320,000-mt/a rolling mill, which started up in late 1989. The company, because of its location (Sivas), suffered from exceptionally high transportation costs for scrap; deliveries were aggravated by severe winter conditions. Output for the year was only 18,000 tons.

Because of the growth of the private-sector minimills, all of which have, to date, produced only long products, a severe products imbalance has developed in the country. The strong demand for flat products, largely due to increased sales of automobiles and major appliances, has been the justification for the expansion program at Erdemir, but also has led TDÇİ and at least one minimill, Çukurova, to consider installing thin slab continuous casters. Work was continuing at Borçelik, a new cold-rolling mill to come on-stream in 1994. The plant's output will be of flats.

The increase in electric arc steel mill output in 1992 obscured the fact that

many of the companies had lower-than-expected revenues in 1992 and 1991 and were finding it difficult to service the considerable debts incurred through their expansion programs. The financial difficulties resulted from rapidly increasing costs, including losses of export subsidies, and low world prices. Wage-related cost increases were significant but controllable through retrenchments. Electricity costs were a major source of concern, especially given the fact that all of the minimills were alternating current facilities. But at least one company, Diler Demir Çelik Endüstri ve Tic. A.Ş., was planning to build a new direct current arc mill, which would be cheaper to operate.

Industrial Minerals

Cement.—The Turkish cement industry had a record output in 1992, bolstered by strong domestic and export markets and expansion programs at a number of the facilities. In recent years there has been a major population shift from rural areas to cities, particularly those along the Aegean and Marmara coasts. The resulting demand for housing has been a boon to the cement (and steel) producers in those regions, and more than one-half of the country's 46 cement plants were in these areas. Overall demand for cement was forecasted by the Government to increase by about 1 Mmt/a through the year 2000, at which time Turkey's consumption was projected to be about 34 Mmt/a and production capacity to be slightly in excess of 37 Mmt. Production capacity in 1992 totaled 31.9 Mmt. For several years, there has been a geographic supply imbalance owing to inadequacies in the country's transportation infrastructure. This led to high levels of imports in some areas. But with the recent increases in production capacities at mills in the high-demand areas, imports have been dramatically reduced and the country has had a large net surplus of cement for export. Imports of cement in 1992 amounted to only 230,700 tons and clinker imports amounted to only about 245,500 tons.

Total cement plus clinker imports in 1991 amounted to 582,500 tons. Total cement plus clinker exports increased by 27% in 1992 to 4.27 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 16 plants during 1992, and these had a combined clinker-grinding capacity of 4.5 Mmt, only 17.5% of the country's total. By yearend, six of these plants had been sold, leaving ÇİTOSAN in operational control of only 2.4 Mmt of clinker-grinding capacity—about 9% of the country's total.

Initial privatization of ÇİTOSAN cement mills took place in 1989 with the sale of five plants. The sales were fiercely contested in court, owing to the fact that the first sales were made directly to a foreign company (Ciments Français) and not to the Turkish public as the law required. The sales were ruled invalid, but finally, in late 1992, were allowed to stand following appeals by the Government. Following the resolution of this problem, a further 11 ÇİTOSAN mills were transferred to the PPFA for privatization. The sale of six of the plants near yearend, surprisingly, was to Turkish companies rather than to major international cement companies as had been expected. Yibitaş Holdings bought Çorum Çimento and Sivas Çimento, Rumeli Holding bought Gaziantep Çimento and Trabzon Çimento, Modern Çimento bought Denizli Çimento, and a joint venture headed by the Sabancı Group bought İskenderun Çimento. The combined grinding capacity of these plants was 3.2 Mmt.

Fluorite.—Taneks Foreign Trade Inc. reportedly commenced production in October of metallurgical- and chemical-grade fluorite from a deposit about 50 km west of Elazığ. The operation's processing plant has a capacity of 24,000 mt/a of concentrate, and reserves were reported to be 500,000 tons of contained fluorite. Most of the output, which was to

reach full capacity in 1993, was to be exported.

Magnesite.—The PFFA announced that it would be privatizing the ÇİTOSAN subsidiary KÜMAŞ Kütahya Manyezit İşletmeleri A.Ş. The facility has been the largest producer of dead-burned magnesite in the country.

Mineral Fuels

Coal.—Although lignite deposits are found and exploited all over Turkey, hard coal reserves, mostly of subbituminous coal, 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.

On March 3 there was a methane explosion at the İncirharmani coal mine at Kozlu near Zonguldak. The accident, which killed 262 miners, was reportedly the worst mining disaster in Turkish history.

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 declined slightly in 1992. 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. The gas was first used to augment the domestic feed for the Hamitabat powerplant. In 1988, as the pipeline was extended, gas was used as feedstock for a fertilizer plant near İstanbul, for a powerplant nearby, and for domestic heating purposes in Ankara. Industries in Ankara began using the gas in 1989. Natural gas only began to be used for domestic heating purposes in İstanbul in early 1992. 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.

A major goal of using natural gas is to reduce the use of lignite for power generation and for domestic heating. This fuel substitution will reduce the level of air pollution, which has been especially severe over several cities in the winter. Winter air pollution has decreased dramatically in Ankara since natural gas use commenced, and similar benefits have been anticipated for other cities. The existing import pipeline will be inadequate to supply all of the planned future users although the Government reportedly reached agreement with Russia to increase imports, starting in 1996, to 8 billion m³/a. Imports in 1992 amounted to 4.44 billion m³. Negotiations also were being conducted to import gas into eastern Anatolia from Azerbaijan, Iran, Russia, and Turkmenistan. In addition, work was under way to build a 57-Mm³/a LNG terminal at Marmaraereğlisi to receive Algerian and Libyan gas. The terminal would feed the existing gas pipeline and was expected to be operational late in 1993.

Petroleum.—The largest oil producer in Turkey in 1992 continued to be the parastatal Türkiye Petrolleri Anonim Ortaklığı (TPAO). Output by this company amounted to 74% of the country's total production. The largest private-sector producer was N.V. Turkse Shell, accounting for 16% of the country's total output. Most of Turkey's production was from fields near Adıyaman, Batman, and Diyarbakır. A number of Turkish petroleum refineries were undergoing expansion projects during the year.

Most oil exploration activity in Turkey was in southeast Anatolia, although activities in some parts of that region continued to be hampered by civil unrest. According to Petrol İşleri, there were 5 Turkish and 28 foreign companies conducting oil exploration in 1992. The number of holes drilled declined 21% during 1992 and amounted to 42 wells, of which 9 had been spudded in 1991 and all but 11 of which had been completed by yearend 1992. TPAO drilled 22 of the

wells. Two discoveries were announced, both by TPAO; one was on a lease jointly held with Arco. Both discoveries were in southeast Anatolia. BP and TPAO were evaluating almost 5,000 line-km (each) of seismic and airborne gravity and magnetics surveys conducted early in the year over their joint offshore exploration license covering the southeast Black Sea.

Reserves

Turkey's mineral inventory is diverse and is hosted in a very large number of deposits, most 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 ore, 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 out of date and difficult to evaluate under present economic conditions. Most of the data appear to be simply mineral inventories, not necessarily having been subject to economic evaluation. For this reason, the "reserves" for some deposits or even at some mines may represent material that is physically recoverable rather than economically minable, and thus should be viewed as resources rather than reserves. Further, exploration work on a given deposit, whether by drilling or by drifting underground, has commonly been limited to very shallow depths. In this respect, the work has been geared to the labor-intensive, nonmechanized mining methods traditionally used rather than to large-scale mechanized mining. The aforementioned notwithstanding, the mineral inventories have formed the basis of hundreds of mines, some operated by only a few miners on a part-time basis,

and others operated at fairly large scale. But in recent years, many of these mines, particularly the smaller private operations, have closed because of rapidly increasing labor and other costs. As the parastatal corporations are privatized, it remains to be seen how many of their operations will pass economic reevaluation. 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. The ore is exported. The country's sole alumina refinery and reduction plant is fed by the Mortaş and Doğanlı bauxite mines. These have remaining bauxite reserves of 6 Mmt and 6.1 Mmt, respectively, both 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. Most Turkish chromite deposits are of the podiform type, but MTA has been drilling a very large, low-grade stratiform deposit in the Karsantı (Aladağ) district, about 50 km north of Adana. The deposit has a resource, according to MTA, of about 86 Mmt grading 5.4% Cr₂O₃. Lesser amounts of higher grade material exist within this inventory. Exploitation of this deposit envisions an open pit mine with a captive ferrochromium smelter. The economics of such a project have yet to be demonstrated.

The Çayeli copper-zinc massive sulfide ore body at yearend 1992 reportedly contained 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 1992, the Ceretepe copper deposit was reported to have proven plus probable reserves of 1.2 Mmt grading 10% copper, plus other resources of lower grade material including a possible resource of 1 Mmt grading 3 g/mt gold and 150 g/mt silver. Reserves (all classes) claimed by KBI for mines under its control total about 34 Mmt grading 1% to 4% Cu. ÇINKUR claims 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 1992 market conditions and production for the year was nil.

Proven plus probable minable reserves as of yearend 1992 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 has 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 lists estimated reserves of 2.45 billion tons. Etibank's proven and probable reserves at Bigadiç, Emet, Kestelek, and Kırka total in excess of 300 Mmt grading 27% to 40% B₂O₃. 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 reserves have not been defined for the country. Similarly, Turkey's limestone reserves are immense but not well defined. Perlite and pumice reserves 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. Output from the mine in recent years has been first or second in the world.

Turkey's known resources of petroleum and natural gas are not large by world standards. The Government has speculated that the country's ultimate recoverable petroleum reserves may amount to about 2 billion bbl, but the reserves 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. According to the Petrol İşleri, recoverable petroleum reserves at yearend 1992 were 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. Road transport of minerals is slow and is generally by 10- to 30-ton trucks. Road transport is greatly hindered by the country's mountainous terrain and severe winter snows. Turkey has 8,401 km of railroads, all 1.435-m standard gauge. In 1992, Turkish trains carried about 15.7 Mmt of freight, including about 9.6 Mmt of ores and mine supplies, about 2.4 Mbbl of refined petroleum products, and 373,000 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 47.3 Mbbl of crude petroleum in 1992. The Yumurtalık-Iraq pipeline carried no crude petroleum in 1992 or 1991 in line with the 1990 UN sanctions against Iraq. 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. There are plans for extensions of the pipeline grid,

in the near-term west from Bursa to Çanakkale and then south to İzmir, and from İzmit to Ereğli.

Turkey has many ports capable of handling mineral commodity shipments. Refined petroleum products are handled at many Turkish 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.

Although detailed data for 1992 were unavailable, Turkish ports handled almost 280 Mbbl of oil, 21 Mmt of construction materials, 9.3 Mmt of coal, and 8.2 Mmt of other minerals during the year. About 44% of the oil and 30% of the other mineral commodities shipments were coastal trade; the remainder represented international trade.

Turkish electrical output totaled 68,205 GW·h in 1992, of which 61% was from thermal plants and the rest from hydroelectric facilities. Of the thermal powerplant output, lignite-fired plants accounted for 52%; natural gas, 26%; fuel oil, 12%; and hard coal, 10%. In 1991, the latest year for which data were available, the major industrial electricity consumers were the iron and steel industry, which consumed 5,105 GW·h; the chemical industry, with 4,435 GW·h; the ceramics and cement industries, which consumed a total of 4,212 GW·h; and the nonferrous basic metals industries, with 2,669 GW·h. The coal and lignite mines consumed 765 GW·h, and the other mines a total of 501 GW·h. Total electrical generating capacity in 1991 was 17,206 MW, of

which about 59% 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 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. Four of the eight turbines at the Atatürk Dam had been installed by yearend 1992. 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. It is likely that some of the new plants will instead be designed for natural gas, but such use will require a significant expansion of the country's natural gas distribution network. In 1992, the Government began considering again the construction of one or more nuclear powerplants; such projects had been shelved a decade previously.

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. High levels of public and private borrowing have fueled the expansion programs, and the servicing of debt is anticipated to be a significant burden to future economic growth. Turkey's high inflation rate has led to a rapid escalation of wage and other production costs throughout the industrial sector. For many industries, particularly the steel sector, competition from inexpensive foreign products has meant that prices for Turkish production were administratively held below the inflation rate. Accordingly, profits and the ability to service debts have declined. Dumping by eastern European countries and members of the former U.S.S.R., together with the

world economic recession, have led to a glut of many mineral commodities on the world market and attendant low commodity prices. Both factors have hurt Turkish mineral commodity exports and have led to 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 anticipating closer relations with the EC, but the economic policies required to further this relationship have proved burdensome for Turkish industries. Turkey is actively pursuing trade and other investment opportunities in the nearby Turkic republics and throughout the Middle East. But although numerous agreements have been signed already, it is as yet unclear how successful these ventures will be. Political instability and severe fiscal and infrastructural problems throughout the region make these ventures uncertain, at least in the short term.

The Government is progressing with its privatization program, which already has had significant results in the cement and, to a lesser extent, in the steel sectors, and which will eventually affect the petroleum and petrochemical sectors. Privatization of the more purely mining parastatals is less certain, given the perception that many of the operations therein are uneconomic. Although privatization is expected to lead to significant worker retrenchments, and perhaps the closure of some operations, the sales are seen as a way to reduce the public debt. Also, it is expected that private investment will lead to much-needed capital improvements at some facilities.

The prospects for growth in the mineral commodities sector are greatest in the value-added industries. Despite rising costs, the Turkish steel industry, particularly the private sector, has shown itself very resilient so far in finding new customers when regional political developments have ruined traditional markets. Profits, however, have suffered from low world steel prices and increasing costs for steel scrap feed. The industry faces severe competition on the export market. If the domestic construction boom declines through

Government efforts to curb spending, long-term growth of the steel sector could be severely jeopardized. The cement industry faces a similar future on the domestic market, but appears reasonably certain of healthy exports to southern Europe because of environmental and other cost constraints on the European cement producers. Output of most primary minerals will continue to be largely export-driven and will depend on world demand. The future of the Turkish chromite mining and ferrochromium industry is particularly bleak 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. Gold production is poised to increase significantly, pending issuance of environmental permits to mine at two locations on the Aegean coast. 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, but the aforementioned, and any new, gold projects are also threatened.

¹Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL6,872=US\$1.00. The average exchange rate in 1991 was TL4,172=US\$1.00.

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

OTHER SOURCES OF INFORMATION

Agencies

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Publications

Etibank Annual Report.
General Directorate of Petroleum Works:
Petroleum Activities, annual.

State Institute of Statistics:

Monthly Bulletin of Statistics.

Statistical Yearbook of Turkey, annual.

Mining Statistics, annual.

**Turkish Petroleum Corporation Annual
Report.**

TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992 ²
METALS					
Aluminum:					
Bauxite ²	269,437	⁵ 534,273	⁷ 772,673	³ 488,640	419,872
Alumina:					
Gross weight	181,657	200,560	177,144	159,091	156,474
Al content	94,699	104,552	92,746	83,290	81,570
Metal, smelter	56,692	61,776	60,903	⁵ 55,821	58,550
Antimony:					
Ore, mine output:					
Gross weight	42,640	30,023	⁸ 8,997	⁵ 5,565	5,065
Sb content	1,877	1,471	⁵ 552	³ 370	309
Concentrates:					
Gross weight	2,303	1,607	613	³ 394	³ 355
Sb content	1,370	1,035	³ 367	² 236	² 213
Regulus	62	5	⁸ 84	—	—
Cadmium	22	54	46	² 22	23
Chromite:					
Gross weight (34% to 43% chromic oxide)	1,157,075	1,608,043	¹ 1,204,691	¹ 1,381,633	758,732
Salable product	851,425	¹ 1,076,834	⁸ 835,704	² 940,000	531,112
Copper:					
Mine output (exclusive of pyrite):					
Gross weight	3,135,661	3,468,288	⁴ 4,018,506	3,942,254	3,158,674
Cu content of ore	37,746	38,151	³ 39,825	⁴ 40,000	³ 32,000
Cu content of pyrite ³	³ 1,946	2,360	¹ 1,000	⁹ 920	620
Concentrates (exclusive of pyrite):					
Gross weight	167,701	166,833	¹ 179,429	¹ 178,719	143,196
Cu content	28,509	30,364	³ 33,499	² 33,100	² 26,500
Metal:					
Smelter output	12,910	² 25,015	² 25,167	³ 32,401	31,568
Refined ⁴	⁶ 68,400	86,400	84,200	⁸ 80,800	93,500
Gold, byproduct of base metals refining ⁵ ⁴ kilograms	820	1,040	1,010	970	1,120
Iron and steel:					
Iron ore:					
Gross weight thousand tons	5,481	4,518	⁴ 4,925	5,335	5,917
Fe content do.	2,983	2,453	² 2,689	² 2,900	³ 3,200
Metal:					
Pig iron and ferroalloys:					
Ferchromium	54,030	59,715	62,040	⁸ 84,641	85,755
Ferrosilicon	5,200	4,970	5,225	¹ 1,736	1,250
Pig iron and other ferroalloys thousand tons	4,462	3,523	4,827	4,594	4,508
Steel, crude including castings do.	⁷ 7,983	7,934	⁹ 9,322	⁹ 9,335	10,253
Lead:					
Mine output, Pb and Pb-Zn ores:					
Gross weight	286,269	345,051	³ 397,765	³ 323,164	233,944
Pb content	10,212	14,147	¹ 18,371	¹ 15,317	¹ 10,800

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992 ²
METALS—Continued					
Lead—Continued:					
Concentrates:					
Gross weight	37,332	43,721	*34,153	*40,000	*28,000
Pb content	9,396	10,591	*10,678	*10,000	*7,000
Metal, refined ³	11,000	7,000	9,000	8,500	9,000
Manganese ore, gross weight ⁴	—	—	—	*500	*500
Mercury kilograms	97,359	197,364	59,650	*25,119	—
Silver, mine output, ⁵ Ag content ⁶ do.	*38,600	*49,400	*52,500	*63,800	103,000
Tungsten, W content of concentrate	125	—	—	—	—
Zinc:					
Mine output, Zn and Pb-Zn ore:					
Gross weight	387,844	446,616	*450,185	*367,163	*320,000
Zn content	37,494	39,412	*39,066	*32,546	*27,500
Concentrates:					
Gross weight	44,639	69,856	*41,650	*40,000	*35,000
Zn content	14,418	18,707	*15,717	*13,000	*12,000
Metal, smelter, primary	22,476	24,170	20,063	*17,370	18,770
INDUSTRIAL MINERALS					
Abrasives, natural: Emery	12,267	11,299	*10,828	*24,018	41,474
Asbestos:					
Run of mine	1,296	—	—	—	—
Fiber	*50	—	—	—	—
Barite, run of mine	405,017	425,519	*366,995	*250,579	311,335
Boron minerals:					
Run of mine	*2,045,041	*1,983,050	2,062,758	1,815,177	1,802,175
Concentrates	*1,247,601	*1,174,520	1,252,591	*1,117,483	1,058,885
Calcium carbide	34,100	38,000	38,050	19,500	*19,000
Cement, hydraulic thousand tons	22,675	23,796	24,416	*26,091	28,607
Clays:					
Bentonite	80,218	93,256	*97,464	*123,928	123,516
Kaolin	204,478	238,251	*251,182	*186,517	134,416
Other	368,241	379,311	*463,560	*750,000	*750,000
Feldspar, run of mine	82,225	84,932	*182,266	*229,543	464,736
Fluorspar	13,240	*13,000	*10,000	*5,000	3,074
Glass, crude thousand tons	933	986	1,156	1,127	1,171
Graphite	12,911	11,873	*18,712	*25,867	20,978
Gypsum, other than that for cement	231,218	213,731	*171,518	*307,246	278,402
Lime ⁷ thousand tons	*1,382	*1,432	*1,407	*1,581	1,582
Magnesite, crude ore	1,125,844	1,343,893	*845,124	*1,365,287	1,224,900
Meerschaum ⁸ kilograms	6,450	10,350	*4,000	2,800	1,050
Nitrogen: N content of ammonia	*308,582	379,697	373,287	*356,574	*375,000
Perlite, run of mine	154,231	132,941	*138,510	*87,994	280,883
Phosphate rock (salable product)	74,230	84,810	86,788	*3,630	*30,000
Pumice ⁹	1,470,675	753,745	*438,276	*447,476	736,316

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992 ²	
INDUSTRIAL MINERALS—Continued						
Pyrites, cupreous, gross weight	176,964	214,434	¹ 145,510	¹ 133,600	89,000	
Salt, NaCl, all types	thousand tons	1,358	1,739	¹ 1,889	1,440	1,418
Silica sand, washed product	do.	438	495	¹ 469	¹ 358	¹ 510
Sodium compounds, n.e.s.:						
Soda ash (trona) [*]	do.	379	381	385	385	385
Sulfate, concentrates		79,427	68,183	¹ 110,273	¹ 115,000	75,058
Stone:						
Dolomite		262,773	323,136	¹ 184,155	² 288,728	255,310
Limestone, other than for cement	thousand tons	⁴ 680	3,742	⁴ 221	³ 940	6,937
Marble [*]	do.	² 20	¹ 95	¹ 70	³ 00	550
Quartzite		885,059	571,980	⁹ 96,680	¹ 1,000,000	1,310,259
Strontium minerals: Celestite:						
Run of mine		89,000	137,000	117,000	105,000	59,000
Concentrates		55,800	86,375	73,790	70,000	37,940
Sulfates, n.e.s.: Aluminum sulfate (alunite)		11,173	3,919	¹ 14,077	¹ 19,826	9,278
Sulfur:						
Native, other than Frasch		30,030	² 2,960	19,550	² 2,300	² 1,000
S content of pyrites		75,387	95,852	⁶ 4,643	¹ 59,000	40,000
Byproduct:						
Petroleum		15,684	13,166	13,547	¹ 6,910	16,861
Other [*]		5,000	49,000	7,000	5,000	5,000
Total[*]		<u>126,101</u>	<u>¹180,978</u>	<u>¹104,740</u>	<u>¹103,210</u>	<u>82,861</u>
Talc		5,397	6,280	⁵ 557	⁶ 122	3,918
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural		624,113	415,456	270,238	¹ 260,000	249,535
Carbon black [*]		31,955	32,000	25,000	30,000	35,000
Coal:						
Hard coal	thousand tons	6,688	6,259	⁵ 629	⁵ 209	5,225
Lignite	do.	39,025	52,567	⁴ 6,892	⁴ 9,727	50,439
Coke and semicoke	do.	³ 414	³ 039	3,435	³ 381	3,257
Gas:						
Natural, marketed	thousand cubic meters	99,167	173,822	212,488	202,713	197,796
Coal, manufactured	do.	104,583	71,565	39,644	43,046	38,789
Petroleum:						
Crude ¹⁰	thousand 42-gallon barrels	<u>18,360</u>	<u>20,596</u>	<u>26,614</u>	<u>31,875</u>	<u>30,656</u>
Refinery products:						
Liquefied petroleum gas	do.	8,029	7,770	7,845	⁷ 742	7,755
Gasoline	do.	19,204	19,869	22,291	² 2,466	23,846
Naphtha	do.	15,278	13,185	12,455	⁹ 497	10,558
Jet fuel	do.	4,505	4,373	4,951	¹ 4,431	5,495
Kerosene	do.	3,902	2,691	1,293	¹ 1,137	1,125
Distillate fuel oil ¹¹	do.	49,489	46,167	49,071	⁴ 7,717	49,570
Lubricants	do.	1,726	1,833	1,976	¹ 1,803	1,985
Residual fuel oil	do.	61,214	54,483	56,516	⁵ 6,920	57,705
Asphalt	do.	3,993	2,583	4,368	⁵ 280	5,657

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992 ²
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum—Continued						
Refinery products—Continued						
Refinery fuel and losses	do.	'5,120	'5,072	'4,814	'4,912	5,686
Unspecified	do.	780	1,054	961	505	1,321
Total	do.	'173,240	'159,080	'166,541	'164,410	170,703

¹Estimated. ²Preliminary. ³Revised.

⁴Table includes data available through Oct. 8, 1993. Large quantities of construction materials (clay, sand and gravel) are quarried, as are limestone and gypsum for cement manufacture. Information is inadequate to make accurate estimates of output levels.

⁵Data 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.

⁶Reported figure.

⁷Data are estimated content of Turkish copper refinery tankhouse slimes.

⁸Does 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 %.

⁹Includes content of base metals refinery tankhouse slimes.

¹⁰Data are lime produced for steel production and do not include the widespread artisanal production of lime for whitewash and for sanitation purposes.

¹¹Data are based on reported units of 50-kilogram boxes.

¹²Turkish 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.

¹³Data are reported in metric tons and have been converted to barrels using 7.161 bbl/mt.

¹⁴Diesel fuel and special heating oil.

TABLE 2
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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 south-west 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.	Elmadağ, 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.	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%)	18 plants	10,310 cement.
Chromium:			
Chromite ores and concentrates	Etibank Şark Kromları İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Mines at Güleman, 80 kilometers southeast of Elazığ	150 lump ore, 70 concentrate.
Do.	Etibank Üçköprü Maden İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	8 mines in Göcek District, near Fethiye	15 lump ore, 30 concentrate.
Do.	Birlik Madencilik Ticaret ve Sanayi A.Ş.	Kayseri	240 lump ore.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners ^{1 2}	Location of main facilities	Annual capacity
Chromium—Continued:			
Do.	Akpaş Madencilik ve Paz. ve Ticaret A.Ş.	Mines at Erzurum, Erzincan, and Kayseri	200 lump ore, 70 concentrate.
Do.	Bilfer Madencilik A.Ş.	Mines at Kayseri and Sivas	100 lump ore, 45 concentrate. ⁵
Do.	Türk Maadin 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	56 lump ore.
Do.	Egemetal Madencilik A.Ş.	Mines at Bursa, Mersin, Eskişehir, and Erzurum	35 lump ore, 40 concentrate.
Do.	Pinar Madencilik ve Turizm A.Ş.	Mines at Kayseri and Adana	25 lump ore, 14 concentrate.
Do.	Akdeniz Madencilik Ticaret ve Sanayi A.Ş.	Adana	25 lump ore.*
Do.	Other (9) private producers	Mines at Köyceğiz, Bursa, Adana, İskenderun, Eskişehir	114 lump ore, 12 concentrate.
Ferrochrome	Etibank Elazığ Ferrokrom İşletmesi (Etibank, 100%)	Ferrochrome plant at 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.*
Do.	do.	Open pit Kutular 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.	do.	70 refined copper.
Do.	Er-Bakır Elektrolitik Bakır Mam. A.Ş.	Denizli	18 refined copper.
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.*

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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—Continued:				
Steel	Türkiye Demir ve Çelik İşletmeleri Genel Müdürlüğü (TDÇİ) (Government, 100%)	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.	İzmit	650 crude steel, 1,050 semifinished steel.	
Do.	Çukurova Çelik Endüstrisi A.Ş.	Aliğa, 40 kilometers north-northeast of İzmir	2,000 semifinished steel.	
Do.	Diler Demir Çelik Endüstri ve Ticaret A.Ş.	İzmit	312 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)	550 semifinished steel.	
Do.	Habaş Sinai ve Tibbi Gazlar İstihsal Endüstrisi A.Ş.	Aliğa	570 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 southeast of İstanbul	420 semifinished steel.	
Do.	Metaş İzmir Metalurji Fabrikası T.A.Ş.	İzmir	450 special and semi-finished 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.
Do.	Etibank Konya Çıva İşletmesi (Etibank, 100%)	Mine at Sarayönü, 47 kilometers north of Konya	100 mercury.	
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. Türkse 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 İzmir	70,000 crude input.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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—Continued:			
Refined petroleum thousand 42-gallon barrels	Türkiye Petrol Rafinerileri A.Ş. (TÜPRAŞ) (Government, ³ 100%)	Refinery at İzmit	91,000 crude input.
Do.	do.	OAR refinery at Kırıkkale	35,000 crude input.
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.	Hamitabat Field in Thrace	205,000.*
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.

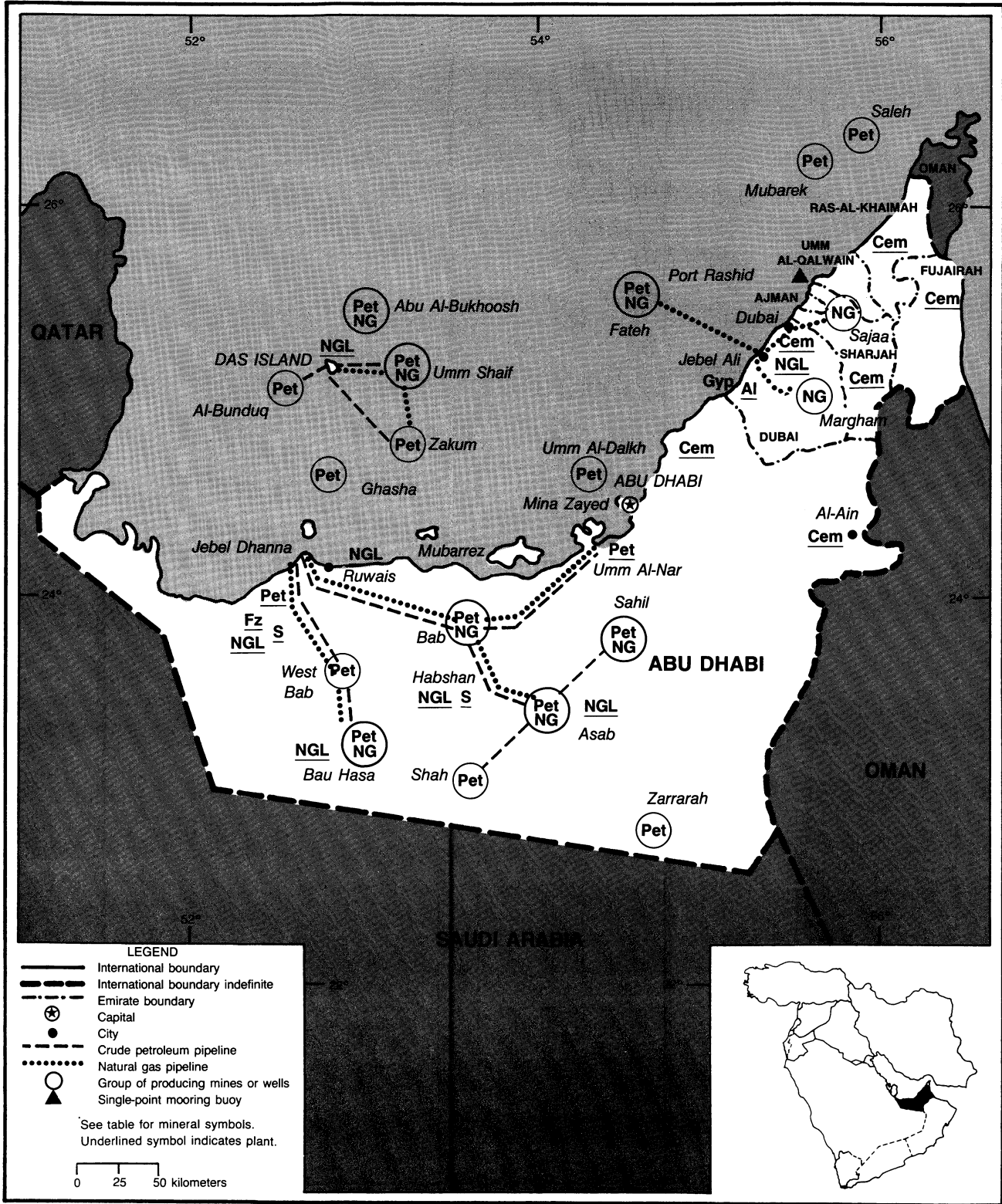
⁴ÇİTOSAN operated all plants in 1992, but 11 were held by the PPFA for privatization and 6 of these had been sold at yearend.

⁵Facilities were idle in 1992.

UNITED ARAB EMIRATES

AREA 83,000 km²

POPULATION 2.5 million



THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES

By George A. Morgan

The production of crude petroleum and natural gas was the most important sector of the country's mineral industry and the economy in 1992. Crude oil output was down slightly because the country brought production quotas in line with those of other Middle East producers. Aluminum metal, ammonia, and cement were also significant in terms of production volume and export earnings. Crude petroleum and natural gas contributed \$16.2 billion to the economy in 1990, the latest year detailed data were available, compared with a GDP of \$34.8 billion.

Following the Gulf War in 1991, building construction and infrastructure projects increased sharply. Total road reconstruction was about \$270 million. The cost of steel and cement was reported to have increased 25% and 30%, respectively, by early 1993.

GOVERNMENT POLICIES AND PROGRAMS

In recent years, all of the Emirates have exercised increasing control over the nation's mineral wealth. 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 coordinated Federal United Arab Emirates activities in the international community. Since 1988, the Supreme Petroleum Council (SPC) has been responsible for all oil and gas policies in the Emirate of Abu Dhabi. The SPC consists of the board of directors of the Abu Dhabi National Oil Co. (Adnoc) and the Department of Petroleum.

The Council of Ministers approved the

1993 budget of \$4.8 billion, financed by general revenues of \$4.335 billion, leaving a deficit of \$465 million.

Talks again took place on resolving disputes over Abu Musa and the Tungs Islands in the Persian Gulf between the United Arab Emirates and Iran.

PRODUCTION

Early in 1992, crude oil production was about 2.1 Mbb/d. The increase of 25,000 bbl/d from yearend 1991 was due to the expansion of output of onshore crude oil by Abu Dhabi. By yearend 1992 average production was about 2.3 Mbb/d. Although the variety of crude minerals produced was small, economic growth based on income from mineral fuels continued to expand demand for industrial minerals. (See table 1).

TRADE

Petroleum and refined crude oil products were the principal mineral products exported. They accounted for about 80% of total exports of \$19 billion in 1990, the latest year data were available.

An Indian company, Gujrat Bauxite, was contracted to supply 50,000 tons of bauxite to the United Arab Emirates. Presumably it was calcined bauxite for use in abrasives.

The Federation of UAE Chambers of Commerce began an investigation of obstacles to local exporters. Among concerns were the imposition of tariffs by Gulf Coordination Council members on locally produced or processed material. Current rules were that a product must have a minimum of 40% local value added to it to qualify for tariff exemption.

STRUCTURE OF THE MINERAL INDUSTRY

The Government is heavily involved in the mineral industry. Nonetheless, private participation continues to grow as emphasis on expansion of the nonfuel sector continues. International petroleum companies are heavily involved in crude oil and natural gas development schemes, as well as transport infrastructure. (See table 2).

COMMODITY REVIEW

Metals

Aluminum.—Output by the Dubai Aluminum Co. Ltd. was close to full capacity owing to increases in regional construction and infrastructure projects. The company added 70,000 mt/a of metal capacity in 1991 with the addition of a new potline.

Iron and Steel.—The UAE Contractors Association, with the financial assistance of local investors, proposed construction of a steel plant. High domestic and regional demand for reinforcing bars and sheet metal were the reasons for the action. Imports of steel in 1992 were about 500,000 tons valued at \$455 million. The proposed plant would have an initial capacity of 75,000 mt/a of reinforcing bars, possibly increasing to 1.3 Mmt/a. Exports to Oman were considered possible, because demand there was about 150,000 mt/a. Companies in the United States and Japan were the primary contenders for building the plant.

The Ahli Steel Co. near Dubai had a 70,000-mt/a steel plant for production of deformed reinforcing bar. It was owned

by a private citizen. About 65% of output was sold within the Emirates; the remainder was exported, mainly to Oman. The company planned construction of a 150,000-mt/a reinforcing bar plant at Al-Goaz, about 45 minutes by car from the Dubai plant.

Following a visit by investors from western India, a nonferrous castings foundry was planned for the Sharjah Emirate. No capacity or location was reported.

Industrial Minerals

Cement.—Heavy demand for cement for construction and refurbishing projects in the United Arab Emirates led to higher prices. The price situation was worsened by maintenance problems at domestic plants, plus unavailability of domestic production that was previously contracted for export. Demand was also high owing to purchases by other Middle East countries. Additionally, a 4% to 6% tariff on cement imports was an impediment to satisfying demand. Most of the companies were joint ventures with Government participation or complete ownership. The UAE Contractors Association was particularly active in trying to assist the domestic construction industries.

Fertilizer.—Ruwais Fertilizer Industries began a program to expand fertilizer exports to the Far East, particularly China.

Mineral Fuels

Natural Gas.—Bids for the supply of four gas platforms for the Umm Shaif gas development project were received. Later work is to include a new gas treatment plant and 35 km of main gas pipeline. Bechtel of the United States was the manager for the project for Abu Dhabi Marine Operating Co.

Options for development of the lower Zakum Field were examined. Bechtel may be approached to incorporate it as part of its current contract on the Umm Shaif gas scheme. Alternatively, international companies may be invited to

bid for engineering, procurement, and construction. Included in the development are well head platforms and gas-oil separation plants. Cost was estimated at \$75 million.

A contract for the Bu'Hasa gas injection project was to be awarded in early 1993. It was valued at about \$75 million.

Amoco Sharjah Oil Co., an affiliate of Amoco Corp. of the United States, reported production of 15,000 bbl/d of condensate and 2.83 Mm³/d of natural gas from four new wells in its onshore fields.

Petroleum, Crude.—The Government expected to complete its plans for increasing production capacity for crude petroleum to 3 Mbbbl/d by yearend 1994. Current capacity was about 2.3 Mbbbl/d.

In line with these plans, bids were received from seven companies for construction of 500 to 600 km of pipelines for the Bab oilfield. Additional bids were for electrical and instrumentation work for the field.

Reserves

According to Abu Dhabi's Ministry of Petroleum and Minerals Resources, the country had proven petroleum reserves of 116 billion bbl. Proven natural gas reserves were estimated at 10,000 billion m³, which was far higher than previous industry estimates of 5,690 billion m³. The bulk of the United Arab Emirates' hydrocarbon reserves were in Abu Dhabi. The only other significant reserves were in Dubai, where industry sources reported petroleum reserves estimated at 4 billion bbl.

Crude oil reserves for the Abu Dhabi Marine Operating Co. were 17 billion barrels. Capacity was to be raised from 100,000 bbl/d to 600,000 bbl/d in the company's 8,098-km² concession, which includes 15 new fields to be developed.

INFRASTRUCTURE

Construction continued on the \$1.7 billion combined power station and desalination plant for Abu Dhabi's Water

and Electricity Department.

The combined throughput of Port Rashid and Jebel Ali Port ranked them as the 16th largest container port in the world. General cargo, excluding oil, was 2.8 Mmt in 1992. Imports of automobiles and lumber were 13% and 49%, respectively, above those of 1991. Sea-air cargo shipments were 9.1 Mmt. A number of Japanese companies were reportedly moving their regional distribution centers to Dubai.

OUTLOOK

Privatization and expanding economic interests should ensure growth for the mineral industry. Concerns about exhaustion of resources for the most important sector, petroleum and natural gas, should continue to lead to diversification and downstream processing of higher valued materials. The country's port facilities and merchandising capabilities are expected to attract further commerce.

¹Where necessary, values have been converted from Emirian dirhams (Dh) to U.S. dollars at the rate of Dh3.67=US\$1.00.

TABLE 1
UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1988	1989	1990	1991	1992 ³
Aluminum, metal, primary ingot	162,000	168,250	¹ 174,251	239,000	240,000
Cement, hydraulic ³ thousand tons	3,285	3,387	3,264	3,473	3,700
Fertilizer materials:					
Ammonia:					
Gross weight	361,000	394,000	358,000	347,600	350,000
N content	297,000	324,000	294,500	286,100	290,000
Urea:					
Gross weight	524,000	579,000	496,000	517,000	517,000
N content	244,000	270,000	231,000	241,000	241,000
Gas, natural:					
Gross cubic meters	27,354	² 30,837	30,925	³ 33,000	35,000
Dry do.	18,604	² 22,993	² 23,786	² 24,500	25,550
Gypsum ⁴ thousand tons	84	87	89	95	95
Lime ⁴ do.	45	45	45	45	45
Natural gas plant liquids ⁴ thousand 42-gallon barrels	47,450	¹ 47,450	¹ 58,400	¹ 60,000	60,000
Petroleum:					
Crude ⁴ do.	<u>571,225</u>	<u>715,400</u>	<u>772,700</u>	<u>889,505</u>	<u>850,000</u>
Refinery products:					
Liquefied petroleum gas do.	2,190	² 2,555	3,300	³ 3,300	3,300
Gasoline do.	9,855	¹ 10,220	10,800	¹ 10,800	10,800
Jet fuel do.	8,395	¹ 8,760	9,100	¹ 9,100	9,100
Kerosene do.	3,285	² 2,555	4,400	¹ 4,400	4,400
Distillate fuel oil do.	18,250	¹ 18,980	19,700	¹ 19,700	19,700
Residual fuel oil do.	17,155	¹ 18,980	18,100	¹ 18,100	18,100
Other do.	5,475	¹ 5,840	11,300	¹ 11,300	11,300
Total do.	<u>64,605</u>	<u>¹67,890</u>	<u>76,700</u>	<u>¹76,700</u>	<u>76,700</u>
Sulfur, byproduct: ⁴					
From petroleum refining	10,000	10,000	10,000	10,000	10,000
From natural gas processing	100,000	70,000	80,000	64,000	65,000
Total	110,000	80,000	90,000	74,000	75,000

⁴Estimated. ²Revised.

¹Table includes data available through July 21, 1992.

²In addition to the commodities listed, crude construction materials such as common clays, stone, and sand and gravel presumably are produced, but output is not reported quantitatively, and general information is inadequate to make reliable estimates of output levels.

³Includes white cement.

TABLE 2
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Dubai Aluminum Co. Ltd. (Government, 80%; Southwire Corp., 7.5%; Nisshom Iwai, 7.5%; various local interests, 5%)	Jebel Ali, Dubai	250.
Cement	Ajman Cement Co. (Government, 100%)	Ajman, Ajman	800.
Do.	Al-Ain Cement Co. (Government, 100%)	Al-Ain, Abu Dhabi	780.
Do.	Fujairah Cement Industries (Fujairah Government, 21.4%; Abu Dhabi, 3.4%; Sharjah Cement, 5.7%; Islamic Development Bank of Saudi Arabia, 11.4%; Gulf Financial Center, 5.7%; private, 52.4%)	Dibba, Fujairah	750.
Do.	Gulf Cement Co. (Ras Al-Khaimah Government, 21%; Kuwait, 26%; private-Ras Al-Khaimah interest, 2%; private-Kuwait interest, 51%)	Al-Nakheel, Ras Al-Khaimah	1,000.
Do.	Jebel Ali Cement Co. (Sheikh Hamdan Maktoum, 100%)	Jebel Ali, Dubai	100.
Do.	National Cement Co. Ltd. (Government, 100%)	Dubai, Dubai	1,600.
Do.	Sharjah Cement and Industrial Development Co. Ltd. (private, 100%)	Sharjah, Sharjah	1,300.
Do.	Union Cement Co. (Government is the major shareholder)	Union, Ras Al-Khaimah	960.
Do.	Ras Al-Khaimah Co. for White Cement and Construction Materials (Government, 100%)	Khor Kuwair, Ras Al-Khaimah	300.
Fertilizer	Ruwais Fertilizer Industries (Government, 66.7%; total, 33.3%)	Ruwais, Abu Dhabi	400 ammonia.
Do.	do.	do.	580 urea.
Gypsum	General Gypsum Co. (private, 100%)	Jebel Ali, Dubai	80.
Natural gas million cubic meters	Abu Dhabi Co. for Onshore Oil Operations (Adco) [Abu Dhabi National Oil Co. (Adnoc), 60%; Total CFP (Total), 9.5%; Shell Oil Co., 9.5%; British Petroleum Co.(BP), 9.5%; Mobil, 4.75%; Exxon, 4.75%; Partex, 2%]	Associated gas from the oilfields: Asab, Sahil, Bab, and Bau Hasa; onshore, Abu Dhabi	4,645.
Do.	Abu Dhabi Marine Operating Co. (Adma-Opco) (Adnoc, 60%; BP, 14.67%; Total, 13.33%; Japan Oil Development Co. (Jodco), 12%)	Associated gas from the Umm Shaif oilfield; offshore, Abu Dhabi	6,200.
Do.	Dubai Marine Areas Ltd.- Dubai Petroleum Co. (Government, 15%; Conoco, 15%; Total 25%; Repsol, 25%; Rheinoel, 10%; Wintershall, 5%; Dubai Sun Oil Co., 5%)	Associated gas from the oilfields: Fateh, Southwest Fateh, and Rashid; offshore, Dubai	7,000.
Do.	Arco Oil and Gas Co. (Arco in partnership with Britoil)	Nonassociated gas from the Margham gasfield; onshore, Dubai	4,135.
Do.	do.	do.	1,175 condensate.
Do.	Abu Dhabi National Oil Co. (Adnoc) (Government, 100%)	Two processing plants at Habshan, Abu Dhabi	7,300.

TABLE 2—Continued
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

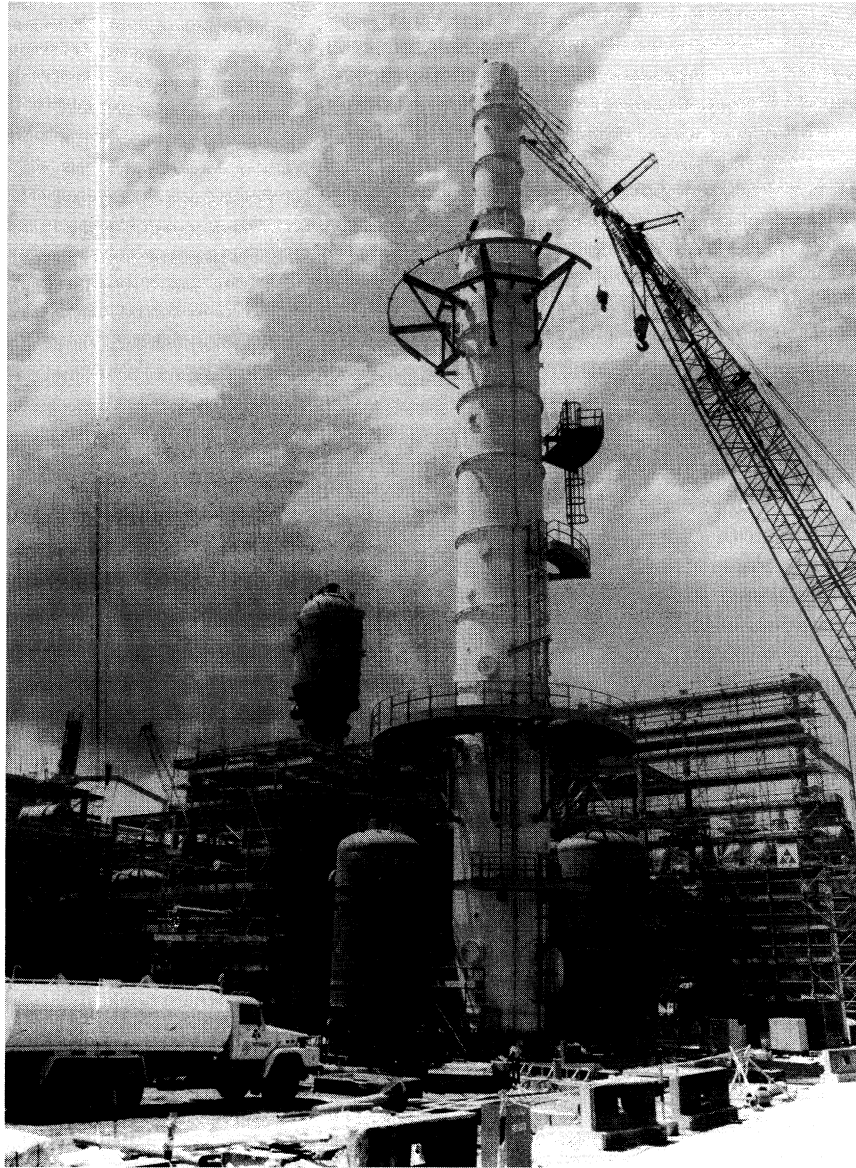
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Natural gas million cubic meters	Dubai National Gas (Dugas) (Government, 80%; Canadian Sunningdale Oils Ltd., 20%)	Processing plant at Jebel Ali, Dubai	1,345.
Do.	do.	do.	915 natural gas liquids.
Do.	do.	do.	425 condensate.
Do.	Ras Al-Khaimah Gas Commission (Government, 100%)	Associated gas from the Saleh oilfield; offshore, Ras Al-Khaimah	570.
Do.	do.	do.	60 natural gas liquids.
Do.	do.	do.	20 condensate.
Do.	Sharjah Liquefaction Co. (Government, 60%; Amoco Sharjah Co., 25%; Itoh, 7.5%; Tokyo Boeki, 7.5%)	Processing plant at Ash Shariqah, Sharjah, near the Sajaa gasfield	595 natural gas liquids.
Do.	do.	do.	335 condensate.
Do.	Amoco Sharjah Oil Co. (Amoco, 100%)	Nonassociated gas from the Sajaa gasfield; onshore, Sharjah	1,800.
Do.	do.	do.	410 natural gas liquids.
Do.	do.	do.	1,695 condensate.
Do.	Abu Dhabi Gas Liquefaction Co. (Adgas) (Adnoc, 51%; Mitsui, 22.05%; BP, 16.3%; Total, 8.2%; Mitsui Liquefied Gas, 2.45%)	Processing plant at Das Island; offshore, Abu Dhabi	3,350 liquefied natural gas.
Do.	do.	do.	2,160 natural gas liquids.
Do.	Abu Dhabi Gas Industries Ltd. (Gasco) (Adnoc, 68%; Total, 15%; Shell Oil Co., 15%; Partex, 2%)	Liquefaction plants at the Bau Hasa, Bab, and Asab oilfields. Fractionation plant at Ruwais, Abu Dhabi	7,475 natural gas liquids.
Petroleum, crude thousand barrels	Abu Dhabi Co. for Onshore Operations (Adco) [Adnoc, 60%; Total, 9.5%; Shell Oil Co., 9.5%; BP, 9.5%; Mobil, 4.75%; Exxon, 4.75%; Partex, 2%]	Asab, Bab, Bau Hasa, and Sahil oilfields; onshore, Abu Dhabi	365,000.
Do.	Abu Dhabi Marine Operating Co. (Adam-Opco) (Adnoc, 60%; BP, 14.67%; Total, 13.33%; Japan Oil Development Co. (Jodco), 12%)	Umm Shaif and Zakum oilfields; offshore, Abu Dhabi	208,000.
Do.	Zakum Development Co. (Zodco) Operator (Adnoc, 50%; Total, 50%) Shareholders-(Adnoc, 88%; Jodco, 12%)	Upper Zakum oilfield; offshore, Abu Dhabi	117,000.
Do.	Total Abu Al-Bukhoosh Oil Co. (TBK) (Total, 65.7%; Canadian Sunningdale Oil Ltd., 12.25%; Amerada Hess, 12.25%; Charter, 9.8%)	Abu Al-Bukhoosh oilfield; offshore, Abu Dhabi	21,900.
Do.	Umm Al-Dalkh Development Co. (Udeco) Operator (Adnoc, 50%; Jodco, 50%) Shareholders-(Adnoc, 88%; Jodco, 12%)	Umm Al-Dalkh and Satah oilfields; offshore, Abu Dhabi	14,600.

TABLE 2—Continued
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, crude thousands barrels	Al-Bunduq Oil Co. Ltd. (BOC) (BP, 33.3%; Total, 33.3%; United Petroleum Development Co. Ltd., 33.3%)	Al-Bunduq oilfield; offshore, Abu Dhabi	11,000.
Do.	Abu Dhabi Oil Co. (Adoc) (Cosmo Oil, 51%; Nippon Mining, 25.6%; Japan National Oil Corp., 17.8%; other Japanese Companies, 5%)	Mubarrez oilfield; offshore, Abu Dhabi	7,300.
Do.	Mubarrez Oil Co. (Moco) (Adnoc, 23.3%; Japan National Oil Corp., 43.4%; Cosmo Oil, 22.2%; Nippon Mining, 11.1%)	Umm Al-Anbar oilfield, near Mubarrez; offshore, Abu Dhabi	4,300.
Do.	Dubai Marine Areas Ltd.- Dubai Petroleum Co. (Dubai Petroleum Co., 15%; Repsol, 25%; Rheinoel, 10%; Wintershall, 5%; Dubai Sun Oil Co., 5%)	Fateh, Southwest Fateh, and Rashid oilfields; offshore, Dubai	127,750.
Do.	Crescent Petroleum Co. (CPC) (Buttes Gas and Oil Co., 98.2%; other, 1.8%)	Mubarek oilfield; offshore, Sharjah	3,650.
Petroleum, refined thousand barrels	Abu Dhabi National Oil Co. (Adnoc) (Government, 100%)	Ruwais and Umm Al-Nar, Abu Dhabi	71,200.
Sulfur	Adnoc	Habshan, Abu Dhabi	292.
Do.	do.	Ruwais, Abu Dhabi	10.

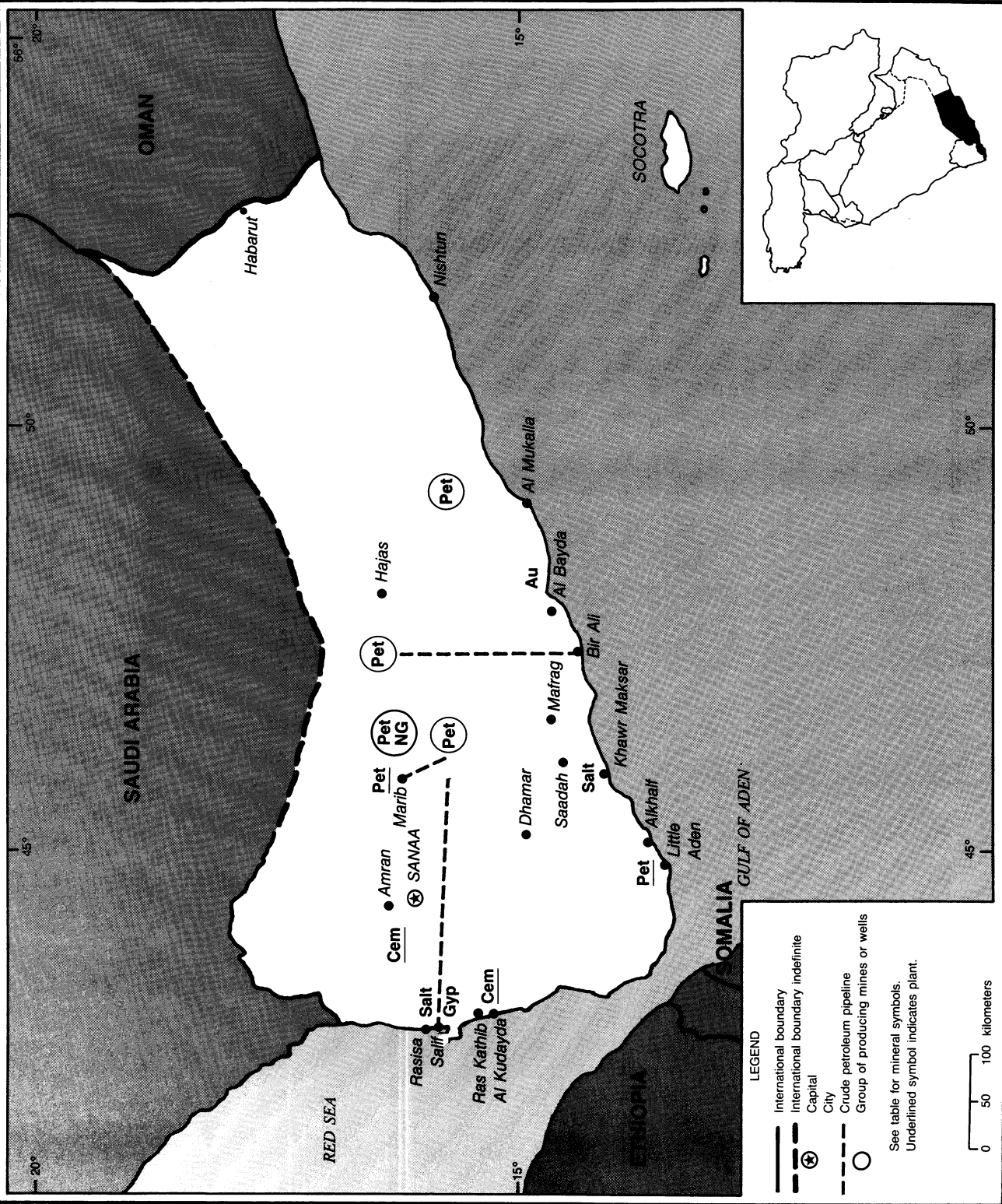


Abu Dhabi Gas Liquefaction Co., Ltd. (Adgas) facilities on Das Island yielded 2,625,690 tons liquefied natural gas (LNG), 708,769 tons propane, 549,654 tons butane, and 309,083 tons pentane plus in 1992 from two liquefaction trains. Photo shows a 170 foot high cryogenic tower, part of a third liquefaction train, under construction. Completion of the third liquefaction train is expected in 1994, at which time LNG capacity will increase to 4.6 Mmt/a. All the LNG and most natural gas liquids are exported to Japan.

REPUBLIC OF YEMEN

POPULATION 10.4 million

AREA 527,970 km²



THE MINERAL INDUSTRY OF

THE REPUBLIC OF YEMEN

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 GDP was estimated at more than \$5 billion, of which the minerals industry accounted for more than \$2 billion. Recent commercial discoveries resulted in heightened petroleum exploration activity. In 1992, at least 25 concessions were active covering nearly one-half of the nation's land mass.

The Government's foreign debt obligations in 1992 included \$71 million in principal repayments and \$27.8 million in interest payments. The Government financial statement for the year included a 40% increase in the Education Ministry's budget, resulting in education expenditures exceeding military spending for the first time.

Pro Iraqi sympathy during the Kuwait occupation jeopardized Yemen's potential for foreign aid. The country is besieged by high unemployment, inflation, and exchange rate crisis. Late in 1992 the riyal dropped by 65% against the dollar on the black market in a matter of weeks, reaching an alltime low of \$1=YR55. This compares with an official rate of \$1=YR12. As prices soared, riots broke out in all major cities of the north in December. The Government announced it would stabilize the prices of basic goods for a least 1 year. The Government is still trying to integrate the expatriates returning from Saudi Arabia into the economy. Unemployment is as high as 40%, and the Yemeni central banks reports a deficit of \$1.7 billion in 1992.

GOVERNMENT POLICIES AND PROGRAMS

The Government of Yemen abstained

from voting on the UN 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 normally accounted for 20% of Yemen's foreign exchange earnings.

Originally scheduled for 1992, the presidential council has postponed the unified republic's first general election to April 27, 1993. This election should name members to the 301-seat Parliament, which elects the president. A weak economy, social tensions, and political squabbles brought on civil disruption that culminated in riots in 1992. By the first quarter of 1993, voter registration recorded 2.7 million, about one-half of eligible voters.

Between March and May of 1992, the Saudi Foreign Affairs Ministry informed six foreign oil companies exploring on the Yemeni side of the ill-defined border that they were trespassing on Saudi territory, threatening possible oil revenues that could bring economic benefit to the republic. A series of formal talks on the Yemen-Saudi Arabia border were under way in 1992.

In October 1992, a border agreement between Yemen and Oman settled an age old-dispute.

PRODUCTION

Mineral production was limited to the extraction and processing of crude oil, gypsum, rock, and brine salt and to the manufacture of cement. The border

dispute that resurfaced in early 1992 with Saudi Arabia has thus far only minimal effect on petroleum output. (See table 1.)

TRADE

The Government 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 are now permitted to bring these commodities into the country, provided they can supply the financing. Individual import licenses have the following ceilings: 15,000 tons for cement; \$600,000 for iron products, and \$350,000 for fertilizers.

Petroleum accounted for approximately three-quarters of Yemen's total export earnings. However, the value of imported raw materials and consumer goods continued to exceed export earnings. In 1992, unfinished oils and residual fuel oil delivered to the United States totaled only 5,900 bbl/d compared with 19,500 bbl/d of crude oil exported to the United States in 1991.

The Government-owned India Oil Corp. entered negotiations in 1992 to purchase Yemen crude oil exports commencing in March 1993.

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 offering both expertise and capital. (See table 2.)

COMMODITY REVIEW

Metals

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 Awtaq where lead, zinc, and silver in carbonate terrain are under investigation. The program includes detailed exploration of reported occurrences discovered by earlier prospecting parties. This includes the Dubaq prospect where surface indications over a width of 30 m revealed a deposit containing zinc at 12% and lead 3.8%. Exploration continued as scheduled in 1992.

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 former U.S.S.R. in the mid-1980's, estimated reserve-resource was 23 tons of gold to a depth of 550 m at an average mineralized grade of 11 to 12 g/mt.

Industrial Minerals

Cement.—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 1.3 Mmt. Existing plants, the Japanese built the 500,000-mt/a-capacity Amran plant and the 300,000-mt/a-capacity Bajil plant constructed by the former U.S.S.R., were being considered for modernization and expansion.

Dimension Stone.—Yemen has traditionally produced stone in limited quantities at small quarries near populated areas. Total output paralleled population growth.

Salt.—Present salt operations are centered at Salif where rock salt is mined and at Khawr Maksar where brine is evaporated. China has signed an agreement to provide a loan for the development of the salt industry.

Mineral Fuels

Petroleum.—Exploration.—At yearend, Canadian Oxy Offshore International Ltd., a subsidiary of Canadian Occidental Petroleum Ltd., declared its discoveries in the 37,200-km² Masila block concession in southeastern Yemen as commercial. Combined, the Sunah, Hejjah, and Camaal Fields have an estimated recoverable reserve of 235 Mbbl. In early 1993, Canadian Occidental Petroleum announced the discovery of three additional fields in the Masilla block. The three new fields are North Camaal testing at 31° to 36° API gravity, Tawila testing at 32° to 35° API gravity, and Haru. One of the partners in the Masila block, the Athens-based Consolidated Contractors International Co. (CCC), has a contract to build a gathering system, a central processing unit, and a 138-km pipeline to a coastal export terminal near Mukalla on the Gulf of Aden. By yearend 1992, Canadian Occidental had drilled 28 wells on about 13 structures. Development wells, pipeline, and associated facilities are estimated to cost \$500 million. Initial production, estimated at 24,000 bbl/d, is anticipated by late 1993. With production from the Marib al Jawf and Shabwa regions under way, and the commercial discoveries in the Masila region, exploration activity has become

intense. The British Gas Co. has signed a memorandum of understanding covering an offshore concession in the Gulf of Aden, and Oman Al-Saad Al-Qawi acquired an offshore concession off Makalla. British Petroleum has resumed drilling in the offshore Antufash block. A memorandum of understanding was signed with Dominion Oil and Gas Corp. of the United States to explore block 34, an 8,000-km² area known as Jeza. Consolidated Colonnade Resources of the United States signed an initial exploration agreement for block 36, a 10,700-km² tract in the Thamud area. Bin Khalifa Trading Establishment Group of the United Arab Emirates signed a memorandum of understanding for block 37, a 7,000-km² tract known as Marait. Mayfair Ltd. has signed a production-sharing agreement for oil and gas exploration in block 22, an onshore tract at the northern end of the Tihama coastal plain. The block abuts the disputed Saudi border. Crescent Petroleum spudded its first well in block 2 in the Shabwa Basin, while Total drilled its second well in East Shabwa in the third quarter of 1992. Occidental Petroleum of the United States elected to proceed with its optional second phase, although the three wells drilled in the first phase found oil but not in commercial quantities. The company expects to enter its second exploration phase in the Uqla block in Shabwa in the third quarter of 1993.

Several of the companies mentioned are likely to seek joint-venture partners to help finance and or operate the exploration programs. The heightened activity in exploration commitments in the second half of the year indicates eased tensions with Saudi Arabia as negotiations are set in motion to resolve the border dispute.

Production.—The Yemen Exploration and Production Co. (YEPC) produced about 180,000 bbl/d 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 dated Brent crude.

Production from the Shabwa region averaged only 15,000 bbl/d in 1992 but is projected to eventually attain levels of 150,000 bbl/d of low-sulfur crude oil

ranging from 35° to 43° API gravity.

Production from the Canadian Occidental Petroleum operation in Masila is to commence in the third quarter of 1993 at a projected 120,000 bbl/d.

Refining.—The Aden refinery is scheduled to undergo a multimillion dollar modernization program, including the installation of new processing units and storage facilities. However, the Government has not yet succeeded in assembling financing to overhaul the Aden Refinery, which now operates at less than 40% of its 160,000-bbl/d capacity. In mid-1992, Purvin & Gertz of the United States was appointed to carry out a survey and evaluation of the refinery and its facilities.

A new processing unit was commissioned at the Marib refinery in 1992. The Government is considering building the nation's third petroleum refining facility at Mukalla. The 100-bbl/d-capacity refinery would be fed from the Massila Field. Canadian Occidental is building an export pipeline from Massila to a point 40 km away from Mukalla.

Reserves

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

INFRASTRUCTURE

The Republic's road system totals 15,500 km, of which only 4,000 is bituminous surfaced and the remainder, for the most part, unsurfaced.

Seven ports are along the sprawling 1,906-km coastline. The Red Sea ports are Al Hudaydah, Mokha, Salif, and Ras Kathib. The ports in the Gulf of Aden are Aden, Al Khalf, and Nishtun. Aden was inaugurated on May 22, 1991, as a free zone authority. The Port of Salif has grown in significance with the expansion of salt mining in the area and with the development of the floating oil export terminal at nearby Ras Isa. The Yemen

Ports Authority has awarded a \$28.6 million contract to expand the Salif port by construction of a deepwater berth. The project involves construction of a single berth 450 m long and 14 m deep capable of accommodating vessels of up to 55,000 dwt. Construction is scheduled for completion in early 1994.

Progress has been made in further infrastructure development. In October 1992, a contract was awarded to link the north and south electric power grids. At present, all electric power generation is based on fuel oil. However, the natural gas discovery at Marib has prompted the Public Electricity Corp. to consider plans for a 180-MW gas-fired power station near the Marib gasfields, which would supply power to Sanaa.

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.

Another positive aspect of the newly formed Republic is the development of the free zone Port of Aden, which will enable it to compete as a transshipment center with Dubai and Djibouti, bringing in additional foreign exchange.

On the more positive side, relations appear to have improved with the signing of the onshore border agreement with Oman on October 1st. This brought an end to decades of hostilities and opened the door to economic bilateral activity, including the possible granting of exploration rights to the state-owned Oman Oil Co. This accord with Oman could draw Yemen closer to the Gulf Cooperation Council (GCC) and consequently restore financial assistance.

Negotiations were under way with Saudi Arabia with the objective of arriving at a border agreement necessary to establish

legal ownership and thus permit uncontested mineral development.

OTHER SOURCES OF INFORMATION

The Petroleum and Mineral Resource Ministry
Sanaa, Republic of Yemen

The Ministry of Economy, Supply, and Trade
Sanaa, Republic of Yemen

TABLE 1
REPUBLIC OF YEMEN: PRODUCTION OF MINERAL COMMODITIES¹

Commodity		1988	1989	1990	1991	1992 ²
Cement	thousand metric tons	646	700	¹ 828	850	850
Gypsum	metric tons	60,000	63,000	¹ 66,000	¹ 100,000	100,000
Natural gas, gross ³	million cubic meters	—	10,000	20,000	50,000	50,000
Natural gas plant liquids	thousand 42-gallon barrels	—	4	9	25	25
Petroleum:						
Crude	do.	<u>60,390</u>	<u>66,500</u>	<u>¹73,000</u>	<u>73,000</u>	<u>²71,200</u>
Refinery products:						
Gasoline	do.	2,725	² 2,900	² 2,900	3,000	3,000
Kerosene	do.	1,275	1,300	1,300	1,300	1,300
Distillate fuel oil	do.	9,530	9,535	9,535	9,600	9,600
Residual fuel oil	do.	10,135	¹ 10,310	¹ 10,400	10,400	10,400
Other ³	do.	² 2,350	³ 3,100	³ 3,100	3,100	3,100
Total	do.	26,015	27,145	27,235	27,400	27,400
Salt ³	metric tons	225,000	230,000	220,000	² 250,000	250,000
Stone: Dimension ³	cubic meters	350,000	350,000	² 410,000	410,000	410,000

¹Estimated. ²Revised.

³Table includes data available through May 1, 1993.

²Reported figure.

TABLE 2
REPUBLIC OF YEMEN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Yemen Corp. for Cement Industry and Marketing (Government, 100%)	Bajil (near Hodeida)	300
Do.		do.	Amran	500
Gypsum		Yemen Salt Mining Corp. (private, 100%)	Salif	50
Do.		Yemen Co. for the Gypsum Industry (Arab Mining Co., 20%)	Khulakah	50
Petroleum, crude	thousand barrels	Yemen Exploration and Production Co. (Yemen Hunt Oil Co., 51%; Exxon Corp., 49%)	Alif	65,000
Do.		do.	Azal	7,000
Do.		do.	Asaad al-Kamil	9,000
Petroleum, products		do.	Marib	3,650
Do.		Aden Refining Co. (Government, 100%)	Little Aden	60,000
Salt		Yemen Salt Mining Corp. (private, 100%)	Salif	200
Do.		Public Salt Organization (Government, 100%)	Khaw-Maksohr	80

MAP SYMBOLS

Commodity	Symbol				
Alunite	Alu	Iron ore	Fe	Sillimanite	Slm
Alumina	<u>Al</u>	Jade	J	Silver	Ag
Aluminum	<u>AL</u>	Kaolin	Kao	Soapstone	So
Andalusite	And	Kyanite	Ky	Soda ash, trona	NaAsh
Antimony	Sb	Lapis lazuli	Laz	Sodium sulfate	NaSO ₄
Arsenic	As	Lead	Pb	Stone	St
Asbestos	Asb	Lignite	Lig	Strontium	Sr
Asphalt	Asp	Lime	<u>Lime</u>	Sulfur	S
Barite	Ba	Limestone	Ls	Talc	Tc
Bauxite	Bx	Liquefied natural gas	<u>LNG</u>	Tantalum	Ta
Bentonite	Bent	Liquefied petroleum gas	<u>LPG</u>	Tellurium	Te
Beryllium/beryl	Be	Lithium	Li	Thorium	Th
Bismuth	Bi	Magnesite	Mag	Tin	Sn
Bitumen (natural)	Bit	Magnesium	<u>Mg</u>	Titanium (rutile or ilmenite)	Ti
Boron	B	Manganese	Mn	Titanium dioxide (processed)	<u>TiO₂</u>
Bromine	Br	Marble and alabaster	Marb	Tungsten	W
Cadmium	Cd	Marl	Ma	Umber	Um
Calcium/calcite	Ca	Mercury	Hg	Uranium	U
Carbon black	<u>CBl</u>	Mica	M	Vanadium	V
Cement	<u>Cem</u>	Molybdenum	Mo	Vermiculite	Vm
Cesium	Cs	Natural gas	NG	Wollastonite	Wo
Chromite	Cr	Natural gas liquids	<u>NGL</u>	Yttrium	Y
Clays	Clay	Nepheline syenite	Neph	Zinc	Zn
Coal	C	Nickel	Ni	Zircon	Zr
Cobalt	Co	Nitrates	Nit		
Columbium (niobium)	Cb	Nitrogen (ammonia plants)	<u>N</u>		
Copper	Cu	Ochre	Oc		
Corundum	Cn	Oil sands	OSs		
Cryolite	Cry	Oil shale	OSh		
Diamond	Dm	Olivine	Ol		
Diatomite	Dia	Opal	Opal		
Dolomite	Ds	Peat	Peat		
Emerald	Em	Perlite	Per		
Emery	E	Petroleum, crude	Pet		
Feldspar	Feld	Petroleum refinery products	<u>Pet</u>		
Ferroalloys	<u>FA</u>	Phosphate	P		
Ferrochrome	<u>FeCr</u>	Pig iron	<u>Pig</u>		
Ferromanganese	<u>FeMn</u>	Pigments, iron	Pigm		
Ferronickel	<u>FeNi</u>	Platinum-group metals	PGM		
Ferrosilicon	<u>FeSi</u>	Potash	K		
Fertilizer	<u>Fz</u>	Pozzolana	Pz		
Fluorspar	F	Pumice	Pum		
Gallium	Ga	Pyrite	Py		
Garnet	Gt	Pyrophyllite	Pyrp		
Gemstones	Gm	Quartz or quartzite	Qtz		
Germanium	Ge	Rare earths	RE		
Gold	Au	Rhenium	Re		
Graphite	Gr	Salt	Salt		
Gypsum	Gyp	Sand and gravel	Sd/Gvl		
Indium	In	Sandstone	Ss		
Iron and steel	<u>Fe</u>	Selenium	Se		
		Sepiolite, meerschaum	Sep		
		Serpentine	Serp		
		Shale	Sh		
		Silicon	<u>Si</u>		

MAP LEGEND

- Symbol = Mine, including beneficiation plants, wells
- Circled Symbol = Group of producing mines or wells
- Underlined Symbol = Processing plant or oil refinery, including smelters and metal refineries
- (Symbol) = Undeveloped significant resource



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**UNITS OF MEASURE
AND ABBREVIATIONS**

Symbol Unit of Measure

a =	year
°API =	American Petroleum Institute gravity
bbl =	barrel(s)
cal =	calorie(s)
c =	centi (prefix)
cm =	centimeter(s)
m ³ =	cubic meter(s)
d =	day(s)
dwt =	ton(s), deadweight
G =	giga (prefix)
GW =	gigawatt(s)
GW•h =	gigawatt hour(s)
g =	gram(s)
g/mt =	gram(s) per metric ton
ha =	hectare(s)
k =	thousand
kcal =	kilocalorie(s)
kg =	kilogram(s)
kL =	kiloliter(s)
km =	kilometer(s)
km ² =	square kilometer(s)
kmt =	thousand metric ton(s)
kV =	kilovolt(s)
kW =	kilowatt(s)
kW•h =	kilowatt hour(s)
L =	liter(s)
M =	mega (prefix)
MW =	megawatt(s)
MW•h =	megawatt hour(s)
m =	meter(s)
M =	million
Mmt =	million metric ton(s)
m ² =	square meter(s)
mt =	ton(s), metric
SCE =	standard coal equivalent
V =	volt
W =	watt
W•h =	watt hour

Abbreviation

API =	American Petroleum Institute
EC =	European Community
EFTA =	European Free Trade Association
FTA =	Free Trade Agreement
GATT =	General Agreement on Tariffs and Trade
GDP =	gross domestic product
GNP =	gross national product
LNG =	liquefied natural gas (methane)
LPG =	liquefied petroleum gas (propane-butane)

NAFTA =	North American Free Trade Agreement
OECD =	Organization for Economic Cooperation and Development
OPEC =	Organization of Petroleum Exporting Countries
UN =	United Nations
UNDP =	United Nations Development Program