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MINERAL INDUSTRIES OF

THE MIDDLE EAST

U.S.
DEPARTMENT
OF THE
INTERIOR

BUREAU
OF
MINES

1991

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 wisest use of our land and water resources, protecting our fish and wildlife, 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. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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Preface

This edition of the Minerals Yearbook records the performance of the worldwide minerals industry during 1991 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. 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 and Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory. This volume also has a chapter on survey methods used in data collection, including a statistical summary of domestic nonfuel minerals.

Volume III, Area Reports: International, contains the latest available mineral data for the year of review on more than 160 foreign countries and discusses the importance of minerals to the economies of these nations. Volume III is presented as five area reports and one world overview: Mineral Industries of Africa, Mineral Industries of Asia and the Pacific, Mineral Industries of Latin America and Canada, Mineral Industries of Europe and Central Eurasia, Mineral Industries of the Middle East, and Minerals in the World Economy. This year's reports incorporate location maps, industry structure tables, and an outlook section previously incorporated in our Mineral Perspectives Series quinquennial regional books, which have been discontinued. The U.S. Bureau of Mines continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Yearbook are welcomed.

Acknowledgments

The U.S. Bureau of Mines, in preparing these Volume III Minerals Yearbook 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 in 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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Vitae

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THE MINERAL INDUSTRIES OF

THE MIDDLE EAST

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

INTRODUCTION[1]

The production and processing of crude petroleum and natural gas are the dominant economic sectors of the Middle East. Downstream processing of these mineral fuels to petrochemicals and fertilizers is a major investment opportunity. In 1991, the 15 countries that constituted the region accounted for 26% of world crude petroleum output, 15.3% of world natural gas plant liquid production, and 4.5% of world dry natural gas production. Only Cyprus and Lebanon were not crude petroleum producers.

Production of these mineral fuels all declined from that of 1990 owing to the Persian Gulf War, during which output from Kuwait and Iraq either ceased owing to war damage, or was embargoed. Prior to the war, Iraq and Kuwait were the fourth and fifth largest world producers of crude petroleum, respectively. In the war, virtually all of Kuwait's production and transport facilities were destroyed or damaged. Iraq's output was embargoed from export, with only domestic sales taking place. The embargo also affected Jordan, both in terms of transshipment of materials through it to Iraq and in exports of phosphate and potash. Shipments of crude petroleum by pipeline from Iraq through Saudi Arabia and Turkey and by vessel through the Persian Gulf were terminated. However, the loss in production from Iraq and Kuwait was made up by accelerated output from other Middle East and world producers. Saudi Arabia, in particular, with its excess production capacity, accounted for the largest portion, increasing crude petroleum output by 27% to almost 3 billion barrels.

About 66% of total world crude petroleum reserves and 31% of total world natural gas reserves are in the Middle East. The region's consumption of petroleum products was about 6% of the world total, and of natural gas about 5% of the world total. Transportation and port facilities in the region are geared to expediting efficient and rapid shipment of these materials. Export sales of these fuels provide funding for further diversification of the mineral industry and of the national economies. Additional development of downstream facilities for producing energy-intensive metals such as aluminum and byproducts of the fuels such as petrochemicals and fertilizers can be expected. Earnings from the industry are also channeled by several Governments in the region to mineral industry projects in Africa and elsewhere. Mechanisms for this include the Islamic Development Bank and the Arab Bank for Economic Development in Africa. Several countries in the region, such as Kuwait, own major petroleum refineries and distribution facilities worldwide.

Water resources are a critical issue in the Middle East. The world's largest desalinization plants are operating in the region to supply fresh water to countries such as Kuwait and Saudi Arabia. Water resources for human consumption and for agriculture and industry, including minerals, in Iraq and Syria 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. Turkey is ranked 20th in production of hydroelectricity among 115 countries recorded and has plans under way to expand capacity on the Tigris and Euphrates Rivers.

A fairly wide range of nonfuel minerals is 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 second in world production of strontium behind Mexico, second in boron, and fourth in chromite and pumice. It was also a significant world producer of magnesium compounds, mercury, and sodium sulfate. Iran continued to expand output of most mineral commodities following almost 9 years of war with Iraq from 1970 to 1989. It was third in world production of gypsum and strontium. 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 mineral material industries, it was a major world diamond cutting center and exporter of cut diamond. Jordan ranked sixth in world production of phosphate rock. Saudi Arabia was 9th in world production of sulfur, while Iraq fell from 9th to 17th place owing to the war. Sulfur was of major importance in the metallurgical, petrochemical, and fertilizer industries. Most sulfur output from Iraq was from the Frasch process, while Saudi Arabia's output was a byproduct of crude petroleum and natural gas processing.

Nonfuel mineral output from the Middle East supplied primarily local markets, India, and the European Community. Excluding production of

boron, bromine, and strontium, for which the region accounted for 38.6%, 32.4%, and 41.6%, respectively, of world output, production of nonfuel minerals as shown in tables 1 and 2 generally represented a small percentage of total world production. The most significant in 1991 were chromite at 10.2%, gypsum at 11.8%, phosphate rock at 7%, and potash at 8.3% of world output. New mine development and exploration programs continued in Saudi Arabia and Turkey. Downstream mineral-based industries were expanding in the region primarily to make use of abundant associated natural gas. Aluminum production, currently under way in Bahrain, Iran, Turkey, and the United Arab Emirates, was being expanded in Bahrain. Plans for constructing aluminum facilities in Qatar and Saudi Arabia continued. Further advancement of Iraq's ability to build an aluminum refinery in that country remained dependent upon resolution of UN demands and termination of a trade embargo. Realization of these plans could bring Middle East capacity to more than 1 million tons per year of aluminum compared with output of about 555,000 tons in 1991. The higher value obtained from the sale of chemicals and plastics produced from hydrocarbon fuels is the motivation behind much of the expansion of petrochemical facilities in the region.

U.S. imports of mineral-based materials from the region were primarily energy products. U.S. net oil imports from the Middle East, which include crude petroleum, natural gas liquids, and petroleum refinery products, were 28% of total U.S. net oil imports or about 681 million barrels in 1991. Nonfuel minerals, for which the Middle East was considered a significant supplier to the United States, were bromine, gemstones, and potash from Israel, and chromite from Turkey. U.S. exports to the region are primarily food, machinery, equipment, and computers. U.S. companies or banking institutions, among others, which were active in the Middle East in 1991 included Chase Manhattan Bank for an aluminum expansion project in Bahrain; Bechtel Corp. for infrastructure development in Lebanon and the United Arab Emirates; Universal Oil Products for powerplant conversion in Syria; and Ralph Parsons Co. for sulfur plant rehabilitation and expansion in the United Arab Emirates.

The dominance of the Middle East's liquid and gaseous hydrocarbon resources is a result of periodic marine inundations of a large inland basin within and adjacent to the existing Persian 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. Cenozoic and Mesozoic cover of alluvium and volcanics extends throughout much of the region, with economic deposits of barite, copper, lead, and zinc. Ultramafic rocks, including ophiolites, in Cyprus, Iran, Oman, and Turkey contain economic deposits of chromite, copper, and pyrite. Cambrian and Precambrian age granites and gneisses contain small, minable deposits of iron and gold. The region north of the Arabian shield and Persian Gulf remains a highly active earthquake zone, as the Arabian plate continues to move north into the Eurasian plate, widening the Red Sea into a new ocean, with the contemporaneous formation of metal-bearing muds on its floor.

In comparison with the United States, the region covered about 6.2 million square kilometers or about 66% of the U.S. land region of 9.4 million square kilometers. Total population of the region was 199 million compared with 255 million for the United States. Imported labor was an important factor in the work force of the countries of the Middle East. Perhaps 5 million people from Egypt, India, Pakistan, the Philippines, the Republic of Korea, Taiwan, and other countries of Africa and Asia were employed in the Middle East. The estimated gross domestic product (GDP) for the Middle East was $596 billion compared with a GDP for the United States of $5,673 billion. Turkey had the highest GDP at $198 billion, followed by Saudi Arabia at $104 billion. Per capita GDP ranged from $545 for the Republic of Yemen to $15,000 for Qatar. Average per capita GDP for the region was about $3,000 compared with $22,470 for the United States. All tons are metric in this report unless otherwise specified.

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

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 Geologiques et Minieres, Paris.

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.

Penn Well Publishing Co., Tulsa, OK:
International Petroleum Encyclopedia.

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

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 MINERALS COMMODITIES, 1991

(Thousand metric tons unless otherwise specified)

Country	Aluminum, metal	Cement	Chromite	Gypsum	Natural gas plant liquids (thousand barrels)	Natural gas, dry (million cubic meters)	Nitrogen, N in ammonia	Petroleum crude (thousand barrels)	Phosphate rock (gross weight)	Potash, K_2O equivalent	Salt	Steel, crude	Sulfur
Bahrain	215	150	—	—	2,576	5,522	325	15,434	—	—	—	—	48
Cyprus	—	1,134	—	37	—	—	—	—	—	—	—	—	—
Iran	45	12,500	62	8,000	9,900	22,200	336	1,025,650	—	—	800	1,081	510
Iraq	—	12,000	—	460	140	280	360	100,000	1,000	—	300	—	750
Israel	—	3,550	—	26	—	32	34	82	3,370	1,320	1,115	160	66
Jordan	—	1,754	—	55	—	—	—	116	4,433	805	57	200	—
Kuwait	—	300	—	—	—	—	665	68,255	—	—	—	—	30
Lebanon	—	900	—	2	—	—	—	—	—	—	3	—	—
Oman	—	1,000	14	—	2,200	3,000	—	257,300	—	—	—	—	70
Qatar	—	336	—	—	13,140	6,800	761	137,970	—	—	—	580	53
Saudi Arabia	—	13,000	—	375	196,000	31,500	900	2,985,000	—	—	—	1,850	1,500
Syria	—	3,500	—	175	550	700	105	171,550	1,359	—	127	70	29
Turkey	56	26,026	1,271	230	—	203	345	31,875	90	—	1,440	9,336	135
United Arab Emirates	239	3,473	—	95	60,000	24,500	286	889,505	—	—	—	—	74
Yemen, Republic of	—	850	—	75	25	—	—	80,000	—	—	225	—	—
Total Middle East	555	79,623	1,347	9,455	284,506	94,737	4,117	5,682,737	10,252	2,125	3,842	13,277	3,265
Share of world total, percent	3.1	6.4	10.2	11.8	15.3	4.5	3.6	26.0	7.0	8.3	2.1	1.8	5.9
United States	4,121	69,853	—	14,022	605,535	481,382	12,692	2,707,205	48,096	1,749	35,943	79,938	10,816

TABLE 2

MIDDLE EAST: PRODUCTION OF SELECTED MINERALS COMMODITIES, 1990[r]

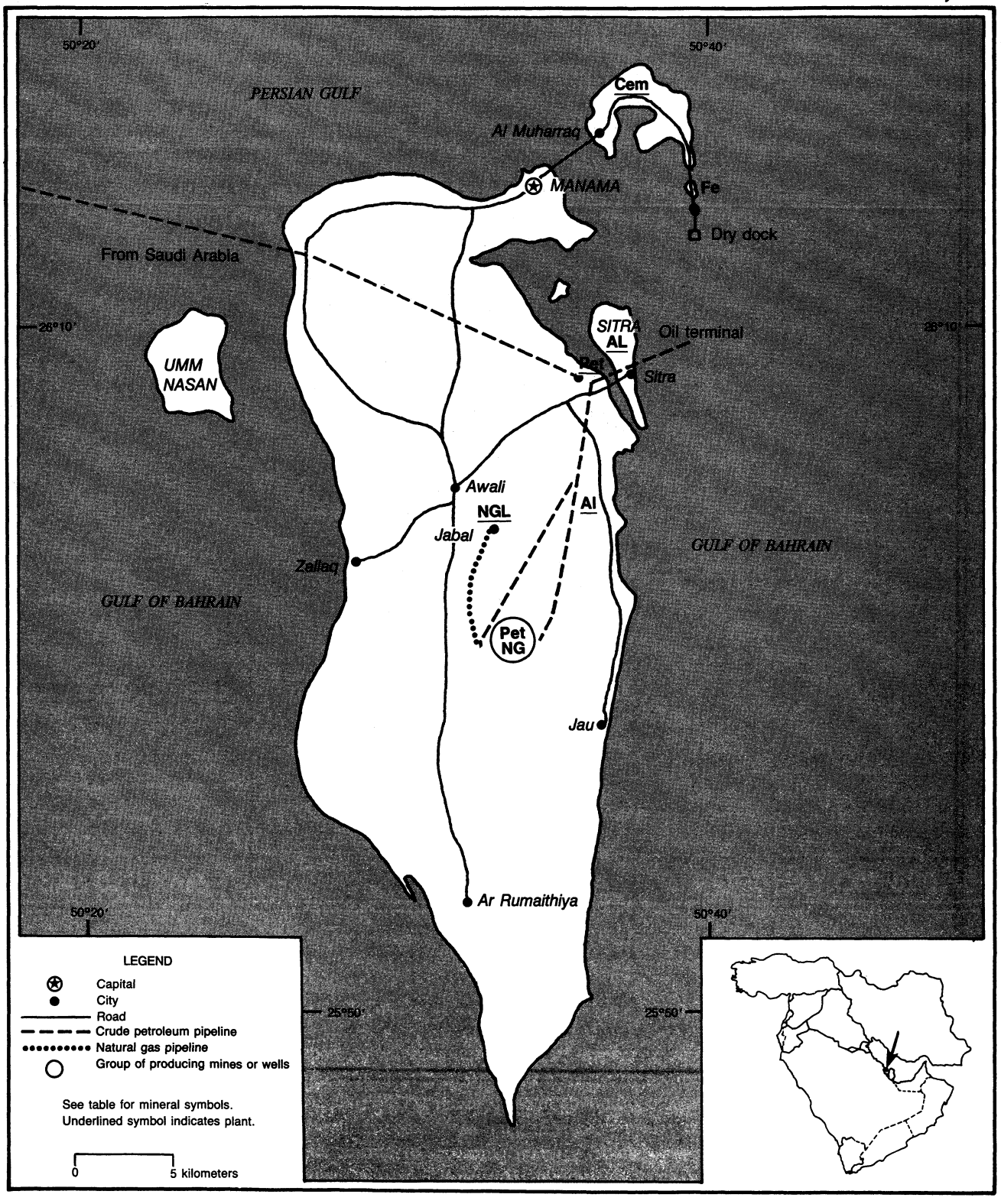
(Thousand metric tons unless otherwise specified)

Country	Aluminum, metal	Cement	Chromite	Gypsum	Natural gas plant liquids (thousand barrels)	Natural gas, dry (million cubic meters)	Nitrogen, N in ammonia	Petroleum crude (thousand barrels)	Phosphate rock (gross weight)	Potash, K_2O equivalent	Salt	Steel, crude	Sulfur
Bahrain	213	148	—	—	2,125	6,000	325	15,875	—	—	—	—	48
Cyprus	—	1,133	—	37	—	—	—	—	—	—	—	—	—
Iran	59	12,500	57	8,200	11,000	24,200	420	1,127,120	—	—	800	1,200	535
Iraq	—	13,000	—	470	1,080	2,170	400	745,000	1,100	—	300	—	1,060
Israel	—	2,868	—	38	—	40	42	94	3,516	1,311	426	144	64
Jordan	—	1,820	—	93	—	—	—	116	6,082	841	55	179	—
Kuwait	—	900	—	—	30,500	6,000	292	427,780	—	—	30	—	300
Lebanon	—	900	—	2	—	—	—	—	—	—	3	—	—
Oman	—	1,000	14	—	2,129	2,800	—	249,300	—	—	—	—	61
Qatar	—	327	—	—	13,200	6,100	760	140,525	—	—	—	560	52
Saudi Arabia	—	12,000	—	375	194,630	30,800	942	2,353,900	—	—	—	1,833	1,435
Syria	—	3,500	—	175	500	700	104	140,000	1,633	—	127	70	30
Turkey	93	24,416	1,094	230	—	212	373	26,614	87	—	1,600	9,462	133
United Arab Emirates	174	3,264	—	89	58,400	23,786	295	772,700	—	—	—	—	90
Yemen, Republic of	—	828	—	66	9	—	—	73,000	—	—	220	—	—
Total Middle East	539	77,776	1,165	9,709	313,564	102,808	3,953	5,999,024	12,418	2,152	3,341	13,448	3,808
Share of world total, percent	3.0	6.5	9.1	10.2	17.7	4.9	4.1	27.2	8.0	7.8	1.8	1.7	6.5
United States	4,048	71,310	—	14,883	569,035	498,655	12,525	2,684,575	46,343	1,713	36,959	89,726	11,560

[r]Revised

BAHRAIN

AREA 620 km² **POPULATION 520,186**



THE MINERAL INDUSTRY OF

BAHRAIN

By Bernadette Michalski

The island nation remained largely dependent on the mineral industry, which supplied more than 90% of Government revenues and export earnings as well as 30% of the GDP. Petroleum and natural gas alone accounted for 62% of Government revenues and more than 80% of export earnings in 1991. By capitalizing on the availability of natural gas for electric power generation, the aluminum smelting and fabrication industries experienced a constant growth pattern. Expansion plans project aluminum smelter capacity at 460,000 mt/a by late 1992, making the Aluminum Bahrain (ALBA) smelter the largest in the Middle East. Other mineral industry diversification efforts include iron ore pelletization, petrochemicals, and a major tanker repair shipyard.

GOVERNMENT POLICIES AND PROGRAMS

The Bahraini Government encourages private ownership of industry. But foreign interests were allowed no more than 49% ownership. Foreign firms were required to have a Bahraini partner or sponsor to bid on Government contracts. However, the Government adopted greater flexibility in these matters. In mid-1991, the Government outlined the four types of fully foreign-owned companies now permitted to be based in Bahrain, as follows:

Offshore Exempt.—It must have a minimum capital of $53,000 and a minimum of two shareholders. It is not permitted to trade in Bahrain.

Joint Stock.—Ownership is restricted to foreign industrial or service companies using Bahrain as their center for regional distribution or operation. It must have a minimum of five shareholders. It can trade inside and outside of Bahrain.

Limited Liability.—It must have a minimum capital of $26,500 and between 2 and 50 shareholders. It cannot carry out banking investment activity.

Branch Representative.—The parent company must take full financial responsibility. It cannot undertake trading within Bahrain. Unless using Bahrain only as a regional distribution center, sponsorship by a Bahraini national is required.

In its endeavor to establish or improve international relations, Bahrain has developed new ties with China, Iran, and the newly created Republics of the former U.S.S.R. during 1991. However, relations with Qatar have deteriorated with the resurgence of a 20-year-old territorial dispute. The International Court of Justice in The Hague is to serve as arbitrator in the dispute between Bahrain and Qatar over the Hawar Islands, which are believed to have good hydrocarbon potential. Qatar is contesting a 1939 decision by the United Kingdom, then colonial administrator, to award the islands to Bahrain. The United Kingdom also put through a delimitation of the Dibal and Qitat Jaradah shoals in 1947 awarding Bahrain sovereign rights in the areas. The case was brought before the Hague Court in July 1991.

PRODUCTION

With the exception of aluminum, the production of the nation's mineral commodities had stabilized. Output of crude petroleum has been maintained at 15 Mbbl or more with the aid of natural gas reinjection and is expected to continue at this level throughout the decade. While the addition of new cells at the ALBA aluminum smelter increased capacity by 20,000 mt/a to 225,000 mt/a in 1990, the further expansion to 460,000 mt/a is expected by late 1992. Output from the Alba aluminum smelter in 1990, the latest year for which data are available, constituted 67,928 tons of extrusion billet, 52,865 tons of standard ingot, 51,622 tons of rolling slab, 3,457 tons of T-ingot, and 36,633 tons of hot metal. Domestic aluminum sales accounted for almost 49% of output with the remainder exported. *(See table 1.)*

TRADE

Imports of feedstock for the aluminum plant in 1990 were reported at 475,766 tons of alumina, 93,759 tons of petroleum coke, 25,505 tons of pitch, 8,466 tons of flourite, and 1,299 tons of cryolite. About 75% of the alumina supply is obtained from Alcoa of Australia.

Aluminum exports were reported at 108,800 tons in 1990 and estimated at approximately 125,000 tons in 1991, accounting for more than 10% of all exports. Nearly two-thirds of the exported aluminum was delivered to member countries of the Gulf Cooperation Council.

Refined petroleum product exports approached 250,000 bbl/d in 1991. About one-half of all exports was destined for Southeast Asia with the remainder distributed among the Far East, the Middle East, and Africa.

Combined exports of methanol and ammonia totaled 837,991 tons in 1991

compared with 825,852 tons in the previous year.

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. The nation's investment policy permitted foreign investment up to 49% providing the remaining 51% was Bahraini held; however, the Government adopted greater flexibility in this matter to the extent of allowing fully foreign-owned companies to register in Bahrain. This concept was prompted by the desire to increase foreign investment and promote rapid rebuilding of the economy after the disruptive 1990-91 Gulf crisis. *(See table 2.)*

COMMODITY REVIEW

Metals

Aluminum.—The modernization and expansion activities at the nation's sole aluminum smelter were well underway with 76 new cells on-stream by February 1990, raising capacity to 225,000 mt/a. Aluminum production capacity is to be further expanded to 465,000 mt/a at a cost of $1.44 billion. 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. Completion of the expansion project was originally projected for 1993, but is currently running ahead of schedule, and is now anticipated by yearend 1992. Downstream manufacturing groups plan 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. The feasibility study was completed in October 1991, and bids for the expansion project were to be accepted in early 1992.

The Middle East Aluminum Cables Ltd. has the capacity to produce 40,000 mt/a of rod and 24,000 mt/a of cable. An expansion project is now underway to bring production capacity for high-tension cable to 50,000 mt/a.

By September 1991, the Bahrain Aluminium Extrusion Co. (Balexco) signed a technical cooperation agreement with an Italian firm setting up a joint venture that will build new production capacity at Balexco's existing plant and open markets for Bahraini products in Europe. Three additional units will be built at Balexco at an estimated cost of $40 million: a 3,000-ton aluminum-extrusion press capable of producing 12,000 mt/a; a casting remelt plant of 15,000 mt/a capacity; and an aluminum-extrusion die manufacturing plant.

Iron.—The Gulf Industrial Investment Co. decided to proceed with the construction of a direct reduction plant with a 1 Mmt/a capacity for the production of hot-briquetted iron (HBI). During 1991, discussions commenced with Midrex of the United States to provide the engineering input for the project. Bahrain's pellet plant, although currently believed to be idle, has found markets for its products with a contract to supply Iran with 1.5 Mmt/a commencing in 1994, and 0.5 Mmt/a is to be delivered to the Perwaja Steel Complex in Malaysia.

Mineral Fuels

Natural Gas.—Nearly one-third of natural gas production is reinjected for enchanced 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. (Banagas) owing to the commissioning of the $74 million central-gas-plant capacity expansion from 4.8 Mm^3/d to 7.1 Mm^3/d. The additional revenues place Banagas in a better position to start reviewing shelved or new expansion plans. These plans include a proposed $365 million polypropylene and methyl tertiary butyl ether (MTBE) plant that would use Banagas feedstock. However, additional feedstock would be required from Bahrain Petroleum Co. and would be dependent on that company's expansion plans.

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 reported in excess of 1.1 billion m^3 in 1991. A $20 million improvement project was completed in 1989, increasing plant capacity by 20% to 1,200 mt/d each of ammonia and methanol. Record production was achieved in 1991 as the plant operated at near capacity. 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.

Petroleum.—Harken Bahrain Oil Co., a subsidiary of Harken Energy Corp. of the United States, concluded an exploration agreement with the Bahraini Government in January 1990. The agreement covered a hydrocarbon exploration program of 3-year duration in the waters off the Fasht al-Jarim, al Muharraq, and Umm Nasan Islands. In November 1991 an exploratory well was spudded under this agreement at Fasht al-Jarim about 30 km northwest of Manama. The test was projected to 4,300 m and will evaluate the Jurassic Arab formation at 2,200 m and the Permian Khuff formation below 4,000 m. Should commercial fields be discovered, a 35-year production license would be granted with a 65%-35% equity in favor of Bahrain. Bahrain's crude oil production, stabilized at about 42,000 bbl/d largely by a gas injection program, was entirely derived from the Awali Field in central Bahrain. The field yields crude oil from the Cretaceous Bahrain zone at the 1,500 m depth and the Arab zone at

the 3,600 m depth. Khuff natural gas is recovered at depths between 5,400 m and 6,600 m. The field has 317 producing wells out of a total of 368.

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

The 250,000-bbl/d-capacity refinery at Sitra has consistently operated near capacity level and reported a record average throughput nearing 260,000 bbl/d in 1991. The refinery is scheduled to undergo a revamping estimated between $500 and $600 million in the next 5 years. The two-stage program will include hydrocracking and will cut fuel oil production to about 10% providing an overall product yield in line with future requirements. This program replaces a more expensive project requiring a $1 billion investment on a conversion unit designed to reduce fuel oil yield to 3%.

About 80% of the refinery's throughput in 1991 was delivered by pipeline from Saudi Arabia and the remainder from the Awali Field and from stocks. The implementation of a yield improvement program, which began in 1989, led to an increase of middle distillates that now accounts for the bulk of the refinery's output. The domestic demand for petroleum products has stabilized at a little more than 8,500 bbl/d, with the remaining output, about 250,000 bbl/d, destined for the export market.

Reserves

Recoverable petroleum reserves were estimated by the Bahrain National Oil Co. at between 150 and 200 Mbbl and proven nonassociated natural gas reserves at 183 m^3.

INFRASTRUCTURE

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

The Directorate of Electricity operates plants at Manama, Sitra, and Rifaa. Their combined capacity is 992 MW. In 1993, a link will be completed, bringing an extra 200 MW to the national grid system from the 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-km^2 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 sizes up to 500,000-dwt tankers. Occupancy of the dry dock averaged 95% before August 1990. The occupation of Kuwait by Iraq reduced interest in dry dock services in the Gulf area. The shipyard, however, recovered in the postcrisis period, reporting a net profit of $3.65 million in 1991. In November 1991, a $30 million loan was secured through Bahraini and Kuwaiti banks to finance two floating dry docks purchased from Jacksonville Shipyards (United States). The docks are expected to be operational by mid-1992 and can accommodate vessels of up to 125,000 dwt.

OUTLOOK

When realized, the 460,000-mt/a-capacity ALBA aluminum smelter will be the largest in the Middle East and will foster new downstream industries and increase employment.

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 promote rapid rebuilding of the postwar economy, which suffered a loss of almost $2 billion as a result of the Gulf War.

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.

[1]Where necessary, values have been converted from Bahraini dinars (BD) to U.S. dollars at the rate of BD0.37=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Industry and Development
Manama, Bahrain

Bahrain National Oil Co.
P.O. Box 25504
Awali, Bahrain
Telephone:(973) 754 666
Fax: (973) 753 203

Bahrain Petroleum Co.
Awali, Bahrain
Telephone: (973) 754 444
Fax: (973) 752 924

Bahrain National Gas Co.
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 HIDD
(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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991[e]
Aluminum, smelter output, primary metal		180,344	182,804	186,889	212,505	215,000
Cement		183,000	158,000	158,000	148,000	150,000
Gas, natural:						
Gross	million cubic meters	7,277	7,524	7,733	8,110	[2]8,087
Dry	do.	5,680	5,720	5,947	6,000	[2]5,522
Natural, gas liquids:						
Butane	thousand 42-gallon barrels	775	897	917	975	[2]1,102
Propane	do.	1,133	880	890	1,150	1,474
Nitrogen, N content of ammonia		308,440	296,400	319,400	325,000	325,000
Petroleum:						
Crude	thousand barrels	15,377	15,671	15,595	15,875	[2]15,434
Refinery products:						
Gasoline	do.	6,157	5,449	6,931	7,500	[2]8,032
Jet fuel	do.	10,818	10,081	8,419	[r]9,000	[2]7,477
Kerosene	do.	5,200	6,286	7,359	7,500	[2]10,427
Distillate fuel oil	do.	28,071	27,562	28,698	[r]28,500	[2]28,110
Residual fuel oil	do.	22,225	22,268	21,983	[r]22,500	[2]23,570
Other	do.	16,500	17,200	16,285	[r]16,300	16,300
Total	do.	88,971	88,846	89,675	[r]91,300	93,916
Sulfur, byproduct of petroleum		47,500	48,000	48,000	48,000	48,000

[e]Estimated. [r]Revised.

[1]Table includes data available through July 1, 1992.

[2]Reported figure.

TABLE 2

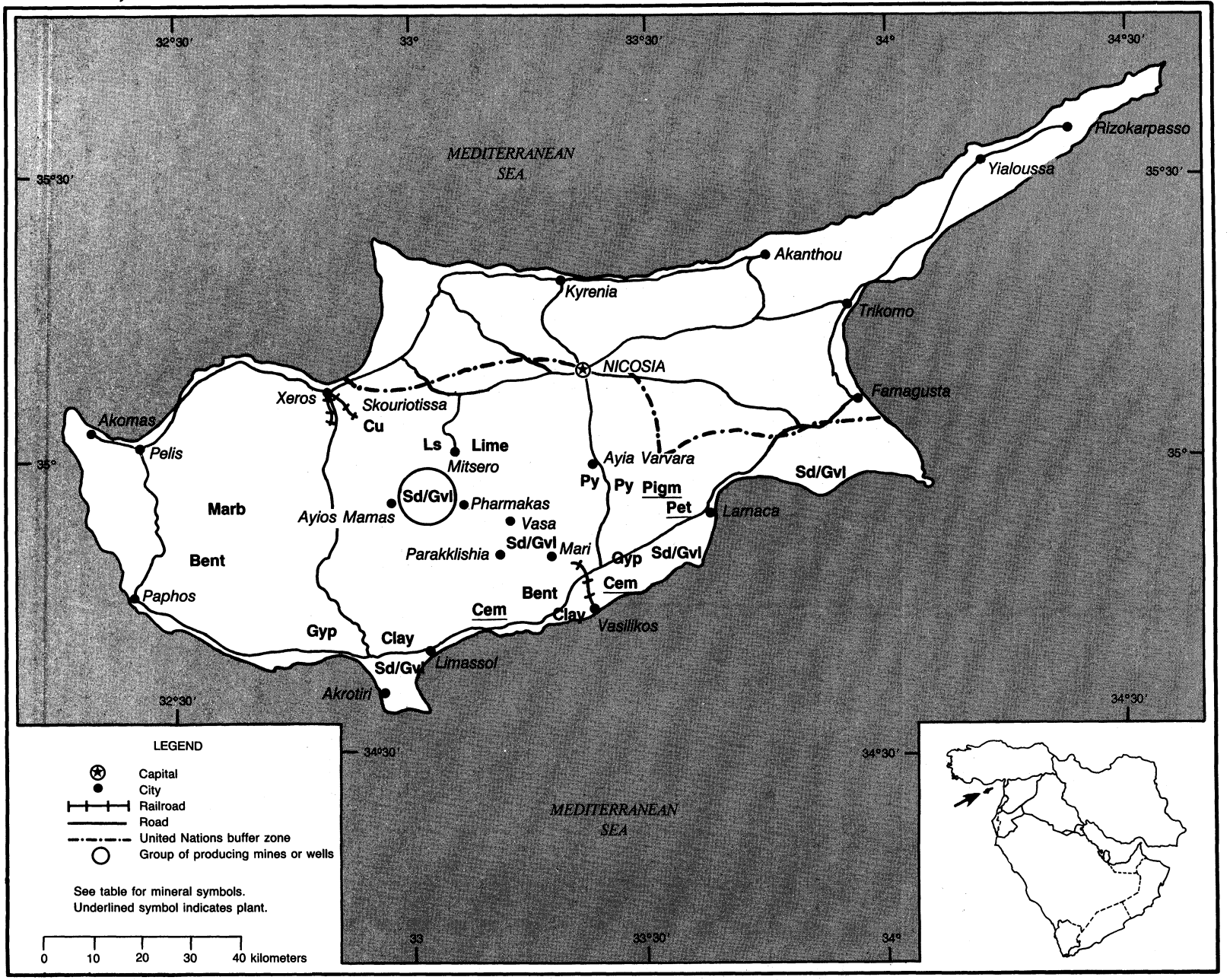
BAHRAIN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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	215
Aluminum products	Bahrain Aluminum Extrusion Co. (Government, 74%; Private, 26%)	do.	6
Do.	Middle East Aluminum Cables Ltd. (Al-Zayani Investments of Bahrain, 51%; Saudi Cable Co., 49%)	do.	40
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.	4,000
Natural gas million cubic meters	Bahrain National Gas Co. (Government, 100%)	Awali Field	8,500
Natural gas liquids:			
Propane thousand barrels	do.	Jabal al-Dukhan	1,400
Butane	do.	do.	1,100
Naphtha	do.	do.	1,500
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.	75

CYPRUS

AREA 9,000 km² **POPULATION 710,000**



THE MINERAL INDUSTRY OF

CYPRUS

By Audie L. King

The Cypriot[1] mineral industry continued a recent trend toward lower mineral production and exports. Over the past few years, operations in Cyprus' historically important export commodities, asbestos, chromite, iron pyrite, copper concentrate, and celestite, have slowed down and finally stopped production. In 1991, the mineral industry benefited, statistically, from the relative strength of the Cypriot pound against the dollar and from a favorable domestic price structure. Although the value of the mineral industry's output, excluding revenues from the petroleum refinery, rose by about 1.9%, from $103.8 million[2] in 1990 to $105.8 million in 1991, the total volume of most mineral commodities mined or produced actually declined. Hydraulic cement production, which accounted for slightly more than one-half of the total value of Cyprus' mineral output, however, increased slightly while its price in local currency remained stable.

In 1991, the mining and quarrying sector, including cement production, kept pace with Cyprus' moderately growing economy. Its proceeds made up about 1.8% of the nation's GDP, roughly the same as in 1990. Once again, the production of sand and gravel and other construction materials for domestic consumption increased in relative importance to mineral exports. The value of mineral exports dropped by about 33% in 1991 to $3.7 million, from about $4.9 million in 1990. Mineral sales accounted for less than 0.5% of the value of Cyprus' 1991 exports.

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. Despite political uncertainty and a steady decline in mineral production, Cyprus' economy continued to expand and diversify, though 1991's 4.5% growth in GDP, to about $5,800 million, was less than in recent years. Although the per capita GDP of the Turkish section was barely one-third that of the Greek section, its economy has also been expanding rapidly. In 1989 market prices, the GDP of the Turkish-occupied territory increased by 6.6% in 1987, 7.5% in 1988, and 8.6% to $423 million in 1989, the latest year that data were available.

Cyprus initiated a set of fiscal reforms in 1991 that included a new tax package and liberalized financial measures to stimulate the economy and harmonize practices with the EC. The new tax structure reduced corporate taxes from 40% to 20%, while the maximum individual tax rate was set at 40%. Government policies that promote the expansion of Cyprus' offshore sector have recently been very successful. Besides aggressively advertising the merits of the island's ideal location between Europe and the Middle East, the Government offered reduced tax rates to companies in Cyprus with business exclusively offshore.

Most of 1991's moderate gain in the value of Cyprus' total mineral production could be attributed to stable to higher mineral commodity prices and to fluctuations in currency exchange rates. The production of most mineral commodities, other than sand and gravel, actually fell during 1991. In general, the production of those mineral commodities for use in the domestic construction industry fared better than those destined for export. *(See table 1.)*

Despite a slowdown in the mineral industry, trade continued to be very important to the Cypriot economy. Its merchant marine fleet, consisting of 2,300 ships, was the seventh largest in the world and was expanding rapidly. Over the past decade, a favorable cost structure had enticed vessels from many European countries to fly the Cypriot flag. In 1990, after a number of Dutch ships withdrew from the fleet because Cyprus' harbors were too shallow, the ports at Larnaca and Limassol were dredged to allow newer-age, deep-draft vessels to use the ports.

In January 1988, Cyprus began a 15-year program to abolish all trade barriers with the 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.

Sales were down in nearly all of Cyprus' remaining mineral export commodities. The value of umber exports was the only exception to the downward trend, increasing slightly to $1.19 million in 1991 from $1.18 million in 1990. Iron pyrite joined the growing list of "former Cypriot export commodities" as the country reported no production or sales during 1991. The value of cement, copper, gypsum, and sandstone exports fell by more than 50%, while the value of bentonite exports was only 10.5% lower than in 1990.

Cyprus' merchandise trade deficit increased about 8.5%, from $1,450 million in 1990 to $1,570 million in 1991. Imports rose about 3.4% to $2,390 million, while exports decreased 3.0% to $820 million. Cyprus' trade deficit with the United States widened to $160 million in 1989, the latest year that such data were available. Exports to the United

States, which accounted for 1.9% of Cyprus' exports, included clothing, footwear, iron oxide pigments, steel tubes and pipes, carob, dairy products, and miscellaneous food items. The United States exported cereals, office equipment, paper and paper products, commercial vehicles, and electrical equipment to Cyprus. These products accounted for 7.3% of Cyprus' total imports.

Mining operations on the island have been privately owned and operated under leases and licenses issued by the Cyprus Mines Service since 1958. 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 was also carried out by foreign and domestic mining companies and by the research agencies of foreign countries.

Mining sector employment continued its downward trend. Fewer than 700 people were employed in 1991 compared with 1,735 in 1980. The Hellenic Mining Co., with 182 employees, was Cyprus' most significant mining company, with output from diverse operations. Production was mainly by small companies working small deposits. *(See table 2.)*

During 1991, Hellenic Mining Co. pursued an exploration program that included drilling and laboratory tests on the Skouriotissa copper ore to determine its amenability to solvent extraction and bioleaching.

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 may continue producing minor quantities of cement copper from waste drainage and concentrates from lower grade ore. Any significant drop in world copper prices would, however, hurt the mining of these low-grade reserves.

The resource base of some commodities, such as asbestos, bentonite, celestite, chromite iron oxide pigments, pyrite, and salt, that have experienced production declines or mine closures in recent years 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, which in recent years emerged as the most economical sector in the mineral industry, should continue to grow in importance to the nation's economy. An economic decline in Europe, however, could hurt the country's fortunes, which are tied to tourism and foreign trade.

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[1]Unless 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.

[2]Where necessary, values have been converted from Cypriot pounds (CP) to U.S. dollars at the rate of CP0.46=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

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Republic of Cyprus
Nicosia, Cyprus

Mines Service
Republic of Cyprus
Nicosia, Cyprus

Publications

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

Mine Service, Republic of Cyprus,
Nicosia:
Annual Report of the Mines Service,
annual.

TABLE 1

CYPRUS: PRODUCTION OF MINERAL COMMODITIES[1 2]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991
METALS						
Copper:						
Cupreous pyrite concentrate:						
Gross weight		—	—	1,752	—	—
Cu content		—	—	251	—	—
Cement copper:						
Gross weight		193	765	1,080	1,032	535
Cu content		80	315	465	472	226
INDUSTRIAL MINERALS						
Asbestos, fiber produced		18,070	14,585	—	—	—
Cement, hydraulic	thousand tons	854	868	1,042	1,133	1,134
Clays, crude:						
Bentonite		79,600	90,300	59,744	82,000	58,500
Other:						
For brick and tile manufacture	thousand tons	300	357	390	400	440
For cement manufacture[e]	do.	250	250	330	300	300
Total	do.	550	607	720	700	740
Gypsum:						
Crude		45,700	32,710	r34,000	37,000	e37,000
Calcined		4,960	3,975	e4,000	4,600	6,200
Lime, hydrated		6,890	6,810	7,060	7,326	6,566
Pigments, mineral: Umber		12,500	10,060	8,534	7,700	5,800
Stone, sand, and gravel:						
Limestone, crushed (Havara)	thousand tons	2,360	2,450	2,580	2,700	2,700
Marble	do.	80	78	96	82	74
Marl, for cement production	do.	567	e565	692	700	1,400
Sand and gravel[3]	do.	4,200	4,400	4,850	5,250	5,450
Unspecifed building stone	do.	285	300	166	200	200
Strontium: Celestite concentrate		6,300	—	—	—	—
Sulfur:						
Pyrite, gross weight		91,380	113,145	57,455	—	—
S content		41,121	50,916	25,855	—	—
MINERAL FUELS AND RELATED MATERIALS						
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	250	342	301	e300	315
Gasoline	do.	1,088	1,224	1,191	e1,100	1,032
Kerosene and jet fuel	do.	281	375	232	e300	301
Distillate fuel oil	do.	1,299	1,489	1,451	e1,500	2,076
Residual fuel oil	do.	1,288	1,506	1,268	e1,300	1,574
Asphalt	do.	191	246	266	e300	171
Refinery fuel and losses	do.	158	222	198	e200	e208
Total	do.	4,555	5,404	4,907	e5,000	5,677

eEstimated. rRevised.

[1]Table includes data available through Sept. 15, 1992.

[2]Mineral 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.

[3]Includes crushed aggregate.

TABLE 2

CYPRUS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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	e5.5.
Do.	D. Mitides Import-Export (private,[1] 100%)	Paphos area	e10.
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., 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., 31%; Italcementi, 20%)	Near Limassol	e600.
Do.	Peletico Plasters Ltd. (Peletico, 96%; private,[1] 4%)	West of Limassol	e120.
Copper	Hellenic Mining Co. Ltd. (Archbishop of Cyprus, Trustee to the Greek Community of Cyprus, 100%)	Skouriotissa	e2 concentrate, e1.1 cement copper.
Diabase	do.		e280.
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	e8 hydrated lime.
Limestone	do.	do.	e280.
Do.	Vasiliko Cement Works Ltd. (Hellenic Mining Co., 31%; Italcementi, 20%)	Vasilikos	e1,500.
Marble	Chrisostomos Peppos Ltd. (private,[1] 100%)	Paphos area	e20.
Do.	Elepem Ltd. (private,[1] 100%)	do.	e12.
Do.	D. Mitides Import-Export (private,[1] 100%)	do.	e8.
Do.	Takis Marble Enterprises Co. Ltd. (private,[1] 100%)	do.	e7.5.
Do.	Nearchos Eliades and Sons Ltd. (private,[1] 100%)	do.	e1.5.
Do.	Evagoras Andreou Ltd. (private,[1] 100%)	do.	e3.8.
Marl	Cyprus Cement Co. Ltd. (private,[1] 100%)	Vasilikos	e700.
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	e160.
Do.	do.	Mari	e24.

See footnotes at end of table.

TABLE 2—Continued

CYPRUS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Sand and aggregates	Hellenic Mining Co. Ltd.[2]	Vasa	e200
Do.	Skyra Lima Ltd. (private,[1] 100%)	Ayia Varvara	e600
Do.	K.M.G. Quarries Ltd. (private,[1] 100%)	Pharmakas	e220
Do.	Mosphiloti Quarries Ltd. (private,[1] 100%)	do.	e196
Do.	Costas Kythreotis and Son Ltd. (private,[1] 100%)	do.	e250
Do.	General Construction Co. Ltd. (private,[1] 100%)	Parakklishia	e270
Do.	Eskal Ltd. (private,[1] 100%)	Ayios Mamas	e175
Do.	Skyropiia "Leonik" Ltd. (private,[1] 100%)	Mitsero area	e135
Sand and gravel	Neefa Ltd. (private,[1] 100%)	Akrotiri	e150
Do.	Geomichanikai and Ergoliptikai Epichirisis Merra Ltd. (private,[1] 100%)	do.	e65
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.	e2
Do.	Oryktaco Ltd. (private,[1] 100%)	Numerous small surface workings near Nicosia	2
Do.	Umber Corp. of Larnaca Ltd. (private,[1] 100%)	Surface workings, 20 kilometers northwest of Larnaca	e13

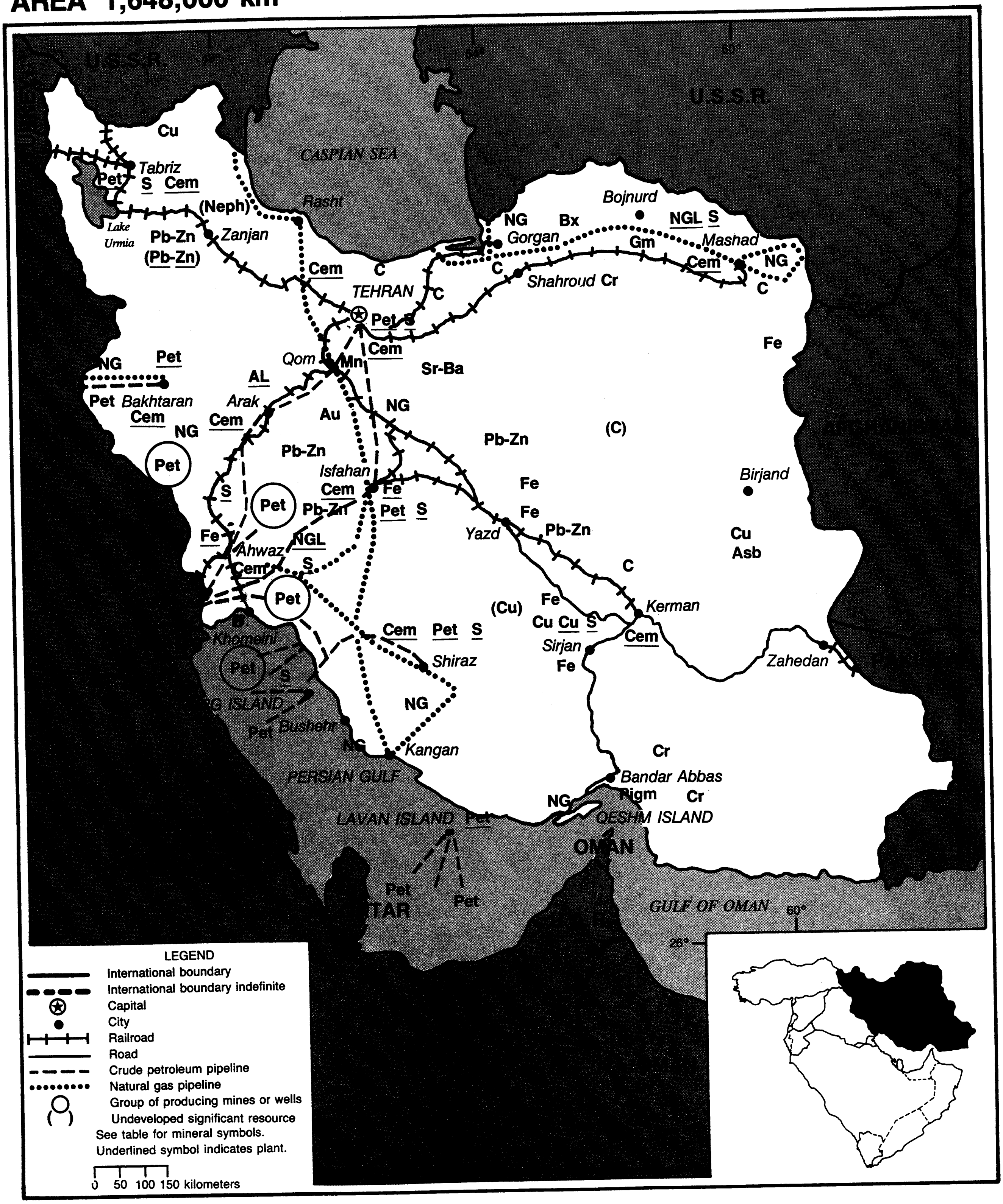
eEstimated.

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

[2]Hellenic 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 59 million**



THE MINERAL INDUSTRY OF

IRAN

By Michael Mir Heydari

Iran's economy in 1991 continued to be dominated by the crude petroleum and natural gas sectors. Iran was the world's fourth largest petroleum producer, with a production level averaging about 3.5 Mbbl/d.[1] Its petroleum reserves were among the top five. Iran was among the top 15 producers of natural gas, with reserves second only to the U.S.S.R.

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

The economy continued to stabilize as idle production capacities were activated. Reportedly, on average, industry operated at 85% of capacity. As a result, GDP grew at about 8%, in line with the target of the current 5-year development plan. Shortages of foreign exchange and problems with exchange rates remained, although the Government worked at its resolution. The inflation rate was estimated at about 20%.

GOVERNMENT POLICIES AND PROGRAMS

The Government undertook economic reforms to reduce state influence in Iran's economy, privatize state companies, promote the stock exchange, and encourage foreign and domestic private investment. As some subsidies disappeared, prices increased markedly to free market levels. In most cases, wage increases did not keep up with the inflation rate, forcing many workers to take up second and third jobs.

Talks with the International Monetary Fund (IMF) continued on rebuilding the economy. The issue of official currency exchange rate versus the free market rate was a major point in discussions. The Government agreed to take a gradual approach to devaluation of the official rate, fearful of the public discontent that could be provoked by a sudden currency devaluation, particularly the sharp increase in prices that would inevitably follow.

Foreign investment was invited in most sectors, especially mining. The 49% ceiling on foreign ownership was lifted in 1991 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 large number of metals and industrial minerals were produced in 1991. 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 1991, the Ministry of Mines and Metals announced plans for major increases in steel production. Steel output was to increase from the March 1991 level of about 3.0 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 from the early 1991 level of 94,000 mt/a to 120,000 mt/a 12 months later and to 200,000 mt/a by 1995. Aluminum output from the Arak plant was to increase from the March 1991 level of 70,000 mt/a to 120,000 mt/a in 1992 and to more than 300,000 mt/a by 1995. Additionally, the first lead and zinc smelters, at Angouran Mine near Zanjan, were slated to come on-stream in 1992 with output capacities of 40,000 and 60,000 mt/a, respectively. *(See table 1.)*

TRADE

In 1991, total exports amounted to $18.5 billion, of which oil and gas exports accounted for $16 billion.

The five leading suppliers of goods and services to Iran were, in order of importance, the Federal Republic of Germany, Italy, the United Kingdom, Japan, and France. Total imports were estimated at about $20 billion.

Export earnings from non-oil and gas minerals amounted to an estimated $300 million in 1991 and were expected to reach $1 billion by the mid-1990's. The most significant minerals exported were chromite, lead, and zinc. More than 200,000 tons of chromite concentrates, 100,000 tons of zinc ore, and 25,000 tons of lead ore, worth a total of more than $50 million, were exported in 1991; largely to Belgium, China, India, Japan, and North Korea.

A number of trade agreements relating to mineral commodities were concluded with European and Japanese partners during 1991. However, their significance remained to be determined. Agreements were reached on natural gas export to Europe and the U.S.S.R. and resumption of crude oil sales to U.S. firms.

STRUCTURE OF THE MINERAL INDUSTRY

Most of the principal mineral commodity production facilities were under Government control in 1991 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. In some cases, the former owners of nationalized operations were invited to buy back or resume the operation of their mines. However, many of the operations for sale, which had been deteriorated owing to ineffective management and lack of technical expertise in the 1980's, did not attract buyers. By yearend 1991, the management of 40 mines throughout Iran had been transferred to the private sector.

COMMODITY REVIEW

Metals

Aluminum.—The current aluminum production from the Arak plant is at about 120,000 mt/a and is to be increased to 200,000 mt/a as a result of the plant expansion.

The first construction contract for Almahdi Aluminum Corp.'s new $1.5 billion smelter, to be built at the Persian Gulf port of Bandar Abbas, was awarded to Kloeckner-Humboldt Deutz AG, the German engineering group that built the Arak aluminum plant in Iran in 1970. 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 Ministry of Mines and Metals and 40% by the Dubai-based International Development Corp., a partnership of Arab, United Kingdom, and Swiss investors and traders.

Construction work started on an alumina plant at Jajroum, 150 km northeast of Shahroud. Technical assistance is being received from Technoexport of Czechoslovakia. The $400 million plant will produce 150,000 mt/a of alumina and will feed the aluminum smelters at Arak and Bandar Abbas. It is due to become operational by March 1995. The ore will be supplied by bauxite deposits near Jajroum having estimated reserves of 22 Mmt averaging 48% Al_2O_3. About 300,000 tons of bauxite have so far been mined under trial conditions.

In northwestern Iran at Sarab, about 120 km east of Tabriz, a large nepheline syenite deposit could be mined for aluminum ore under an agreement with the U.S.S.R., which has developed the appropriate process technology to extract aluminum from 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.

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-MVA Chinese-made electric furnaces with a combined production capacity of 14,000 mt/a. Ore would be supplied by local mines. The Belgian Government has expressed interest in assisting Iran in setting up a 50,000-mt/a ferrochrome plant in the free trade zone on Qeshm Island. Exploitation of the Froumad chromite mine near Shahroud resumed in 1991 after an 18-year closure. About 14,000 tons of ore was produced in 1991.

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 1991. NICICO was studying plans to expand copper output capacity from the current 145,000 mt/a to 200,000 mt/a.

An underground copper mine and concentrator about 150 km south of Birjand was also operated by NICICO. The concentrates, which carry significant gold and silver values, were 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 deposits 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. Outomec is also in the process of putting together tender documents for the renovation and expansion of the concentrator at Sar Cheshmeh.

Excavation work started 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.—Broken Hill Pty. Ltd. of Australia (BHP) was awarded a consultancy contract for investigating the expansion of gold production in the Mouteh area, about 150 km northwest of Isfahan. The planned production capacity is 500 mt/d of ore grading 2 to 5 g/mt of gold. In addition, NICICO is producing gold as a byproduct of its copper mining operations; the quantity has not been disclosed.

Iron and Steel.—Iron ore exploitation was stepped up to feed a growing steel manufacturing industry based at the Soviet-built Mobarakeh mill in Isfahan and the Ahwaz works. Combined

production capacity of various kinds of steel rose to 3 Mmt/a with a target of 4 Mmt/a by 1993 and 5.5 Mmt in 1995. This will reduce the country's steel import needs to about 2 Mmt/a from the current 4.5 Mmt/a. In 1991, raw steel output rose by 55%, the largest percentage rise of any country, to 2.2 Mmt/a.

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 1991, most of the iron production came from the Choghart Mine. Mitsubishi Corp. of Japan, in joint venture with Voest Alpine of Austria and an unidentified German firm, finalized their bid for the expansion of the Choghart iron ore complex. The cost of the scheme was estimated at about $200 million.

Golgohar is scheduled to start supplying 40% of Mobarakeh's needs in 1992 and will later supply Ahwaz. It is scheduled to produce 2.75 Mmt of concentrates in 1993, with output rising eventually to 5 Mmt/a.

Chadormalu's reserves are estimated at 400 Mmt of hematite-magnetite ore grading about 67% iron. Mitsubishi, in consortium with Kobe Steel and Marubeni Corp., won a $398 million contract for Chadormalu's 5-Mmt/a iron ore concentration plant, which is expected to come on-stream in late 1995.

BHP has been involved in feasibility studies of the Sangan project, which envisions a planned capacity of 3.4 Mmt/a of iron ore concentrates. The Government is hoping to develop Sangan as a fast-track turnkey project.

Direct-reduced-iron (DRI) production at the Ahwaz steel complex was planned to commence early in 1993 from its first Mexican HYL module. Total DRI capacity from HYL is targeted at 1 Mmt/a. The 1.2-Mmt/a Midrex plant at Ahwaz produced 240,000 tons in 1991.

The expansion project at National Iranian Steel Corp.'s Kavian plant in Ahwaz, which included building a strip mill at the site, completed the precommissioning phase and is expected to be fully operational by the end of 1992. The expansion will boost slab production at the plant from 270,000 mt/a to 400,00 mt/a and sheet and welded pipe production to 1.33 Mmt/a.

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, to reach 260,000 mt/a within 3 years. The ore for the plant will come from the nearby Chadormalu Mine. This is the second large recent contract for both consortium partners. Danieli was also awarded the $660 million job of modifying and expanding the Soviet-built Mobarakeh steel mill in Isfahan.

Kobe steel was selected to build a 5-Mmt/a sponge iron plant on Qeshm island offshore Bandar Abbas. Kobe has a 40% stake in the project. The Qeshm island was being developed as a free trade zone. A $770 million iron ore handling facility and jetty was announced for the port of Bandar Abbas. It is to be used to transfer shipments to the Iranian steel plants.

Lead and Zinc.—A new 40,000-mt/a-capacity lead smelter is due for startup in 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 is also planned for Angouran. A second zinc smelter, with the capacity of 27,000 mt/a, is proposed for the Bafq Mine, near Yazd, which is the country's second largest lead and zinc mine.

Industrial Minerals

Cement.—Iran continued to expand its cement industry. Several plants were either under construction or planned for future construction. Bulgaria's Multi-International Holding (MIH) had signed an agreement, worth $200 million, to build a white cement plant in Semnan, 150 km east of Tehran. Construction of a 2,400-ton cement plant near Mashad, in the Khorasan Province, continued as scheduled. Kash Co. (Ministry of Industries) is planning on building a 3,600-mt/d plant near Yazd. Humboldt Wedag of Germany will supply the equipment. Startup is scheduled for 1995. Several other contracts were awarded for new plants and additions to existing plants.

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.

Italy reached an agreement with MMM on the exploitation and export of stone slabs for interior decoration from the Froumad marble mine near Shahroud.

Fertilizer.—The Iranian Ministry of Oil let a $358 million contract to a joint venture of Kawasaki Heavy Industries Ltd. and Kellogg International Corp. to build a chemical fertilizer plant at Bojnurd, in northeastern Iran. The capacity will be 330,000 mt/a of ammonia and 500,000 mt/a of urea. Japan's Export-Import Bank will fund about 85% of the contract. Completion is scheduled for fall 1994.

Mineral Fuels

Coal.—In 1991, 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. 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/a 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. German and British firms have submitted proposals for mine development that still need the Government's final approval.

Petroleum and Natural Gas.—In spite of an OPEC ceiling for Iran of 3.184 Mbbl/d, a 9% reduction agreed to in February 1992, petroleum production was slated to rise to more than 4 Mbbl/d by 1993 from an estimated average of 3.5 Mbbl/d in 1991. By 1994, capacity is planned to be 5 Mbbl/d. The export terminal at war-damaged Kharg island was to be expanded as reconstruction continued.

Three major refineries at Abadan, Isfahan, and Tehran each treated about 200,000 bbl/d of crude. Total refining capacity for the country was about 720,000 bbl/d. Projects for rehabilitation of the Adaban refinery and construction of new refineries at Arak and Bandar Abbas were continuing.

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 cubic meters of gas and 2.5 billion bbl of natural gas liquids. A joint venture of Italy's Technologie Pregetti E. Lavori and Saipem and the U.S.S.R.'s Machinoimport drilled the first of the three appraisal wells in the field in July under a $37 million contract.

Iran has signed agreements with Azerbaijan and Ukraine to supply them with 3 billion cubic meters of gas in 1992. Additionally, three pipelines will be laid to export 75 billion cubic meters of gas to Europe via the former Soviet Republics.

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 hard currency investment of about $11 billion during the 1990's is scheduled to give Iran an installed capacity of more than 12 Mmt/a. 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. Plants are also being built or planned in Khorasan, Kerman, and Qeshm Island.

Reserves

Published reserve data are inadequate to provide a meaningful inventory of Iran's mineral resources. 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 over the next 2 years. A collaborative mapping program at the scale of 1:100,000 is underway with technical teams from China, Czechoslovakia, and Germany.

INFRASTRUCTURE

Major efforts were being made to rehabilitate and/or improve transportation facilities throughout the country. Ports were an important focus. The Republic of Korea's Daewoo Corp. and Italy's Italimpianti were awarded contracts to build loading and unloading facilities at, respectively, Bandar Abbas and Bandar Khomeini. 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 U.S.S.R. 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.

An ambitious electric power generation and distribution program was underway in 1991 throughout the country. Several new powerplants were connected to the national power grid, namely as follows: the coal-fired Neka plant close to the Caspian sea, 125 km north of Tehran; Ramin plant in Ahwaz; two steam- and two gas-operated plants in Loshan near Zanjan; and a hydroelectric plant on the Sefid River, about 80 km north of Tehran. The new plants added more than 1,000 MW to the total power capacity of Iran. The total installed capacity amounted to more than 15,000 MW. The Ministry of Energy plans call for an addition of 2,000 MW/a over the next 7 years in order to achieve a balance between power supply and demand.

The Government awarded a consortium led by Asea Brown Boveri (ABB) of Switzerland 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.

The Government expressed interest in completing construction work on the 1,200-MW twin-reactor nuclear powerplant near Bushehr. 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.

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

[2]Where necessary, values have been converted from Iran rials (Rls) to U.S. dollars at the official rate of Rls70.00=US$1.00. This highly overvalued rate was that at which the dollar was sold to Ministries and other parastatal organizations for the import of 32 "basic" commodities. The second exchange rate, the "competitive" rate of Rls600=$US1.00, was used by Ministries and affiliated organizations for the import of nonessential supplies and equipment and for other purposes. The floating rate, which averaged Rls1,430=US$1.00, was used for imports by private sector. Only 10% of foreign exchange dealings was conducted at the floating rate.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Mines and Metals
9248 Somaieh Street
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Telephone: 98-21-83-6050

Ministry of Petroleum
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Geological Survey of Iran
P.O. Box 13185-1491
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96 Ibn Sina Ave., Yussef Abad
Tehran, Iran

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Valiye Asr Ave.
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Publications

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

TABLE 1

IRAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991[p]
METALS						
Aluminum: Metal, primary ingot[e]		45,000	40,000	54,000	60,000	80,000
Chromium:						
Chromite, mine output, concentrate (e46% to 52% Cr_2O_3):						
Gross weight		r92,120	r60,289	r72,628	r77,189	90,119
Cr_2O_3 content[e]		45,000	30,000	35,000	38,000	44,000
Copper:						
Mine output, concentrate (e30% to 32% Cu):						
Gross weight		re150,000	r170,722	r171,477	r219,728	289,621
Cu content[e]		r40,000	51,000	r68,000	r60,300	80,700
Metal:[3]						
Smelter output, blister/anode		40,000	52,000	76,000	54,800	55,200
Refinery output, cathode		25,000	32,000	40,000	43,255	77,900
Gold: Mine output, Au content[e]	kilograms	400	400	400	500	800
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	1,692	2,005	2,296	r2,645	3,745
Fe content[e]	do.	900	1,100	1,300	1,500	2,100
Metal:						
Pig iron	do.	e250	e250	e250	r1,267	1,952
Direct-reduced iron	do.	—	—	70	300	580
Steel, crude (ingots and castings)	do.	r839	978	1,081	r1,425	2,203
Lead:						
Mine output, concentrate (e56% to 60% Pb):						
Gross weight		re23,000	r18,510	r21,866	r19,310	27,468
Pb content[e]		r13,000	r11,000	r13,000	r11,000	16,000
Refinery output[e]		10,000	10,000	9,000	10,000	12,000
Manganese, mine output, (e30% to 35% Mn):						
Gross weight		r62,784	r74,630	r80,953	r54,404	48,422
Mn content[e]		20,000	23,000	24,000	r18,000	16,000
Molybdenum, mine output, concentrate (e55% to 60% Mo):						
Gross weight		874	1,181	1,305	889	707
Mo content[e]		500	r700	r750	500	400
Silver: Mine output, Ag content[e]		28	30	41	38	40
Zinc, mine output, concentrate (e50% to 55% Zn):						
Gross weight		re60,000	r29,015	r54,995	r54,762	135,180
Zn content[e]		r30,000	r15,000	r29,000	r29,000	70,000
INDUSTRIAL MINERALS						
Arsenic: Orpiment and realgar, concentrates		1,981	417	1,039	382	552
Asbestos:						
Concentrate (3% to 8% marketable fiber)		58,750	68,202	65,000	r51,467	62,032
Marketable fiber[e]		2,900	r3,410	3,300	r2,800	3,000
Barite		r42,430	r44,309	r59,660	r77,423	191,238
Boron: Borax		r1,049	r1,720	r466	r1,818	1,030
Cement, hydraulic	thousand tons	12,729	12,202	e12,500	re13,000	e15,000

See footnotes at end of table.

TABLE 1—Continued

IRAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991[p]
INDUSTRIAL MINERALS—Continued						
Clays:						
Bentonite		r52,523	r37,028	r31,547	r51,096	40,452
Kaolin and industrial clays[5]		r362,752	r494,348	r448,980	r213,181	367,183
Bauxite and refractory clays		59,964	92,536	74,097	92,509	98,425
Diatomite		—	r32	—	2,152	90
Feldspar		r16,226	r14,781	r20,458	r32,071	64,754
Fluorspar: Fluorite		r7,352	r6,483	re6,000	r4,767	12,260
Gemstones: Turquoise	kilograms	r27,848	r23,838	r17,408	r24,855	e20,000
Gypsum	thousand tons	r8,112	r7,648	r7,858	r7,724	8,050
Lime[e]	do.	650	650	650	650	650
Magnesium compounds: Magnesite and huntite[6]		r5,261	r2,777	r6,967	r1,405	29,291
Mica		r2,450	r1,167	r2,294	r1,352	4,135
Nitrogen: Ammonia, N content[e]		119,200	145,500	336,000	420,000	4467,700
Perlite		1,594	1,280	2,240	2,266	6,275
Pigments, mineral, natural iron oxide		r1,752	r3,700	r4,869	r3,720	3,753
Pumice and related volcanic materials		e170,000	e190,000	212,442	237,868	215,149
Quartzite and silica		605,499	829,121	822,853	e870,000	832,441
Salt		r710,986	814,842	r989,932	r848,098	900,965
Sodium compound: Caustic soda[e]		12,000	12,000	12,000	15,000	15,000
Stone:						
Construction and building, crushed, n.e.s.	thousand tons	e2,700	2,741	3,086	3,515	3,073
Dimension and decorative: Marble, travertine, granite:[7]						
Blocks and slabs[e]	do.	3,200	3,700	4,450	4,800	4,940
Crushed[e]	do.	400	410	500	4669	4555
Total[8]	do.	re3,600	r4,107	r4,947	r5,469	5,495
Dolomite	do.	93	72	77	71	105
Limestone	do.	r17,244	r17,420	r17,527	r20,546	24,180
Seashell	do.	e85	e85	85	81	73
Strontium: Celestite		r20,066	r39,194	r56,849	r34,140	28,500
Sulfates, natural:						
Aluminum potassium sulfate (alum)[e]		12,000	12,000	12,000	12,000	12,000
Sodium sulfate		264,442	213,521	184,848	176,951	144,204
Sulfur:[e]						
Byproduct of petroleum and natural gas		240,000	206,000	460,000	r635,000	650,000
Byproduct of metallurgical processing, S content of acid		20,000	25,000	40,000	45,000	50,000
Total		r260,000	r231,000	r500,000	r680,000	700,000
Talc		r16,975	r29,261	r11,039	r31,087	6,676
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand tons	r1,519	r1,625	r1,457	r1,435	1,480
Coke[e]	do.	400	400	400	400	400
Gas, natural:						
Gross	million cubic meters	36,700	40,500	43,600	48,000	e50,000
Dry[9]	do.	16,000	20,000	22,200	24,200	e25,000
Natural gas plant liquids	thousand 42-gallon barrels	7,300	7,300	9,900	11,000	e12,000

See footnotes at end of table.

TABLE 1—Continued

IRAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991[p]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	838,770	824,535	1,025,650	1,127,120	1,216,910
Refinery products:						
Liquefied petroleum gas	do.	6,570	6,935	8,760	e10,000	e12,000
Motor gasoline	do.	33,215	33,580	39,055	e40,000	e45,000
Jet fuel	do.	2,555	2,555	2,920	e3,500	e4,000
Kerosene	do.	22,630	22,995	24,820	e26,000	e30,000
Distillate fuel oil	do.	58,400	62,050	75,555	e80,000	e90,000
Residual fuel oil	do.	67,525	76,650	83,220	e85,000	e90,000
Other[10]	do.	18,980	14,235	13,870	e16,000	e20,000
Total	do.	209,875	219,000	248,200	e260,500	e291,000

eEstimated. n.e.s./Not elsewhere stated. pPreliminary. rRevised.

[1]Data are for Iranian years beginning Mar. 21 of that stated, except data for natural gas, plant liquids, petroleum, and all metals other than aluminum, iron ore and pig iron, which are for Gregorian calendar years. Table includes data available through Aug. 22, 1992.

[2]In addition to the commodities listed, other types of crude construction materials, such as common clays, sand and gravel, other varieties of stone, and miscellaneous other minerals are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Apparently includes output of copper smelted and refined from copper scrap, estimated at about 5% of total output.

[4]Reported figure.

[5]In 1991, kaolin production amounted to 150,473 tons.

[6]Figures for 1987-90 is for magnesite; the 1991 figure includes 3,336 tons of huntite ("white clay"), $Mg_3Ca(Co_3)_4$.

[7]For 1991, blocks and slabs production of marble, travertine, and granite, in thousand tons, were as follows: 4,468; 463; and 9 respectively. Figures for crushed production were 498; 56; and 2, respectively.

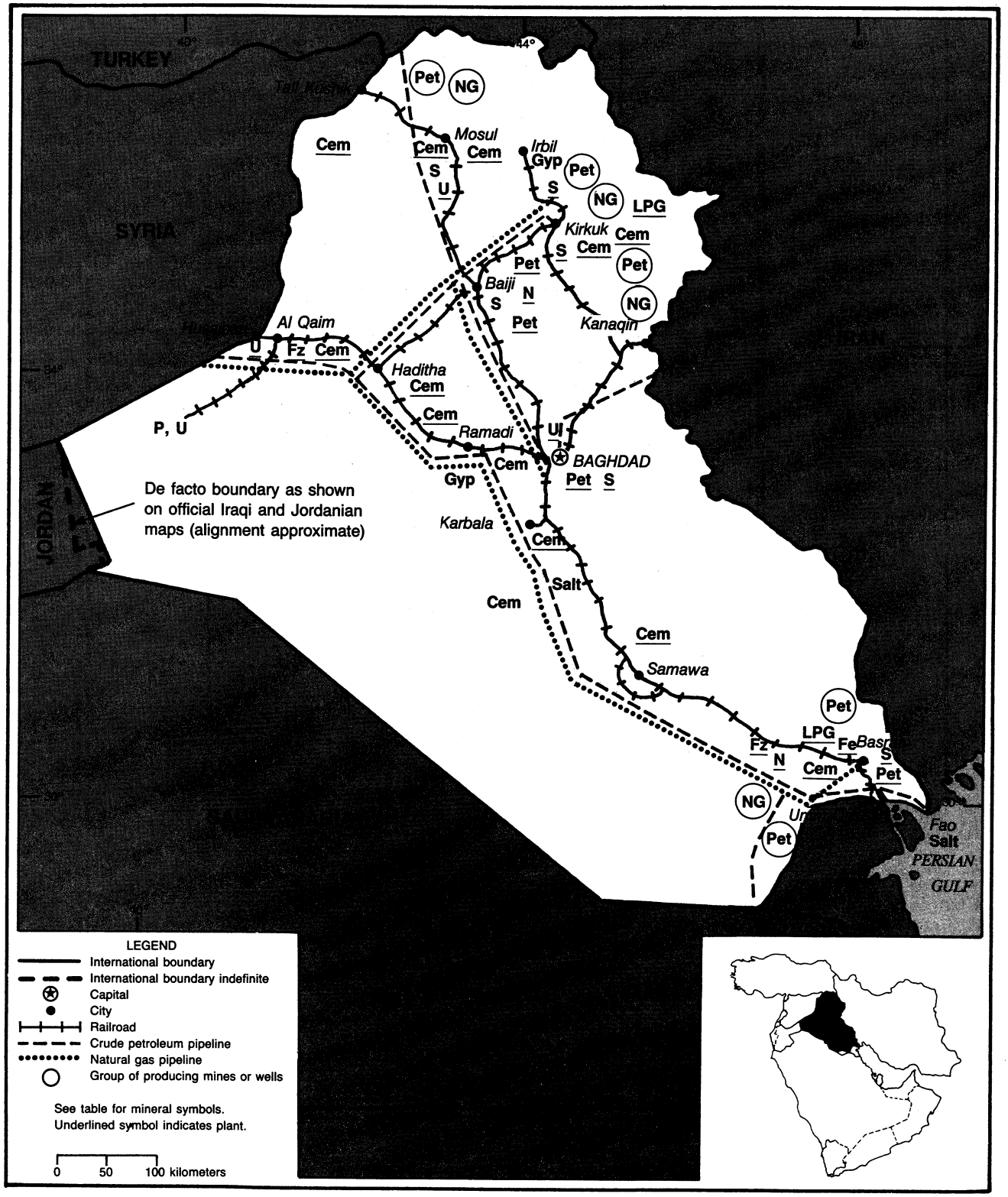
[8]Total may not add up to sum of details due to independent rounding.

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

[10]Includes lubricants (including greases). Refinery fuel and losses are included in output of individual products; totals are as follows, in thousand barrels: 1987—10,950; 1988—10,585; 1989—9,490; 1990—11,000 (estimated); 1991-12,000 (estimated).

IRAQ

AREA 434,920 km² **POPULATION 19.5 million**



THE MINERAL INDUSTRY OF

IRAQ

By Lloyd E. Antonides

Minerals, particularly oil, were essential to Iraq's economy. In recent years, Iraq was among the world's 10 largest oil producers and 12 largest sulfur producers and was a significant Middle Eastern cement, phosphate, and urea producer.

The minerals industry as well as the entire Iraqi economy was severely affected by the conflict resulting from Iraq's August 1990 invasion and occupation of Kuwait. The subsequent UN coalition forces' action called Desert Storm was physically devastating to Iraq's infrastructure, especially transportation, communications, and power, and also to many industrial plants. The greatest damage occurred during the massive aerial bombardment by the coalition in January and February 1991 in preparation for a late February ground assault that lasted 100 hours. Reportedly the minerals sector felt the fury at oil and gas critical points—pipeline junctions and pumping stations—and refineries, as well as at petrochemical, iron and steel, fertilizer, and cement plants. However, reports available early in 1992 remained inconsistent and inconclusive as to the extent of damage.

Despite the great physical damage, the economy was probably most affected by the trade embargo imposed by the UN member countries. It began in August 1990 and, except for some food and medicine, it remained in effect through

TABLE 1
IRAQ: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		1987	1988	1989	1990	1991e
INDUSTRIAL MINERALS						
Cement, hydraulic e	thousand metric tons	10,000	[3]10,500	12,500	r10,000	5,000
Gypsum e [4]	do.	350	350	450	380	190
Nitrogen: N content of ammonia e	do.	60	313	474	330	40
Phosphate rock e [5]	do.	r1,100	r1,270	r1,140	r900	400
Salt e	do.	70	[4]300	300	300	300
Sulfur, elemental: e						
Native, Frasch	do.	707	[4]958	960	800	400
Byproduct [6]	do.	250	[4]227	370	r260	30
Total	do.	957	r1,185	1,330	r1,060	430
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural: e						
Gross	million cubic meters	14,160	14,160	14,400	r10,080	1,310
Dry	do.	2,800	2,800	3,100	r2,170	280
Natural gas liquids: e						
Natural gasoline	thousand 42-gallon barrels	400	400	440	r310	40
Propane and butane	do.	1,000	1,000	1,100	r770	100
Petroleum:						
Crude	do.	r759,000	r980,000	r1,057,000	r [3]745,000	[3]100,000
Refinery products e	do.	r129,000	r146,000	r160,000	r112,000	15,000

eEstimated. rRevised.

[1]Includes data available through Mar. 10, 1992.

[2]In addition to commodities listed, iron; steel (estimated at 300,000 tons in 1989, 150,000 tons in 1990, and 20,000 tons in 1991); 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 and glass; and clays for ceramics and refractories) were also produced but information did not give output or was inadequate to reliably estimate output.

[3]Reported figure.

[4]Estimated 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.

[5]Beneficiated product, estimated as 30% P_2O_5. Crude rock reported only for 1988 as 3.5 million metric tons estimated to contain 22% P_2O_5.

[6]Presumably from petroleum and natural gas processing.

early 1992. 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 the food and medicine allowed.

Before the UN action, the Government had embarked on an industry and infrastructure reconstruction and expansion program after the relatively minor damage of the 8-year Iraq-Iran war that ended in 1988. A number of projects were completed or near so. Some were in the minerals sector other than oil and gas, including fertilizer, cement, and steel.

The Government had been changing its policy from wholely state-owned ventures to inclusion of private and foreign participation. However, the new foreign investment law in 1988 limited it to Arab capital. But in mid-1989 some consideration was being given to other sources on a case-by-case basis.

Mineral commodity production data, long considered classified military information, were starting to become available in 1988 but remained difficult to acquire through early 1992. Undoubtedly 1991 production dropped even lower than in 1990 because of the war and embargo on exports. *(See table 1.)*

International trade essentially ceased in 1991 due to the embargo. Some truck shipments of oil to Jordan were reported.

The structure of the minerals industry was dominated by the Government but in solid minerals there apparently were some private and mixed ventures.

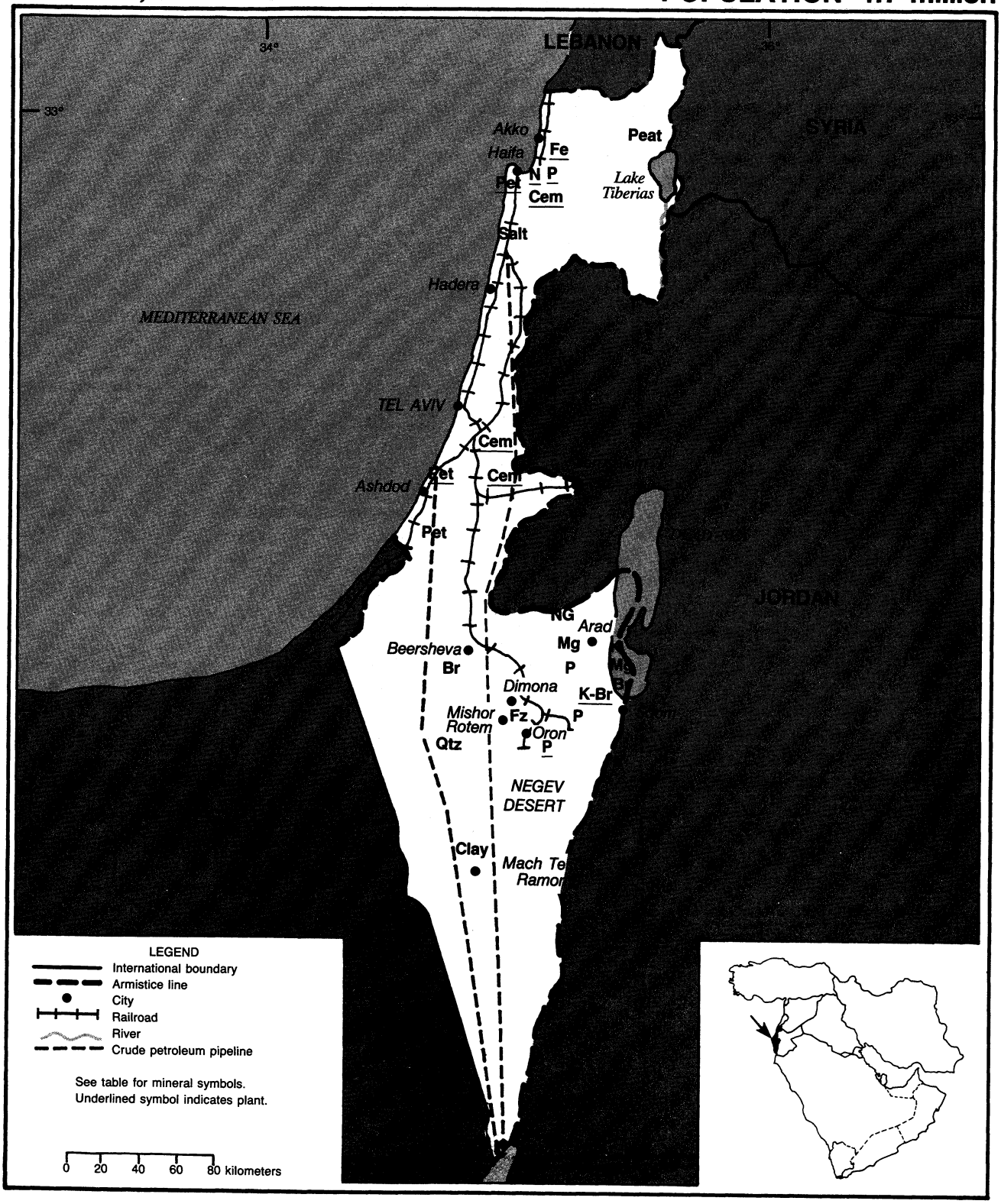
Commodity-specific information was not available during the year.

The infrastructure suffered major war damage but no detailed assessment was available.

The general outlook for the economy and minerals, as of early 1992, remains rather dismal for the near term pending resolution of political matters. Little progress on the extensive reconstruction needed can be expected until the Iraqi Government complies with UN objectives.

ISRAEL

AREA 21,000 km² **POPULATION 4.7 million**



THE MINERAL INDUSTRY OF

ISRAEL

By Audie L. King

The mineral industry of Israel in 1991 was dominated by phosphate mining, the extraction of evaporites from the Dead Sea, the manufacture of fertilizers, and the processing of imported diamond.

Israel was the world's seventh largest producer of phosphate rock and accounted for about 2% of world production. It continued to be the world's second largest producer of bromine and bromine compounds, accounting for more than 31% of total world production in 1991. Israel accounted for about 5% of the world's potash production, making it the third largest producing nation. More than 1% of the world's refractory-grade magnesia was also recovered from Dead Sea brine.

The extractive mineral industry played a relatively minor role in Israel's overall economy, accounting for only 1% to 2% of GDP in 1991. In that more than 90% of the country's mineral production was exported in 1991, the mineral industry was relatively important to Israeli trade. Exports of mineral products from mining and quarrying and manufactured mineral products, excluding cut diamonds, were about $650 million[1] in 1991 or about 5.5% of all exports. Israel was also a significant consumer of mineral products. It had a relatively high per capita consumption rate and a well-developed industrial capacity to process imported raw materials for reexport. If exports of imported minerals that were further processed in Israel such as diamond, primary metal products, fertilizer, refined petroleum products, and inorganic chemicals were considered, mineral commodity exports would account for more than 42% of the value of total exports. The diamond cutting and polishing trade alone accounted for about 6% of the value of total imports and about 26% of the value of total exports.

The Israeli economy was in an upswing, stimulated by higher domestic demand, when it slowed down temporarily during the first quarter of 1991 owing to the Gulf War. By midyear, the economy was again growing at about 8% per year. During the latter portion of 1991, however, the trend toward rising industrial output and employment stalled. The country was unable to keep pace with the influx of about 400,000 new immigrants who had arrived over the previous 2-year period from the former U.S.S.R. By the end of the year, the GDP stood at $53.9 billion, an increase of 5.2% from that of the previous year. Inflation remained in the 17% to 24% range. The economy registered a $5.9 billion trade deficit in 1991, as domestic consumption rose particularly in construction as efforts continued to house the new immigrants. Exports were also down slightly during the year owing to the Gulf War and a worldwide recession.

GOVERNMENT POLICIES AND PROGRAMS

Creating jobs for an estimated 1 million new immigrants who are expected to arrive from the former U.S.S.R. by the end of 1996 was the main priority of Israel's economic policy. Despite the Government's best efforts, unemployment, which stood at less than 10% in the beginning of 1991, was forecasted to reach 13.6% by 1995. Although more than twice as many jobs were created in 1991 compared with 1990, they were mostly in the public sector. Most private-sector companies polled at the end of the year expected work force cuts owing to a severe slowdown in the economy that began in the fourth quarter of 1991.

Under the law for the Encouragement of Investment, which was amended in 1990, Israel encouraged foreign private investment and offered favorable tax treatment and full repatriation of capital and profits in addition to many other incentive programs. In 1991, the Israeli Government announced new investment incentives, meant to further encourage investment in research and development. Under the new plan, the Government would fund 20% of overhead expenses for foreign companies that subcontract research and development work to Israeli companies. A $100 million binational research and development fund was established to encourage partnerships between Israeli and American entrepreneurs. An agreement between the Government and employment organizations called "The Package Deal" was signed on May 24, 1991. Under the deal, the Government would create about 36,000 new jobs and invest about $800 million in infrastructure projects. Most of the new jobs would be in the construction sector. The Government had plans to train and employ 1,000 more engineers. The industrial sector in general would be helped by a Government plan to encourage the purchase of domestically produced products. For their part, representatives from industry pledged to absorb about 150,000 workers over a 4-year period. In a tradeoff designed to help lower the inflation rate, the September cost of living increase was reduced by 2% while employers' payments to the National Insurance Institute were reduced by 2% and the general employers' tax was lowered by 1%.

Although the Government remained committed to freeing up the economy, it has been slow to implement proposed privatization reforms. At the end of 1991, the Government sector still monopolized Israel's oil refining, utilities, telecommunications, aviation, transport, and banking sectors. 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 1991, the production of mineral products destined for the domestic market generally increased, while the production of mineral products for export decreased. The production of mineral products whose end use was in the building sector, such as cement, clay, crushed stone, steel, and sand, increased in 1991 owing to a surge in new home construction.

Low demand for Israel's mineral products, particularly among its Western European and North American customers, caused the production of minerals extracted primarily for export to decline or remain flat. Production for most of Israel's fertilizer products, for example, fell by 10% to 20% from 1990 levels. Potash was an exception; its production rose slightly during the year despite a decrease in exports owing to Dead Sea Works Ltd.'s decision to produce at capacity and sell the surplus when world market conditions improve. Bromine was also an exception; it was produced in quantities slightly higher than the 1989 peak levels. *(See table 1.)*

TRADE

Israel's economy was very reliant on trade. Its foreign trade, valued at more than $30 billion in 1991, was equal to more than 56% of the country's GDP. This is an unusual situation, making Israel one of the most trade-dependent countries in the world. Israel exported an estimated $12,190 million worth of merchandise in 1991 and imported about $18,120 million. The trade deficit widened during 1991 to about $5,930 million from about $3,530 million in 1990.

The United States remained Israel's single most important trading partner, although its trade with the EC was greater overall. The importance of Israel's trade with the United States decreased in recent years as European trade, particularly with Eastern Europe, increased. During 1991, Israeli trade officials spent considerable time cultivating trade relations with China, Russia, Czechoslovakia, and other Eastern bloc nations. Two-way trade with the United States (excluding U.S. military exports) was almost $6.2 billion in 1990, the latest year such data were available. Although Israel's trade surplus with the United States had declined during recent years, in 1990 it maintained a $752 million surplus. Nonmilitary imports from the United States were $2.72 million in 1990. The U.S. share of the Israeli import market remained stable at about 18%. Israel sold about $3.5 billion to the United States in 1990, or about 29% of its total exports.

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. As of 1991, under the Generalized System of Preferences (GSP) most goods already received duty-free status. Some trade practices that fall outside the 1985 agreement still hurt U.S. trade. For example, there is a purchase tax from 25% to 100% on consumer goods such as automobiles, consumer electronics, and building materials and variable duties on agriculture products. Also, quantitative limits are set on the importation of certain American products.

Israel had GSP-type trade preference agreements with Canada, Japan, Australia, New Zealand, Sweden, Finland, Norway, Austria, and Switzerland. A 1975 agreement with the EC eliminated duties on nonagricultural products beginning on January 1, 1991.

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 manufactures.

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.—In 1991, Israel was in the midst of a building boom owing to a large number of new immigrants. This was reflected in Israeli cement consumption, which reached 3.9 Mmt in 1991 compared with 2.9 Mmt in 1990. Finished cement grinding capacity was adapted by Nesher Israel Cement Enterprises Ltd. (Nesher) in anticipation of an increased demand by installing two used cement mills. Together the mills added 1 Mmt/a of finished cement capacity. The company, however, was unable to supply enough clinker to feed the new mills, so much of its clinker supply needed to be imported. Israel imported 350,000 tons of clinker in 1991. During 1992, Nesher plans to begin work on a 1-Mmt/a clinker line at the Ramala plant that will be commissioned by mid-1994.

New 10,000-ton cement silos were installed at two of Nesher's plants during 1991, and a similar silo will be installed at the company's remaining plant in 1992. In 1991, two palletizers were

installed at the Ramala plant for bag handling. A similar pair of palletizers will be installed at the Haifa and Har-Tuv plants in 1992.

Productivity at the Ramala plant will be enhanced when two of the finished cement mills are retrofitted to operate in closed circuit with high-efficiency separators. Another project at the Har-Tuv plant involves the installation of de-dusting equipment on the grate preheater system.

Clays.—Negev Ceramic Materials Ltd. (NCM) operated a clay deposit at Machtesh Ramon in southern Israel. The company had the capacity to produce 60,000 mt/a of plastic clay that was supplied in roughly equal proportions to the ceramic and chemical industries. A magnetic separator at the mine site was used to reduce the Fe_2O_3 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.

Diamond.—Despite a worldwide recession and the negative effects of the Gulf Crisis, the cutting and polishing of imported rough diamonds continued to grow in importance to Israel's economy. In 1991, 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 1991, the diamond industry imported $2,708 million in rough and semifinished stones, a decline of 11.4% from that of 1990. Exports of polished stones in 1991 were down 5.0% from the 1990 level, to $3,074 million. The value of both diamond imports and diamond exports was down due to a worldwide depression that caused the average import price to fall by 20% and the average export price to fall by 16%.

Fertilizer.—Fertilizers and Chemicals Ltd. posted a drop in sales owing to irrigation cutbacks, which reduced agricultural output in Israel by 15% during 1991. The company laid off 15% of its work force.

Rotem Amfert Negev Ltd. (RAN) was formed from the merger of Negev Phosphate Ltd. and Rotem Amfert Ltd. The merger integrated Israel's raw materials producers and the downstream fertilizer industry. RAN plans to make capital investments totaling $120 million from 1991 through 1993. The largest single investment would be for the construction of a 55,000-mt/a monopotassium phosphate plant. The $42 million phosphate salt plant at Mishor Rotem would be the largest of its type in the world. Other proposed projects 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.

The ministerial committee for privatization approved the sale of 72% of the Government's shares in Israel Chemicals Ltd. (ICL), the parent company of RAN. Plans called for 25% of the company's shares to be initially offered on the Tel Aviv stock exchange. Another 15% would then be offered to a yet unnamed strategic foreign partner. Finally another 32% would be sold on Israeli and foreign stock exchanges.

Periclase.—Tateho Dead Sea Fused Magnesia Co. (TDF) was formed during 1991. The new company is a partnership of Dead Sea Periclase Ltd. (DSP) with Japan's Tateho Chemical Industries Co. Ltd. It will produce refractory-grade fused magnesia from a new plant to be constructed on DSP's existing site at Mishor Rotem in the Negev Desert. TDF's product will be used as a raw material in advanced refractory products and will not compete with DSP's other mainstream grade of fused magnesia. Work on the $23 million, 13,000-mt/a plant was expected to begin in 1992, and the first shipments of products to refractory brick manufactures around the world should begin by the end of 1993.

Phosphate.—Phosphate rock from Negev Phosphates Ltd.'s (NPL) three active quarries was shipped to the Port of Ashdod for export. The Zin deposit, the largest producer, about 20 km east by northeast of Oron, had a production capacity of 2.2 Mmt/a. The two smaller producers, Oron and Arad, about 30 km northeast of Oron, had production capacities of 550,000 mt/a and 250,000 mt/a, respectively. Plans to exploit a new deposit in the Zohar phosphate field near Arad were still pending.

Potash.—Haifa Chemicals Ltd. had its potassium nitrate production cut in half for a short period during September 1991 following a fire that badly damaged one of the company's two phosphoric acid units. The plant was able to resume production with phosphoric acid purchased from NPL.

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

Israel will almost certainly experience high levels of economic growth for the next decade as the country struggles to assimilate as many as 1 million new immigrants. Although Israel will experience higher than normal levels of unemployment for many years, the overall effect of a rapidly growing work

force should be extremely beneficial. The key to Israel's economic success lies in its ability to utilize its most important natural resource—its people's abilities. Israel's population is far better educated, on average, than that of any other country, and statistics show that the new immigrants from the former U.S.S.R. have obtained even higher levels of education than the veteran population. Economic growth would increase the domestic consumption of Israel's mineral commodities, but its mining industry will continue to be primarily export-oriented. The health of Israel's mining industry, therefore, will continue to fluctuate with world commodity prices. Trends to export higher valued mineral products such as custom fertilizers, technical-grade chemicals, and other high-tech specialty items should continue.

Considering the advanced structure of the Israeli industrial complex, relatively few multinational companies are operating in Israel. In 1991, 20 international firms operated in Israel. It would need 10 times as many international companies within its borders to parallel the development of a typical Western European nation. To employ its expanded work force at its maximal skill level Israel clearly needs the exposure to the world's markets that international investment would bring. To achieve the economic miracle that it needs to fully assimilate all of its new citizens, the country has a pressing need to improve its domestic stability and convince the world that Israel is a safe place to conduct business. All of the Government's programs designed to entice foreign investment will not be successful if Israel is perceived as being too unpredictable. In 1992, with the change of Government, Israel has the best chance in years to make peace with its neighbors and end the Arab boycott.

[1]Where 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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991
METALS						
Iron and steel: Steel, crude[e]		116,000	120,000	118,000	144,000	160,000
INDUSTRIAL MINERALS						
Bromine:						
Elemental		e110,000	118,000	r134,725	130,000	135,000
Compounds		e78,000	r86,700	r102,300	120,000	125,000
Cement, hydraulic	thousand tons	2,226	2,326	2,289	2,868	e3,550
Clays:						
Bentonite		(3)	(3)	(3)	(3)	(3)
Flint clays		e6,000	6,020	r7,598	13,955	30,000
Kaolin		e29,000	30,600	r31,245	42,212	53,000
Other		e12,000	11,739	r17,369	r e6,800	3,000
Fertilizer materials, manufactured:						
Nitrogenous: N content of ammonia and urea		r e48,000	r47,758	r47,650	r42,030	33,835
Phosphatic: P content		e37,000	36,737	29,685	25,831	23,462
Potassic: K content		e23,000	22,638	18,203	20,938	18,612
Gypsum[e]		35,000	4,31,181	31,000	38,000	3,25,570
Lime		e130,000	130,000	e180,000	230,000	208,000
Magnesia, Mg content		e20,000	r30,159	r34,261	r38,600	38,600
Phosphate rock:						
Beneficiated	thousand tons	3,798	3,479	3,922	3,516	3,370
P_2O_5 content	do.	1,214	1,092	1,223	1,104	1,070
Potash, K_2O equivalent	do.	1,244	1,244	r1,273	r1,311	1,320
Salt, marketed (mainly marine)	do.	e350	361	475	426	1,115
Sand:						
Glass sand		e60,000	59,520	65,300	84,759	60,000
Other[e]	thousand tons	4,500	4,500	4,500	3,4,616	3,6,408
Sodium and potassium compounds: Caustic soda[e]		29,717	29,727	30,897	3,31,575	3,32,180
Stone:[e]						
Crushed	thousand tons	13,000	13,000	13,000	3,16,372	3,17,094
Dimension, marble		10,000	10,000	10,000	3,8,000	3,12,000
Sulfur:						
Byproduct from petroleum[e]	thousand tons	r40	r68	r68	r64	66
Sulfuric acid	do.	142	163	161	154	136
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural, marketed	thousand cubic meters	r49,788	r44,706	r44,406	r39,920	32,295
Peat		(3)	(3)	(3)	(3)	(3)
Petroleum:						
Crude	thousand 42-gallon barrels	r104	r131	r117	r94	82
Refinery products:						
Gasoline	do.	11,400	10,950	11,600	12,200	12,700
Kerosene and jet fuel	do.	5,450	5,500	5,800	6,100	6,400
Distillate fuel oil	do.	14,650	14,700	15,600	16,400	17,100

See footnotes at end of table.

TABLE 1—Continued

ISRAEL: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum—Continued:						
Residual fuel oil	thousand 42-gallon barrels	13,440	13,500	13,700	14,400	15,000
Other	do.	5,200	5,200	4,400	4,600	4,800
Refinery fuel and losses[e]	do.	1,800	1,800	1,800	1,900	2,000
Total	do.	51,940	51,650	52,900	55,600	58,000

[e]Estimated. [r]Revised.

[1]Table includes data available through Sept. 3, 1992.

[2]In 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.

[3]Revised to zero.

[4]Reported figure.

TABLE 2

ISRAEL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

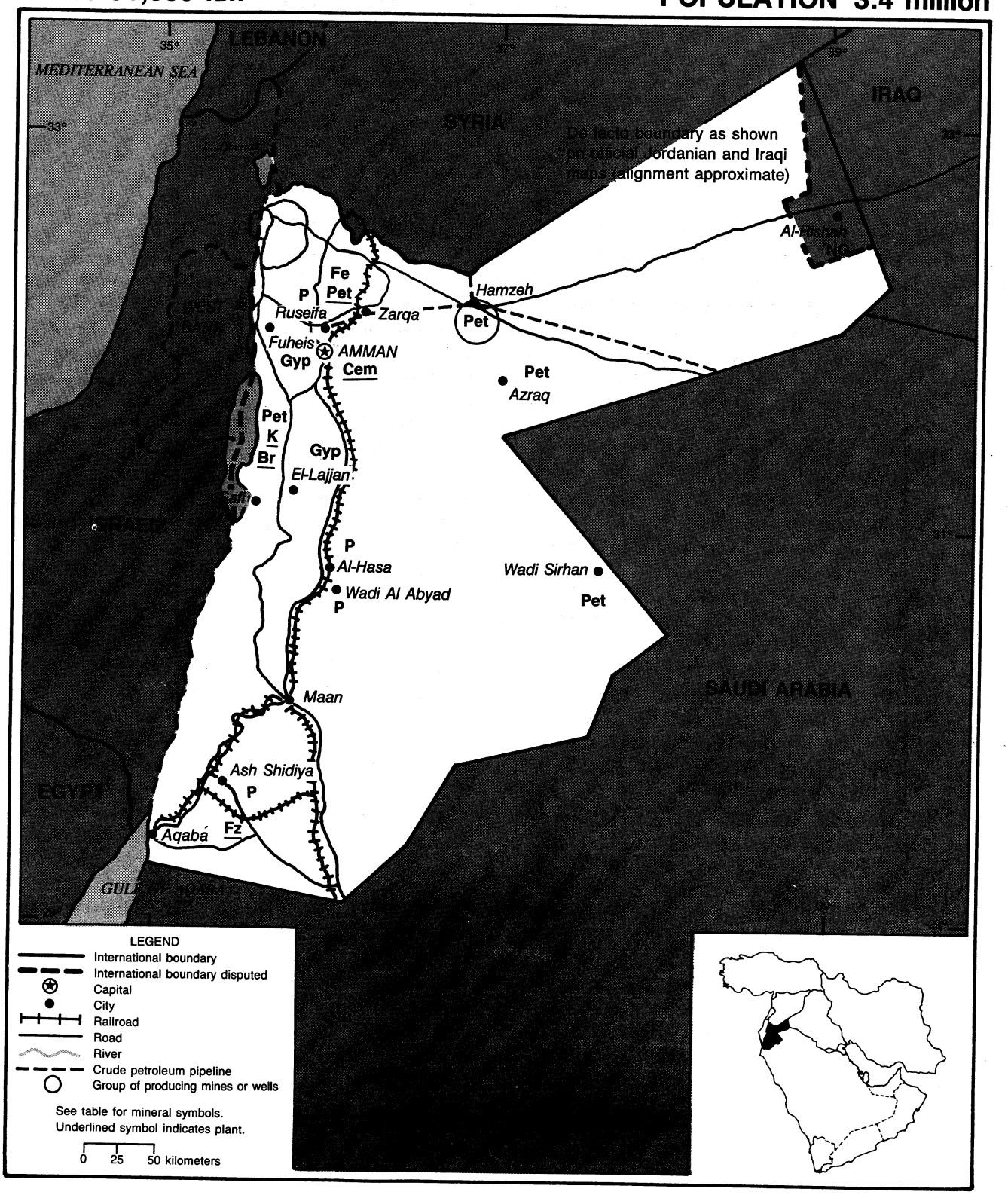
(Thousand metric tons unless otherwise specified)

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.	Ramala, 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%)	Machtesh Ramon	60.
Fertilizer	Rotem Amfert Negev Ltd. (ICL, 100%)	Mishor Rotem	e600 mixed fertilizers.
Magnesia	Dead Sea Periclase Ltd. (ICL, 50%; Austrian-American Magnesite Co., 50%)	Haifa	70.
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.	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 Chemicals Ltd. (ICL, 76%; private, 24%)	Haifa	220.

eEstimated.
[1]ICL is 100% Government owned.

JORDAN

AREA 91,880 km² **POPULATION 3.4 million**



THE MINERAL INDUSTRY OF

JORDAN

By Thomas P. Dolley

The two most important mineral commodities produced in the Hashemite Kingdom of Jordan, phosphate rock and potash, experienced significant declines in both production and export in 1991. Kuwait and Iraq being the exceptions, Jordan probably experienced the greatest economic impact of any nation during the Gulf War in 1991. In large part, the industrial mineral production decline can be attributed to the cutoff of the export markets for these commodities from Jordan due to the economic embargo on Iraq, Jordan's most important trading partner. Jordan's Port of Aqaba was one of the main targets of the naval blockade by UN Coalition Forces (UNCF), owing to the fact that the port is a main trade conduit for Iraq. As a result, increased insurance premiums for shipping due to the blockade had a negative effect on the export economy. Exports of phosphate rock and potash along with principal products of the Aqaba Industrial Complex were directly impacted. These latter products included aluminium fluoride, phosphoric acid, and diammonium phosphate (DAP). Additionally, aerial bombing by the UNCF from 1990 to 1991 of the Baghdad-Amman highway virtually suspended crude oil shipments to the Jordan Petroleum Refinery Co. Ltd. (JPRC) from Iraq. According to Government figures, Iraq typically supplies more than 86% of Jordan's crude oil supply and more than 65% of Jordan's petroleum products.

With the cessation of Gulf War hostilities, Jordan began rebuilding its damaged economy. The return of approximately 300,000 Jordanian workers from various Gulf States inflated the ranks of the unemployed to 25%. Additionally, the Government stated that a minimum of $4.5 billion[1] would be required over the next 3 to 5 years to settle the expatriated workers.

Following the Gulf War ceasefire on April 9, 1991, normalization began to return slowly to the Jordanian economy. The United States canceled its foreign aid ban on Jordan. Additionally, Jordan's diplomatic relations with Saudi Arabia, Syria, and other Arab states improved. By yearend 1991, Jordan had received $1 billion in financial aid from Western nations. The GDP for Jordan in 1991 was approximately $4.1 billion.

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

Phosphate and potash remained the most significant mineral commodities exploited in Jordan for 1991; however, both experienced declines in production. Phosphate rock was particularly affected, and production declined more than 1.5 Mmt from the 1990 figure. Problems with the Jordanian mining industry that existed before the Gulf War were exacerbated by the UN trade embargo. The softening in demand for Jordanian industrial minerals in eastern and western Europe, along with Asia, did not mitigate the mineral industry downturn. *(See table 1.)*

TRADE

For its petroleum requirements, Jordan imported about 17,157,000 bbl of crude oil in 1991. Prior to the Gulf War, the primary mode of transport for crude petroleum from Iraq to Jordan was by tanker truck. The biggest Jordanian transporter is Naber and Sons Co. (Nabresco). Though Nabresco does not transport all of the crude petroleum to Jordan and shares this operation with other transporters, it is one of the largest transporters in the Middle East. By yearend 1990, Jordan had implemented the UN embargo against Iraq, resulting in only 360 trucks out of the 1,000 trucks in Nabresco's fleet remaining active. Of the 360 tanker trucks operating, 200 trucks transported Iraqi crude oil to the Zarqa refinery, and the remaining 160 trucks transported Jordanian phosphate from the mines to the Port of Aqaba. Nabresco employs about 2,000 people and, owing to the embargo, was operating at its lowest recorded capacity level.

In the past, the Eastern European market for Jordanian phosphate represented the second largest export market for the Jordan Phosphate Mines Co. (JPMC). However, in 1991, the global recession had a profound effect on the Eastern European market and precipitated a drop in Jordanian phosphate rock exports. In 1991, Jordan was the fourth largest exporter of phosphate rock in the world, at about 5.1 Mmt.

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. The exploitation of the major mineral commodities of Jordan—cement, kaolin, phosphates, and potash—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.

Government figures for 1989, the most recent year for which published employee statistics are available, indicate that 6,937 persons were employed in 114 mining and quarrying establishments. In petroleum refining, the Government indicates that 3,078 employees support the refinery at Zarqa. Additionally, nonmetallic mineral products industries in Jordan employ 7,962 persons and basic metal products industries employ 1,189 persons. *(See table 2.)*

COMMODITY REVIEW

Industrial Minerals

Phosphate Rock.—In 1991, Jordan maintained fourth place globally in terms of tonnage of phosphate rock mined. However, production of phosphate rock dropped sharply in 1991 to its lowest point since 1982. Additionally, JPMC's profits fell in 1991. The company reported profits of $45.7 million for 1991, 95% of which was attributed to sales of bulk phosphate rock. This figure represents an $18 million decline in profits from those of the previous year.

Of the three mines that are exploited by JPMC, the Al-Hasa Mine produced the greatest amount of ore in 1990 at 3.3 Mmt; Wadi Al Abyad at 2.35 Mmt; and the Ash Shidiya Mine at 43 kmt. Another phosphate mine at Ruseifa halted its rock production due to technical difficulties compounded by marketing problems for its product.

At mid-1991, JPMC initiated production at a new superphosphate plant near the Ash Shidiya Mine. It was designed and built by JPMC at an estimated cost of $380,000. The design capacity of the plant indicates that superphosphate can be produced in an 8-hour shift, producing 10 kmt/d, 365 days per year, supplies all domestic needs. In the event that export markets develop, 30 kmt/d of superphosphate can be achieved with three shifts. Normal or ordinary superphosphate is manufactured by combining pulverized phosphate rock with sulfuric acid that is then cured. In addition to the inauguration of the new plant, JPMC would like to set up an industrial free zone adjacent to the Ash Shidiya Mine. The zone would cover 20 km^2 and be shared by Jordan's Arab Potash Co. (APC).

JPMC has held discussions with India, Pakistan, and the former U.S.S.R., in order to set up joint-venture projects. However, none of these proposed projects would be operating before 1994. By midyear 1991, India's Rashtriya Chemicals and Fertilisers wished to participate with JPMC in the construction of a 205-kmt/a fertilizer plant in India. The proposed $150 million project awaited further approval and funding. Additionally, Southern Petrochemical Industries Corp. of India and JPMC awaited approval for the set up of a 208-kmt/a phosphoric acid plant near Shidiya in Jordan. Estimated cost of the project would be $100 million.

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. Though reported production declined in 1991, production capacity has steadily increased at the 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 salt pan to facilitate brine flow to the pre-carnallite pan; the alteration of the brine flow in the carnallite pan to enhance carnallite deposition; and non-engineering 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. Additionally, 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.

APC is proceeding with plans to increase potash production capacity by 400 kmt/a, with work to begin by yearend 1992. A feasibility study was completed by Jacobs International of the Republic of Ireland, and a construction contract will be awarded in 1992. The estimated cost of the project is $110 million.

Other Industrial Minerals.—APC was investigating the possibility of a joint venture with a U.S. company for the production of elemental bromine and derivatives at its Dead Sea operations at Safi. With negotiations in progress in early 1992, the U.S. company was not identified by APC spokespersons; however, the U.S. consulting firm of Arthur D. Little was conducting a feasibility study on the proposed project. Two plants would be constructed, with the first being a 25-kmt/a bromine unit and the second plant to be a 100-kmt/a magnesium oxide unit. The total cost of both units was estimated to be $250 million. Final decisions on the production of potassium sulfate fertilizers, polyvinyl chloride, and soda ash were also being considered. However, potential heavy market competition in the region could curtail plans for the latter commodities.

Mineral Fuels

Jordan does not have significant oil production. Though hydrocarbons have been detected in the Dead Sea and other areas, no development has taken place. Production exists solely at Azraq, where 8 to 10 wells have been drilled. This production accounts for less than 1% of the petroleum utilized in Jordan. Originally, reserves at Azraq were estimated at 200 Mbbl, but this has been revised to only 5 Mbbl.

Due to the repercussions of the Gulf War, 1991 was a difficult year for Jordan to maintain its petroleum supply. Until the outbreak of hostilities, Jordan remained dependent on imports of crude oil primarily from Iraq and Saudi Arabia. Petroleum imports from Iraq are

transported via trucks on the Baghdad-Amman highway and in 1990, accounted for about 86% of Jordan's petroleum needs. An additional 13% of the petroleum arrives via pipeline, which parallels the highway.

During the year, Saudi Arabia had banned the importation of petroleum via tanker truck into Jordan across their mutual border. Aerial bombing of the Baghdad-Amman highway by the UNCF curtailed petroleum supplies from Iraq. By yearend 1990, about 200 tanker trucks were still transporting Iraqi crude into Jordan along the highway. As of February 1991, 31 tanker trucks had been destroyed by UNCF aircraft. The UNCF stated that the tanker trucks were destroyed because Iraqi military material was being transported in convoy with the civilian oil tanker trucks.

Reserves

The NRA estimated Jordanian phosphate reserves at 1 billion tons. Potash was obtained primarily from Dead Sea brines. Geological surveys had shown that Jordan had additional untapped mineral resources of bromine, dolomite, gypsum, glass sands, iron, lead, oil shale, pyrite, tin, travertine, and tripoli. However, no reports were available on the size or grade of these resources.

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.

The Port of Aqaba contains two petroleum tanker berths. One berth was for the management of imported oil products through a pipeline to a tank farm. The remaining tanker berth was the 120-m Moshterek berth utilized for crude petroleum exports. Additionally, APC owns a terminal at the port with one jetty and two loading berths. Potash storage capacity is about 160 kmt.

As of mid-1992, the United Kingdom's Rendel, Palmer & Tritton won three Jordanian infrastructure contracts. The first contract was a study and conceptual layout for a multipurpose berth at the Port of Aqaba. A second contract, in conjunction with Jordan's Madi & Partners, covered repairs of a phosphate loading berth at the Port of Aqaba that was damaged by a collision with a ship in December 1991. The final contract was to assist a World Bank-funded project to help the Aqaba Railway Corp. to improve railway infrastructure.

OUTLOOK

By early 1992, the Jordanian economy appeared to have weathered the economic fallout of the Gulf War. Despite the production downturns, the mining industry helped to improve an otherwise untenable economic situation. Various projects to improve the mining industry infrastructure indicate the Government's willingness to improve that sector of the economy. Jordan's lack of domestic energy sources, mainly hydrocarbons, will continue to place stress on the nation's balance of trade owing to fuel importation costs. Continued fiscal aid from the international community will certainly be needed in the forseeable future.

[1]Where 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, Dec. 1988.

TABLE 1

JORDAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991e
Cement, hydraulic	thousand tons	2,373	1,828	1,930	1,820	[2]1,754
Clays		14,000	23,452	38,600	38,800	[2]46,200
Gypsum		114,560	84,866	132,400	92,700	[2]55,300
Iron and steel: Steel, crude		217,000	r e200,000	176,500	179,100	[2]200,300
Lime		3,906	2,461	3,100	5,400	[2]4,600
Petroleum:						
Crude e	thousand 42-gallon barrels	153	200	110	116	116
Refinery products:						
Gasoline	do.	2,975	2,368	2,514	3,396	3,300
Jet fuel	do.	1,496	100	85	115	110
Kerosene	do.	1,581	1,398	1,179	1,584	1,500
Distillate fuel oil	do.	5,431	5,104	4,845	5,556	5,500
Residual fuel oil	do.	4,735	4,462	4,887	5,140	5,100
Liquefied petroleum gas	do.	1,032	640	670	185	1,100
Other	do.	1,158	e800	2,500	2,103	2,100
Total	do.	18,408	14,872	16,680	19,079	18,710
Phosphate:						
Mine output:						
Gross weight	thousand tons	6,800	6,611	6,900	6,082	[2]4,433
P_2O_5 content e	do.	2,260	2,182	2,277	2,007	1,458
Phosphatic fertilizers		565,066	615,000	602,000	596,000	[2]599,700
Potash:						
Crude salts		1,200,000	1,309,000	1,320,000	700	[2]1,364,000
K_2O equivalent		720,000	785,000	792,000	841,000	805,000
Salt		18,000	38,000	7,000	55,000	[2]57,000
Stone:						
Limestone e		[2]13,484	[2]3,642	3,600	3,600	3,600
Marble		e4,600	322,800	3,560	484,200	[2]180,000

eEstimated. rRevised.

[1]Table includes data available through Aug. 7, 1992.

[2]Reported figure.

TABLE 2

JORDAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

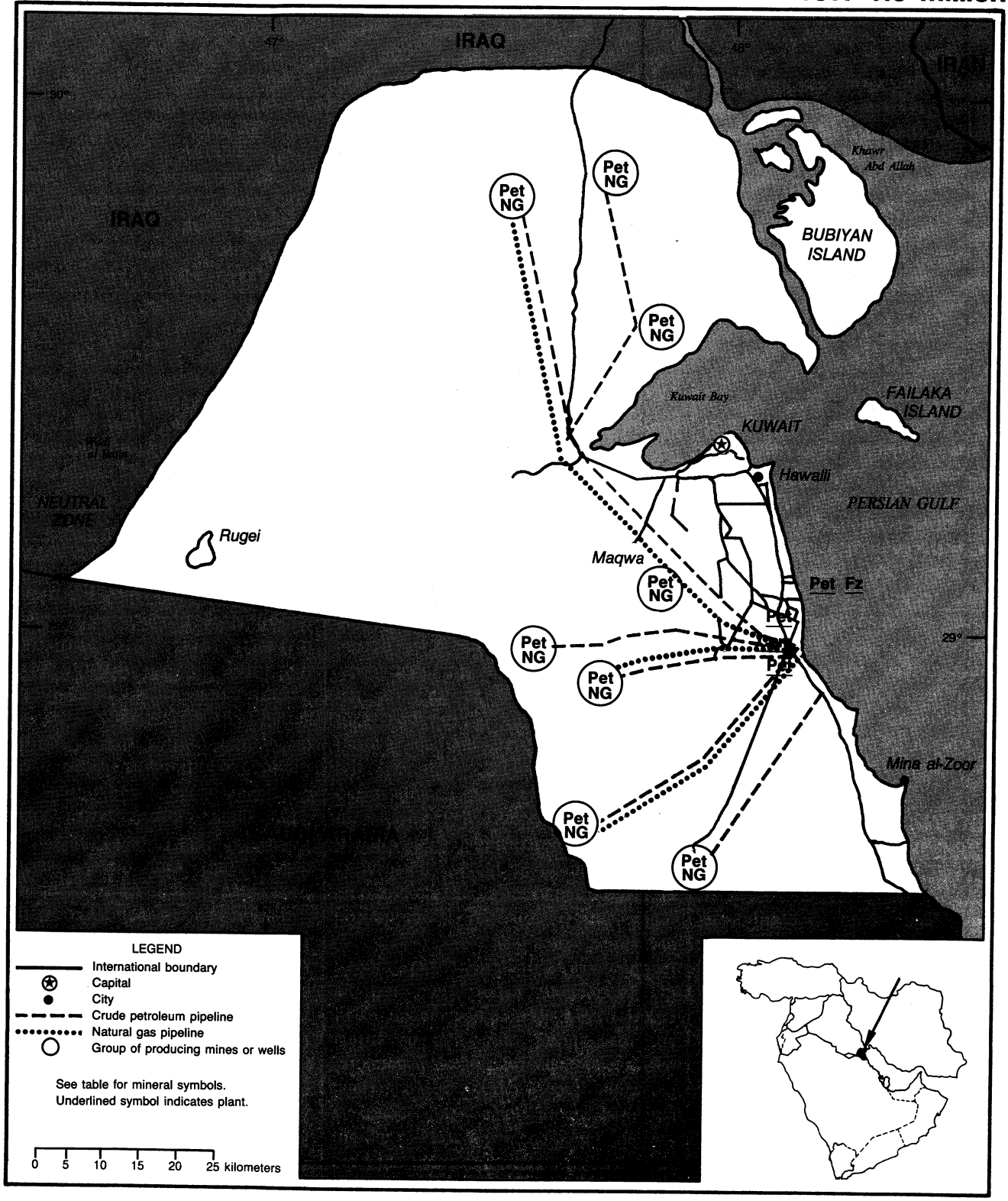
(Thousand metric tons unless otherwise specified)

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	e600
Petroleum, crude	thousand barrels	National Resources Authority (Government, 100%)	Northeast of Azraq, Azraq	e116
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	e3,000
Do.		do.	Ash Shidiya	e1,500
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	e1,400
Steel		Jordan Iron and Steel Co. (private shareholders, 100%)	Zarqa	50

eEstimated.

KUWAIT

AREA 17,820 km² **POPULATION 1.3 million**



THE MINERAL INDUSTRY OF

KUWAIT

By Bernadette Michalski

The production and refining of crude oil and natural gas, together with the output from the downstream industries, contributed 90% of export revenues as well as about 40% of the GDP until the Iraqi invasion of August 2, 1990. 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.

Before the close of 1991, electricity and water supplies were again available, well fires had been extinguished, and oil production was restored to more than one-fourth of the preoccupation level. Oil revenues, as estimated by the National Bank of Kuwait, were placed at $2.4 billion for fiscal year 1991-92. This is expected to increase to $6.9 billion in 1992-93.

GOVERNMENT POLICIES AND PROGRAMS

The accessibility of overseas assets enabled Kuwait to continue running its foreign operations during the Iraqi occupation of Kuwait itself. 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. An estimated $100 billion in foreign assets was available to sustain the Government and populace in exile and to finance reconstruction once liberation was achieved in February 1991.

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. By yearend $21 billion of the $27 billion cost of liberating the country had been paid from reserves.

The Government was distributing free gasoline to motorists since the liberation in late February until mid-April to assist in the postliberation adjustment. In the immediate postliberation period, the Kuwait Emergency Recovery Program extended more than 200 contracts covering the supply of materials, equipment, vehicles, backup generators, and firefighting services. The prime contract for a detailed damage survey of the production, export, and refining facilities was awarded to Bechtel Corp. of the United States.

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.

Before the Iraqi invasion, the Kuwait population was 2.1 million with nonnationals making up 73% of the population and 86% of the labor force. With the invasion, about 90% of the foreign nationals left Kuwait. The Government hoped to slash the size of the postwar population while increasing the proportion of nationals in its population mix. Since the liberation, however, there has been a steady flow of foreign nationals particularly from Pakistan, Bangladesh, India, and Sri Lanka entering Kuwait as laborers and domestics. Positions as teachers, civil servants, and middle managers were largely made up by Egyptians, Jordanians, and Palestinians. The immigration office has limited residence visas to reduce the foreign national population, particularly nationals from the states that did not support the anti-Iraq coalition. The loss of a largely expatriate staff has created a vacuum in the bureaucracy as well as in skilled labor positions.

While 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 were scheduled for late 1992.

In December, Kuwait assumed the presidency of the Gulf Cooperation Council undertaking the responsibility of regional cooperation in economic and defense matters among Bahrain, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

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

Preliminary estimates put the cost of the Gulf War at about $70 billion. Of this figure, $26 billion was pledged to support the military effort and $5 billion for aiding Kuwaiti refugees. The cost of reconstruction came to $40 billion, including $20 billion for the infrastructure, $10 billion for rehabilitating production facilities, and $10 billion for the repairing and rebuilding of the refineries.

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.

During the first 7 months of 1990 and before the Iraqi invasion, Kuwait production, including the Kuwaiti share of the Divided Zone fields, averaged 1.9 Mbbl/d. By the close of 1991, output was restored to 500,000 bbl/d. Production targets announced by the Minister of Oil in November 1991 were as follows: 0.950 to 1.000 Mbbl/d by July 1992, 1.6 Mbbl/d by December 1992, and 2 Mbbl/d by January 1994. *(See table 1.)*

TRADE

After the Iraqi retreat in late February 1991, 550 of the 980 active wells in Kuwait were ablaze. When the fields in the Wafra area of the Divided Zone are included, the total number of wells involved was 1,330, of which 732 wells were ablaze. Kuwait was unable to resume even limited oil shipments until July 27, 1991. Exports to the United States averaged 6,000 bbl/d for 1991.

Crude oil shipments from Kuwait averaged 875,000 bbl/d in the preembargo period of 1990, including 385,000 bbl/d delivered to the Far East; 370,000 bbl/d delivered to Europe, of which 300,000 bbl/d supplied the Kuwait Petroleum Corp.'s European refineries; and 80,000 bbl/d shipped to the United States.

Petroleum product exports averaged approximately 700,000 bbl/d in the first 7 months of 1990. Western Europe, which hosts the Kuwait Petroleum Corp.'s extensive retail network, was the major outlet absorbing nearly 50% of product exports. The preinvasion surge in higher valued petroleum product exports was attributable to the more than $5 billion refinery modernization and expansion program implemented between 1982 and 1989. This program resulted in a combined capacity of 770,000 bbl/d for the nation's three refineries. Damage inflicted on the refining facilities during the Iraqi occupation was extensive, and capacity was restored to only 330,000 bbl/d by the close of 1991. Product exports to the United States were minimal, averaging 8,200 bbl/d in 1989 and 6,250 bbl/d during the preembargo period of 1990 and none in 1991. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Government of Kuwait imposed few restrictions on trade or financial flows and placed considerable emphasis on the private sector to develop the economy. The petroleum and natural gas extraction and processing industries, however, were under Government control. Total control of the Kuwait Oil Co. (KOC) and the Kuwait National Petroleum Co. (KNPC) was in effect since 1975. In 1980, the Government established a state umbrella company for hydrocarbon operations known as the Kuwait Petroleum Corp. (KPC). This organization oversees all the state hydrocarbon companies and also manages Government shareholdings in various oil ventures, including those operations in the Kuwait-Saudi Arabia Divided Zone and the acquired interests in foreign operations. Despite the liquidation of several billion dollars in stocks and bonds in several industrialized countries in 1990 and 1991, Kuwait retains substantial worldwide investments, including an extensive refining and distribution network in Western Europe as well as several downstream investments in Eastern Europe and Southeast Asia. Kuwait also has interest in oil exploration and production activities in many nations, including the Yacheng Gasfield in southern China. *(See table 4.)*

COMMODITY REVIEW

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 Shuaiba Fertilizer Complex, which had the capacity to produce almost 1 Mmt/a of ammonia and 800,000 mt/a of urea. In the first 7 months of 1990, urea production averaged almost 10% above design capacity. This complex, particularly the urea plant, was severely damaged by Iraq, inhibiting any production for the foreseeable future. Domestic production facilities have been severely damaged or destroyed; however, PIC has acquired interests in fertilizer manufacturing operations in other Gulf countries, North Africa, Europe, and China.

Mineral Fuels

Natural Gas.—No discovery has, as yet, yielded commercial deposits of nonassociated natural gas in Kuwait. The nation is dependent on natural gas associated with crude oil production for domestic power stations and petrochemical plants. With crude oil production restored to a little more than one-fourth of the preinvasion capacity by yearend, electric power restoration was often forced to supplement fuel oil for natural gas as the source of power.

Before the Iraqi invasion, Kuwait's domestic supply of associated natural gas from the Raudhatain and Sabiriya Fields near the northern Iraqi border was processed in northern Kuwait, and a mixed liquids stream was delivered by pipeline to the fractionator at Shuaiba. Natural gas from the Minagish, Umm Gudair, and South Umm Gudair Fields near the western border with Saudi Arabia flowed as wet gas to the processing plant at Shuaiba. Natural gas from the Burgan and Maqwa-Ahmadi Fields was processed at two field

recovery plants. The recovered liquids were then delivered by pipeline to Shuaiba for fractionation. While 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.

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.**—Kuwait's production, including output from its share in the Divided Zone, averaged 1.9 Mbbl/d just before the Iraqi invasion in August 1990. The Kuwait Oil Co., the operating company for the KPC, had increased production of light crude oil to maintain the export crude blend at 31.5° API gravity. Additional reservoirs of light crude were brought into production by mid-1990 with the oil flow from the deep Marat formation under the Burgan, Maqwa, Umm Gudair, and Minagish Fields in south-central Kuwait yielding crude oil of 36° to 38° API gravity. The first shipments of light Marat crude oil were sent to KPC's European refineries for testing. Most of the damage to Kuwait's oil facilities was inflicted in the last hours of the Iraqi occupation. Of the 1,330 active wells in Kuwait and in the Wafra area of the Divided Zone, 732 were on fire. Many other wells were spewing uncontrolled. Crude oil gathering and export facilities suffered extensive damages. However, Kuwait petroleum output was restored to 500,000 bbl/d by the close of 1991. This represents more than one-fourth of the prewar level. Production targets were announced by the Minister of Oil in November 1991 as follows: 0.950 to 1.000 Mbbl/d by July 1992, 1.6 Mbbl/d by December 1992, and 2 Mbbl/d by January 1994.

Before Iraq retreated from Kuwait, at least 1.5 Mbbl of crude was intentionally spilled from Mina al Ahmadi terminal, in effect using oil as a weapon polluting the Gulf and adversely affecting the desalination plants along the coast. On January 26 two UN coalition aircraft bombed the manifold stations to cut off the terminal's source of crude oil. Another oil slick was created by the Iraqi release of oil from the Mina al Bakr terminal near the head of the Gulf.

Despite the Iraqi invasion in 1990, the Arabian Oil Co. (AOC), operating offshore in the Divided Zone near the Kuwaiti border, continued to produce about 250,000 bbl/d. By mid-January 1991 production was cut to 80,000 bbl/d. With the first attack on Khafji facilities, AOC responded by shutting down facilities and evacuating its staff. Production from Khafji was restored to near prewar levels by yearend 1991.

The Divided Zone's onshore fields of Wafra, South Fuwaris, and South Umm Gudair were heavily damaged during the war. Production resumption, even on a limited scale, was not anticipated before February 1992. Prewar production from these fields averaged 120,000 bbl/d.

About 10% of all the Kuwaiti wells were damaged beyond economic repair and were plugged and abandoned. These were being replaced with new wells, 26 of which were completed by the close of 1991.

Refining.—After completion of an 8-year multibillion dollar refinery expansion and modernization program, combined refining capacity was reported by the KNPC at 770,000 bbl/d before the Iraqi invasion. One of the goals of the modernization project was to increase the proportion of light products from 50% to 70% of total product output. The integration of all three refineries was achieved through a complex pipeline network that provided for flexibility and greater efficiency by enabling the interchange of feedstocks between refineries for further processing. All three refineries in Kuwait and the two smaller refineries in the Divided Zone (70,000-bbl/d capacity Mina Saud and 30,000-bbl/d capacity Khafji) were stripped of process control equipment and other spare parts and were further damaged by deliberate explosive detonation. Only one refinery remained operating after the invasion. The Mina al Ahmadi, the largest refinery at 270,000 bbl/d capacity, operated at 80,000 bbl/d for most of the last quarter, with production increased to 200,000 bbl/d in late December. With the boycott in effect, the refinery operated only to satisfy local consumption but was rendered inoperable as the Iraqi forces retreated. The refinery output of 100,000 bbl/d was restored by late August. By yearend, production capacity was restored to 170,000 bbl/d. Overall damage to the Mina al Ahmadi refinery was relatively light while the Mina Abdullah and Shuaiba refineries were subjected to extensive damage.

A refinery reconstruction program was under way at the beginning of 1992 to boost refining capacity to 500,000 bbl/d from the 330,000 bbl/d capacity available at the close of 1991. A further increase to 630,000 bbl/d was planned by 1993, still far below the preinvasion capacity of 775,000 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 was in Shuaiba and was operated by PIC, a wholly owned subsidiary of KPC. Initially commissioned in 1966, the complex has steadily expanded, including a fertilizer complex and salt and chlorine plants. Repairs costing $200 million were under way in the fertilizer plants, and production is expected to resume in early 1993. Output 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 Shuaiba. The complex was to have a 750,000-mt/a capacity ethylene cracker that was to supply 500,000 mt/a of ethylene to feed downstream units and

250,000 mt/a of ethylene for export. The complex was to include at least eight main units. Among these are the 400,000-mt/a capacity paraxylene unit, the 385,000-mt/a capacity styrene monomer unit, and the 300,000-mt/a capacity benzene unit. With reconstruction efforts centered on restoring crude oil production and in view of the extensive damage suffered at the existing Shuaiba Industrial Complex, the proposed $3 billion petrochemical complex has been put on hold pending a joint-venture partner willing to contribute marketing and technology expertise as well as capital.

The exodus of expatriate workers from PIC facilities has left the processing sector short of skilled labor. Two complete process units were looted from PIC. The problem is further compounded by the lack of natural gas feedstock. While limited production has been restored, the associated natural gas is expected to be vented and flared until such time as the Gas Gathering System can be restored.

Reserves

After reassessments of the potential of known fields, Kuwait's proven reserves of crude oil were officially estimated at 97.1 billion bbl before the invasion, an increase from the 94.5 billion bbl estimated a year earlier. 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 m^3 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 will 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. Before the invasion, Kuwait's highway system totaled 3,000 km, with a greater concentration of highways between Kuwait City and the port cities of Shuaiba and Mina al Ahmadi to the south. The roads were heavily damaged by military action. Repairs were further complicated by the necessity of removal of damaged, stripped, and abandoned military and private vehicles as well as unexploded ordnance strewn all along the highway system.

The petroleum and natural gas industry was serviced by a network of pipelines operated by KOC. These pipelines connected major fields to the export terminals or to the refineries, which themselves were interconnected to permit more efficient use of feedstocks. The pipeline network and storage facilities supporting hydrocarbon production, processing, and transportation suffered serious damage. Most of the water supply and electric power infrastructure was destroyed. Of the four power and desalination complexes at Shuwaykh, Doha East, Doha West, and Ras az Zawr, only the latter with its 2,400 MW power and 48 Mga/d water capacity was not seriously damaged.

By April, 85% of electric power had been restored following the reconnection of the generators that were still operational at the damaged Doha West power station to the distribution network linking Kuwait City to Ras az Zawr after 90 km of overhead powerlines cut in 202 places was repaired.

The opening of port facilities was a major issue in the immediate postoccupation period. Port repair costs were estimated by the Ports Public Authority (PPA) to be $1 billion. Container cranes, fork lift trucks, floating mobile cranes, and conveyer systems for sulfur and cement were extensively damaged or looted. The first operational port was Shuaiba, which was accepting vessels up to 50,000 dwt by mid-March. In addition to the many mines and other unexploded ordnance, a total of 48 wrecks was removed from Kuwait's harbors before the PPA Director was able to announce that all the country's main ports were open for shipping. This occurred in early August with the reopening of the largest port, Shuwaykh. The reopening of the ports was vital to the flow of equipment and materials required to implement the reconstruction program.

OUTLOOK

The mineral industry, particularly the oil sector, was a prime target for the Iraqi military forces. The scale of damage to the Arabian Gulf ecosystem and the petroleum and natural gas reservoirs has yet to be adequately assessed. The cost of restoring the Kuwait petroleum industry to its preinvasion status was estimated by the Kuwaiti Minister of Oil at $10 billion to $15 billion. Long before the Kuwaiti liberation began, Kuwaiti officials planned a massive postwar reconstruction program.

The organization and financing of Kuwait's reconstruction remains a tremendous task. Restoration priority will be given to the wealth-creating sectors of the economy, petroleum production and downstream processing. Until these industries begin generating revenues once again, the financing of daily existence, financial commitments, and the reconstruction program will be obtained from loans or through liquidation of assets. Under Article 16 of the UN Resolution 687 that outlines the terms of the cease-fire, a compensation fund is to be created and financed by a percentage of Iraq's future petroleum revenues. 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 was 1.5 Mbbl/d.

While the impact of the invasion on Kuwait's economy was profound, it also focused the attention of Kuwaiti exiles on the restoration of a democratic parliament in Kuwait. Strong support for parliamentary elections in a restored Kuwait was evident. Parliamentary elections are scheduled for October 1992. In addition to emergency reconstruction work, previous Government policies are under reassessment and could involve privatization of utilities.

In spite of the liquidation of several billions of dollars in stocks and bonds in

several industrialized countries in late 1990 and early 1991, Kuwait retained substantial worldwide industrial and financial investments. Without the strategic accumulation of these foreign assets, the consequence of the Iraqi occupation would have had even more serious results.

OTHER SOURCES OF INFORMATION

Kuwait Petroleum Corporation (KPC)
P.O. Box 26565
Safat, 13126, Kuwait
Telephone: 245-5455 and
245-2686

Bechtel Group, Inc.
50 Beale Street
San Francisco, CA 94105
Telephone: (415) 768-1234

TABLE 1

KUWAIT: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991e
Chlorine		22,000	24,700	23,610	19,000	—
Cement	thousand tons	1,000	888	1,110	900	300
Clay products, nonrefractory:						
Sand lime bricks	cubic meters	336,000	300,100	354,800	300,000	100,000
Lime: Hydrated and quicklime		62,700	65,000	65,000	50,000	5,000
Natural gas:[2]						
Gross	million cubic meters	6,960	8,980	11,100	8,000	1,000
Dry	do.	4,780	6,490	8,160	6,000	—
Natural gas liquids	thousand 42-gallon barrels	29,200	34,000	38,500	30,500	—
Nitrogen: N content of ammonia		577,500	497,500	664,600	292,100	—
Petroleum:						
Crude[2]	thousand 42-gallon barrels	496,770	546,000	657,700	r427,780	68,255
Refinery products:e						
Gasoline, motor	do.	11,500	16,425	r22,265	r14,000	NA
Jet fuel	do.	9,500	12,775	r19,690	r12,000	NA
Kerosene	do.	13,000	14,600	r22,200	r14,000	NA
Distillate fuel oil	do.	45,000	60,225	r71,200	r46,000	NA
Residual fuel oil	do.	90,000	93,075	r99,350	r70,000	NA
Other	do.	45,000	41,610	r44,700	r28,000	NA
Total	do.	r214,000	r238,710	r279,405	r184,000	NA
Salt		21,000	39,500	31,950	30,000	—
Sodium and potassium compounds: Caustic soda		12,000	16,100	15,700	12,000	—
Sulfur:						
Elemental, petroleum byproduct		310,000	360,000	375,000	300,000	30,000
Sulfuric acid		4,600	4,500	5,000	4,000	—

eEstimated. rRevised. NA Not available.

[1]Table includes data available through Mar. 31, 1992.

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

TABLE 2

KUWAIT: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	Destinations, 1989	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys, semimanufactures	239	NA	Saudi Arabia 115; Iraq 88; unspecified 37.
Copper: Metal including alloys, unwrought	85	NA	Iraq 25; Saudi Arabia 19; unspecified 21.
Gold: Metal including alloys, unwrought and partly wrought kilograms	2,808	NA	United Kingdom 1,349; India 429; Switzerland 351.
Iron and steel: Metal:			
Scrap	159,985	NA	United Arab Emirates 96,341; unspecified 63,644.
Semimanufactures:			
Bars, rods, angles, shapes, sections	55,842	NA	Iraq 49,553; Netherlands 3,909; unspecified 2,272.
Universals, plates, sheets	3,884	NA	Iraq 3,456; unspecified 428.
Hoop and strip	283	NA	Iraq 142; Bahrain 111; unspecified 30.
Wire	869	NA	Iraq 825; unspecified 44.
Tubes, pipes, fittings	3,711	NA	Iraq 1,785; United Arab Emirates 344; unspecified 1,582.
Lead: Metal including alloys, unwrought	1	—	All to Iraq.
Zinc: Metal including alloys:			
Unwrought	3	—	Do.
Semimanufactures	57	—	Saudi Arabia 42; India 15.
Other:			
Oxides and hydroxides	11	NA	Qatar 10; unspecified 1.
Base metals including alloys, all forms	3,235	NA	Iraq 2,577; Italy 33; unspecified 606.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	13	NA	Iraq 11; unspecified 1.
Bromine[2]	2	—	All to Iraq.
Cement	1,500	—	Mali 1,400; Iraq 45; United Arab Emirates 38.
Clays, crude	985	NA	Iraq 520; Jordan 345; Syria 103.
Fertilizer materials:			
Crude, n.e.s.	492	—	All to United Arab Emirates.
Manufactured:			
Ammonia	307,735	126,000	Morocco 35,000; unspecified 146,735.
Nitrogenous	839,799	NA	China 365,700; Syria 137,500; unspecified 336,599.
Phosphatic	1,233	—	All to Saudi Arabia.
Unspecified and mixed	1	—	All to Lebanon.
Lime	25	—	Syria 15; Iraq 10.
Salt and brine	309	NA	Saudi Arabia 208; Iraq 58; unspecified 43.
Stone, sand and gravel:			
Dimension stone: Worked	326	NA	Iraq 240; Saudi Arabia 15; unspecified 71.
Gravel and crushed rock	40	—	All to Bahrain.
Sand other than metal-bearing	60	—	All to Iraq.
Sulfur:			
Elemental: Colloidal, precipitated, sublimed	764,058	NA	India 246,000; Morocco 152,500; unspecified 365,558.
Sulfuric acid	295	—	All to Iraq.

See footnotes at end of table.

TABLE 2—Continued

KUWAIT: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	Destinations, 1989	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		2	—	All to United Arab Emirates.
Coal: Briquets of anthracite and bituminous coal		12	—	United Arab Emirates 9; Saudi Arabia 3.
Petroleum:				
Crude[3]	thousand 42-gallon barrels	310,250	60,225	Japan 97,346; Netherlands 48,071; Italy 17,338.
Refinery products:				
Mineral jelly and wax	do.	5	—	India 3; Pakistan 2.
Kerosene and jet fuel	do.	1	NA	Mainly to Syria.
Lubricants	do.	12	(4)	Saudi Arabia 4; Iraq 2; unspecified 6.
Bituminous mixtures	do.	1	NA	Mainly to Iraq.
Petroleum coke	do.	2,846	NA	Japan 1,821; Egypt 404; unspecified 621.

NA Not available.
[1]Comparable data not available for 1990. Table prepared by Virginia A. Woodson.
[2]May include iodine and fluorine.
[3]Estimated. Source: OPEC Statistical Bulletin, 1990.
[4]Less than 1/2 unit.

TABLE 3

KUWAIT: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	Sources, 1989	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	47	—	United Kingdom 26; Egypt 20.
Metal including alloys:			
Unwrought	4,534	NA	Bahrain 3,967; unspecified 567.
Semimanufactures	13,399	1,966	Bahrain 4,946; Hungary 1,796.
Copper: Metal including alloys, unwrought	11,879	NA	Saudi Arabia 5,203; United Kingdom 1,822; unspecified 4,853.
Iron and steel: Metal:			
Pig iron, cast iron, related materials	326	NA	United Kingdom 148; West Germany 144; unspecified 34.
Steel, primary forms	62	NA	Japan 17; unspecified 45.
Semimanufactures:			
Bars, rods, angles, shapes, sections	386,949	9,329	Qatar 127,038; Saudi Arabia 80,454; Japan 33,790.
Universals, plates, sheets	83,484	NA	Japan 56,303; unspecified 27,181.
Hoop and strip	3,013	—	Italy 1,094; Japan 959; unspecified 960.
Wire	9,685	NA	Republic of Korea 3,868; China 2,387; unspecified 3,430.
Tubes, pipes, fittings	71,883	7,780	France 34,413; West Germany 6,098.
Lead: Metal including alloys, unwrought	63	—	Japan 49; Lebanon 11.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$62	—	All from West Germany.
Silver: Metal including alloys, unwrought and partly wrought do.	$295	NA	Mexico $146; Switzerland $127.
Zinc:			
Blue powder	101	NA	Belgium-Luxembourg 50; West Germany 20; United Kingdom 20.
Metal including alloys: Unwrought	708	NA	Republic of Korea 300; Belgium-Luxembourg 250; Australia 60.
Other: Base metals including alloys, all forms	3,773	NA	United Kingdom 486; Italy 387; unspecified 2,160.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Natural, corundum, emery, pumice, etc.	91	—	Saudi Arabia 62; Italy 24.
Asbestos, crude	1,597	—	Canada 1,291; Republic of South Africa 306.
Bromine[2]	25	—	United Kingdom 24; Belgium-Luxembourg 1.
Clays, crude	17,596	NA	India 16,060; unspecified 1,536.
Diamond, natural: Gem, not set or strung value, thousands	$34	—	All from United Kingdom.
Fertilizer materials:			
Crude, n.e.s.	407	—	Iraq 301; Saudi Arabia 90.
Manufactured:			
Ammonia	3	—	Netherlands 2; United Kingdom 1.
Nitrogenous	148	—	Norway 54; Spain 40; Sweden 34.
Phosphatic	21	—	Finland 11; Morocco 10.
Unspecified and mixed	1,766	—	West Germany 515; Netherlands 450; Finland 161.

See footnotes at end of table.

TABLE 3—Continued

KUWAIT: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Graphite, natural		784	—	Republic of Korea 500; United Kingdom 128; Italy 86.
Precious and semiprecious stones other than diamond: Natural	value, thousands	$106	—	Switzerland $37; India $30; Thailand $26.
Salt and brine		7,752	NA	Saudi Arabia 4,308; France 1,500; unspecified 1,944.
Stone, sand and gravel:				
Dimension stone: Crude and partly worked		44,259	—	United Arab Emirates 35,681; Italy 8,578.
Gravel and crushed rock		398,707	—	United Arab Emirates 215,281; Italy 129,450; Iraq 12,357.
Sand other than metal-bearing		23,529	315	Saudi Arabia 20,714; Iraq 2,071.
Sulfur:				
Elemental: Colloidal, precipitated, sublimed		220,000	—	All from Iraq.
Sulfuric acid		2,117	NA	Iraq 2,076; unspecified 41.
Other: Crude		3,535	NA	Netherlands 1,285; West Germany 1,717; unspecified 532.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		21	—	France 20; unspecified 1.
Coal:				
Anthracite		47	—	West Germany 25; Netherlands 20.
Briquets of anthracite and bituminous coal		711	287	Netherlands 69; United Kingdom 34; Japan 17.
Gas, natural: Gaseous	million cubic meters	1,210		NA.
Petroleum, refinery products:				
Liquefied petroleum gas	42-gallon barrels	228,334	—	All from Iraq.
Mineral jelly and wax	do.	5,344	—	Do.
Kerosene and jet fuel	do.	6,735	—	France 4,634; Japan 791; United Kingdom 326.
Lubricants	do.	225,673	10,948	Netherlands 91,315; United Arab Emirates 55,909; Saudi Arabia 23,443.
Bituminous mixtures	do.	97,796	—	Saudi Arabia 68,599; unspecified 29,136.

NA Not available.

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

[2]May include iodine and fluorine.

TABLE 4

KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991[1]

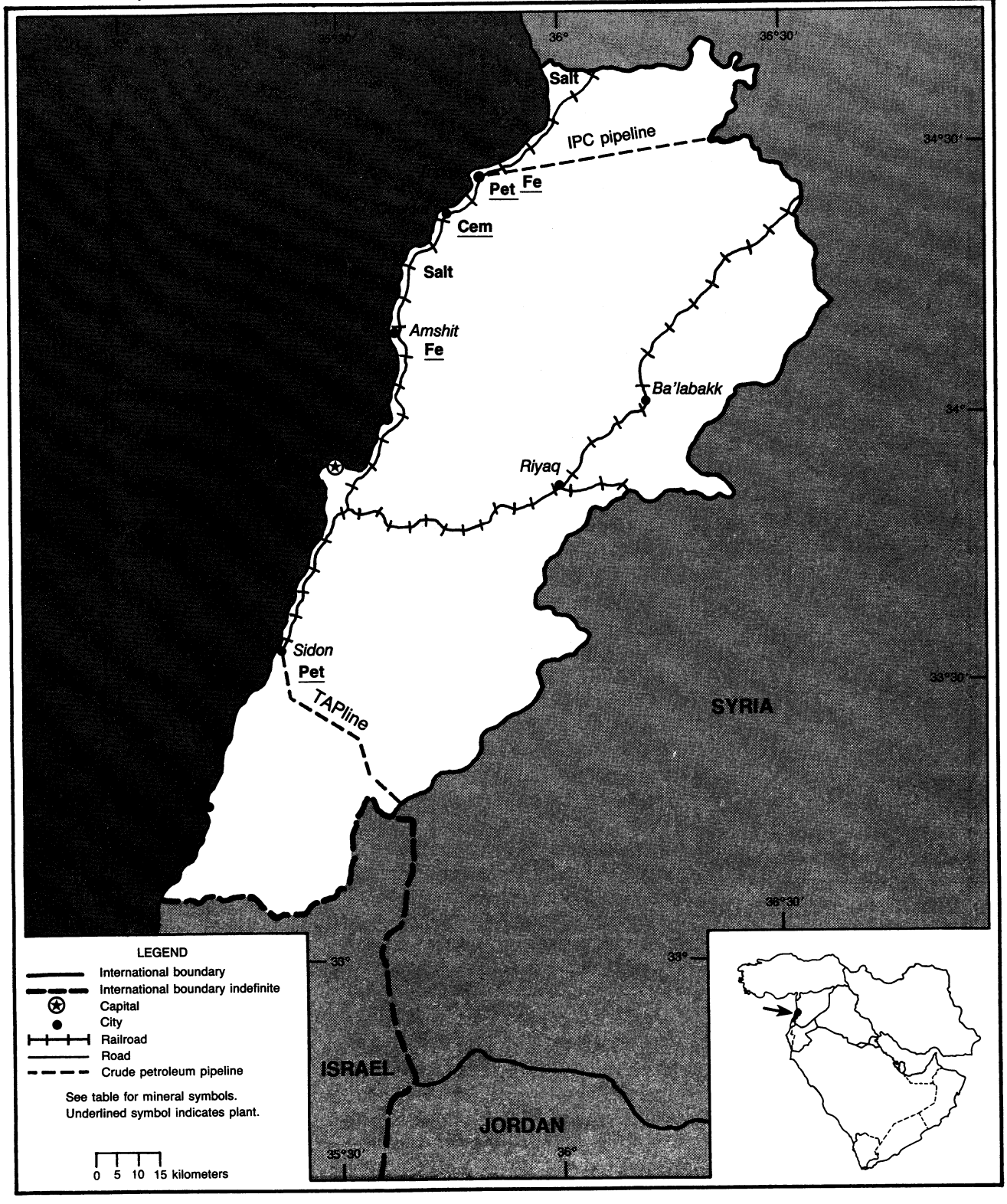
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Caustic soda		Petrochemical Industries Co. (Government 100%)	Shuaiba	(70) 0
Cement		Kuwait Cement Co. (Government 100%)	do.	(1,500) 500
Chlorine		Petrochemical Industries Co. (Government 100%)	do.	(58) 0
Natural gas	million cubic meters	Kuwait Oil Co. (Government 100%)	All oilfields	(10,000) 0
Natural gas liquids	million 42-gallon barrels	Kuwait National Petroleum Co. (Government 100%)	Shuaiba	(57) 0
Nitrogen:				
Ammonia		Petrochemical Industries Co. (Government 100%)	do.	(990) 0
Urea		do.	do.	(792) 0
Sulfuric acid		do.	do.	(5) 0
Petroleum, crude	million 42-gallon barrels	Kuwait Oil Co. (Government 100%)	Burgan	(500) 90
Do.	do.	do.	Maqwa	(25)
Do.	do.	do.	Raudhatain	(110) 0
Do.	do.	do.	Sabriya	(70) 0
Do.	do.	do.	Ahmadi	(25) 0
Do.	do.	do.	Minagish	(20) 0
Do.	do.	do.	Umm Gudair	(20) 0
Do.	do.	do.	Bahra	(18) 0
Do.	do.	WAFRA Oil Co. (Texaco Corp. 50%; Kuwait Oil Co. 50%)	Wafra	(40) 0
			South Fuwaris	(2) 0
			South Umm Gudair	(15) 0
Do.	do.	Arabian Oil Co. (Japanese Petroleum Trading Co. 80%; Saudi Arabia 10%; Kuwait 10%)	Khafji	(70) 70
			Hout	(10) 10
Petroleum, products	do.	Kuwait National Petroleum Co. (Government 100%)	Mina al Ahmadi	(99) 65
Do.	do.	do.	Shuaiba	(73) 0
Do.	do.	do.	Mina Abdullah	(91) 35
Salt		Petrochemical Industries Co. (Government 100%)	Shuaiba	(125) 0

[1]Preinvasion annual capacities are reported within parentheses. During the occupation, industrial installations were dismantled and transported to Iraq, rendering the cement, petroleum, and petrochemical facilities inoperative. Crude oil production facilities were destroyed, and most wells were flowing uncontrolled and ignited until the last well was brought under control in November 1991. Operations of the Arabian Oil Company were suspended from January 17 through June 2.

LEBANON

AREA 10,400 km² **POPULATION 3.3 million**



THE MINERAL INDUSTRY OF

LEBANON

By Bernadette Michalski

Lebanon's industrial enterprises, including those of its minerals sector, were seriously damaged during the course of the civil war. Most seriously affected was the fuel supply network and, consequently, electric power generation. Dependent upon imports of crude oil and petroleum products for 90% of its energy requirements, the nation suffered serious shortages when tankers were unable to call at Lebanon's besieged ports. The Arab League sponsored the Taif Agreement, which required that all militia forces withdraw as well as the surrender of all weapons by April 1991. The implementation of the agreement provided relative security after a civil war that spanned more than 15 years.

Domestic fuels sales were controlled, subsidized, and priced by the Government; however, limited private imports of gasoline were permitted between 1988 and 1991. With the return of a centralized Government, the import of crude oil and products was reestablished under the sole authority of the Government. In 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 February 1991, the price of 20 liters of gasoline was $5.50.

In April, the Government announced that it was ending subsidies on several staples and gasoline as a precondition to resumption of aid from the World Bank. Lebanon obtained a $60 million grant from Saudi Arabia in April 1991 to help finance restoration of basic services to Beirut.

The Lebanese Reconstruction and Development Council engaged the Bechtel Group Inc. of the United States to assess damages and propose means of financing the reconstruction of the infrastructure. United Nations authorities have estimated civil war damage at $18 billion. The rebuilding of the infrastructure was estimated at $5 billion.

The Ministry of Electricity and Water Resources reported the nation's 1991 electric power capacity at approximately 1,000 MW. The cost of emergency repairs to restore power supply to the country by the end of 1992 was estimated at $210 million.

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 the steel industries 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.)*

The Arab States were Lebanon's principal trading partners. However, the 1990-91 Gulf crises sealed off two of Lebanon's major markets, Kuwait and Iraq. As a result, industrial exports dropped to one-fourth or $121 million in 1990 as compared with $480 million in 1989. The Gulf crises also deprived Lebanon of remittances from nationals employed in the region. In 1989, the remittances totaled $700 million.

Trade in mineral commodities firmed with the returning stability to the region and to the Lebanese economy in 1991. The Islamic Development Bank of Jeddah granted a $10 million loan for financing petroleum imports in 1991. Petroleum imports were estimated at more than 7 Mbbl crude oil, 5 Mbbl of residual fuel oil, 3 Mbbl of gasoline, 2 Mbbl of distillate fuel oil, and 1 Mbbl of liquefied petroleum gas. Iraqi crude oil and petroleum products shipments were replaced by Syrian crude oil and for the most part Syrian products.

With the return of basic security in 1991, customs revenues rose dramatically. Preliminary reports place revenues at $110 million compared with just $2.5 million in 1990.

Lebanon was basically a free-enterprise-oriented economy. Most mineral operations in Lebanon remained privately owned, including all cement plants, steel mills, and building material quarries. Petroleum imports as well as the nation's refineries near Tripoli and Sidon, however, are controlled by the Lebanon Ministry of Petroleum.

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.

While political instability precluded any mineral exploration activities for more than a decade, early 1991 natural gas finds near El-Marq may encourage exploration.

The Tripoli refinery with its post-civil war capacity of about 20,000 bbl/d is under consideration for expansion to an estimated 85,000 bbl/d capacity. By an agreement signed in late 1990, this refinery is supplied with 20,000 bbl/d of Syrian crude oil delivered via a 530-km-long spur line connecting the main Iraq Petroleum Co. (IPC) line to the refinery at the 825-km point.

Refinery yields from Syrian crude were reported as follows in 1991: 28%, gasoline; 42%, fuel oil; 22%, diesel oil; and 6%, kerosine. The refinery was able to meet one-third of the local demand for gasoline and diesel oil and about two-thirds of the fuel oil necessary to operate the two main power stations in the country.

The nation's only known commercial minerals were salt and quarried building materials. No information about reserves has been reported.

Lebanon's ports reopened by March 1991, affording the Government a means to obtain customs revenues. The nation's 378-km railroad, most of which is 1.435-m gauge, remained virtually inoperable because it primarily paralleled the coastal area where most of the hostilities took place.

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. Any firming of the Government's financial position should be reflected in an increased value of the Lebanese pound. Now that the militias have withdrawn from their hold over the ports, the Government hopes to alleviate budget problems by maximizing customs income. Government revenues should permit servicing the external debt, now reported at less than $500 million.

The private sector is in a favorable position to contribute to the estimated $18,000 million reconstruction cost. Private funds totaling $3,000 million are deposited in Lebanese banks, and about $12,000 million are deposited in banks abroad.

OTHER SOURCES OF INFORMATION

United States Embassy
P.O. Box 70-840
Beirut, Lebanon
Telephone: (961) 41-77-74

Bechtel Group, Inc.
50 Beale Street
San Francisco, CA 94105
Telephone: (415) 768-1234

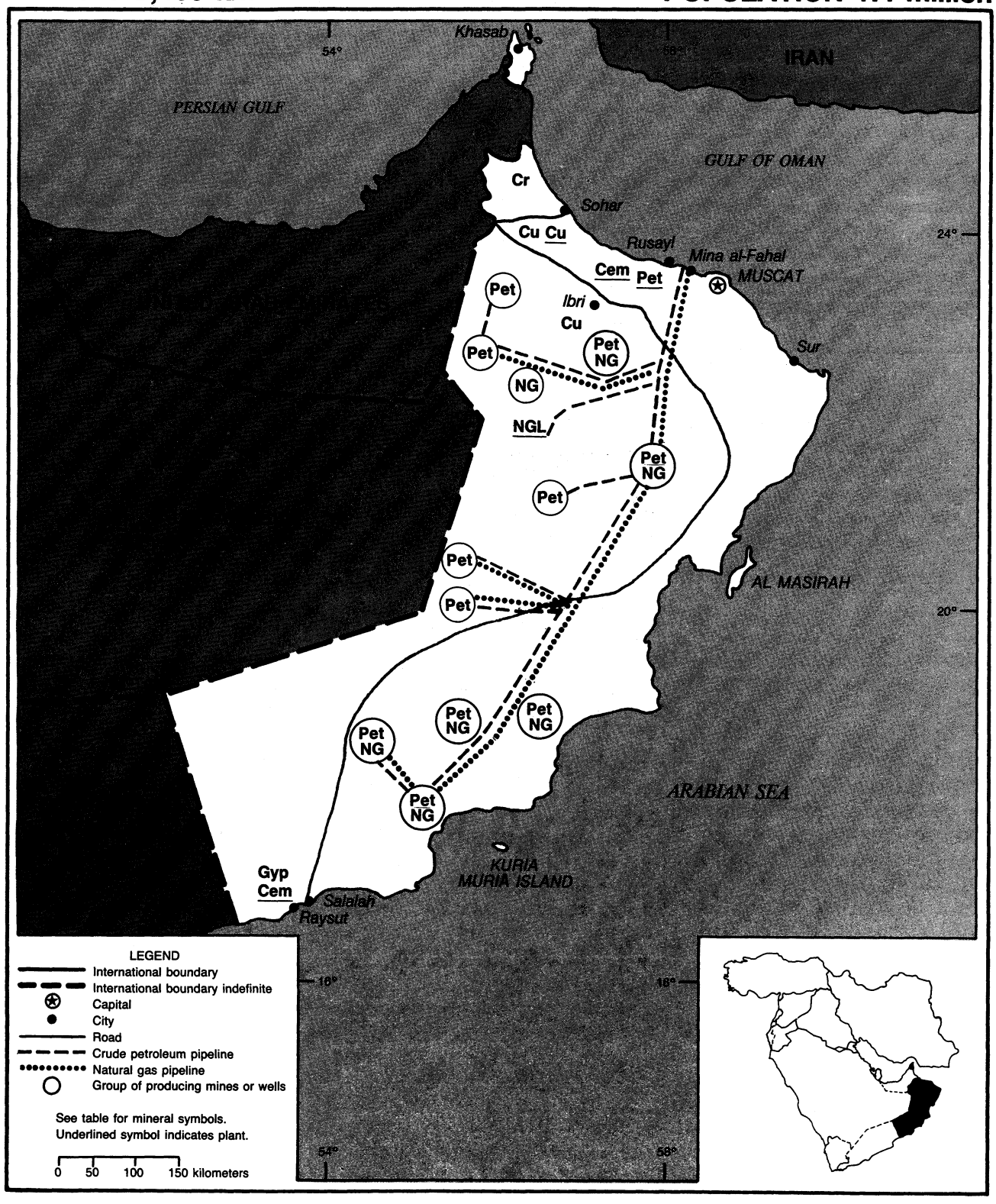
TABLE 1
LEBANON: PRODUCTION OF MINERAL COMMODITIES[1]

		1987	1988	1989	1990	1991e
Cement, hydraulic e	thousand metric tons	900	900	900	900	900
Gypsum e	metric tons	2,000	2,000	2,000	2,000	2,000
Iron and steel: Metal, semimanufactures e	do.	80,000	80,000	75,000	75,000	75,000
Lime e	do.	10,000	10,000	10,000	10,000	10,000
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	141	140	125	102	100
Gasoline	do.	2,015	r2,015	1,800	2,093	2,200
Jet fuel	do.	92	r90	90	—	—
Kerosene	do.	151	150	130	70	50
Distillate fuel oil	do.	1,723	1,725	1,600	2,877	2,000
Residual fuel oil	do.	3,388	3,400	r3,400	3,805	3,600
Other	do.	35	40	35	40	40
Total	do.	7,545	r7,560	r7,180	r8,987	7,990
Salt e	thousand metric tons	3	3	3	3	3

eEstimated. rRevised.
[1]Table includes data available through May 1, 1992.

OMAN

AREA 212,460 km² **POPULATION 1.4 million**



THE MINERAL INDUSTRY OF

OMAN

By Bernadette Michalski

Although the entire Sultanate is undergoing an extensive search for other valuable minerals, for the present and foreseeable future hydrocarbons will continue to underwrite Oman's developing economy. Commercial solid mineral ventures include mining and refining of copper with gold and silver as byproducts, mining of chromite, 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 gas processing plants. All but the copper and currently idle chromite operations produce primarily for the domestic market.

The hydrocarbon industry accounted for about one-half of the gross domestic product or nearly $5 billion[1] in 1991. The industry provides about 85% of Government revenues, thus serving as the principal support for other sectors of the economy, which are largely dependent on Government spending.

GOVERNMENT PROGRAMS AND POLICIES

While 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; however, actual cutbacks have been minimal. As a relatively small producer with pressing development needs, Oman seeks to produce as close to the maximum sustainable level as possible.

Greater economic diversification with the objective of reducing dependence on hydrocarbons continues to be an Omani Government objective. In support of this goal, an extensive 3-year mineral exploration and mapping program is now under way by France's Bureau de Recherche Géologiques et Minières (BRGM).

A new commercial law came into effect in 1991 covering commercial contracts and business activities, business acquisitions, agency relationships, banking operations, creditors' rights and security interests, and bankruptcy. The code requires that a foreign company operate only through an Omani commercial agent.

In support of anticipated solid mineral development, a new mining law was being drawn in 1991. Small cooperatives are encouraged, and the Ministry of Mines offers technical advice, rental equipment, and marketing services, all aimed at creating a more favorable climate for mineral development.

The Government has allocated $3,385 million in the 1991-95 plan to maintain oil production at its present level. This includes $923 million for exploration, $1,145 million for drilling and production, and $1,317 million for equipment.

PRODUCTION

Crude oil production increased to record levels as development activity and enhanced recovery operations continued. Omani crude oil production averaged 705,000 bbl/d for 1991. Because of 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/bbl. This figure is high relative to other Gulf States where costs are as low as $0.50/bbl.

Chromite production was entirely dependent on export contracts. Although production was reported for 1989, it was discontinued pending a decision to construct a ferrochrome plant. *(See table 1.)*

TRADE

Nearly 95% of all export earnings in 1991 was derived from petroleum. About 250 Mbbl was exported in 1991. The Far East was the destination for most of Oman's petroleum exports. The United States imported only 4 Mbbl in 1991. Except for 0.5 Mbbl of residual fuel oil, most of the U.S. import was crude oil.

Copper exports were estimated about 10% below the previous year's level due to lower ore grades and mining problems. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Government maintains a majority interest in most companies; however, foreign partnerships are encouraged. *(See table 4.)*

COMMODITY REVIEW

Metals

Copper.—More than one-half of Oman's copper production was extracted from the Lasail Mine, with much of the remaining output derived from the Aarja surface mine. A minor amount was produced 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, under a contract with Amalgamated Metals Corp. of the United Kingdom. Copper output did not meet expectations owing to lower ore grade and problems in mining the complex mineralization of the Aarja deposit. Additionally, the Government-owned Oman Mining Co. recovers about 22 kg of combined silver and gold annually as byproducts in the anode slime.

The Sohar copper deposits were nearing exhaustion; however, commercial deposits of copper with a relatively high gold content were discovered at Hajl al-Safi and Raka in Ibri about 150 km south of the Oman Mining Co.'s smelter at Sohar. Early studies conducted on behalf of the Sultanate indicate that the deposits may contain 8 to 12 Mmt ore grading 2% copper and 1 g/mt of gold. Copper deposits discovered in the Yanqui region were said to have proven reserves of 7 Mmt, extending mining activity by another 14 years.

Chromite.—The Rajmi chromite mine near Sohar yielded about 2,000 tons of ore annually between 1985 and 1988. Mine output was generally both refractory-grade and metallurgical-grade chromite. All production was destined for export. The Minister of Petroleum and Minerals announced plans to reopen chromite mines in late 1992. Output is expected to average 13,000 mt/a.

A joint committee of the Ministries of Commerce and Industry and Petroleum and Minerals was considering the construction of a ferroalloy plant having a proposed annual capacity of 25,000 to 50,000 tons of product. Exports and, consequently, mining operations were suspended pending final decision.

Industrial Minerals

Cement.—The manufacture of cement was conducted at Rusayl and at Salalah. The Oman Cement Co.'s Rusayl plant accounted for about 85% of the nation's output. The company was engaged in a market feasibility study to determine the merits of increasing clinker production or installing a second kiln.

Mineral Fuels

Coal.—The UN Department of Technical Cooperation and Development conducted a feasibility study on the exploitation of 22 Mmt of recoverable coal in the Sultanate. The World Bank approved a $1 million development program that will permit the utilization of the high-sulfur coal at Al-Kamil, near the Port of Sur, in eastern Oman. The coal will replace fuel oil for electricity generation.

Natural Gas.—About 85% 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 Mm^3 of natural gas was produced daily from the Yibal Field while the Fahud and Sayh Nuhaydah Fields each accounted for almost 1 Mm^3/d. In early 1991, the Petroleum Ministry announced discovery of a gasfield at Saih Rawl, in central Oman.

The collection and processing of natural gas in Oman is centered at three plants: the Fahud gas processing plant, the 2.2-Mm^3/d capacity Sayh Nuhaydah gas treatment plant, and the Yibal gas processing plant now under expansion with capacity projected at 16.6 Mm^3/d by 1992.

A major gas liquefaction shipping and marketing project is under consideration between the shareholders of Petroleum Development Oman and three Japanese companies. The project's total cost is estimated at $9,000 million for the plant, which will have a capacity of 5 million tons annually. The first exports are expected in 1999.

Oman hopes to replace the domestic use of petroleum products with natural gas as much as possible. This would release more petroleum for export. Natural gas is currently used as fuel for the Government Power System. It is also piped to the copper refinery, the Sultan Qaboos University, and the cement plant. A pipeline carries gas from Yibal to the Ghubrah desalinization and powerplant near Muscat and to the Rusayl Industrial Estate. Connecting lines extend up the Batinah Coast to Sohar at the site of the copper refinery and south from Sayh Nuhaydah to Zufar. The latter transports gas for use in the southern oilfields.

A contract was signed in November 1990 for a $74 million expansion of the Government Gas System treatment plant at Yibal. The project will raise throughput from 8.5 Mm^3/d to 16.5 Mm^3/d by yearend 1992.

The Omani Government originally considered assembling a methanol plant on a tanker floating off the Omani town of Khasab. However, the offshore Bukha Field natural gas reserve (4.5 billion m^3) was considered insufficient to justify construction of the floating plant. Revised plans call for the construction of a 35-km pipeline to deliver the Bukha natural gas and condensate to Ras al Khaimah, United Arab Emirates, where it will be processed at the Khor Khwair plant. Bukha dry gas will be sold to Ras al Khaimah households, and the natural gas liquids will be trucked to Dubai. Initial production from the Bukha Field was projected to be 5,000 bbl/d of condensate, 800 bbl/d of natural gas liquids, and more than 1 Mm^3/d of dry gas.

Petroleum.—An intense decade of exploration resulted in crude oil reserves approaching 4.5 billion bbl. Reportedly an additional 1.5 billion barrels could be recovered through steam soak, polymer and steam flooding, hot water injection, and/or electromagnetic heating of the reservoirs. Steam soak facilities were commissioned at the Amal Eastern High structure in 1991. Five steam soak wells have been completed while the sixth well is designed for electromagnetic heating. The last four steam soak wells will be drilled in the first quarter of 1992.

Production over the past decade maintained a constant growth spiral. The Petroleum Development Oman Co. accounted for most of this output. By yearend 1991, Petroleum Development Oman accounted for 675,000 bbl/d in production or 96% of the total production from the Sultanate. The company has

approved a $500 million waterflood project to increase production from its Lekhwair Field in northwest Oman from current levels of 25,000 bbl/d to more than 150,000 bbl/d in 1993. Petroleum Development Oman initiated drilling its first offshore well at a site 300 km northeast of Salalah in October of 1991. The site is 63 km offshore in water depth of 105 m.

An oil discovery was announced in Occidental Oman's Sumeimah concession about 40 km from the Safah Field. Production from its Safah Field averaged 26,000 bbl/d in 1991. Finland's Neste bought into the concession in late 1991, via Chevron Corp.'s holdings.

Oman projects a sustained level of production at 700,000 to 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, recognizing the strategic importance of a supply source independent of the Strait of Hormuz, has been a traditional market for Omani crude oil, purchasing 40% to 50% of all exports for the past decade.

Oman's sole refinery, the Mina al-Fahal, was designed to meet domestic product demand, and the bulk of its output is consumed in the Sultanate. Refinery throughput in 1991 was estimated at 62,000 bbl/d yielding a product mix of gasoline, jet fuel, diesel oil, and bunker fuel. Engineering studies are under way to determine how best to increase the refinery's capacity. Another study is under way to upgrade the refinery. Fuel oil upgrading was estimated to cost $500 million.

Desiring to engage in overseas investments, Oman has organized a consortium to transport oil from the Tengiz Field and other western fields in the former Soviet Republic of Kazakhastan. The landlocked Republic is considering eight options for the pipeline route. Estimated costs range between $700 million and $1,600 million depending on the chosen route. Final selection of the route will depend on engineering studies and negotiations with right-of-way owners. It is expected to require 3 years to build and eventually have a capacity of 1.5 Mbbl/d.

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 increased by 130 M/bbls to 4.43 billion bbl at yearend 1991. Recoverable reserves of natural gas are reported at 280 billion m^3. Coal resources in the Misaw Valley are reported at 36 Mmt.

INFRASTRUCTURE

The Omani highway system totals 22,800 km, of which only 18% is bituminous surfaced. The Communication Ministry announced plans to construct a 41.5-km road linking Khasab and Bukha on the Musandam peninsula, which should improve access and stimulate economic activity.

Petroleum and natural gas pipelines total 1,300 km and 1,030 km, respectively. The bulk of crude oil production is serviced by the central pipeline running from the Dhiab Field in the south to Mina al-Fahal near Muscat. The petroleum terminal at Mina al-Fahal 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 Enonomic Development for $20.4 million to help finance an expansion of Mina Qaboos, which was expected to cost $65 million. The port's annual handling capacity is to be expanded from 1.6 Mmt to 2.6 Mmt. To allow handling the increased traffic, the port entrance channel and basin are to be dredged to a depth of 13 m. A cargo storage area of 15 hectares will be created by using landfill from the dredging to level the existing terrain.

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 and natural gas 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 is projected to rise to 750,000 bbl/d in 1992 and should maintain that level for the next decade unless voluntary cutbacks are practiced to maintain price levels.

Oman's solid mineral resource potential should be properly assessed by BRGM's project and discoveries may be anticipated. The new mining law exacted in 1991 should serve to encourage foreign investment.

The mining of copper and chromite offers a basis for some diversification and the potential for increased export earnings.

[1]Values were converted from Omani rial (RO) to U.S. dollars at the rate of RO 0.3845=US$1.00, a fixed rate since 1986.

OTHER SOURCES OF INFORMATION

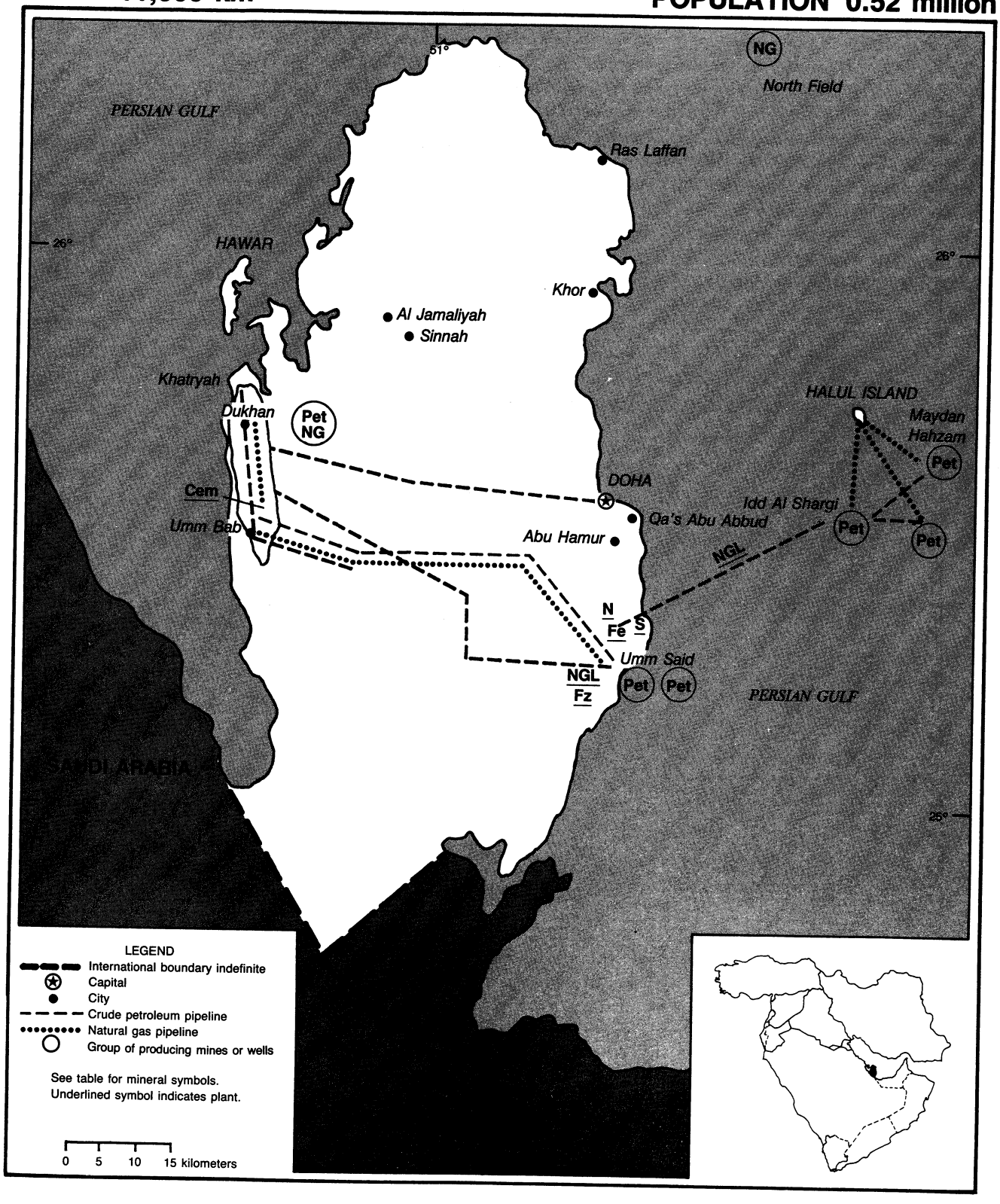
Ministry of Petroleum and Minerals
P.O. Box 551
Muscat, Oman
Phones: 603333/603341/603563
Fax: 696972

Petroleum Development Oman
P.O. Box 81
Muscat, Oman
Phone: 678111
Fax: 677106

Oman Cement Co.
PO Box 3560
Ruwi-Muscat
Sultanate of Oman
Fax: 626414

QATAR

AREA 11,000 km² **POPULATION 0.52 million**



THE MINERAL INDUSTRY OF

QATAR

By David Izon

Qatar's role as a world producer of oil and as a member of OPEC was minimal in 1991. Qatar produced less than 1% of world output. However, Qatar's North Field's abundant nonassociated gas reserves have paved the way for continued industrial development in the country. Qatar has continued to diversify its industrial base, but the economy depended largely on oil exports. Exports generated about 90% of Government revenues and 90% of export. The oil industry accounted for about 28% of GDP.

The Government's plan to expand its industries to include an aluminum smelter with a production capacity of 193,000 mt/a was on schedule. Plans were also underway for the expansion of existing cement, fertilizer, and steel plants. Efforts to help diversify the mineral industry were centered around construction of a petrochemicals plant that will produce 550,000 mt/a of methyl tertiary butyl ether (MTBE) and 660,000 mt/a of methanol, a gypsum plant, and development of phase 2 of the North Field gas project.

The Government actively sought foreign and local investors for its natural gas projects. The investment laws of 1980 were amended to allow foreign equity participation in private-sector joint ventures. This was designed to encourage the private sector to play an important role in industrial development in the country. It would also expose the local business firms to international markets and contacts. New laws instituted also included allowing neighboring gulf state nationals to own businesses or participate in economic activities in Qatar.

GOVERNMENT POLICIES AND PROGRAMS

Government policy continued to favor the development of new industrial sites dependent on gas as the main energy source and feedstock, owing to the fact that Umm Said was becoming congested. Some of the comprehensive plans previously approved were being revised relative to present economic conditions. The Government revised a planned ferroalloy plant. Under the new scheme, the plant would produce only ferromanganese. Another gas-based metallurgical project that was revised was the Doha Aluminum Co. (DOHAL) smelter. Plans were underway to modernize or build a new cement plant to boost production by 2,000 mt/d. The Qatar General Petroleum Co. and Condotte a'Acqua of Italy signed an agreement on September 7, 1991, to design and construct a port at Ras Laffan. Qatar's Chamber of Commerce and Industry established a standing committee to act as intermediary between Government and business to promote the role of private sector in industry and boost economic activity.

PRODUCTION

Output of nonfuel minerals such as cement, fertilizer, limestone, steel, and sulfur increased slightly in 1991. Plans were being implemented to improve the fertilizer and petrochemical production to cope with demand. Petroleum and natural gas production also improved, and the refinery was working at full capacity. The $1.3 million first phase of the North Field gas project started production of 23 Mm^3/d in September 1991. *(See table 1.)*

TRADE

Although Qatar has established some industrial base not confined to downstream oil-related activities, its economy continued to be largely dependent on the oil sector. Oil exports accounted for about 90% of Government revenue amounting to about $3 billion. Trade included other commodities such as cement, fertilizer, and iron and steel to other gulf countries. In 1991, Qatar sold almost all of its crude oil and refined products under term contracts to Japan and the Far Eastern countries, which together absorb about 94% of all oil exports. Japan accounted for about 88%, South Korea about 6%, and the remaining to Brazil, Western Europe, and the United States. 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.

STRUCTURE OF THE MINERAL INDUSTRY

Qatar's mineral industry continued to be dominated by the oil and gas sector. In 1991, about 25% of the labor force was employed in oil-related industries. The ownership of DOHAL changed in 1991. 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 the Federal Republic of Germany (35%) and an Indian group (30%). Al Jabor owns a 35% interest in the company. This was a new project to be completed in 1993. *(See table 2.)*

COMMODITY REVIEW

Metals

Aluminum.—Construction of the new primary aluminum smelter that began in 1990 was on schedule. Efforts to complete this initial phase of the 193,000-mt/a capacity plant by October 1992 was also on schedule with new partners. The capacity would eventually be increased to 300,000 mt/a. Davy McKee, who was to finance and manage the project, withdrew because it failed to reach an agreement with the Government on the price of gas to be supplied by the state-owned Qatar General Petroleum Corp. (QGPC). The project was to be sited at Doha, and the 50-MW powerplant had planned to utilize natural gas from the North Field.

Iron and Steel.—In 1991, Qatar Steel Co. (QASCO) maintained production above the design capacity of 350,000 mt/a for the second year. It continued to sell 90% of the output to neighboring Gulf Cooperation Council (GCC) states. The Government took over technical operations from Kobe Steel in 1989. In April 1991, the Government announced that it would also take over all marketing operations from Tokyo Boeki in January 1992. QASCO distributed one-half of its profits to the employees. The Government was making arrangements to replace the foreign managers with Qatari nationals.

Ferroalloys.—The Government and Pennant Holdings of Australia were committed to building the $300 million ferroalloy smelter at Umm Said. The revised plan for this complex excluded the production of ferrochrome and silicomanganese because of the weakness of the world market for these products. The scaled-down smelter would cost $200 million. The original plans included the production of 100,000 mt/a of ferromanganese, 70,000 mt/a of silicomanganese, and 60,000 mt/a of ferrochrome. A revised 40-MW power station was designed to be built at the site by Vitkovice Co. of Czechoslovakia.

Industrial Minerals

Qatar Fertilizer Co. (QAFCO) was the country's sole fertilizer producer. A third plant to supplement QAFCO's fertilizer production was proceeding according to plans. The estimated cost for the new complex was about $500 million. Completion was planned in 3 to 4 years. The new plant would consist of a 1,000-mt/d ammonia unit and a 2,000-mt/d urea unit. In the meantime, QAFCO continued to upgrade the two existing plants. The three plants would be managed by Norsk Hydro of Norway. On completion, the complex would be operated by Qatar Ferroalloy Smelter (QAFAS).

Mineral Fuels

Natural Gas.—The Government of Qatar reached agreement to share production of the natural gas and gas liquids with a French company, Compagnie Francaise des Petroles (Total), from the offshore North Fields. The agreement was valid for 25 years and renewable every 25 years. Total was to maintain this average production level, which corresponded to 21 Mm^3 of residue gas and would be passed to QGPC for LNG purposes. The Qatari Government granted Total all necessary facilities to achieve its goals. The operation was to be managed by a committee of six members, with the Government and Total each represented by three members. The chairperson shall be from the Government of Qatar and eligible to vote 5 years after commencement of first export. The agreement provided terms for Total to recover its cost through sales of condensates recovered from the gas produced.

After cost recovery, the condensates will be shared by Total and the Government of Qatar on a ratio of 22% to 78% or 10% to 90%, respectively. Gas production from the phase 1 project started in late 1991 due to delays created by the uncertain situations caused by the Gulf situation.

Petroleum.—The country's continued exploration program did not yield any commercial discoveries in 1991. However, development of a known oilfield onshore at Dukhan, called Diyab, was expected to raise onshore production capacity by 50,000 bbl/d to 280,000 bbl/d. The $95 million project was scheduled for completion in July 1992. Advanced oil recovery methods were being implemented to help the existing oilfields maintain their current levels of production. These reservoir upgrade programs were estimated to cost about $300 million.

Reserves

Qatar was estimated to have the world's largest nonassociated gas reserves in the North Field. The North Field's recoverable gas reserves were put at 5 trillion m^3. 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 Government expects to continue to give top priority to the North Field gas project. The development of the gasfields to full capacity by the year 2010 is an urgent program that will guarantee its economic well-being into the next century. Industrial developments are focused on three key areas: upstream development, incorporation of the first and second phase of the North Field, and downstream projects, requiring the establishment of new industries and expansion of existing ones. This should increase job opportunities for Qatar's 35,000 citizens and its foreign residents. Natural gas should continue to provide cheap energy for Qatar's domestic industries, including aluminum, fertilizer, ferroalloys, petrochemicals, and steel. These in turn should provide a substantial cost benefit for exporting goods produced in these industries. Factors that may limit Qatar's economic development are its dependence on foreign labor and world market conditions on oil and gas prices. The completion of several natural gas projects with their long-term subcontracts for liquefied natural gas may provide additional economic stability.

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[1]Where necessary, values have been converted from Qatari riyals (QRS) to U.S. dollars at the rate of QRS3.64=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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991[e]
Cement, hydraulic		303,000	[e]300,000	294,300	327,000	[3]336,000
Gas, natural:						
Gross	million cubic meters	6,440	6,490	6,750	7,500	7,500
Marketed[e]	do.	5,610	5,860	6,090	6,100	6,800
Iron and steel: Metal:						
Steel, crude	thousand tons	492	527	550	560	580
Semimanufactures	do.	503	505	530	540	540
Natural gas liquids:[e]	thousand 42-gallon barrels	13,500	15,000	[3]13,231	13,200	[3]13,140
Nitrogen: N content of ammonia		560,800	605,665	714,000	760,000	761,000
Petroleum:						
Crude	thousand 42-gallon barrels	106,945	116,581	117,214	140,525	[3]137,970
Refinery products:						
Gasoline	do.	2,125	2,920	3,650	4,750	4,750
Jet fuel	do.	608	2,336	2,920	3,800	3,800
Kerosene	do.	873	1,054	1,310	1,710	1,710
Distillate fuel oil	do.	2,685	4,526	4,745	6,175	6,170
Residual fuel oil	do.	3,929	4,526	5,840	7,595	7,500
Other[4]	do.	[e]800	438	1,825	1,800	2,000
Total	do.	[e]10,980	15,800	20,290	25,830	25,930
Stone: Limestone[e]	thousand tons	900	900	900	[3]810	850
Sulfur		53,300	[e]55,000	52,000	52,000	53,000

[e]Estimated.
[r]Table includes data available through May 11, 1992.
[2]In addition to the listed commodities, Qatar also produced clays, gypsum, and sand and gravel for construction purposes.
[3]Reported figure.
[4]Includes refinery fuel and losses.

TABLE 2

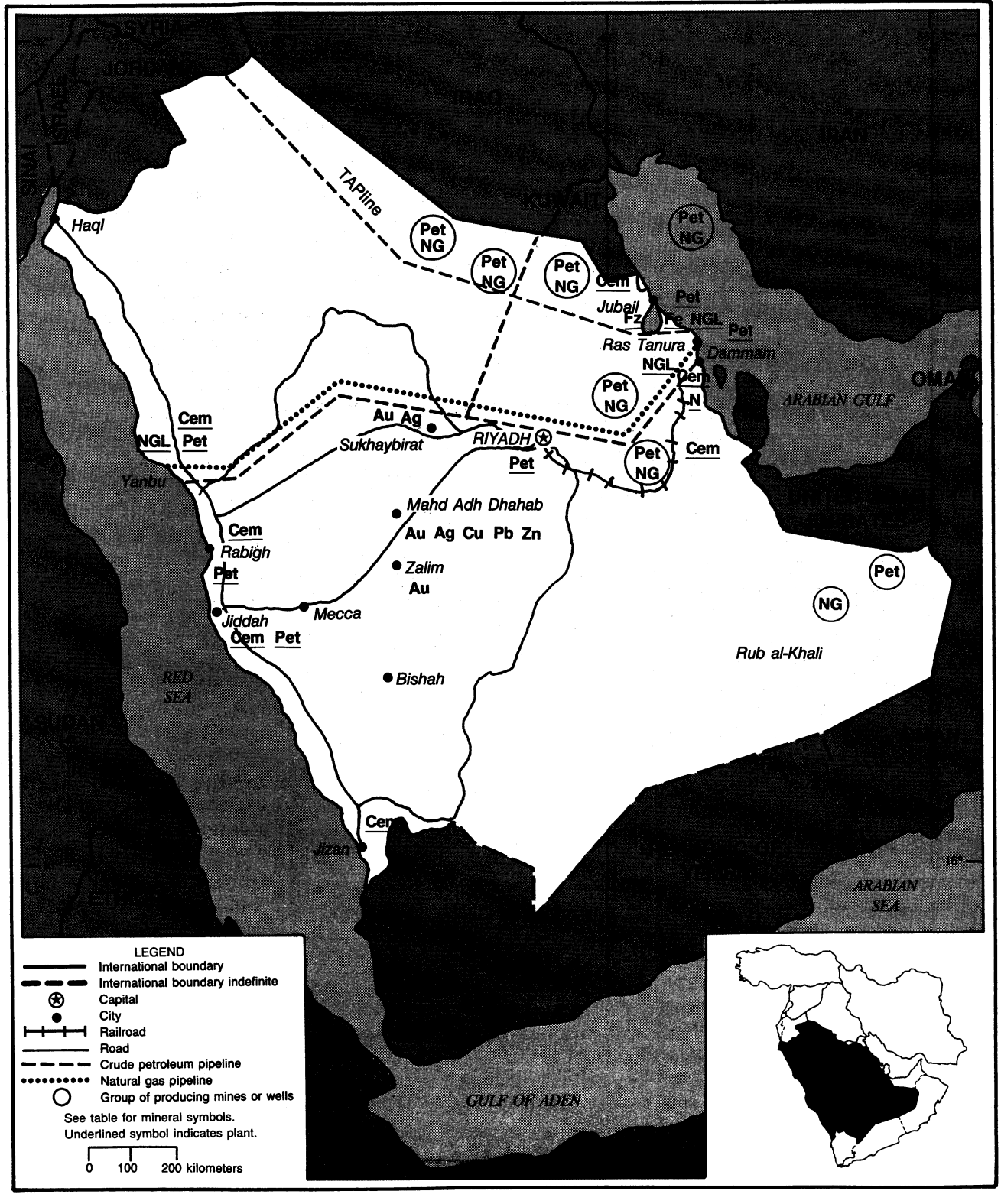
QATAR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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.	Umm Said	22,630.
Iron and steel	Qatar Steel Co. (QASCO) (Government, 70%; Kobe Steel Ltd. of Japan, 20%; Tokyo Boeki Ltd. of Japan, 10%)	do.	400.
Sulfur	Qatar Petrochemical Co. (QAPCO) (Qgpc, 84%; Charbonnagesde France—Chemie, 16%)	do.	52.

SAUDI ARABIA

AREA 2.2 million km² **POPULATION 17.1 million**



THE MINERAL INDUSTRY OF

SAUDI ARABIA

By Bernadette Michalski

Although Saudi Arabia has achieved a significant diversity in mineral production through the cement, gold, and steel industries, it is 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 expansion of oil output supported strong economic growth in 1990 and 1991. Provisional estimates put total GDP growth at 8.8% in 1990 and 9.4% in 1991. The growth was mainly because of the oil sector. The GDP is reported to have topped $100,000 million[1] in 1991. The economic challenge imposed by the Gulf crisis brought the 1991 budget deficit to an estimated $21,000 million.

Exploration efforts have located about 3,000 showings for at least 50 metallic and nonmetallic minerals. The Kingdom consists of two distinct geological settings. The West is composed of metamorphosed rock of Precambrian age, forming the Arabian Shield. The remaining portion of the Kingdom is composed of undisturbed sediments of Paleozoic, Mesozoic, and Tertiary ages. The Arabian Shield is the major source of mineralization.

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 and the enhancement of the competitiveness of domestic industry to increase exports and provide job opportunities for nationals. 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.

The Government encouraged state-owned companies to raise their own finance through commercial loans. Examples include the electric utility, the Saudi Consolidated Electric Co. for the Western Province (SCECO WEST), which raised $320 million in mid-1991, and Saudi Aramco, which raised loans totaling $2,900 million in early 1992. The 1992 budget projected a 27% increase in spending and projected revenues.

For the past decade, Saudi Arabia has injected a sense of moderation into OPEC politics by restraining production on more than one occasion. However, with the additional expenses incurred in the Gulf War reducing the Kingdom's treasury, production is now unrestrained, increasing the Saudi Arabian share of OPEC output from 24% to 36%. Crude oil prices have remained fairly stable since the end of the war, and Saudi Arabia did not disrupt the market through its demands for continued high production. International market conditions have been favorable for the Kingdom, particularly the reduced availability of oil exports from the former U.S.S.R.

PRODUCTION

Crude oil production, the Kingdom's principal mineral commodity, increased by 62% between 1989 and 1991. Production averaged less than 5.1 Mbbl/d in 1989 but almost 8.2 Mbbl/d in 1991. The rapid rise in production was attributable to the additional capacity activated after the Iraqi invasion of Kuwait.

The commercial production of copper, gold, silver, and zinc commenced in 1988 with the opening of the Mahd Adh Dhahab Mine. In mid-1991, a second gold mine, Sukhaybirat, was inaugurated.

Nearly all cement produced is consumed in Saudi Arabia. Private capital and company mergers in this sector have been encouraged to foster economies of scale. Cement manufacturers also have the advantage of a 20% duty on cement imports. *(See table 1.)*

TRADE

Most imports were subject to customs duties at rates ranging from 12% to 20%. Imports from members of the Cooperation Council for the Arab States of the Gulf (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 import or export gold in any form with the exception of gold of 14 carats or less, the import of which was prohibited.

Crude oil exports were valued at $24 billion in 1989, $39.7 billion in 1990, and more than $41 billion in 1991 when a large increase in the volume of oil exports was offset by a 17% fall in price. Crude oil exports averaged 6.6 Mbbl/d, and product exports averaged about 0.4 Mbbl/d in 1991. The principal markets for Saudi Arabian crude petroleum and products in 1991 were, by volume, Western Europe with combined imports of 2.2 Mbbl/d; the United States, which imported 1.8 Mbbl/d, including only 98,000 bbl/d of petroleum products, mostly unfinished oils and gasoline; and Japan, whose combined imports averaged 1.4 Mbbl/d. Saudi Arabia is the leading supplier to the United States, accounting for 29% of the United State's petroleum imports in 1991. Shipments to the United States nearly doubled in recent years, partially reflecting the Saudi Arabian participation in the Texaco-Aramco joint venture, Star Enterprise, which imported almost 600,000 bbl/d of Saudi crude oil in 1991. Saudi Aramco purchased the South Riding Point oil transshipment facility in the Bahamas, including a petroleum storage capacity of 5.2 Mbbl. This acquisition provides a strategic location for supplying the east and gulf coasts of the United States.

In 1991, Saudi Arabia shifted its position from a net importer to a net exporter of iron and steel products with inaugural shipments to the Far East.

STRUCTURE OF THE MINERAL INDUSTRY

All minerals, including the vast petroleum and natural gas reserves, are owned by the Government. Their exploitation was predominantly controlled by Government organizations. *(See table 2.)*

COMMODITY REVIEW

Metals

Copper.—The Directorate General of Mineral Resources (DGMR) issued a tender for prospecting licenses near the Jabal Sayid copper mines, 315 km north of Jiddah. The DGMR had already conducted preliminary studies in the area, including the drilling of bore holes totaling 46,000 m, which revealed deposits estimated at 16.9 Mmt of ore containing 2.6% copper.

Ferroalloys.—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, one 7,000-mt/a silicon metal furnace, and a 30,000-mt/a silico-manganese 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, silico-manganese, and ferromanganese production is intended for local consumption.

Gold.—Several commercially significant gold deposits have been discovered in the Arabian Shield. The Mahd Adh Dhahab deposit, 275 km northeast of Jiddah, offered the most favorable recovery with a grade of 27 g/mt and a reserve of 1.1 Mmt. Current annual output averages 3,400 kg of gold and 15,300 kg of silver.

The Saudi Co. for Precious Metals, a joint venture between Petromin and Boliden of Sweden, was established in 1989 to develop the Sukhaybirat gold deposit, about 480 km northwest of Riyadh, where reserves were reported at 8.4 Mmt of ore yielding an average of 2.5 grams of gold per metric ton. Sukhaybirat is an open pit mine, a key factor in making the project profitable in spite of the relatively low gold grade. Production commenced in May 1991. Eventual capacity was anticipated to be 600,000 mt/a of ore yielding 1,500 kg/a of gold. Ore processing commences with a three-stage crushing plant designed for a maximum ore throughput of 270 mt/h. Primary crushing is followed by fine crushing and screening, after which the product is stored in a fine ore bin. A conveyor belt is used to transfer the fine ore to the grinding plant, which consists of a rod and ball mill. The resulting pulp is pumped to eight leach tanks. After dissolution occurs, the gold is adsorbed on active carbon. The carbon is screened out, and the gold-containing solution is pumped to electrolyte tanks. Gold is retrieved from the solution and is plated onto steel wool cathodes. Loaded cathodes are placed in a calcination oven. After smelting, the gold is cast into molds containing 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. These include Hiajar, 80 km northwest of Bishah; Bir Tawilah, 50 km east of Zalim; Al-Amar, 650 km northeast of Jiddah; and Al-Shukhtaliat, 50 km west of Zalim. Combined, these properties contain more than 10 Mmt of ore with gold content ranging from 3 to 25 g/mt. More than 800 occurrences of gold have been reported, of which 30 prospects have been drilled. At least 12 sites have been selected for further development. A demonstration heap-leach test was completed at the Hamdah site in 1991.

Iron Ore.—In late 1990, the DGMR awarded a contract to British Steel

Consultants Ltd. with the objective of determining the technical feasibility of producing high-grade (67.5% Fe content with less than 2.2% total acid gangue) direct reduction pellets from the Wadi Sawawin iron ore deposit near the northern Red Sea coast. The assessment will include the conceptual design of a full-scale beneficiation and pelletizing plant.

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 in 1991 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 Mmt/a and should be completed by the close of 1993. A $133 million loan was approved to the Saudi Iron and Steel Co.

Industrial Minerals

Cement.—The merger of the Saudi Cement Co. and the Saudi-Bahraini Cement Co. was effected on January 1, 1992, marking the first merger of two Saudi Arabian joint stock companies. The resulting company, Saudi Consolidated Cement, has an annual capacity of 3.4 Mmt or more than 25% of the Kingdom's available cement capacity. Domestic demand approaches 12 Mmt/a, and about 1 Mmt is destined for the export market, principally in Asia.

Phosphate.—Phosphate reserves of 4 billion tons have been discovered in the Tareif area. Phosphate deposits averaging 21% to 24% of P_2O_5 had been discovered near Al-Jalamid. The deposits were estimated to contain 120 Mmt of readily minable ore. The exploitation rate was projected at 6 Mmt/a of run-of-mine ore yielding 3 Mmt of concentrate averaging 30% to 35% P_2O_5 for a 20-year period. The concentrate would be transported 1,090 km to the National Chemical Fertilizer Co.'s plant at Jubail for use in the manufacture of diammonium phosphate.

Soda Ash.—Final Government approval has been received by the International Chemical Industries and Trading Co. Ltd. for a 264,000-mt/a-capacity soda ash plant. Total project cost was estimated at $240 million. Financing will include company equity capital, a $107 million loan from the Saudi Industrial Development Fund, and loans from other commercial banks. 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. A potential market for soda ash was developing in Bahrain as a feedstock for the United Gulf Industries' proposed anhydrous sodium sulfite and sodium metabisulfite plant.

Sulfur.—The production of sulfur of 99.8% purity was estimated at 1.5 Mmt in 1991 and was derived from the processing of hydrocarbons. While the domestic requirements continued to grow, most of the sulfur output was exported to markets among members of the GCC, India, Pakistan, Bangladesh, Tunisia, and Morocco.

Titanium Dioxide.—Cristal, the National Titanium Dioxide Co., has announced the commissioning of a 51,500-mt/a-capacity TiO_2 plant at Yanbu in mid-1991 utilizing a chloride route process on rutile and ilmenite imported from Australia. Original plans for the plant called for a capacity of 45,000 mt/a. The $200 million plant includes a $6 million investment to reduce waste volumes. To ensure a chlorine supply, Cristal has formed a joint-venture company, Arabian Chlorine Industries, with Basic Chemical Industries. While most of the production is to service the domestic market, 5,000 tons is to be exported to the Asian market.

Mineral Fuels

Natural Gas.—Most of the Kingdom's natural gas was produced in association with crude petroleum. Until the development of the Master Gas System (MGS), a network for recovering, processing, and distributing natural gas, Saudi Arabia flared much of the gas it produced. The MGS consists of 60 gas-oil separation plants set in the Khurais, Safaniyah, Ghawar, and Zuluf Fields; three gas processing plants at Berri, Shedgun, and Uthmaniyah; the East-West natural gas liquids pipeline; and two gas fractionation plants at Yanbu and Ju'aymah. The system has a raw gas gathering capacity of 170 Mm^3/d and a processing capacity of 115 Mm^3/d. With the decline in oil production during the 1980's, it was necessary to supplement the system's gas feed by developing the Kingdom's nonassociated gas resources. By 1990, Saudi Aramco had added about 60 Mm^3/d of nonassociated gas gathering capacity to the MGS. A gas sweetening facility with the capacity to process 8.5 Mm^3/d was installed at the Shedgum plant in 1991.

The system's overall capacity has some limitations. 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.

Petrochemicals.—The state-owned Saudi Basic Industries Corp. (Sabic) has evolved into a leading world supplier of base petrochemicals, producing more than 7.1 Mmt of chemicals and petrochemicals, 2.2 Mmt of fertilizers, and 1.4 Mmt of plastics in 1991. The principal markets for these products were the Far East, Western Europe, and Southeast Asia.

The United States Clean Air Act has created a new market for methyl tertiary butyl ether (MTBE) as an oxygenate. Sabic expansion plans include nearly quadrupling MTBE output from the present 500,000 Mmt/a to 1.9 Mmt/a by 1995. In addition, an 800,000-mt/a

MTBE plant is to be built in Yanbu as a joint venture between Mobil Corp. of the United States and Chemvest of Saudi Arabia, raising Saudi Arabian MTBE capacity to 2.7 Mmt/a. Another project is under consideration for a 500,000-mt/a MTBE plant by Teldene and Himont, another United States and Saudi Arabian joint venture that would further boost capacity to 3.2 Mmt/a. A feasibility study is underway for a 90,000- to 520,000-mt/a-capacity plant by the Saudi Arabian Marketing & Marketing Co. (Samarec), which plans to make Saudi Arabia the largest exporter of unleaded gasoline by 1995.

***Petroleum.*—Production.**—Saudi Arabia increased production by 62% in a 2-year timeframe attaining an average production level of 8.18 Mbbl/d in 1991. In the first 8 months of 1992, production averaged 8.40 Mbbl/d. Much of the rapid increase in production experienced over the past 2 years resulted from the recommissioning of facilities mothballed in the early 1980's, which activated production capacity of more than 3 Mbbl/d. All of the above activity was done at a price. Production cost increased by 25%, from $2.00 per bbl to $2.50 per bbl. 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 Mbbl/d of Arabian Light, about 1.2 Mbbl/d of Arabian Medium, and about 1.5 Mbbl/d of Arabian Heavy. Income from oil was estimated at about $4.5 billion per month.

In the Kuwait-Saudi Arabia Neutral Zone, production did not resume at the war-damaged facilities of the Khafji Field until June 1991, with output at 150,000 bbl/d. By the close of 1991, output was reported at 280,000 bbl/d, nearing its prewar level of 300,000 bbl/d. Production at the Wafra Field did not resume until early 1992.

The Gulf crisis prompted Saudi Aramco to accelerate the timetable and increase the scope of its longer term oil capacity expansion program, which projects maximum capacity of 10 Mbbl/d by 1993 and sustainable capacity of 10 Mbbl/d by 1995. In support of this plan, Saudi Aramco increased drilling activity sharply in 1991, drilling more than 200 delineation and development wells. Saudi Aramco leased two more rigs from contractors, raising total active rigs to 17. Saudi Aramco is also proceeding with the development of recently discovered oilfields in the Central Province. Discoveries of light, sweet crudes, at Dilam, Raghib, Naeem, Hawtah, and Hazmiyah-Ghinah, have been declared commercial. The discoveries contain crude oil ranging from 44° to 52.9° API gravity. The Hawtah Field is the first to be in production, anticipated by 1994, with total output at 170,000 bbl/d from 135 wells. All of the Central Province fields are just south of Riyadh and near the east-to-west trans-Saudi Arabian pipeline, Petroline, which carries crude to export facilities and refineries at Yanbu on the Red Sea. Petroline's capacity has been boosted to more than 4 Mbbl/d.

Two construction contracts were signed at the close of 1991, and a third contract in early 1992 for the development of the Hawiyah area of the Ghawar Field. The $1,000 million development project is part of the program to expand the Kingdom's production capacity to 10 Mbbl/d. The United Engineers & Constructors International of the United States are expanding the Qurayyah seawater treatment plant. The Bechtel Corp. of the United States, in partnership with the Consolidated Contractors International Co., was awarded the construction contract for a new gas-oil separation plant and an expansion contract on two existing gas-oil separation plants. The latter includes providing crude oil handling facilities and adapting existing gas-gathering facilities to permit the processing of 300,000 bbl/d at each plant.

Saudi Arabia borrowed $2,000 million in March 1992 for expansion of oil production capacity. About 20 United States, European, Japanese, and Gulf banks participated in the loan.

Refining.—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 in the Kingdom. 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. A contract for the project management and engineering of the first phase was awarded in December 1991 to Foster Wheeler of the United States. Phase two of the refinery expansion program, scheduled for completion in 1995-96, envisions upgrading units at the Ras Tanura and Rabigh refineries by 1995. The third phase calls for enhancement of facilities at two joint-venture refineries—the 300,000-bbl/d Petromin-Mobil Yanbu refinery and 284,000-bbl/d Petromin 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 Aramco's Ras Tanura refinery is slated for a major reconstruction that will restore its design capacity of 530,000 bbl/d and may take 12 years to complete. Project manager is Brown & Root Braun of the United States.

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 France and Italy as well as an additional position in the United States were underway.

Saudi Aramco purchased a 35% equity in the Ssangyong Oil Refining Co. of South Korea for $470.4 million in May 1991. This action replaced earlier proposals that called for acquiring 50% equity in two South Korean refineries.

An agreement was concluded in May 1991 with the Japanese firms, Nippon Oil, Nippon Mining, and Arabian Oil Co., together with Caltex for the recommissioning and expansion as necessary of three refineries in Japan. Saudi Aramco would hold a 50% equity, the three Japanese firms combined would hold 40% equity, and Caltex of the United States would hold the remaining 10%. The three existing Japanese refineries involved in the agreement are: the Nippon Oil refinery in Kudmatsu, the Nippon Oil-Caltex refinery at Muroran on Hokkaido Island, and the Nippon Mining refinery near Nagoya.

A private Saudi Arabian group, the Arabian Petroleum Co., has expressed interest in purchasing one-half of Petrofina's refining and marketing assets in the United States and forming a joint-venture operation. The holdings include two Texas refineries, the 150,000-bbl/d-capacity Port Arthur refinery and the 60,000-bbl/d-capacity Big Spring refinery, product pipelines and storage facilities, and 3,000 service stations operating in 20 States.

Direct investment in foreign refining, marketing, and distribution operations establishes for Saudi Arabia a guaranteed market for crude oil and provides stability in the face of market fluctuations.

Reserves

Saudi Arabia's subsoil has the world's largest known concentration of oil. 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, with 17 billion bbl; Berri, with 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. At the present accelerated rate of output, Saudi Arabia enjoys a reserve-production ratio sufficient to last 90 years. *(See table 3.)*

INFRASTRUCTURE

Construction activities of the past two decades have created a basic infrastructure. Highways totaled 74,000 km, of which 35,000 km was bituminous surfaced and 39,000 km was gravel and improved earth. Railroad lines totaled 886 km of 1.435-m standard gauge.

Further expansion of the East-West pipeline was underway. The maximum throughput on Petroline, which runs from Abqaiq in the Arabian Gulf to Yanbu on the Red Sea, was in the process of attaining a throughput capacity of 5 Mbbl/d through the installation of additional pumps and turbines at the 11 pumping stations now in operation along the line. Originally, the pipeline operated at 1.8 Mbbl/d and was expanded to 3.6 Mbbl/d with the construction of a parallel pipeline.

The completion of the second phase of Iraq's oil pipeline transiting the Arabian Peninsula from the Gulf to the Red Sea at Yanbu was completed. The 1,600-km pipeline had a reported capacity of 1.5 Mbbl/d, but did not operate after the Iraqi invasion of Kuwait in August.

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 Mm^3/d. Electric power generation capacity was 16,500 MW. Expansion of several existing power and desalination stations and the development of new plants were being prepared for tenders. A $730 million expansion project at the Al-Khobar power and desalination complex was offered for bids in 1991. The project would increase desalination capacity by 60 Mbbl/d and power generation by 350 MW.

All power projects like the rest of Saudi Arabia's infrastructure expenditures were paid for directly by the Government. In mid-1991, the Saudi Consolidated Electric Co. for the Western Province broke from tradition by raising its own capital, $320 million from seven local banks, to finance expansion of the Rabigh powerplant. The expansion program will include the installation of the Kingdom's first combined-cycle unit with the capacity of 640 MW. Seven additional major power projects with a combined capacity of 2,670 MW were pending bid responses or financing proposals.

Following the pattern of seeking nongovernmental financing, Saudi Aramco's shipping subsidiary Vela International Marine has raised $1,200 million in two loans in early 1992 and others are still in negotiation. The largest was $900 million from a group of international banks led by J. P. Morgan and Co. The second loan was for $300 million, and borrowing was led by the National Commercial Bank. The loans are to be used to add 21 tankers to the present fleet of 28 vessels. Vela bought six very large crude carriers (VLCC) in early 1991 and another three in early 1992. Vela plans to carry 70% of the Kingdom's crude exports.

OUTLOOK

The financial burden of supplying a major share of troop deployment costs as well as the cost of compensating the countries most seriously affected by the application of the UN embargo against Iraq has reduced the Kingdom's treasury in the short term; however, 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 key oil exporter. The Kingdom's business climate had developed favorably since the Gulf War. Both state and private companies are expanding. Private-sector expansions involve both trading companies rebuilding their stocks after running them down during the Gulf War and manufacturing firms extending their capacity. The economy is set to continue at a dynamic pace for at least the next 5 years.

Saudi Aramco is expanding sustainable production to 10 Mbbl/d by 1995, involving a capital investment of $15,000 to $25,000 million. This expansion will place the Kingdom in a position to take advantage of the expected growth in world oil demand during this decade. A similar improvement of the downstream oil refining sector is also planned. The proposed restructuring of the giant Ras Tanura Refinery is expected to cost $12,000 million over the next 12 years. The phase 1 program for the Kingdom's other refineries has begun at a cost of $4,000 million.

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

Concerns about oil prices mount with the persistence of the recession in the West softening demand. Saudi Arabia is reluctant to resume its role as swing producer to accommodate declines in world demand. Continued weak pricing may cause Saudi Arabia to abandon its 8-Mbbl/d floor by agreeing to cuts or maintaining its market share while watching prices fall further. This decision will be critical to the future of the Kingdom's current economic boom because a sharp drop in prices would stall the economy.

Growth in MTBE demand has been fueled by heightened concern in the United States over environmental issues. Its compatibility with existing refinery equipment and high octane rating 109 gave it the edge over its rivals. Under the provisions of the Clean Air Act, which comes into being in the United States in November 1992, gasoline used in heavily populated areas that does not conform to emission standards will have to be reformulated to include 2.7% oxygen by volume. Initially, the ruling will only apply in winter, but by 1995, areas with ozone level problems will have to use reformulated gasoline all year. While Saudi Arabia has heavily invested in MTBE production, the market could be inhibited by the introduction of a new or as yet undiscovered additive or cheaper alternative.

The Saudi Arabian ferroalloy production project is marginal. It will become viable if manganese ore prices decline by 20% or alloy prices increase by 10%.

The Kingdom borrowed abroad for the first time in 1991, raising $4.5 billion from international banks. The J. P. Morgan Group also arranged a $1.5 billion loan for Saudi Aramco during the year. The kingdom relies on oil receipts rather than taxes but oil has not been sufficient to pay Government expenses since 1982. The Government began issuing medium-term development bonds, short-term depository instruments, and more recently short term T-bills. The structural nature of the budget portends fiscal stress when significant levels of Iraqi and Kuwaiti oil will be back on the market, and barring a severe and sustained drop in production from the former U.S.S.R., oil earnings will be hard pressed to keep pace with Government spending.

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[1]Where necessary, values have been converted from Saudi riyals (SRls) to U.S. dollars at the rate of SRls3.7450=US$1.00.

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TABLE 1

SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991e
Copper: Cu content of concentrate and bullion[2]		—	e300	765	895	900
Cement, hydraulic	thousand tons	8,595	10,951	11,442	12,000	13,000
Gold:						
Mine output, gross weight:						
Ore		—	e40,000	100,000	146,000	450,000
Concentrate[2]		—	2,800	6,977	7,000	7,800
Bullion, crude, gross weight	kilograms	—	e1,500	3,642	5,630	6,400
Au content of concentrate and bullion	do.	—	e1,000	2,900	3,536	4,300
Gas, natural:[3]						
Gross	million cubic meters	39,070	41,050	46,400	51,265	52,000
Dry	do.	26,700	29,150	29,900	30,800	31,500
Gypsum[e]		373,000	375,000	375,000	375,000	375,000
Iron and steel: Metal, steel, crude	thousand tons	1,365	1,614	1,810	1,833	1,850
Lead: Pb content of concentrate[2]		—	65	205	250	250
Natural gas liquids, all forms	thousand 42-gallon barrels	125,896	149,145	153,645	194,630	196,000
Nitrogen: N content of ammonia	thousand tons	637	867	863	942	900
Petroleum:[3]						
Crude	thousand 42-gallon barrels	1,535,555	1,890,100	1,848,500	r2,353,900	2,985,000
Refinery products:						
Liquefied petroleum gas	do.	7,949	9,559	7,909	r7,000	6,000
Gasoline and naphtha	do.	130,102	130,539	124,104	r98,000	98,000
Jet fuel	do.	20,572	15,822	18,214	r37,800	39,900
Kerosene	do.	26,913	30,917	29,918	44,000	42,000
Distillate fuel oil	do.	149,129	161,590	145,670	r124,200	112,500
Residual fuel oil	do.	152,577	164,282	148,348	r122,200	114,700
Unspecified	do.	14,442	13,084	13,437	13,000	12,000
Total	do.	501,684	525,793	487,600	r446,200	425,100
Silver: Ag content of concentrate and bullion[2]	kilograms	—	e3,600	13,321	16,237	16,400
Sulfur: Byproduct, hydrocarbons	thousand tons	1,432	1,378	1,423	1,435	1,500
Zinc: Zn content of concentrate[2]		—	e700	2,580	2,472	2,500

eEstimated. rRevised.

[1]Table includes data available through Nov. 1, 1992.

[2]Mahd 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.

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

TABLE 2

SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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 Enterpises Co. of Bahrain, 15%)	Ayn Dar, 75 kilometers southwest of Dammam	1,800.
Do.		Saudi Cement Co. (Government, 100%)	Al-Hufuf	1,352.
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%)	Jiddah Rabigh	650. 1,320.
Do.		Southern Province Cement Co. (Government, 100%)	Suq al-Ahad, 10 kilometers northeast of Jizan	1,500.
Do.		Yanbu Cement Co. (Government, 100%)	Yanbu	1,460.
Fertilizer		Al-Jubail Fertilizer Co. (Samad) (Sabic, 50%; Taiwan Fertilizer Corp., 50%)	Jubail	632 urea. 300 ammonia.
Do.		National Chemical Fertilizer Co. (Ibn al-Baytar) (Sabic, 50%; Safco, 50.%)	do.	500 urea. 500 ammonia. 500 NPK. 200 TSP. 100 DAP. 10 liquid fertilizer.
Do.		Saudi Arabian Fertilizer Co. (Safco) (Saudi Arabian private interests, 100%)	Dammam	330 urea. 200 ammonia. 100 sulfuric acid. 20 melamine.
Gold		General Organization for Petroleum and Mineral Resources (Petromin) (Government, 100%)	Mahd Adh Dhahab, 270 kilometers northeast of Jiddah	150 ore. 3,000 metal, kg.
Do.		The Saudi Company for Precious Metals (Petromin, 50%; Boliden International Mining, 50%)	Sukhaybirat, 480 kilometers northwest of Riyadh	600 ore. 1,500 metal, kg.
Natural gas	million cubic meters	Saudi Aramco (Government, 100%)	All oilfields, Eastern Province Khuff Zone, Eastern Province Abqaiq Gas Cap, Eastern Province	35,000. 20,150. 4,600.
Natural gas liquids[1]	million barrels	do.	Ju'aymah, 33 kilometers northwest of Ras Tanura Yanbu	145. 110.
Do.		do.	Shedgum, 150 kilometers southwest of Dammam	55.
Do.		do.	Uthmaniya, 30 kilometers west of Al Hufuf	110.
Do.		do.	Berri, 15 kilometers north of Jubail	20.
Petrochemicals	million barrels	Saudi Petrochemical Co. (Sadaf) (Sabic, 50%; Pecten Saudi Arabia, 50%)	Jubail	760 ethylene. 560 ethylene chloride. 60 styrene. 300 industrial ethanol. 375 caustic soda.
Do.		National Methanol Co. (Ibn Sina) (Sabic, 50%; Celanese Arabian, 25%; Texas Eastern Arabian, 25%)	do.	770 methanol.

See footnote at end of table.

TABLE 2—Continued

SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petrochemicals—Continued: million barrels	Saudi Methanol Co. (Al-Razi) (Sabic, 50%; Japan Saudi Arabia Methanol Co., 50%)	Jubail	630 methanol.
Do.	Arabian Petrochemical Co. (Sabic, 100%)	do.	650 ethylene. 100 polystyrene.
Do.	Saudi European Petrochemical Co. (Ibn Zahr) (Sabic, 70%; Ecofuel, 10%; Neste Oy, 10%; Arab Petroleum Investments Corp., 10%)	do.	700 methyl-tertiary-butyl-ether.
Petroleum, crude million barrels	Saudi Aramco (Government, 100%)	Eastern Province and offshore	2,900.
Do.	Arabian Oil Co. (AOC) (Japan Petroleum Trading Co., 80%; Kuwait, 10%; Saudi Arabia, 10%)	Khafji Al Hout	100. 20.
Do.	Texaco (former Getty Oil Co.) (Neutral Zone production shared by Saudi Arabia and Kuwait)	Wafra South Fawaris South Umm Gudair	(2). (2). (2).
Petroleum products	Saudi Aramco (Government, 100%)	Ras Tanura	200.
Do.	Rabigh Petroleum Refining Co. (Samarec, 50%; Petrola, 50%)	Rabigh	115.
Do.	Jubail Petroleum Refining Co. (Samarec, 50%; Shell, 50%)	Jubail	95.
Do.	Yanbu Petroleum Refining Co. (Samarec, 50%; Mobil, 50%)	Yanbu	92.
Do.	Riyadh Oil Refinery Co. (Samarec, 100%)	Riyadh	50.
Steel	Saudi Iron and Steel Co. (Hadeed) (SABIC, 95%)	Jubail	1,800.
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.

[1]Natural 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.
[2]This field was severly damaged during the Gulf crises, and production was not yet restored as of this writing.

TABLE 3

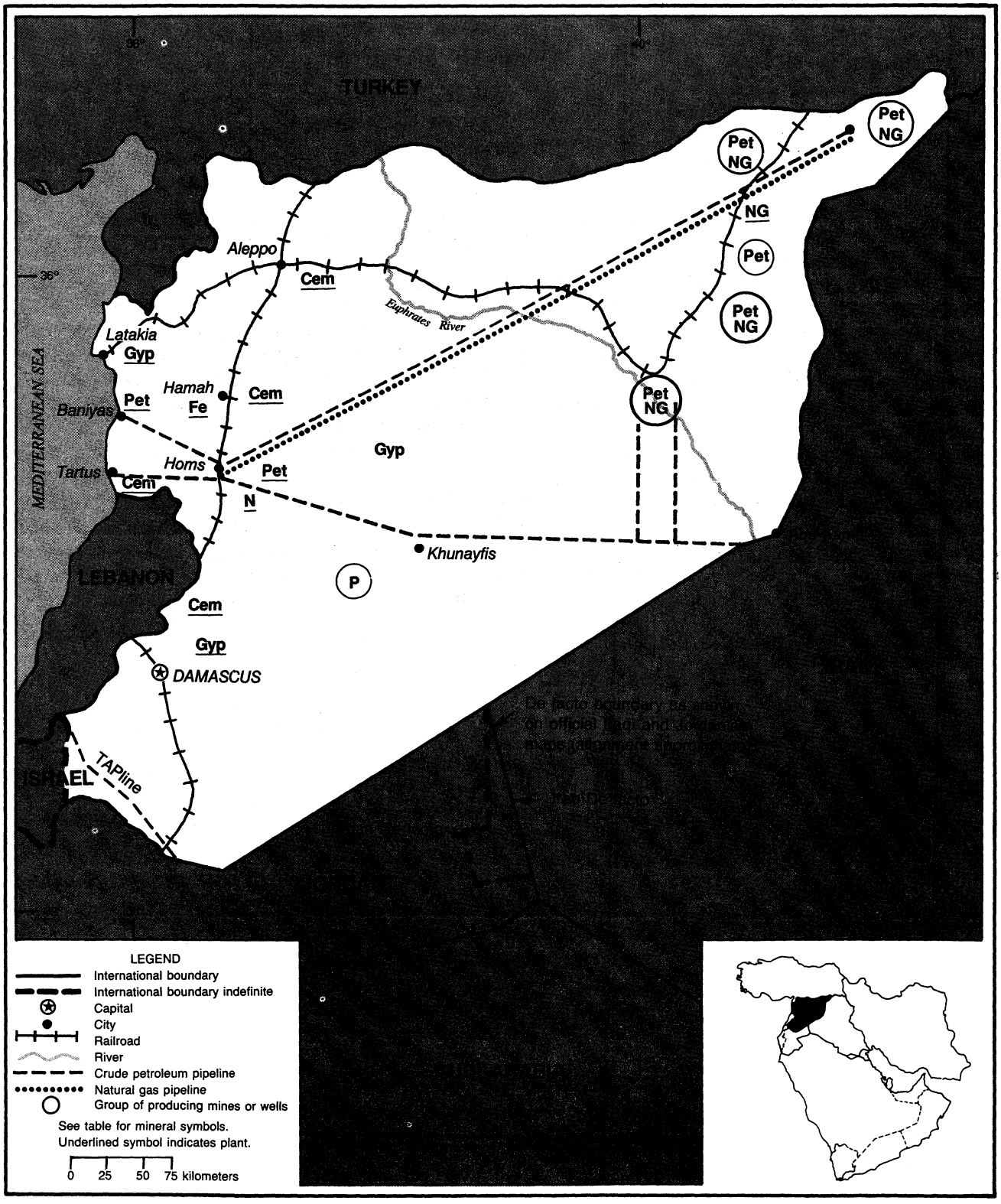
SAUDI ARABIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1991

Commodity		Reserves
Gold, ore:		
20 to 30 grams	metric ton	2.1
1 to 7 grams	do.	18.0
Petroleum	million 42-gallon barrels	260,350
Natural gas	billion cubic meters	6,500

Source: Ministry of Petroleum and Mineral Resources.

SYRIA

AREA 185,180 km² **POPULATION 12.0 million**



THE MINERAL INDUSTRY OF

SYRIA

By Bernadette Michalski

The mineral industry, dominated by hydrocarbons, contributed about 20% to the GNP. Other significant mineral industries included gypsum and phosphate rock mining, the manufacture of fertilizers and cement, and the manufacture of steel from domestic and imported scrap.

The discovery and development of petroleum fields yielding low-sulfur, light crude oils has improved the nation's trade balance. Since 1989, imported light crudes were no longer required to blend with Syria's heavy crudes, and modest quantities of light crudes were available for the export market. Associated natural gas flaring was reduced to approximately one-half of production. The development of nonassociated natural gas deposits in the north and northeast with accompanying gas gathering and processing facilities will make it possible to replace fuel oil for the electric power industry, provide a feedstock for the production of ammonia, and eventually provide exports to neighboring countries via pipeline.

GOVERNMENT POLICIES AND PROGRAMS

While several non-Syrian companies are conducting mineral exploration activities on behalf of the Syrian Government, the Government controls all mineral exploration and production in Syria. The Syrian Ministry of Petroleum and Mineral Resources has placed approximately 72,500 km² under exploration and production-sharing agreements with foreign companies.

An investment law designed to encourage domestic and foreign private investment by lifting restrictions on foreign exchange transactions as well as providing tax and customs concessions was passed by the People's Assembly and signed by the president in May 1991, thus shifting from a totally state dominated industry to greater private-sector involvement. Under Investment Law 10, about 70 companies, including joint ventures and mixed companies, have been approved with a total foreign exchange capital input of more than $177 million. At present, private investment is for the most part directed toward agricultural and tourism activities.

Syria's support of the United Nations' coalition during the Iraqi occupation of Kuwait placed Syria in a position to receive aid from the coalition nations.

PRODUCTION

Crude oil production exceeded 500,000 bbl/d at the close of 1991, raising the annual average to 470,000 bbl/d. Output from the Dayr az-Zawr region where crudes range from 36° to 41° API gravity contributed about 310,000 bbl/d or two-thirds of total production. Crudes from the northeastern fields, which range between 18° to 25° API gravity, supplied only one-third of total output. Until 1989 the heavy crude oils from the northeastern fields were Syria's only domestic source of crude oil.

Production of the nonhydrocarbon minerals remained for the most part below capacity levels. Lack of investment capital has precluded mineral exploration, deposit development, or equipment repair, replacement, or improvement. The financial aid made available to Syria for support in the expulsion of the Iraqi forces from Kuwait should improve performance in this sector. *(See table 1.)*

TRADE

After three decades of negative trade balances, Syria reported a trade surplus for each year between 1989 and 1991. Government import restrictions combined with the increased production and price of petroleum were the principal reasons for the surplus. Crude oil exports averaged 165,000 bbl/d in 1990. Refined product exports averaged 70,000 bbl/d, most of which was fuel oil.

In late 1990, an oil supply agreement was signed with Lebanon providing 20,000 bbl/d of light crude oil for delivery to the Tripoli refinery through the pipeline from Baniyas, reactivating the pipeline closed since 1982. In February 1991, an agreement was reached with Jordan for the purchase of approximately 35,000 bbl/d of crude oil and refined products to fill the vacuum created by the embargo imposed on Iraqi exports.

Oil revenues were expected to gross $5 billion in 1991. Although Europe, particularly Eastern Europe, was the principal market for Syria's petroleum, shipments to the United States in 1991 totaled 1.6 Mbbl of crude oil or 4,400 bbl/d.

Exports of Syria's other significant mineral, phosphate rock, was estimated at 1.3 Mmt in 1991. The principal export market for Syrian phosphates was Europe, accounting for almost 80% of phosphate rock exports. The political-economic changes in eastern Europe were reflected by reduced markets in Romania and Yugoslavia. However, new markets were opened in northern Europe.

STRUCTURE OF THE MINERAL INDUSTRY

Syria has a state socialist economic system with a growing and vigorous private sector. 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. When commercial hydrocarbons are discovered and developed, the Government-owned Syrian Petroleum Co. activates a production-sharing agreement.

Law 10 provides for mixed private- and public-sector joint ventures that accord the state 25% to 50% ownership but leaves management in private hands. The law also covers provisions for conventional joint stock companies, partnerships, limited liability companies, and wholly owned private companies. Thus far, only services supporting tourism and to some extent agriculture have been open to private investment. The objective of Law 10 is to encourage the return of overseas capital for reinvestment.

The public-sector development program includes a 750,000-mt/a-capacity iron and steel complex, a 500,000-mt/a-capacity triple superphosphate (TSP) plant near Palmyra, and two cement factories with a combined capacity of almost 2 Mmt/a. *(See table 2.)*

COMMODITY REVIEW

Metals

The General Organization of Engineering Industries is considering the construction of an integrated iron and steel plant at Al-Zara near Hamah in east-central Syria. The plant will include a direct reduction unit, electric arc furnaces, and a mill to produce reinforced steel bars and wire rods. Output is planned at 750,000 mt/a. Cost is projected at $750 million. Saudi Arabia has pledged $500 million in support of the project.

Industrial Minerals

Cement.—The General Organization for Cement and Building Materials has invited bids for a 3,000-mt/d-capacity plant at Hamah and a 1,200-mt/d-capacity plant at Rustaim.

Fertilizers.—A phosphatic fertilizer complex is planned at Palmyra. The complex will include a 500,000-mt/a-capacity TSP plant, a 198,000-mt/a-capacity phosphoric acid plant, and a 660,000-mt/a-capacity sulfuric acid plant. Most of the finance for the estimated $350 to $500 million complex will be provided by Saudi Arabia with the Syrian Government providing 25%. Most of the fertilizer output will be used domestically; however, some triple superphosphate will be available for export.

Phosphate Rock.—Phosphate rock production declined to 1.4 Mmt as a result of reduced foreign and domestic sales in 1991. Tenders have been offered for equipment supply and construction of a new phosphate mine and upgrading plant to produce 2 Mmt of washed and dried phosphate concentrate annually at the Eastern Mine of the General Co. for Phosphate and Mines (GCPM). The recent discovery of deepwater resources allows washing to produce a superior phosphate concentrate to that currently being sold.

Mineral Fuels

Natural Gas.—The Government has put a high priority on increased utilization of natural gas. This energy source supplied only 10% of Syria's total power generation and accounted for only 4% of total energy consumption in 1991. However, 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 gasfields in the Palmyra region, Cherrife and Ash Shaer, with combined reserves of 85 billion m^3, encouraged the increased reliance on natural gas.

Universal Oil Products 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 almost 18 Mm^3/d while industrial plant consumption is expected to reach almost 4 Mm^3/d by 1993.

The Al-Furat Petroleum Co. development plans now underway include construction of a natural gas gathering system encompassing the Umar, North Umar, Shahel, El Isba, and Tanak Fields. When the Cherrife and Ash Shaer 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 Mm^3/d of dry gas that will be piped to the 400-MW Tishrin power station near Damascus.

In February 1991, an agreement was signed with Turkey to sponsor a joint feasibility study of the potential of a natural gas field in the Suwaidiyah-Karachok area, about 250 km from the Turkish border.

Petroleum.—The Syrian Petroleum Corp. has entered into exploration and production-sharing agreements with foreign companies to the extent that the country has been divided into 18 concession areas for which 14 contracts have been signed by yearend 1991. 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.

Crude oil production averaged 470,000 bbl/d in 1991. Of this total the Al Furat Petroleum Co. accounted for 305,000 bbl/d with 20 fields in production. Daily production for the entire country exceeded the 500,000-bbl level by yearend.

Elf Aquitaine brought the North Attala Field on-stream in early 1991. 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.

Reserves

The Syrian Ministry of Oil, Electricity and Natural Resources has announced in early 1990 reevaluated hydrocarbon mineral reserves, which substantially increased recoverable natural gas reserves from the 113 billion m^3 announced in 1989 to 181 billion m^3. 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 an area 72 km^2 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 m^3 of natural gas.

INFRASTRUCTURE

Railway transportation is available in northern and western Syria servicing the major cities and the three principal ports of Tartus, Latakia, and Baniyas. The existing pipelines include the Iraq Petroleum Co. (IPC) pipeline traversing Syria from east to west; the Syrian Petroleum Co. (SPC) pipelines carrying crude petroleum and natural gas from the northeastern fields to the refineries, powerplants, and port facilities in the west; and the long-closed trans-Arabian pipeline (TAPline), which crosses Southern Syria into Lebanon. The IPC pipeline was originally intended as Iraq's conduit to the Mediterranean while also supplying light blending crudes to the Homs refinery. With the onset of production from the Dayr az-Zawr area, 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. In 1991, hydroelectric power accounted for 13.4% of total electric output or 1,560 MkW•h.

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

OUTLOOK

By sending a military division to the Gulf in support of the UN coalition, Syria has reaped substantial political and financial dividends, winning at least $2 billion in combined aid from Saudi Arabia and Kuwait. Kuwait and Saudi Arabia renewed pledges of aid, prompting the Syrian Government to review investment projects such as a new iron and steel complex and a new fertilizer factory to absorb expansion of local phosphate rock production. Syria will be one of the principal beneficiaries of the $10 billion Gulf Fund established in early 1991.

The availability of finance has been the direct consequence of Syria's posture during the Gulf crisis. In addition to the 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.

The World Bank has revised its figures on Syria's total external debt to $16,446 million for 1990. Most of this debt is owed to the former U.S.S.R. and Eastern Europe for military sales. While much of foreign debt has been canceled, Syria still remains in arrears to the World Bank for the sum of $500 million.

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.

Military spending accounted for 50% of budget. With the restoration of diplomatic relations with Egypt and eased tension in Lebanon, military spending might well be reduced. In the atmosphere of declining risks, financial resources reserved for the military could be redistributed.

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[1]Where necessary, values have been converted from Syrian pounds (£Syr) to U.S. dollars at the rate of £Syr 11.2=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

General Organization for Engineering Industries
Damascus, Syria

Banias Refining Co.
P.O. Box 26
Banias, Syria
Telephone: 238307, 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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		1987	1988	1989	1990	1991[e]
Cement, hydraulic	thousand tons	3,870	3,330	3,501	3,500	3,500
Gas, natural:[e]						
Gross	million cubic meters	[r]1,217	1,275	1,360	1,375	1,385
Dry	do.	[r]623	652	695	700	700
Gypsum		248,000	179,000	180,000	175,451	175,000
Iron and steel: Steel, crude[e]		69,000	70,000	70,000	70,000	70,000
Natural gas liquids[e]	thousand 42-gallon barrels	500	500	500	500	550
Nitrogen: N content of ammonia		92,533	78,700	122,500	103,600	105,000
Petroleum:						
Crude	thousand 42-gallon barrels	84,570	[r]96,800	[r]130,000	[r]140,000	[2]171,550
Refinery products:						
Liquefied petroleum gas	do.	1,763	1,750	1,825	1,900	2,000
Gasoline	do.	7,242	8,570	[r]10,950	[r]11,100	11,300
Naphtha	do.	5,124	5,000	5,000	5,000	5,000
Jet fuel	do.	2,624	3,125	[r]4,000	[r]4,000	4,200
Kerosene	do.	1,565	1,460	1,500	1,500	1,500
Distillate fuel oil	do.	21,750	21,535	[r]23,700	[r]24,000	24,300
Residual fuel oil	do.	34,500	38,490	[r]35,800	[r]36,000	36,000
Asphalt	do.	1,357	1,400	1,400	1,400	1,400
Other	do.	1,900	1,800	1,700	1,700	1,700
Total	do.	77,825	83,130	[r]85,875	[r]86,600	87,400
Phosphate rock	thousand tons	1,986	2,186	2,256	1,633	[2]1,359
Salt		81,000	127,000	137,950	127,172	127,000
Stone, sand and gravel:						
Stone: Dimension, marble	cubic meters	15,062	17,804	18,000	18,000	18,000
Sand and gravel	thousand tons	[e]6,000	8,000	8,000	8,000	8,000
Sulfur, byproduct of petroleum and natural gas		[r e]40,000	[r e]40,000	40,000	29,652	29,000

[e]Estimated. [r]Revised.

[1]Table includes data available through Apr. 30, 1992.

[2]Reported figure.

TABLE 2

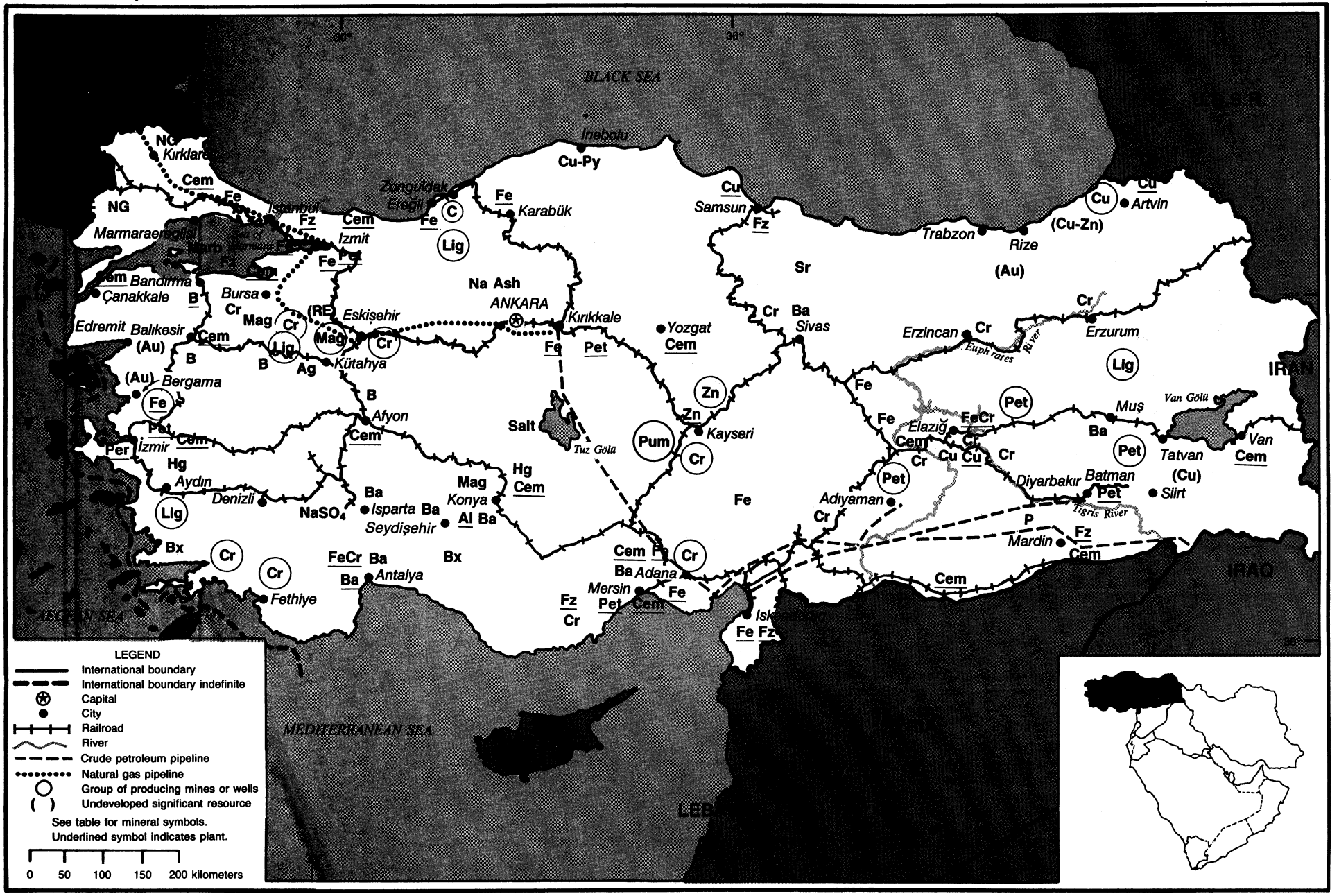
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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	240
Do.	do.	do.	Jubaisseh plant	640
Petroleum, crude	thousand barrels	do.	Northeastern fields Suwaydiyah, Jabisah, Gbebeh, Tichrine, Karatchuk, and Rumaylah	55,000
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, and Al-Ward	150,000
Petroleum, refined	do.	Baniyas Refining Co. (Government, 100%)	Baniyas	46,000
Do.	do.	Homs Refining Co. (Government, 100%) equity owners	Homs	42,000
Phosphate rock		General Co. for Phosphates and Mines (GECOPHAM)	Khunayfis	400
Do.		do.	Al-Sharqiye Eastern A 20 kilometers south of Khunayfis	600
Do.		do.	Al-Sharqiye Eastern B 26 kilometers southeast of Khunayfis	400
Salt		do.	Dayr az-Zawr	60
Do.		do.	Mine 35 kilometers southeast of Aleppo	100
Steel		General Co. for Iron and Steel Products (Government, 100%)	Plant 8 kilometers north of Hamah	120
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**



THE MINERAL INDUSTRY OF

TURKEY

By Hendrik G. van Oss

The Turkish mineral industry was mixed in 1991. In general, production and exports of crude minerals, especially the metal ores, were either stagnant or at lower levels than in 1990. However, the production of value added mineral commodities was generally slightly higher. The mineral industry was an important component of the Turkish economy. Turkey's GDP was $117.5 billion[1] in 1991, about 8% higher than that in 1990. Domestic sales of primary and secondary mineral commodities, other than those imported, are estimated at almost 18% of the GDP. Mineral commodity exports in 1991 were at about the same level as those in 1990, or about $2.5 billion, equivalent to about 18% of Turkey's total exports. Mineral commodity imports in 1991 were worth about $8.1 billion, equivalent to about 38% of the country's total imports.

Turkey had more than 800 mining establishments in 1991, exploiting a wide variety of minerals from, reportedly, more than 3,000 mines. The vast majority of these operations were, however, very small. Even the large parastatal mining companies, which dominated the production of several commodities, operated a number of small mines. Despite this, the cumulative production during the year for many mineral commodities was significant.

Turkey was a major producer of industrial minerals, being among the top two producers in 1991 for boron, emery, and strontium (celestite), and among the top three for perlite, pumice, and soda ash (trona). The country was among the top six producers of chromite and was a major world producer of barite, lignite, magnesite, and marble. In terms of value added commodities, Turkey was a significant world producer of cement, glass, and steel.

Turkey's mineral production and trade reflect a diverse manufacturing and agricultural economy, strategically located to Western and Eastern Europe, the U.S.S.R., and the Middle East. The Turkish economy was adversely affected by the Persian Gulf War and its related trade sanctions and other disruptions. However, war-related losses were minimized by diversification of trading partners and through the assistance of several NATO and Middle Eastern countries. Turkey is an Associate Member of the EC, and many of its trading practices and investment regulations are geared toward trade with EC countries. Major trade occurs with the U.S.S.R., much of which is through a barter arrangement for Soviet natural gas. The political instability in the U.S.S.R. during 1991 offered both problems and opportunities for Turkish trade. Turkey has longstanding ethnic and cultural ties to the neighboring republics of the U.S.S.R. Work was ongoing to establish a major trading interrelationship among the countries bordering or near the Black Sea.

Much of the Turkish mineral industry, particularly that involving value added products, was undergoing or planning capacity expansion of production facilities. The Government was engaged in a major privatization program of its mineral-producing and other companies; progress in this effort was only modest.

GOVERNMENT POLICIES AND PROGRAMS

The Government has been actively involved in mining since 1935, mostly through a number of large parastatals. In more recent years, the Government has encouraged increased mineral exports and both domestic and foreign private mining investment in Turkey. This encouragement has come through the 1985 Mining Law and various recent investment decrees. One of the most significant outcomes of this legislation is that foreign companies have the same rights as domestic companies in terms of factors such as taxation and access to exploration permits. A number of new incentives for mining were incorporated into a 1991 draft of a new mining law. However, the new law was never enacted owing to the election of a new Government in October. The new Government recognized the need for revisions to the 1985 law and appointed a committee to draft a new one. The new law was not expected to be ready for consideration before mid-1992.

High levels of inflation and public debt in the late 1980's and in 1990-91 have been the outcome of otherwise successful Government policies in the 1980's to encourage exports and overall industrial growth. These policies have included direct export incentives, import restrictions to protect domestic industry, and high levels of Government spending, particularly in the construction sector. The latter began to be reduced in 1988 in an effort to reduce the growth of public debt. Turkey's European trading partners, particularly EC members, have sought the elimination of Turkey's export subsidies. Under this pressure, the Government began removing export subsidies in early 1989.

In several key industries, most notably the steel sector, labor stoppages in 1989 and 1990 led to large wage settlements in

1990. These settlements, together with inflation-induced cost increases of other inputs and the removal of export subsidies, decreased the competitiveness of Turkish exports. Production disruptions in the steel industry in 1990 and the removal of import restrictions led to large increases in steel imports that year and in 1991. These imports were in excess of need and, together with reduced demand in the construction sector for steel, severely hurt the domestic sales by private-sector steel mills. In 1991, the Government was under heavy pressure from the private steel companies for renewed assistance. It began to reintroduce import tarrifs and was considering the partial reinstatement of export subsidies.

Apart from debt incurred through public works spending, a significant factor in the deteriorating Turkish economy has been the high level of Government spending and borrowing to support large parastatal corporations, several of which were in the mineral and energy sectors. Most of these corporations were unprofitable; all were considered overstaffed. In 1989, in response to mounting pressure from domestic companies and international lending institutions, the Government began implementing a major privatization program. The program transferred total or partial ownership in several corporations, notably in the cement, petroleum refining and petrochemicals, and steel sectors, to the Public Participation Fund Administration (PPFA). The PPFA was to sell shares in the corporations to both Turkish and foreign investors. However, ambiguities in the legislation governing PPFA transfer of state assets led to a successful court challenge of the 1989 sale of five cement plants to a French company. It was clear that a new transfer mechanism was needed for privatization and, at yearend 1991, the Government formed a new privatization agency to replace the PPFA. It was unclear if the new agency would be more effective, given early indications that the new Government was less committed than its predecessor to the privatization timetable. The Government was under pressure to minimize the social disruptions that would accompany the privatization and breakup of the large parastatals. Public demand for privatization was perceived by the Government to be weakening, as evidenced by the disappointing level in 1991 of stock purchases in these companies on the İstanbul stock exchange. However, the main reasons for this appeared to be the low Turkish lira profits and dividends of many of the companies together with the high rate of inflation. In 1991, it was more profitable to put money in banks, where 65% interest, about 5% over inflation, could be received. The PPFA reportedly had to buy back about 25% of the shares of Petrokimya Anonim Şirketi (Petkim) to support the stock price.

Turkey has sought to diversify its economic ties. In October 1991, Turkey signed a free trade and cooperation protocol with EFTA, which was to take effect in April 1992. In addition to its own extensive trade with Eastern Europe, the U.S.S.R., and the Middle East, Turkey has begun to promote itself as an intermediary for other countries seeking to invest in these regions. Significant foreign investment in Turkey has resulted. In 1991, Turkey began promoting the concept of a Black Sea Regional Cooperation Region. The aim was to strengthen the historical economic and cultural ties within that region and to create an alternative market to the EC.

Environmental issues became a growing concern in Turkey starting in the mid-1980's, owing to the expansion and increased urbanization of the Turkish population and the extraordinary growth of Turkish industry since 1980. Although some Turkish industrial legislation contains environmental protection provisions, these are generally perceived to be weak. The Government has been receptive to arguments to spare industry the major costs involved in environmental protection. The common use of lignite coal for domestic heating purposes and for electricity generation is a major cause of the severe air pollution in several regions, especially in the winter. Public opposition to the continued use of lignite for fuel and to the construction of new coal-fired powerplants has grown. Although the coal-fired powerplants were supposed to install emissions control devices, none had yet done so by yearend 1991, and none was expected to do so soon, owing to the enormous costs involved. In response, the Government has accelerated plans for the expansion of the country's natural gas pipeline infrastructure, which will largely carry imported gas. It is intended that, where feasible, this cleaner burning fuel will be substituted for coal and lignite for domestic and industrial uses. The Government has also embarked on a program to expand the country's hydroelectrical generation capacity. Some of these are part of a major program in southeast Turkey aimed at increasing both power and, through irrigation, agricultural production.

The impending opening of gold mines in western Anatolia has led to some local opposition to the proposed use of sodium cyanide in the mines' gold recovery circuits. However, no opposition has been expressed to the use of cyanide since 1987 in a Government-operated silver mine in the same general region.

PRODUCTION

The production of mineral commodities was mixed in 1991. *(See table 1.)* Output of most metallic minerals declined, largely owing to modest domestic and export demand. The country's mercury mines closed during the year because of persistent low world prices. Antimony production appeared about to cease for the same reason. The tungsten mines remained closed for the second year because of low world prices and low grades. Ongoing modernization work at the country's only aluminum smelter interrupted production schedules. Steel production declined slightly, largely as a result of a decline in export demand and due to increased competition for domestic sales owing to the availability of inexpensive steel from Eastern Europe. In contrast, chromite and ferrochrome output increased, reflecting greater use of the country's expanded capacity. Silver production also increased as a result of

improved ore and mill throughput at the country's sole silver mine.

Industrial minerals output generally showed significant increases, reflecting strong demand in the domestic ceramics and construction industries and, in the case of magnesite, strong demand for furnace brick. Fairly strong demand for drilling mud by the domestic petroleum exploration industry allowed a modest increase in production, although output remained well below that in 1989. Crude petroleum production increased significantly for the third year, reflecting a high level of development drilling in the previous year. In contrast, coal production was stagnant, owing to modest demand by powerplants and a slight decrease in crude iron production.

TRADE

Turkey exports a wide range of mineral commodities. *(See table 2.)* Mineral commodity exports in 1991 totaled about $2.5 billion, about the same as those in 1990. In contrast, the country's total exports were $13.6 billion, a 4.9% increase over the total in 1990 due mainly to an increase in agricultural exports.

The value of mineral commodity exports in 1991 showed significant sectoral differences from those in the previous year, but again were dominated by value added products. Exports of steel fell 10.4% to $1.445 billion, largely owing to modest world demand, competition from cheap East European steel, and price increases for Turkish steel resulting from increased costs and the removal of some export subsidies. Exports of petroleum and refined petroleum products increased 30% to about $290 million. Cement exports, following a major increase in 1990, increased 44% in 1991 to $110.7 million.

Overall, exports of crude and refined nonfuel minerals fell 10.7% to $425 million, largely reflecting poor world industrial demand and/or prices. Among the metallic minerals, exports of copper ores and concentrates fell 85% to $1.4 million, and exports of chromium ores and concentrates fell 18% to $50.7 million. Exports of ferrochrome actually increased 9% by weight to 73,835 tons but declined 1.6% in value to $47.3 million owing to a glut of ferrochrome on the world market. This made it difficult for the ferrochromium industry to utilize its newly expanded production capacity. Alumina exports fell 60% to $6.3 million, again reflecting a world surplus of this commodity. Strontium (celestite) exports again fell, by 22% to $4.9 million, apparently as a result of competition from expanded Mexican production. Exports of boron minerals declined almost 9% to $133.9 million, evidently reflecting lackluster demand by the world fiberglass industry. Boric acid exports fell 44% to $6.9 million; however, exports of boron chemicals declined only very slightly, to $41.8 million. The once substantial exports of abrasives, mostly pumice, fell almost 17% to $12.4 million as a result of the continuing decline in demand for stonewashed clothing. Low world demand resulting from low levels of world oil exploration drilling caused a 6% decline in Turkish barite exports to $9.9 million; this was in contrast to good domestic demand. There were, however, export increases for a few commodities. The most significant industrial mineral export increases were of magnesite, which showed a gain of 12% to $41.4 million; feldspar, which increased almost 41% to $5.2 million; perlite, which increased 16% to $2.5 million; and salt, exports of which increased twelvefold, albeit only to $2 million.

Turkey imports a wide variety of mineral commodities. *(See table 3.)* Total mineral commodity imports in 1991 declined 33% to $8 billion. In comparison, total Turkish imports declined 5.6% in 1991 to $21.05 billion. Much of the decline in mineral commodity imports in 1991 was attributable to a 29% decrease in the value of petroleum imports to $2.46 billion. This represented an 8% volume decrease. The declines were, in part, because of lower world oil prices and increased Turkish production. More important, the lower oil bill reflected imports of free or reduced price oil, largely from Saudi Arabia. This was compensation to Turkey for monetary and petroleum losses incurred as a result of the world economic embargo of Iraq. Imports in 1991 of refined petroleum products, however, increased about 15% to $576 million; some of this material evidently was destined for reexport. In line with an expanded distribution system, imports of Soviet natural gas increased about 30% in value to about $250 million. Imports of gold for the Turkish gold exchange fell 27% to $1.31 billion, partly because the early end of the Persian Gulf War reduced panic buying, and because of the depreciation of the Turkish lira. It is also likely that some of the gold demand in 1991 was met by the resale of gold purchased in 1990.

Imports of ores and related materials in 1991 increased by 1% to $198 million. Manufactured fertilizer imports, as well as ammonia, phosphoric acid, and sulfuric acid, increased slightly to a total of about $413 million. Imports of iron and steel semimanufactures increased 9.5% to $2 billion, largely due to an influx of cheap steel from Eastern Europe. Coal imports, largely for the integrated steel plants, showed a modest increase to about $385 million. Copper (metal) imports increased by 0.8% to $177 million, and aluminum imports rose 1% to $208 million, partially reflecting the decline in Turkish production.

In terms of trading partners, few mineral-specific data were available for 1991. Most of Turkey's general trade continued to be with the EC, the Gulf states, the United States, Japan, and the U.S.S.R. The EC took about 52% of Turkey's total exports and was the source of 44% of the country's imports in 1991. As in 1990, Germany continued to be Turkey's largest trading partner, taking 25% of all Turkish exports and providing 15% of all imports. Trade with the EC involved a wide variety of mineral commodities, particularly steel. As a region, the Gulf states took 9% of all Turkish exports and provided 11% of imports. Turkey was about 80% import-dependent for petroleum, and most of its trade with the Gulf states involved this commodity, in exchange for Turkish cement, fertilizers, and steel.

Traditionally, Turkey has provided transit services for Middle East products, especially petroleum. The volume of this trade continued the decline begun in 1990, mainly owing to the continued sanctions-related closure of the oil pipeline from Iraq to Yumurtalık, 46 km southeast of Adana. Turkish trading losses related to the war have, in part, been compensated by financial or commodity grants from various countries, most notably oil grants from Saudi Arabia.

The United States took 6.7% of all Turkish exports in 1991, mostly agricultural products, textiles, and steel. The United States accounted for 10.7% of all Turkish imports and was Turkey's second largest single supplier. Imports from the United States were mostly of machinery, iron and steel products and scrap, coal, and chemicals. Turkey was the second largest export customer for U.S. scrap steel in 1991, at about $197 million, but these were only 49% of the 1990 purchases. Official data on U.S. exports to Turkey, however, are incomplete because they do not include sales of U.S. products through European subsidiaries of American companies.

STRUCTURE OF THE MINERAL INDUSTRY

The Turkish mining industry remained characterized by several large, state-owned conglomerates and a large number of private producers. *(See table 4.)* Private-sector producers ranged from large concerns with several hundred employees or more to family-operated mines with only a few employees. In 1989, the latest year for which such information was available, there were 852 mining establishments listed as in operation. The state-owned enterprises are a major part of the mineral industry but have been criticized as uneconomic. The various subsidiaries of the parastatal Etibank group dominate or produce the country's entire output of aluminum, boron minerals and chemicals, blister copper, ferrochrome, mercury, and zinc. Etibank sales in 1991 accounted for about 2% of all sales of Turkish mineral commodities and about 10% of all mineral commodity exports. Excluding such commodities as cement, coal, fertilizers, iron ore, steel, and petroleum and natural gas, which are also dominated by parastatal companies, Etibank's component of total mineral sales and exports was about 40% and 55%, respectively. State participation in Turkey's mineral industry is being gradually reduced by the implementation of the Government's privatization plans.

Maden Tetkik ve Arama Genel Müdürlüğü (MTA) is the state agency responsible for geologic exploration and research in Turkey. Apart from doing its own exploration, MTA can provide laboratory and field services for private-sector exploration efforts. Until recently, 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.

Approximately 200,000 workers were employed in the mineral industry in 1991. The largest employers were the coal and lignite producers, with a total of about 81,000 employees; the iron and steel producers, with about 40,000 employees; the glass and ceramics industries, with about 20,000 workers; the metallic minerals producers, with about 20,000 workers; the cement producers, with about 14,000 workers; and the industrial minerals producers, with about 13,000 workers. Total annual wages in the mineral sector exceeded $700 million, an increase of about 40% over 1990 wages. This stemmed from large wage settlements reached in 1990 and 1991. The 1991 settlements were largely without significant labor strikes; the main exception was a 20-day strike of private-sector steel mills in January. Increased labor costs led to some worker retrenchments in 1991, and more were expected in the future.

COMMODITY REVIEW

Metals

Aluminum.—Etibank completed the feasibility study of its Seydişehir aluminum smelter expansion and rehabilitation project. The present reduction plant capacity of 60,000 mt/a is to be expanded to 100,000 mt/a and eventually to 120,000 mt/a. The plant's rolling mill capacity is to be increased by 20,000 mt/a to 100,000 mt/a; excess billet will be sold to private-sector rerollers. A major facet of the project is the automation of the potlines and the computerization of the control systems. Energy consumption is to be reduced. Bauxite production from the facility's mines is to be doubled. The goal of the expansion project is to reduce the country's imports of aluminum. Current Turkish aluminum consumption is about 130,000 mt/a.

Chromite.—Etibank continued to be Turkey's single largest chromite producer, accounting for about one-third of the country's output of ore and concentrates. Turkish exports of chrome ores and concentrates in 1991 were almost entirely by the private sector and fell slightly to about 652,000 tons. However, owing to low world prices, revenues derived from these exports fell 18% to $50.6 million. Etibank was Turkey's only producer of ferrochrome and related ferroalloys. Etibank's output of ferrochromium increased markedly in 1991 owing to greater use of two new ferrochromium furnaces inaugurated at Elazığ in 1989. Etibank's exports of ferrochromium in 1991 fell well short of production because of low world demand and overcapacity. Exports increased, nevertheless, 9% to 73,835 tons, but revenues fell 1.6% to $47.3 million. The United States, as in years past, was the largest customer for Turkish ferrochromium, taking about 59,000 tons in 1991, up 30% from 1990. Turkish consumption of ferrochromium continued to be negligible, due to a lack of

significant alloy steel production in-country.

Copper and Zinc.—Turkish production of copper ore, copper concentrates, and blister copper continued to be dominated by Etibank and, particularly, its wholly owned subsidiary Karadeniz Bakır İşletmeleri A.Ş. (KBİ). The latter is responsible for about 75% of Turkey's copper output.

Etibank continued development of an underground mine at Aşiköy, near the company's Küre facilities. An automatic process control system for the facility's concentrator was tendered in mid-August. Etibank reported cupreous pyrite output from Küre of 205,000 tons for 1991, more than threefold the production in 1990, but still below the 460,000-mt/a capacity of the facility's concentrator. Copper and pyrite concentrates from Küre are shipped to the nearby KBİ smelter at Samsun for both copper smelting and sulfuric acid production. Etibank's own copper smelter facilities are at its Ergani Mine complex southeast of Elaziğ.

A decision to proceed with development of the Çayeli copper-zinc-silver deposit 23 km northeast of Rize was made during the year by Metall Mining Corp. of Canada. Reserves are adequate to support an underground operation for 18 years. Output would be 600,000 mt/a of ore to produce 110,000 mt/a of concentrate grading 23% copper, plus 70,000 mt/a of concentrate grading about 53% zinc. The operating company, Çayeli Bakır İşletmeleri A.Ş., is 49% owned by Metall, 45% by Etibank, and 6% by the Turkish company Gama Industri Tesisleri İmlat ve Montaj A.Ş. Contracts for the development work on a turnkey basis were tendered, and financing was being arranged at yearend. Construction work was to be completed in 1994. Copper concentrate, reportedly, will be sold to the KBİ smelter at Samsun, while the zinc concentrate will be exported. Shiploading facilities for the concentrates were to be built at Rize.

Cominco Resources International Ltd. of Canada reported that its 1991 drilling program on the Çereteppe pyrite breccia deposit, about 50 km east of Rize, had returned several ore-grade copper-gold intercepts. Additional exploration work, including both geophysics and drilling, was planned for 1992 to further test the deposit.

Gold and Silver.—Several domestic and foreign exploration companies were actively engaged in gold exploration in Turkey during the year. The most promising projects were along the Black Sea coast in northeast Turkey and on the Aegean coast. Two projects appeared destined for production. 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%, announced that it was going to proceed with the development of the Ovacık (Dikili) gold deposit, about 12 km west-southwest of Bergama. The mine will be a combination open pit-underground operation, exploiting two auriferous quartz veins. The company envisioned mining at a rate of about 300,000 mt/a, to produce about 3,100 kg/a of gold. Recovery of gold (in doré) will be by carbon-in-pulp (CIP), and the required use of sodium cyanide therein, albeit in a closed circuit, generated some local opposition. The Government, however, seemed satisfied with the proposed mining and processing plans, and mine construction was expected to commence in mid-1992. Eurogold had several gold exploration projects ongoing during the year.

Tüprag Madencilik Ticaret ve Ltd. Şti., a 50-50 joint venture between Preussag AG of Germany and Gencor of the Republic of South Africa, was planning to open a gold mine on the Küçükdere deposit, about 10 km southeast of Edremit. The 250,000-mt/a open pit operation was to exploit auriferous quartz veins and would recover doré with a CIP circuit. Reserves were adequate for 6 to 8 years of production to support an annual output of about 3,100 kg/a doré, grading about 33% gold and 77% silver.

Cominco continued to drill two gold properties south and southeast of Trabzon. Results were reported to have been mixed, and the company was concentrating its efforts on its Çereteppe copper-gold project to the east.

In 1991, production of silver in Turkey was from Etibank's Aktepe (Gümüşköy) Mine, about 20 km west of Kütahya, and as byproduct of base metals refining. Since its startup in 1987, the Aktepe operation has been plagued by milling problems. These were largely due to the ore being softer and wetter than anticipated by the mill designers, with attendant problems with the crushing circuit. Etibank planned to substitute a semiautogenous grind mill for part of the crushing circuit. By altering its mill flowsheet somewhat, Etibank was able to improve mill throughput in 1991, with the result that silver production increased 49% to 39,414 kg.

Iron and Steel.—Throughout the 1980's, the Turkish steel industry, stimulated by export incentives, high domestic demand, and duties on imported steel, was one of the fastest growing in the world. The period saw the establishment of new electric arc steel mills and major expansion programs at most of the country's existing facilities. Output was below capacity in 1989 as a result of prolonged strikes and, accordingly, increased dramatically in 1990. Future expansion of output is expected to be at a much slower rate. Many of the production incentives of the 1980's were removed during the period 1989-91, largely as a result of dumping accusations on the part of rival steel producers in the EC. Large wage settlements, together with Turkey's high rate of inflation and attendant currency depreciation, have made Turkish steel less competitive on the world market, particularly in Europe and in Asia. As a result of the Gulf War, Turkey's once lucrative sales of steel to the Gulf region have been almost entirely curtailed. Exports in 1991 declined 8.6% to 4.3 Mmt. Turkish steel producers have been hard-pressed to sell their output even to the domestic market because of increasing competition from cheap imports. Much of this material has been from Eastern Europe. Several producers have found themselves unable to service the

significant debts incurred through their capacity expansion projects. Despite these problems, Turkish steel production probably would have shown a slight increase in 1991 but for the loss of an estimated 300,000 tons of production in January as a result of a strike in the private sector.

The Turkish iron and steel industry is dominated by state-owned or partially state-owned integrated facilities and dominantly private-sector electric arc furnace plants. State-owned Türkiye Demir ve Çelik İşletmeleri (TDÇİ) was the largest single steel-producing company in Turkey in 1991, producing steel from two integrated plants. TDÇİ also produced about 95% of Turkey's iron ore in 1991, largely from the Divriği Mines northwest of Elazığ. The largest single facility steel output, however, was that of Ereğli Demir ve Çelik Fabrikaları T.A.Ş. (Erdemir). Prior to 1991, Erdemir was a parastatal operated as a private company. Through its privatization efforts, the Government became a minority shareholder in 1991, at least in terms of direct participation. TDÇİ and Erdemir together accounted for 47% of Turkey's 1991 production of crude steel.

Imports of iron and steel in 1991 jumped 19% to 7.35 Mmt, largely because of the continued availability of inexpensive steel from Eastern Europe, a lack of import tariffs, and as compensation for the private-sector strike in January, which reduced domestic output of long products. Private-sector steel producers complained in 1990 that much of the imported East European steel was of poor quality. The Government, in response, imposed strict quality controls on imported steel, effective the end of January 1991. Importers were now required to obtain documents both before and after importing steel certifying that the material met international standards.

Most of the capacity growth in the steel industry has been in the private sector. These producers operate electric arc furnaces and produce only long products. As a result, there has long been a steel product imbalance in the country, namely a surplus of long products and a shortage of flat products. Turkish demand for flats, largely for automobiles and major appliances, is predicted to remain strong. This has led the country's sole flats producer, Erdemir, to embark on a major capacity expansion program. The private-sector electric arc mills do not have the financing to consider producing flats by the expensive traditional casting technology. At least two companies, encouraged by developments in the United States, were reportedly considering installing new, relatively inexpensive thin slab continuous casting technology. The addition of flat products rolling capacity was under way and/or planned by at least two other companies.

TDÇİ's Karabük and İskenderun integrated steel mills operated at nearly full capacity in 1991. İskenderun's output fell 4% to 1.79 Mmt, but this was offset by a 14.5% increase at Karabük to 0.69 Mmt. The company was forced to raise prices several times during the year, largely to recover costs resulting from wage increases granted after a major strike in 1989. A new labor contract was signed in August 1991, granting further wage increases. Energy and other input costs also increased significantly during the year as a result of general inflation. Further, exports to the Middle East, particularly from İskenderun, were down. The company reportedly had large losses for the year and was expected to do even worse in 1992.

TDÇİ planned to reduce its production costs through a combination of staff retrenchments and capacity expansion and modernization at both its plants. At İskenderun, TDÇİ 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 is to be installed eventually. The capacity of the wire rod mill at İskenderun is being expanded from 500,000 mt/a to 700,000 mt/a. A sponge iron plant was to be constructed at either Izmir or Sivas to reduce dependency on imported scrap; typically 500,000 mt/a to 600,000 mt/a of scrap is imported for İskenderun alone.

At Karabük, TDÇİ was installing a new casting machine and a new ladle furnace and was continuing to modernize the blast furnace. Liquid metal capacity was to be increased to 1.1 Mmt/a by 1994. Karabük continued to have cost problems with coal. The plant obtained 60% of its requirements from Zonguldak; this coal was of relatively poor quality and added to the company's energy costs. The remaining 40% 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's sales have greatly benefited from its position as Turkey's sole producer of flat products. Profits were up moderately in 1991 to about $150 million. This performance was despite modest domestic demand and increased competition for exports. Profitability was achieved through significant cost savings and improved productivity and energy efficiency. The work force was reduced by 10% in 1991. Nevertheless, the company raised its prices several times during the year to cover high input costs. Future sales, espcially exports, may be impacted by these higher prices. A wage agreement signed in April averted a strike but augured poorly for future labor cost containment.

Erdemir was in the process of a major modernization and capacity expansion program involving virtually every facet of its production facilities and port infrastructure. When the project is completed in late 1994/mid-1995, Erdemir will have an output capacity of 3 Mmt/a of flat products, up 50% from the present. A major part of the expansion plan will be the installation of a new basic oxygen furnace (BOF); this should eliminate the current overcapacity of the plant's rolling mill and thus obviate the imports of 0.4 Mmt/a of slabs. In 1991, contracts were awarded for a variety of projects, including a new cleaning line, a continuous annealing line, a new tempering mill, and blast furnace and BOF modernization. Work completed during the year included modifications to a slab reheating furnace and installation

of water-treatment facilities for the powerplant. Distinct from the ongoing capacity expansion project, the company was studying the possibility of increasing output capacity, ultimately, to 6 Mmt/a.

Production from Turkey's private-sector electric arc mills increased only 0.7% in 1991 to 4.99 Mmt. This was largely due to a strike-induced loss of about 300,000 tons in January and to continued modest domestic demand and high levels of competition on both the domestic and export markets. Exports to the Middle East, traditionally the major export destination for many of the companies, were adversely affected by economic sanctions and other effects of the Gulf War. Owing to costly wage settlements in January, and the reduction and/or elimination of power and other export subsidies, the Turkish private-sector companies had difficulty in controlling their costs and were forced to raise prices during the year. Changes in production levels were unevenly distributed among the companies, reflecting, in the main, the status of various expansion programs at many of the electric arc mills and the degree to which they were affected by the strike.

Given that the demand for flats in Turkey exceeds that which even an expanded-capacity Erdemir will be able to supply, a number of companies planned to get into the production of flat products, if only on a rolling mill basis. Construction work was under way for a new cold-rolling mill, for which ground was broken in 1990. The strip mill, situated at Gemlik, about 25 km north-northeast of Bursa, will be operated by Borçelik, a joint venture of Turkish tubemaker Borusan, 34%; Erdemir, 17%; Usinor Sacilor of France, 24.5%; and Ilva of Italy, 24.5%. The mill equipment was ordered in 1991, and the facility was due on-stream in 1993. The mill is to have a capacity of 300,000 mt/a of flats, and will utilize hot coil feed supplied by Erdemir, Usinor Sacilor, and Ilva. Çolakoğlu Metalurji A.Ş. planned to establish a flat products rolling mill having a capacity of 1.8 Mmt/a. The company had, in 1990, virtually doubled its long products rolling capacity with the addition of a 500,000-mt/a bar mill. Çolakoğlu exceeded its nominal crude steel capacity of 650,000 mt/a; production in 1991 was 787,545 tons.

Çukurova Çelik Endüstri A.Ş., by far the largest electric arc steelmaker in Turkey, was also reported to be planning to get into the production of flat products as part of its ongoing expansion project. Like TDÇİ's İskenderun plant, this move would be through the addition of a 1.5-Mmt/a thin slab continuous caster. Çukurova's meltshop capacity is being increased to 2.2 Mmt/a, expected to be available in 1992. Çukurova's steel production in 1991 declined 20% to 1,000,461 tons, largely because of severe strike disruptions at the beginning of the year.

Capacity expansion projects in the public- and private-sector steel companies have involved the assumption of heavy debt burdens on the part of most companies. Servicing of these debts has proved difficult for several companies, a situation aggravated by lackluster steel prices and an increasingly tight export market. In early 1990, Metaş İzmir Metalurji Fabrikası T.A.Ş. was forced into receivership as a result of financial problems from debt servicing and poor sales the previous year. Owing to the Government's efforts, a complex rescue package was negotiated with the company's creditors, and the rolling mill resumed production in July 1991 using billet purchased from another company. The meltshop was not used. At the end of July, production was again halted because one of the creditor banks had balked at signing the agreement. A new financing agreement was negotiated, and Metaş expected to resume production toward yearend.

Mercury.—For the second year, mercury production in Turkey suffered a severe decline, entirely owing to very low world prices. Lacking any real expectation of a price improvement, Etibank, the sole producer, was forced to close its mines during the year.

Industrial Minerals

Boron.—The mining of boron minerals is virtually all by Etibank, as is the production of boron chemicals. The only non-Etibank production of boron minerals is of 3,000 mt/a to 5,000 mt/a of colemanite by a private company that, despite its mine being held by Etibank, retained the right to reprocess its old dumps and to sell material derived thereby. At Etibank's Espey colemanite mine outside of Emet, underground operations ceased and production was all from the open pit. A new, larger washing plant was planned for the mine, perhaps to be constructed in late 1992. Etibank's production of boron chemicals is from its Kırka and Bandırma plants. The Kırka plant had the capacity to produce 160,000 mt/a of borax pentahydrate (Etibor-46), 17,000 mt/a of borax decahydrate, and 60,000 mt/a of anhydrous borax (Etibor-65). At midyear, Etibank began reviewing bids for the installation of an additional steam boiler and turbine alternator for the powerplant. At the Bandırma Boraks ve Asit Fabrikaları İşletmesi plant, production capacities were 5,000 mt/a of borax pentahydrate, 50,000 mt/a of borax decahydrate, 20,000 mt/a of sodium perborate, and 35,000 mt/a of boric acid. A bid to upgrade the facility's sodium perborate monohydrate capacity was under review during the year.

Exports of boron minerals in 1991 fell about 5% to about 660,000 tons worth about $134 million. Exports of boron chemicals, including boric acid, fell 2% to about 142,812 tons worth $48.7 million.

Cement.—The Turkish cement industry continued to expand, bolstered by strong domestic and export demand. Most of the domestic demand was along the Aegean and Marmara coasts, and many of the country's 41 cement plants are in this region. Many of the plants have undergone or are undergoing capacity expansion to meet future domestic demand. Demand was forecast by the Government to increase by about 1 Mmt/a through the year 2000, at which

time Turkish consumption was projected to be about 34 Mmt/a. Total Turkish cement production capacity was expected to reach 37.2 Mmt/a at the end of the century, up about 7% from the capacity in 1991. The Turkish road and railing infrastructure has proven to be inadequate for efficient distribution of cement within the country, and the resulting geographic supply imbalance led to significant imports of cement to some regions and exports from others. Because of capacity improvement projects at the country's cement plants, much of this supply imbalance was eliminated; indeed, the country had a significant net surplus of cement exports in 1990 and 1991. Cement exports amounted to 3.37 Mmt in 1991, up 28% from those in 1990 and threefold those in 1989.

The Government-owned Türkiye Çimento ve Toprak Sanayii T.A.Ş. (ÇİTOSAN) operated about 40% of Turkey's cement plants in 1991 and controlled almost 30% of the country's cement capacity. Through other parastatals, the Government controlled an additional 16% of total cement capacity. Foreign companies controlled about 12% of the country's capacity, and the rest was held by Turkish private concerns.

The issue of privatization was of major concern to the cement industry. Of interest was the PPFA's sale in 1989 of a controlling interest in five former ÇİTOSAN plants to Ciments Français. The sale was ruled invalid in 1990 following a lawsuit by the then opposition party in Parliament. However, Ciments Français claimed that the courts had invalidated the right of the PPFA to sell the plants, and not the sale itself. Accordingly, the company continued to operate the plants and to proceed with capacity improvement projects for them. And, in September 1991, a further 11 ÇİTOSAN plants were transferred to the PPFA for privatization. Following the October 1991 elections, the new Government, claiming to share the privatization goals of the former administration, found itself siding with Ciments Français in court. The cement industry was of the opinion that the sales would stand, but questions remained as to how parastatals were to be sold.

Rare Earths.—In September it was reported that Etibank had invited foreign participation in a project to open up the Karkın rare earths deposit. The thorium-rare earth (bastnasite)-barite-fluorite deposit is in the Sivrihisar district, about 60 km east-southeast of Eskişehir.

Soda Ash (Trona).—For a number of years, Etibank has planned to develop a 750,000-mt/a underground mine on the Beypazarı trona deposit. In 1991, Etibank was reported to have signed a contract with a French consortium led by Soframines for a feasibility study of the project.

Mineral Fuels

Natural Gas.—The Government continued to expand the natural gas distribution network to further the use of Soviet natural gas in Turkey. Natural gas was envisioned as a clean-burning replacement for lignite/coal for domestic heating and for some industrial power generation. The use of natural gas in Ankara had already dramatically reduced the winter levels of air pollution in the city. It was expected that 40% of the houses in Ankara would be connected to the gas grid by yearend 1991. Major planned grid extensions were from the Bursa area to Bursa itself, and thence to Çan, about 55 km east of Çanakkale, and from İzmit (Pazarcık) to Ereğli. The latter was mainly to service the Erdemir steel mill. Talks continued during the year regarding the possibility of building a natural gas pipeline into eastern Anatolia from the U.S.S.R. An agreement with Iran was signed in May to construct a pipeline to carry Iranian natural gas through Turkey to Bulgaria and Greece. The project envisioned a pipeline capacity of 10 billion m^3/a, 50% of which would be consumed in Turkey. Work continued on an LPG terminal and regassification plant at Marmaraereğlisi in Thrace. The facility, to be completed in 1992, was to have a capacity of about 57 Mm^3/a and would feed Algerian and Libyan LPG into the existing natural gasline bringing Soviet natural gas to İstanbul and Ankara.

Petroleum and Petrochemicals.—In accord with UN sanctions against Iraq, the Government, in 1990, shut off the twin pipeline carrying Iraqi crude to the Turkish oil transshipment port of Yumurtalık. Before the shutoff, Iraq had been Turkey's major supplier of imported crude. Several countries, most notably Saudi Arabia, agreed to supply crude oil at low price or gratis to compensate Turkey for losses incurred. These supplies enabled Turkish refineries to operate without significant interruption. The Iraqi pipeline shutoff evidently was the stimulus for a major increase in crude oil production from Turkey's own wells; production in the first 4 months of 1991 was 50% greater than in the same period in 1990. Production of crude oil in 1991 by Türkiye Petrolleri Anonim Ortaklığı (TPAO) amounted to 23.1 Mbbl, about 75% of the country's entire output. The largest private-sector producer was N.V. Turkse Shell with 4.8 Mbbl. Most of Turkey's petroleum refineries had capacity expansion and/or modernization projects underway.

Petroleum exploration was ongoing by both TPAO and by private companies in several parts of Turkey, mostly in the southeast near Diyarbakır and offshore of the Black Sea coast. Several modest discoveries were announced during the year. Political instability in southeast Turkey, however, was hindering the exploration efforts of some companies.

Reserves

Turkey has large resources of certain industrial minerals and of lignite, but the country's resources for most metallic commodities are not large by world standards. Resources of metallic commodities minable by large-scale methods are known for bauxite, chromite, copper and copper-zinc, gold, iron ore, and silver. In terms of industrial minerals, Turkey's most significant resources are in barite, boron, limestone

and marble, magnesite, perlite, pumice, strontium, and trona. Turkey is a geologically and mineralogically diverse country and, with some notable exceptions, is characterized by a relatively large number of small deposits rather than a few large ones. Apart from more than 800 active mining operations, there are also many closed or long-idle operations potentially having additional reserves.

Much of the data on Turkish ore reserves are difficult to evaluate. A significant proportion of the country's primary mineral production is by large parastatal firms, the profitability of which in recent years has been questionable, at least for some commodities. In this respect, "reserves" at some operations may refer to physically minable material rather than that which is economically minable. Given the relatively low wage levels in Turkey, many deposits in both the public and private sectors have traditionally been able to be mined, and at a scale, that would not be economic in Europe or North America. Few of these deposits have had their mineral inventories well delineated, and for those that have, the "reserves" have commonly only been outlined to relatively shallow depths—suitable for nonmechanized mining methods. Many of the "reserves" cited in the literature are given without grades, or are given with broad ranges of grades, or are of uneconomic grades in terms of modern, large-scale mining standards. Consequently, many of the published "reserves" would be considered "resources" by Western standards but may nevertheless be considered minable on a small-scale or artisanal basis. This is especially true for most of Turkey's base metal and chromite deposits. However, as wage levels increase, and as Turkey privatizes its parastatal mining firms, it is likely that the country's "reserves" for a number of minerals will be reevaluated. Summaries of Turkey's mineral inventory can be found in an investment brochure put out by the Government[2] and in reports by MTA.[3]

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 Mortaş and Doğankuzu bauxite mines have remaining bauxite reserves of 6 Mmt and 6.1 Mmt, respectively, both averaging about 56% alumina. Additional resources are known in the region.

Chromite reserves are not well defined and are spread out over more than 500 chromite deposits. Most of these are small. In 1989, there were 116 chromite mining establishments listed as in production. MTA estimated that total chromite reserves (all classes) amount to about 14 Mmt of ore grading 30% to 54% Cr_2O_3 within a larger inventory of lower grade material. Most Turkish chromite deposits are of the podiform type. 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% Cr_2O_3; 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 1990 reportedly contained proven plus probable reserves of about 10.6 Mmt grading 4.7% copper, 7.3% zinc, 0.45% lead, 69 g/mt silver, and 1.2 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.

MTA lists Turkey's mercury reserves as 5.5 Mmt grading 0.15% to 0.30% mercury, but the continued economics of mercury mining in Turkey was in doubt owing to low world mercury prices.

Proven plus probable minable reserves announced in March 1991 by the Eurogold consortium for the Ovacık (Dikili) gold deposit amounted to, for the open pit portion, 840,000 tons grading 8.3 g/mt gold, and for the underground portion, 330,000 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.

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% B_2O_3. Turkey's magnesite deposits are numerous; the largest are in Eskişekir, 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 as 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% Na_2CO_3.

Turkey is believed to have, by world standards, only moderate resources of petroleum and natural gas. The Government has speculated that the

country's ultimate recoverable petroleum reserves may amount to about 2 billion bbl. In recent years, production of petroleum and natural gas has exceeded replacement of reserves. According to the Petrol İşleri, recoverable petroleum reserves at yearend 1991 were 297.5 Mbbl, down 16% from yearend 1990. Recoverable natural gas reserves at yearend 1991 were 17.94 billion m^3, down 8.5% 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, the geology in the Zonguldak Basin makes for very difficult, labor-intensive mining conditions, and it is not clear what proportion of this inventory is economic.

INFRASTRUCTURE

Turkey has a fairly well-developed 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 is generally by 10- to 30-ton lorries and is greatly hindered by winter snows in the more mountainous regions. Turkey has 8,401 km of railroads, all 1.435-m standard gauge, and 479 km of which are electrified. In 1991, Turkish trains carried about 14.85 Mmt of freight, including about 9.5 Mmt of ores and mine supplies, about 2.1 Mbbl of petroleum products, and 220,000 tons of fertilizers.

Turkey has 2,092 km of crude oil and 2,321 km of petroleum products pipelines. The longest stretch of pipeline is the 641-km 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. In 1990, the latest year for which data were available, Turkey had 842 km of natural gas pipeline, which was used to import natural gas from the U.S.S.R. It extended from the Bulgarian border to Ankara and carried 4.1 billion m^3 of natural gas in 1991. The Government plans to significantly extend the natural gas pipeline grid, including a direct connection from the U.S.S.R. into eastern Anatolia.

Turkey has many ports capable of handling mineral commodity shipments. Several of these were undergoing capacity expansion during the year.

Turkish electrical output totaled 57,105 GW•h of electricity in 1991, of which 62% was from thermal plants and virtually all of the rest from hydroelectric plants. The parastatal Türkiye Elektrik Kurumu produced 61% of the thermal output and almost all of the hydroelectric output. Of the total electrical output, lignite-burning plants accounted for 34%, natural gas 21%, fuel oil plants 5.5%, and hard coal 2%. In 1990, the latest year for which data were available, the major industrial electricity consumers were the iron and steel industry, which consumed 4,839 GW•h; the chemical industry, with 4,519 GW•h; and the nonferrous basic metals industries, with 2,553 GW•h. The coal and lignite mines consumed 718 GW•h, and the other mines a total of 471 GW•h. Total electrical generating capacity in 1990 was 16,315 MW, of which about 51% 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 1984, is the largest of the GAP facilities and will have a capacity of 2,400 MW. 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 of gas imports.

OUTLOOK

Turkey's economic growth for the rest of the 1990's is likely to approximate the modest levels experienced in 1990-91 rather than the high levels of the 1980's. It is unlikely that the Government will easily solve the country's problem of high inflation rates, and thus Turkish industries can expect costs of inputs, especially labor, to continue to increase. Servicing of the large debts incurred to finance capacity expansion and modernization projects throughout the mineral commodity sector is likely to become increasingly burdensome. As input costs increase, Turkish companies may be forced to charge more for their products, reducing the competitiveness of Turkish products on the export market and, to a lesser extent, the domestic market. In the steel sector, competition from Eastern European and Soviet producers may continue. The costs associated with environmental protection are likely to increase significantly, given the growth of public environmental awareness and the fact that almost none of the present industry operates under significant environmental legislation. The degree to which future environmental regulations are enforced and the magnitude of the associated costs are not possible to estimate.

The future health of the Turkish minerals industry will in part depend on the success of the ongoing privatization of the country's parastatal corporations. The social costs of privatization may be significant, in that the process will likely result in staffing reductions and the closure of unprofitable operations, especially the smaller mines. Many small mines in the private sector are likely to close because of increasing costs, especially for labor, and because of low world commodity prices. Turkish

aluminum production would appear to be particularly vulnerable in the long term, owing to limited bauxite reserves near the smelter and the high production costs at the reduction plant. It is likely that at least some operations will be able to postpone closure and others to reopen if commodity prices rise. For some commodities, notably chromite and a number of industrial minerals, and for petroleum, sufficient economies of scale are already in place to allow significant levels of production for the foreseeable future. However, market conditions may not allow full utilization of the expanded capacity at many Turkish production facilities. For example, barring a significant increase in world demand for ferrochromium, the economics of Turkey dramatically increasing its ferrochromium output, especially through the construction of additional smelters, would be questionable. Domestic demand in the construction sector for Turkish steel and cement is likely to grow, albeit at modest rates. Owing to the planned opening of two mines, Turkey is likely to become a modest gold producer starting in 1993, and additional deposits are likely to be developed. Turkish output of copper and zinc will increase, owing to the planned startup of at least one major mine.

Although they offer some immediate problems for Turkey, political changes in Eastern Europe and the U.S.S.R. augur well for the Turkish economy in the long term. Increasing acceptance in those countries of market economic policies may force the closure of significant components of their industry, thus reducing export competition for Turkey. The economic focus of these countries is likely to change. Turkey's longstanding cultural and economic ties, and geographic proximity, to the former Soviet bloc, and to the Middle East, should continue to afford Turkey significant long-term opportunities to supply both consumer goods and industrial services to these regions. The establishment of a Black Sea regional economic community has the potential to create new markets.

[1]Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL4,172=US$1.00. The average exchange rate in 1990 was TL2608.7=US$1.00.

[2]Government of Turkey. Turkey—The Mining Industry: Opportunities for Investors, 1985.

[3]Erseçen, N. Known Ore and Mineral Resources of Turkey. MTA Bull. 185, 1989, 108 pp.

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General Directorate of Petroleum Works
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State Institute of Statistics (T.C. Başbakanlık Devlet İstatistik Enstitüsü)
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Turkish Miners Association
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TABLE 1

TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991[e]
METALS						
Aluminum:						
Bauxite		259,075	269,437	561,505	[2]779,172	[2 3]488,640
Alumina:						
Gross weight		95,236	181,657	200,560	177,144	[3]159,091
Al content		49,647	94,699	104,552	92,746	83,290
Metal, smelter		41,685	56,692	61,776	60,903	[3]55,800
Antimony:						
Ore, mine output:						
Gross weight		51,399	42,640	[r]30,023	9,000	5,000
Sb content		2,344	1,877	[r]1,471	[e]400	250
Concentrates:						
Gross weight		2,591	2,303	[r]1,607	613	300
Sb content		1,674	1,370	[r]1,035	[r e]400	195
Regulus		204	62	5	—	[3]—
Cadmium		11	22	54	46	45
Chromite:						
Gross weight (34% to 43% Cr_2O_3)		1,048,927	1,157,075	[r]1,608,043	[r]1,093,680	[3]1,271,092
Salable product		762,071	851,425	[e]1,100,000	[r e]800,000	870,000
Copper:						
Mine output (exclusive of pyrite):						
Gross weight		2,645,367	3,135,661	[r]3,468,288	[r]4,020,918	[3]3,942,254
Cu content of ore		31,531	37,746	[r]38,151	[r e]44,200	43,350
Cu content of pyrite		564	1,946	[r e]2,360	[e]2,300	2,300
Concentrates (exclusive of pyrite):						
Gross weight		136,729	167,701	[r]166,833	[r e]193,400	189,600
Cu content		25,778	28,509	[r]30,364	[r e]35,200	34,500
Metal:						
Smelter output		19,247	12,910	21,129	[r]20,854	[3]28,379
Refined[e]		75,600	90,000	86,400	84,200	80,000
Iron and steel:						
Iron ore:						
Gross weight	thousand tons	5,366	5,481	[r]4,518	[r]5,050	[3]5,335
Fe content	do.	2,881	2,983	[r]2,453	[r e]2,740	3,000
Metal:						
Pig iron and ferroalloys:						
Ferrochromium		52,530	54,030	59,715	62,040	[3]84,700
Ferrosilicon		4,400	5,200	4,970	5,225	7,000
Pig iron and other ferroalloys	thousand tons	[r]4,100	[r]4,462	[r]3,523	[r]4,827	[3]4,594
Steel, crude including castings	do.	7,044	7,982	7,934	[r]9,462	[3]9,336
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight		236,907	286,269	[r]345,051	[r]341,916	350,000
Pb content		9,463	10,212	[r]14,147	[r e]14,000	14,400
Concentrates:						
Gross weight		31,447	37,332	[r]43,721	[r e]43,000	44,000
Pb content		7,274	9,396	[r]10,591	[r e]10,400	10,500

See footnotes at end of table.

TABLE 1—Continued

TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991[e]
METALS—Continued						
Lead—Continued:						
Metal, refined[e]		10,000	11,000	r7,000	r9,000	3,500
Manganese ore, gross weight[4]		e7,000	e10,000	e10,000	e8,000	3,000
Mercury	kilograms	210,519	97,359	197,364	59,650	25,118
Silver, mine output, Ag content[e]	do.	8,800	22,500	28,500	r e33,300	46,000
Tungsten, W content of concentrate		163	125	5—	5—	5—
Zinc:						
Mine output, Zn and Pb-Zn ore:						
Gross weight		355,252	387,844	r446,616	r451,788	400,000
Zn content		42,223	37,494	r39,412	r e40,000	35,000
Concentrates:						
Gross weight		40,273	44,639	r69,856	r e70,000	62,500
Zn content		13,517	14,418	r18,707	r e19,000	16,700
Metal, smelter, primary		22,160	22,476	24,170	20,063	24,000
INDUSTRIAL MINERALS						
Abrasives, natural: Emery		9,171	12,267	r11,299	e15,000	23,000
Asbestos:						
Run of mine		10,097	1,296	—	—	3—
Fiber		806	e50	—	—	
Barite, run of mine		291,913	405,017	r425,519	r271,296	278,827
Boron minerals:						
Run of mine		1,629,345	2,043,628	r1,979,044	2,062,758	1,815,177
Concentrates		980,150	1,230,828	r1,173,528	1,252,591	1,100,000
Cement, hydraulic	thousand tons	21,980	22,675	23,796	r24,416	26,026
Clays:						
Bentonite		89,262	80,218	r93,256	100,000	116,000
Kaolin		126,119	204,478	r238,251	230,000	275,000
Other		310,002	368,241	r379,311	r e450,000	750,000
Diatomite		5,149	—	—	—	—
Feldspar, run of mine		30,336	82,225	r84,932	155,000	200,000
Fluorspar		e10,000	13,240	e13,000	e13,000	13,000
Graphite		11,760	12,911	r11,873	e12,000	12,000
Gypsum, other than that for cement		301,743	231,218	r213,731	e230,000	230,000
Lime[e]	thousand tons	1,100	1,500	1,400	e1,650	1,625
Magnesite, crude ore		1,189,667	1,125,844	r1,343,893	r812,660	1,595,818
Meerschaum	kilograms	8,300	6,450	r10,350	r3,600	2,800
Nitrogen: N content of ammonia		329,771	e308,600	r379,697	r373,287	345,000
Perlite, run of mine		143,958	154,231	r132,941	150,000	165,000
Phosphate rock (salable product)		19,197	74,230	84,810	86,788	90,000
Pumice[e 6]		760,661	1,470,675	r753,745	412,500	1,538,000
Pyrites, cupreous, gross weight		51,245	176,964	r214,434	208,000	210,000
Salt, NaCl, all types	thousand tons	1,218	1,358	r1,739	1,600	1,440
Silica sand, washed product	do.	397	438	r495	e540	510
Sodium compounds, n.e.s.:						
Soda ash (trona)[e]	do.	376	379	381	e385	385
Sulfate, concentrates		82,628	79,427	r68,183	r e70,000	75,000

See footnotes at end of table.

TABLE 1—Continued

TURKEY: PRODUCTION OF MINERAL COMMODITES[1]

(Metric tons unless otherwise specified)

Commodity		1987	1988	1989	1990	1991e
INDUSTRIAL MINERALS—Continued						
Stone:						
Dolomite		394,187	262,773	[3]323,136	r e350,000	400,000
Limestone, other than for cement e	thousand tons	2,700	3,200	r3,742	4,250	[3]2,350
Marble e	do.	490	515	540	e405	[3]1,100
Quartzite		541,226	885,059	r571,980	650,000	[3]725,000
Strontium minerals: Celestite		r e65,000	r e60,000	r e90,000	r e95,000	65,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)		12,726	11,173	r3,919	r e5,000	10,000
Sulfur:						
Native, other than Frasch		39,325	30,030	r22,266	19,550	21,250
S content of pyrites		22,035	75,387	r95,852	r e93,000	94,000
Byproduct:						
Petroleum		8,615	15,684	13,166	13,547	15,000
Other e		11,000	5,000	49,000	r e7,000	5,000
Total e		80,975	126,101	r180,284	r e133,097	135,250
Talc e		15,000	[3]5,397	r [3]6,280	6,000	6,000
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural		631,159	624,113	r415,456	r270,238	140,450
Carbon black e		[2]33,141	[2]31,955	32,000	r e25,000	30,000
Coal:						
Hard coal	thousand tons	7,084	6,688	6,259	5,604	5,500
Lignite	do.	46,481	39,025	r52,567	r47,507	[3]46,029
Coke and semicoke	do.	r3,277	r3,408	3,036	r3,435	[3]3,303
Gas, natural, marketed	thousand cubic meters	297,125	99,167	173,822	212,488	[3]202,713
Petroleum:						
Crude	thousand 42-gallon barrels	18,830	18,360	r20,596	r26,614	[3]31,875
Refinery products:						
Liquefied petroleum gas	do.	6,511	8,029	7,770	r7,845	[3]8,059
Gasoline	do.	20,020	19,204	r19,869	r22,291	[3]23,604
Naphtha	do.	r12,741	r15,278	r13,185	r12,455	[3]9,687
Jet fuel	do.	3,561	4,505	4,373	r4,951	[3]6,993
Kerosene	do.	3,043	3,902	2,691	1,293	[3]1,248
Distillate fuel oil[7]	do.	r48,638	r49,489	r46,167	r49,071	[3]47,599
Lubricants	do.	r1,465	1,726	1,833	1,976	2,000
Residual fuel oil	do.	r55,586	r61,214	r54,483	r56,516	[3]56,900
Asphalt	do.	5,517	3,993	2,583	4,368	[3]5,345
Refinery fuel and losses	do.	2,898	2,940	r e2,900	e2,900	2,900
Total	do.	r172,065	r184,735	r e168,386	r e176,666	177,335

eEstimated. rRevised.

[1]Table includes data available through Nov. 30, 1992. Large quantities of limestone and gypsum are quarried for cement manufacture; however, information is inadequate to make accurate estimates of output levels.

[2]Data 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.

[3]Reported figure.

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

[5]Revised to zero.

[6]Turkish 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.

[7]Diesel fuel and special heating oil (1987-1990); diesel fuel only (1991).

TABLE 2

TURKEY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	1990	Destinations, 1990	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	101,875	83,015	31,515	France 51,500.
Oxides and hydroxides	77,483	62,892	12,500	China 24,000; U.S.S.R. 15,900.
Metal including alloys:				
Scrap	94	359	—	West Germany 342; Switzerland 18.
Unwrought	8,945	9,890	—	Netherlands 6,353; Italy 2,021; Greece 1,347.
Semimanufactures	26,827	32,605	5,130	West Germany 6,877; Italy 3,851; Syria 2,493.
Antimony:				
Ore and concentrate	2,204	610	NA	NA.
Metal including alloys, all forms	494	293	—	Netherlands 140; United Kingdom 100; Spain 20.
Cadmium: Metal including alloys, all forms	130	—		
Chromium:				
Ore and concentrate	913,375	676,499	24,750	Norway 132,370; Yugoslavia 130,127; Romania 91,615.
Oxides and hydroxides	3	—		
Metal including alloys, all forms value, thousands	—	$1	—	All to West Germany.
Cobalt: Metal including alloys, all forms	—	14	—	Switzerland 13; West Germany 1.
Copper:				
Ore and concentrate	17,669	30,873	—	Republic of South Africa 13,373; Japan 11,000; West Germany 5,500.
Metal including alloys:				
Scrap	86	56	—	All to West Germany.
Unwrought	6,113	2,145	33	Romania 1,090; Greece 300.
Semimanufactures	41,021	41,128	678	Algeria 9,535; Egypt 8,256; Greece 2,806.
Gold: Metal including alloys, unwrought and partly wrought[2] kilograms	6,866	29	29	
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	50	—	—	
Metal:				
Scrap	4,431	6,586	—	West Germany 6,163; Japan 294.
Pig iron, cast iron, related materials	31,920	179,091	—	Italy 96,057; Saudi Arabia 32,886; Malaysia 15,746.
Ferroalloys:				
Ferrochromium	46,238	64,488	45,900	Japan 15,718; Netherlands 1,575.
Ferromanganese	10	22	—	All to Iraq.
Ferrosilicon	3,001	—		
Steel, primary forms thousand tons	1,124	1,230	51	China 381; Japan 218; Switzerland 114.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	317,711	257,308	—	Iran 77,461; Italy 56,605; West Germany 38,521.
Clad, plated, coated	159,574	127,888	116	Iran 47,030; U.S.S.R. 28,744; Syria 9,609.
Of alloy steel	1,530	109	—	Iran 50; Cyprus 17; Iraq 4.
Bars, rods, angles, shapes, sections thousand tons	1,402	2,453	153	Iran 287; Republic of Korea 251; Italy 212.

See footnotes at end of table.

TABLE 2—Continued

TURKEY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Destinations, 1990	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Semimanufactures—Continued:					
Rails and accessories		251	93	—	Iraq 72; Netherlands 18.
Wire		29,067	19,392	166	Syria 7,617; Libya 2,296; Iran 1,748.
Tubes, pipes, fittings		309,498	313,161	11,640	U.S.S.R. 94,394; Italy 42,293; Iran 42,215.
Lead:					
Ore and concentrate[3]		6,810	5,303	—	Italy 3,798; Switzerland 1,505.
Oxides		—	20	—	All to Cyprus.
Metal including alloys:					
Unwrought		430	257	—	United Kingdom 240; Cyprus 12.
Semimanufactures		44	32	—	Libya 24; Saudi Arabia 4; Jordan 3.
Magnesium: Metal including alloys:					
Unwrought		—	55	—	All to West Germany.
Semimanufactures		365	409	—	West Germany 372; Austria 37.
Manganese: Ore and concentrate, metallurgical-grade		10,271	11,671	—	Netherlands 4,372; Italy 4,300; France 2,090.
Mercury		306	—		
Nickel:					
Matte and speiss		—	500	—	All to Italy.
Metal including alloys:					
Unwrought		—	1	—	All to Saudi Arabia.
Semimanufactures		(4)	—		
Silver: Metal including alloys, unwrought and partly wrought[2]	value, thousands	$675	$1,168	—	United Kingdom $1,099; Norway $68.
Tin: Metal including alloys:					
Unwrought	do.	$1	$2	—	All to Saudi Arabia.
Semimanufactures		1	2	—	Cyprus 1; Saudi Arabia 1.
Titanium: Metal including alloys:					
Unwrought	value, thousands	—	$4	—	All to Netherlands.
Semimanufactures		—	2	—	All to Italy.
Tungsten:					
Ore and concentrate		1,800	36	—	All to Japan.
Metal including alloys, unwrought		—	55	—	All to West Germany.
Zinc:					
Ore and concentrate		11,524	12,755	—	Belgium-Luxembourg 6,500; Netherlands 1,920; Finland 1,800.
Oxides		840	854	—	Belgium-Luxembourg 242; West Germany 220; Austria 198.
Ash and residue containing zinc		2,000	—		
Metal including alloys:					
Unwrought		—	3	—	Saudi Arabia 2; Cyprus 1.
Semimanufactures		—	4	—	U.S.S.R. 3; Cyprus 1.
Zirconium:					
Ore and concentrate		1	500	NA	NA.

See footnotes at end of table.

TABLE 2—Continued

TURKEY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	1990	Destinations, 1990	
			United States	Other (principal)
METALS—Continued				
Zirconium—Continued:				
Metal including alloys, unwrought	—	3	—	United Kingdom 1; West Germany 1.
Other:				
Ores and concentrates:				
Of base metals	11,977	8,622	—	Bulgaria 8,080; France 332.
Of precious metals, n.e.s.	—	181	—	France 120; West Germany 61.
Ash and residue:				
Of base metals	1,974	6,975	—	Belgium-Luxembourg 4,281; Switzerland 1,315; Yugoslavia 1,300.
Of precious metals, n.e.s.	—	19	—	All to Italy.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	123,319	133,500	10,343	Italy 32,382; France 20,877.
Artificial: Corundum	547	—		
Grinding and polishing wheels and stones	624	833	—	Cyprus 548; Iraq 122; Saudi Arabia 75.
Asbestos, crude	—	48	—	Libya 29; Iraq 19.
Barite and witherite	314,737	177,017	6,301	U.S.S.R. 81,917; Egypt 20,211; Syria 15,700.
Boron materials:				
Crude natural borates	820,791	698,168	(5)	NA.
Oxides and acids	162,946	145,613	—	NA.
Bromine	—	[6]2	—	All to Cyprus.
Cement thousand tons	1,093	2,626	89	Spain 1,163; Italy 366; Thailand 294.
Chalk	2,828	1,590	—	Congo 800; United Kingdom 330; Netherlands 251.
Clays, crude:				
Bentonite	40,248	29,401	—	West Germany 8,820; Italy 4,867; Austria 3,896.
Kaolin	57,077	48,814	—	United Arab Emirates 33,890; Lebanon 7,191; Tunisia 5,000.
Unspecified	42,085	64,308	—	Romania 49,405; Italy 12,770.
Diamond, natural: Gem, not set or strung value, thousands	$7	$12	—	All to Israel.
Diatomite and other infusorial earth	314	968	—	France 784; Netherlands 80; West Germany 50.
Feldspar	43,751	96,546	—	Italy 69,233; West Germany 5,100.
Fertilizer materials:				
Crude, n.e.s.	2	—		
Manufactured:				
Ammonia	5,987	12	—	Cyprus 10; Libya 1; U.S.S.R. 1.
Nitrogenous	366,363	295,556	—	France 51,973; Spain 48,856; Italy 35,314.
Phosphatic	36,101	85,675	—	Syria 29,675; Sudan 27,500; Malaysia 22,000.
Potassic	—	451	—	All to Cyprus.
Unspecified and mixed	196,574	96,673	—	Iran 38,028; Switzerland 29,887.
Graphite, natural	—	8	NA	Syria 4; unspecified 4.
Gypsum and plaster	882	2,130	—	Egypt 800; Cyprus 447; Lebanon 360.
Lime	26,176	16,109	—	Cyprus 115,226; Greece 345.

See footnotes at end of tables.

TABLE 2—Continued

TURKEY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	1990	Destinations, 1990	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Magnesium compounds:				
Magnesite, crude	296,030	219,659	NA	NA.
Oxides and hydroxides	141,682	110,996	1,500	Austria 39,669; Romania 27,000; Yugoslavia 12,600.
Meerschaum, amber, jet	1	—		
Mica:				
Crude including splittings and waste	118	4,544	—	Egypt 4,450; Saudi Arabia 50.
Worked including agglomerated splittings	5	17	NA	Iraq 16; unspecified 1.
Perlite	98,454	117,602	—	France 22,000; Italy 19,147; United Kingdom 14,945.
Phosphates, crude	66	—		
Pigments, mineral: Iron oxides and hydroxides, processed	266	49	—	Greece 38; Austria 10.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$12	$4	—	France $2; West Germany $1.
Synthetic do.	$65	$5	$2	Kuwait $2.
Salt and brine	4,368	2,368	—	Cyprus 2,188; Lebanon 142.
Sodium compounds, n.e.s.:				
Soda ash, natural and manufactured	107,217	80,318	500	Iran 37,412; Iraq 13,722; Syria 12,762.
Sulfate, natural and manufactured	55,621	80,625	200	Egypt 23,040; Yugoslavia 7,382; Jordan 7,200.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	135,483	50,575	567	Italy 23,798; Israel 7,146; Spain 5,154.
Worked	61,957	78,144	8,570	West Germany 35,140; Netherlands 9,292; Saudi Arabia 5,240.
Dolomite, chiefly refractory-grade	2,662	1,989	—	Cyprus 1,820; France 75.
Gravel and crushed rock	4,135	11,076	56	Belgium-Luxembourg 7,000; United Kingdom 2,605; France 520.
Limestone other than dimension	3,400	6,000	—	All to Liberia.
Quartz and quartzite	151	859	—	France 826; Syria 22.
Sand other than metal-bearing	49	363	128	Cyprus 79; Greece 70.
Strontium: Sulfate (celestite)	88,490	77,150	NA	Mainly to West Germany.
Sulfur:				
Elemental: Crude including native and byproduct	—	10	—	All to West Germany.
Dioxide	72	—		
Sulfuric acid	63	105	—	Cyprus 69; Libya 22; Netherlands 13.
Talc, steatite, soapstone, pyrophyllite	135	86	—	Iran 40; West Germany 20; Greece 19.
Other:				
Crude	138,828	75,680	—	West Germany 41,237; Republic of Korea 16,275; Republic of South Africa 15,050.
Slag and dross, not metal-bearing	19,862	62,778	—	Israel 39,414; Cyprus 23,350.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	964	6	—	All to Romania.

See footnotes at end of table.

TABLE 2—Continued

TURKEY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Destinations, 1990	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued					
Carbon black		3,053	5,261	—	Egypt 2,645; Czechoslovakia 1,528; Greece 998.
Coal:					
Anthracite		1,703	5,224	—	Iraq 5,223.
Lignite including briquets		2,900	3,350	—	All to Cyprus.
Other, n.e.s.		5	11	—	Do.
Coke and semicoke		561	631	—	Syria 558; Cyprus 32.
Peat including briquets and litter		8	20	—	All to Cyprus.
Petroleum:					
Crude	thousand 42-gallon barrels	—	170	—	Netherlands 137; Italy 33.
Refinery products:					
Liquefied petroleum gas	do.	1,098	1,332	1,113	Italy 162.
Gasoline	do.	(7)	(7)		
Mineral jelly and wax	do.	39	28	(4)	West Germany 14; Italy 10.
Kerosene and jet fuel	do.	NA	1,261	NA	NA.
Distillate fuel oil	do.	NA	516	NA	NA.
Lubricants	do.	NA	154	NA	NA.
Residual fuel oil	do.	NA	11,132	NA	NA.
Asphalt	do.	NA	128	NA	NA.
Bitumen and other residues	do.	133	145	—	Italy 89; Lebanon 33; Cyprus 18.
Bituminous mixtures	do.	1	(4)	—	Mainly to Cyprus.
Unspecified including gasoline, diesel and light fuel oils	do.	20,384	19,236	1,424	Italy 11,643; France 1,802; Greece 1,190.

NA Not available.
[1]Table prepared by Virginia A. Woodson.
[2]Nonmonetary.
[3]Includes content of polymetallic ores.
[4]Less than 1/2 unit.
[5]Unreported quantity valued at $25,647,000.
[6]May include iodine and fluorine.
[7]Included in unspecified.

TABLE 3

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS					
Alkali and alkaline-earth metals: Alkali metals		—	3	—	Italy 1; United Kingdom 1.
Aluminum:					
Ore and concentrate		51,367	44,790	52	China 43,377; Italy 1,107.
Oxides and hydroxides		848	1,851	5	West Germany 1,330; Switzerland 61.
Metal including alloys:					
Scrap		138	301	—	West Germany 189; Cyprus 93.
Unwrought		48,243	100,961	41	Canada 36,064; U.S.S.R. 23,697; Spain 6,029.
Semimanufactures		5,028	5,158	173	West Germany 2,404; Hungary 723; Italy 361.
Antimony: Metal including alloys, all forms		—	6	—	All from Netherlands.
Bismuth: Metal including alloys, all forms		3	1	(2)	Mainly from United Kingdom.
Cadmium: Metal including alloys, all forms		1	11		Belgium-Luxembourg 7; Switzerland 2.
Chromium:					
Ore and concentrate		15	179	—	Belgium-Luxembourg 158; Italy 21.
Oxides and hydroxides		257	448	80	West Germany 106; Italy 91.
Metal including alloys, all forms		4	11	—	Italy 4; West Germany 2; United Kingdom 2.
Cobalt:					
Oxides and hydroxides		55	63	(2)	Finland 34; Belgium-Luxembourg 16; United Kingdom 9.
Metal including alloys, all forms		13	23	—	West Germany 17; France 2; Italy 2.
Columbium and tantalum: Tantalum metal including alloys, all forms	value, thousands	—	$111	—	All from Austria.
Copper:					
Ore and concentrate (excluding cupreous pyrite)		446	12	—	Mainly from Belgium-Luxembourg.
Matte and speiss including cement copper		—	120	—	U.S.S.R. 100; West Germany 20.
Metal including alloys:					
Scrap		3,120	1,088	—	Saudi Arabia 851; Iraq 114; United Kingdom 55.
Unwrought		62,230	55,915	—	Italy 10,061; Republic of South Africa 9,249; Chile 5,886.
Semimanufactures		11,910	17,977	7	West Germany 10,638; Greece 850; Belgium-Luxembourg 678.
Germanium: Metal including alloys, all forms		—	1	—	All from Japan.
Gold: Metal including alloys, unwrought and partly wrought[3]	kilograms	274	113	—	West Germany 75; Switzerland 38.
Iron and steel:					
Iron ore and concentrate:					
Excluding roasted pyrite	thousand tons	2,525	1,973	—	Republic of South Africa 940; Brazil 563; India 200.
Pyrite, roasted		—	20	—	All from West Germany.
Metal:					
Scrap	thousand tons	4,422	3,650	2,624	Netherlands 477; Belgium-Luxembourg 156.
Pig iron, cast iron, related materials		216,608	169,516	3,020	Brazil 68,805; U.S.S.R. 41,546; Republic of South Africa 24,676.
Ferroalloys:					
Ferrochromium		15	178	—	Zimbabwe 167; Sweden 7.
Ferromanganese		51,081	32,047	500	United Kingdom 11,500; Republic of South Africa 8,817; Brazil 4,516.

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Ferroalloys—Continued:					
Ferronickel		8	77	—	Austria 74; Yugoslavia 3.
Ferrosilicomanganese		27,975	48,830	—	Yugoslavia 18,195; Republic of South Africa 12,940; U.S.S.R. 8,155.
Ferrosilicon		29,276	32,409	100	Yugoslavia 18,126; U.S.S.R. 4,840; China 3,145.
Silicon metal		743	899	—	Netherlands 418; China 202; France 144.
Unspecified		5,443	4,463	1,278	Yugoslavia 955; Norway 863.
Steel, primary forms	thousand tons	1,005	522	(2)	Brazil 245; U.S.S.R. 143.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		782,583	985,863	509	Yugoslavia 176,575; Italy 144,679; Belgium-Luxembourg 117,464.
Clad, plated, coated		62,245	88,631	4,545	West Germany 24,966; Netherlands 17,046; Italy 8,331.
Of alloy steel		45,829	89,177	822	West Germany 21,735; Spain 10,128; United Kingdom 9,768.
Bars, rods, angles, shapes, sections		798,240	381,868	30,102	Yugoslavia 78,320; Romania 57,079; Italy 31,856.
Rails and accessories		51,533	12,502	—	Italy 6,626; Poland 2,840; Tunisia 1,636.
Wire		7,806	7,331	20	United Kingdom 2,084; Belgium-Luxembourg 1,499; Austria 1,243.
Tubes, pipes, fittings		85,728	88,478	745	West Germany 48,778; United Kingdom 20,321; Yugoslavia 5,994.
Lead:					
Oxides		275	893	—	Spain 436; Italy 240; France 183.
Metal including alloys:					
Scrap		2,345	713	—	Cyprus 341; Portugal 292; Malta 40.
Unwrought		10,039	13,715	37	Morocco 5,757; Canada 2,022; Mexico 1,050.
Semimanufactures		55	37	—	Belgium-Luxembourg 24; Austria 10.
Magnesium: Metal including alloys:					
Scrap		26	21	—	All from West Germany.
Unwrought		286	220	42	Norway 75; France 46.
Semimanufactures		—	26	—	United Kingdom 15; West Germany 11.
Manganese:					
Ore and concentrate, metallurgical-grade		1,107	1,408	—	Brazil 1,355; U.S.S.R. 44.
Oxides		532	437	—	Republic of South Africa 320; Greece 80; West Germany 11.
Metal including alloys, all forms		81	108	—	Netherlands 50; Belgium-Luxembourg 29; France 10.
Mercury		(2)	22	—	West Germany 20; Spain 1.
Molybdenum: Metal including alloys:					
Unwrought	value, thousands	$8	—		
Semimanufactures		—	8	(4)	Austria 3; Belgium-Luxembourg 3; West Germany 2.
Nickel:					
Ore and concentrate		—	1	—	All from West Germany.

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS—Continued					
Nickel—Continued:					
Matte and speiss	value, thousands	$42	$4	—	Do.
Metal including alloys:					
Unwrought		780	936	(5)	Canada 502; United Kingdom 153; U.S.S.R. 78.
Semimanufactures		85	93	(2)	West Germany 33; Austria 21; France 10.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	value, thousands	$1,445	$1,501	—	West Germany $712; Spain $660; United Kingdom $108.
Silver: Metal including alloys, unwrought and partly wrought[3]	do.	$2,276	$9,245	$6	Switzerland $7,564; West Germany $644; Belgium-Luxembourg $176.
Tin:					
Ore and concentrate		—	1	—	All from Netherlands.
Metal including alloys:					
Scrap	value, thousands	—	$2	—	All from West Germany.
Unwrought		1,053	1,436	—	United Kingdom 813; West Germany 226; Indonesia 180.
Semimanufactures		21	18	(2)	Italy 10; West Germany 4; United Kingdom 4.
Titanium:					
Ore and concentrate		1,576	3,208	—	Republic of South Africa 1,440; Australia 1,241.
Oxides		2,643	2,949	200	West Germany 971; United Kingdom 822; France 440.
Metal including alloys:					
Unwrought	value, thousands	$2	—		
Semimanufactures		—	41	(2)	Italy 37; United Kingdom 3.
Tungsten:					
Ore and concentrate		—	50	—	All from West Germany.
Metal including alloys:					
Unwrought		2	2	(2)	Mainly from West Germany.
Semimanufactures		—	23	1	Belgium-Luxembourg 13; West Germany 4; Netherlands 2.
Uranium:					
Ore and concentrate	value, thousands	—	$1	—	All from Singapore.
Oxides and other compounds	do.	$67	—		
Metal including alloys, all forms	do.	—	$3	—	All from West Germany.
Zinc:					
Ore and concentrate		—	7,947	—	Greece 7,941.
Oxides		745	650	—	West Germany 349; Netherlands 111; France 86.
Metal including alloys:					
Unwrought		16,152	29,841	105	Italy 17,583; Belgium-Luxembourg 7,124; Spain 1,925.
Semimanufactures		96	359	—	Belgium-Luxembourg 150; West Germany 130; France 52.
Zirconium:					
Ore and concentrate		371	613	—	Netherlands 300; Italy 270; United Kingdom 19.
Metal including alloys:					
Unwrought	value, thousands	$6	$5	$5	

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS—Continued					
Zirconium—Continued:					
Semimanufactures		—	2	—	All from Italy.
Other:					
Ores and concentrates:					
Of base metals	value, thousands	—	$2	—	All from France.
Of precious metals, n.e.s.	kilograms	500	—		
Oxides and hydroxides		491	1,234	46	Italy 788; Netherlands 114.
Ashes and residues		—	2,477	—	Saudi Arabia 851; Cyprus 462; Portugal 292.
Base metals including alloys, all forms	value, thousands	$4	$15	—	West Germany $13; United Kingdom $2.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		(3)	59	37	West Germany 10; Norway 10.
Artificial: Corundum		3,055	4,532	2	West Germany 1,168; Austria 1,129; Netherlands 625.
Dust and powder of precious and semiprecious stones including diamond	value, thousands	$3,058	$2,628	$203	Ireland $1,654; West Germany $349; United Kingdom $210.
Grinding and polishing wheels and stones		451	803	5	West Germany 351; Italy 172; Poland 47.
Asbestos, crude		35,581	26,259	125	Canada 8,683; Greece 7,634; Zimbabwe 4,767.
Barite and witherite		30	—		
Boron materials:					
Crude natural borates		—	92	10	West Germany 82.
Oxides and acids		18	62	1	Netherlands 22; France 21; Italy 13.
Bromine and iodine		14	11	(2)	Israel 4; West Germany 2; Spain 2.
Cement	thousand tons	360	1,080	(2)	Romania 304; Iraq 302; Greece 233.
Chalk		33	591	—	Austria 300; France 245; Switzerland 22.
Clays, crude:					
Bentonite		45	58	16	West Germany 30; United Kingdom 2.
Kaolin		15,387	16,258	2,092	United Kingdom 13,321; West Germany 792.
Unspecified		8,846	15,790	49	United Kingdom 6,342; China 5,984; Republic of South Africa 2,461.
Cryolite and chiolite		3	4	—	Denmark 2; Canada 1; Switzerland 1.
Diamond, natural:					
Gem, not set or strung	value, thousands	$540	$1,086	—	Belgium-Luxembourg $802; India $215; West Germany $62.
Industrial stones	do.	$416	$358	—	Netherlands $206; Ghana $43; Belgium-Luxembourg $41.
Diatomite and other infusorial earth		232	383	17	France 239; United Kingdom 86; Austria 20.
Feldspar		33	19	—	Sweden 10; Republic of Korea 5; West Germany 4.
Fertilizer materials:					
Crude, n.e.s.		(6)	27	—	Netherlands 24; United Kingdom 3.
Manufactured:					
Ammonia		625,034	644,030	2	U.S.S.R. 633,722; Libya 9,711.
Nitrogenous	thousand tons	1,425	1,486	135	U.S.S.R. 434; Romania 318.
Phosphatic		31,536	—		
Phosphoric acid		433,305	461,128	4	Morocco 272,341; Republic of South Africa 123,629; Tunisia 42,148.

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	1990	Sources, 1990	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Fertilizer materials—Continued:				
Manufactured—Continued:				
Potassic	80,693	105,348	2,648	Israel 54,376; U.S.S.R. 16,061.
Unspecified and mixed	613,980	535,630	188,119	Morocco 164,130; U.S.S.R. 63,274.
Fluorspar	446	595	—	West Germany 299; Mexico 236; Netherlands 30.
Graphite, natural	725	1,436	—	China 837; West Germany 456; Iran 127.
Gypsum and plaster	35,873	23,428	6	Spain 21,549; Cyprus 1,100.
Lime	—	3,833	—	Iran 3,828.
Magnesium compounds:				
Magnesite, crude	2	20	—	All from West Germany.
Oxides and hydroxides	307	3,312	61	Israel 2,705; West Germany 210; United Kingdom 141.
Mica:				
Crude including splittings and waste	7	12	—	United Kingdom 2; Switzerland 1.
Worked including agglomerated splittings	50	57	(2)	Belgium-Luxembourg 37; Spain 10.
Nitrates, crude	823	1,113	—	Chile 570; Poland 160; Belgium-Luxembourg 140.
Phosphates, crude	808,922	730,320	—	Jordan 468,696; Tunisia 150,411; Syria 53,415.
Pigments, mineral: Iron oxides and hydroxides, processed	650	758	140	West Germany 566; Japan 34.
Potassium salts, crude value, thousands	$3	$9		All from West Germany.
Precious and semiprecious stones other than diamond:				
Natural do.	$457	$1,960	—	Belgium-Luxembourg $1,162; China $410; Thailand $186.
Synthetic do.	$72	$255	—	China $118; West Germany $47; Thailand $32.
Pyrite, unroasted	38	15,053	—	Albania 15,008.
Salt and brine	9,265	18,072	(2)	Iran 12,305; Egypt 5,000.
Sodium compounds, n.e.s.:				
Soda ash, manufactured	6	60,948	49,189	Romania 5,593; Poland 4,406.
Sulfate, manufactured	1,524	116	—	Belgium-Luxembourg 59; West Germany 37; Italy 20.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	43	106	—	Iran 69; West Germany 25; Italy 11.
Worked	473	1,330	—	Italy 1,201; France 49; Netherlands 43.
Dolomite, chiefly refractory-grade	38	171	—	Norway 103; France 44; United Kingdom 21.
Gravel and crushed rock	338	668	17	West Germany 404; France 240.
Limestone other than dimension	4	—		
Quartz and quartzite	497	426	—	West Germany 212; Sweden 123; Belgium-Luxembourg 37.
Sand other than metal-bearing	8,841	10,183	3	Belgium-Luxembourg 9,449; West Germany 689.
Sulfur:				
Elemental:				
Crude including native and byproduct	126,749	160,870	—	Iraq 114,516; Saudi Arabia 40,243; Albania 3,951.
Colloidal, precipitated, sublimed	6,746	304	—	Bangladesh 125; West Germany 117; United Kingdom 39.
Dioxide	(2)	—		

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Sulfur—Continued:					
Sulfuric acid		303,636	183,347	1	Italy 112,663; Spain 52,078; Algeria 12,678.
Talc, steatite, soapstone, pyrophyllite		608	1,322	—	West Germany 455; Austria 261; Italy 192.
Other:					
Crude		7,014	7,522	2	West Germany 2,240; Italy 1,797; United Kingdom 1,409.
Slag and dross, not metal-bearing		6	144	—	West Germany 105; Netherlands 20; United Kingdom 19.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		99	126	24	West Germany 61; Switzerland 31.
Carbon black		14,312	12,845	54	Italy 7,673; Portugal 2,089; West Germany 1,701.
Coal:					
Anthracite		—	77,402	6,544	U.S.S.R. 70,605.
Bituminous	thousand tons	2,854	3,460	1,732	Australia 637; Austria 503.
Briquets of anthracite and bituminous coal		—	369	—	All from Iran.
Lignite including briquets		253,380	446,168	4	U.S.S.R. 364,652; Iran 2,684.
Other, n.e.s.	thousand tons	1,189	1,234	7	Republic of South Africa 1,085; U.S.S.R. 48.
Coke and semicoke		102,366	136,010	40,476	Iran 44,115; France 30,559.
Gas, natural:					
Gaseous	million cubic meters	3,107	3,312	—	All from U.S.S.R.
Liquefied	cubic meters	—	8,400	—	All from Netherlands.
Peat including briquets and litter		827	1,485	—	West Germany 537; U.S.S.R. 530; Netherlands 218.
Petroleum:					
Crude	thousand 42-gallon barrels	r139,431	150,275	—	Iraq 47,916; Iran 24,549; Saudi Arabia 20,094.
Refinery products:					
Liquefied petroleum gas	do.	8,641	10,342	—	Kuwait 3,517; Saudi Arabia 3,113; Algeria 891.
Gasoline	do.	(2)	(2)		
Mineral jelly and wax	do.	14	22	—	West Germany 6; United Kingdom 6; Netherlands 3.
Distillate fuel oil	do.	NA	7,075	NA	NA.
Lubricants	do.	—	310	NA	NA.
Residual fuel oil	do.	—	159	NA	NA.
Bitumen and other residues	do.	134	6	—	France 3; Syria 3.
Bituminous mixtures	do.	2	12	—	West Germany 4; United Kingdom 4.
Petroleum coke	do.	1,894	4,987	3,087	Syria 1,265; Romania 352.
Unspecified including gasoline, diesel and light fuel oils	do.	9,651	2,190	75	U.S.S.R. 3,929; Iraq 1,385; Italy 1,327.

[r] Revised. NA Not available.
[1] Table prepared by Virginia A. Woodson.
[2] Less than 1/2 unit.
[3] Nonmonetary.
[4] Unreported quantity valued at $14,000.
[5] Unreported quantity valued at $21,000.
[6] Revised to zero.
[7] Included in unspecified.

TABLE 4

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners[1] [2]	Location of main facilities	Annual capacity
Aluminum and bauxite	Etibank Milas Boksit İşletmeleri Müdürlüğü (Etibank, 100%)	Open pit mine at Milas, 127 kilometers southwest of Denizli	150 diaspore.
Do.	Etibank Seydişehir Alüminyum Tesisleri Müessesesi Müdürlüğü (Etibank, 100%)	Doğankuzu and Mortaş bauxite mines at Madenli, 25 kilometers south of Seydişehir	450 bauxite.
Do.	do.	Alumina refinery and aluminum smelter at Seydişehir	200 alumina, 60 aluminum.
Barite	Barit Maden Türk A.Ş.	Mines near Sivas and Adana	220 ground barite.
Do.	Baser Maden Sanayi ve Ticaret A.Ş.	Mines at Isparta and Konya	90 ground barite
Do.	Emas Endüstri Mineralleri A.Ş.	Mine at Muş	100 ground barite
Do.	Etibank Beyşehir Barit İşletmesi (Etibank, 100%)	Mine at Beyşehir, 72 kilometers southwest of Konya	70 barite ore.
Do.	Etibank Antalya Elektrometalurji Sanayi İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Grinding plant at Antalya	100 ground barite.
Do.	Polbar Barit Endüstrisi A.Ş.	Mine near Antalya	120 ground barite.
Boron minerals	Etibank Bigadiç Madencilic 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.	Büyükçekmece, 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. (Government[3])	Near Ezine, 40 kilometers south of Çanakkale	1,330 cement.
Do.	Set Group Holding (Soc. des Ciments Français[4], France, 100%)	6 plants	2,600 cement.
Do.	Türkiye Çimento ve Toprak Sanayii T.A.Ş. (ÇİTOSAN) (Government[3], 100%)	17 plants	10,310 cement.
Do.	Other private-sector and mixed public- private-sector companies	13 plants	10,720 cement.

See footnotes at end of table.

TABLE 4—Continued

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners[1 2]	Location of main facilities	Annual capacity
Chromium:			
Chromite ores and concentrates	Etibank Şark Kromları İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	Mines at Güleman, 80 kilometers southeast of Elaziğ	150 lump ore, 70 concentrate.
Do.	Etibank Üçköprü Maden İşletmesi Müessesesi Müdürlüğü (Etibank, 100%)	8 mines in Göcek District, near Fethiye	50 lump ore, 30 concentrate.
Do.	Birlik Madencilik Ticaret ve Sanayi A.Ş.	Kayseri	240 lump ore.
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.
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	e25 lump ore.
Do.	Other (9) private producers	Mines at Köyceğiz, Bursa, Adana, İskenderun, Eskişehir	114 lump ore, 12 concentrate.
Ferrochrome	Etibank Elaziğ Ferrokrom İşletmesi (Etibank, 100%)	Ferrochrome plant at Elaziğ	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	e7,000.
Lignite	Türkiye Kömür İşletmeleri Kurumu (TKİ) (Government, 100%)	38 mines throughout Turkey	e45,000.
Do.	Private-sector producers	About 200 small mines throughout Turkey	e8,000.
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 Elaziğ	16 blister copper.
Do.	Karadeniz Bakır İşletmeleri A.Ş. (Etibank, 99.91%)	Murgul, Damar, and Çakmakkaya mines and smelter near Artvin	e175 copper concentrate, e20 blister copper.
Do.	do.	Open pit Kutlular Mine near Trabzon	e15 copper concentrate.
Do.	do.	Underground mine near Küre	e95 ore.
Do.	do.	Smelter and acid plant at Samsun	38 blister copper.

See footnotes at end of table.

TABLE 4—Continued

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners[1 2]	Location of main facilities	Annual capacity
Iron and steel:				
Iron ore		Türkiye Demir ve Çelik İşletmeleri Genel Müdürlüğü (TDÇI) (Government, 100%)	Divriği Mines, 115 kilometers northwest of Elaziğ	e3,000 run of mine ore; 1,100 pellets; 600 concentrate; 500 lump ore.
Do.		do.	Deveci Mine at Hekimhan, 112 kilometers west of Elaziğ	e750 ore.
Steel		do.	İskenderun	2,200 crude steel.
		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.	Aliağa, 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.	Aliağa	570 semifinished steel.
Do.		İzmir Demir Çelik Sanayi A.Ş. (İDÇ) (Is-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 semifinished steel.
Do.		Other (8) private-sector companies.	Plants near Bursa, İzmir, and İstanbul	1,448 semifinished steel.
Magnesite		Çitosan Konya Krom Magnezit Tuğla Sanayii A.Ş. (Government, 100%)	Konya	40 dead-burned magnesite, 38 bricks, 12 mortar.
Do.		Çitosan 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 Çiva İsletmesi (Etibank, 100%)	Mine at Sarayönü, 47 kilo meters north of Konya	100 mercury.

See footnotes at end of table.

TABLE 4—Continued

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners[1 2]	Location of main facilities	Annual capacity
Petroleum and natural gas:			
Crude petroleum thousand 42-gallon barrels	Türkiye Petrolleri A.O. (TPAO) (Government, 100%)	Production from 34 fields, mostly in Diyarbakır, Gaziantep, and Siirt Provinces	e25,000.
Do. do.	N.V. Turkse Shell (Royal Dutch/Shell)	Production from 20 fields, all in Diyarbakır and Siirt Provinces	e5,000.
Do. do.	Other producers (private sector and in joint venture with TPAO)	Production from 9 fields, mostly in Diyarbakır, Gaziantep and Siirt Provinces	e3,500.
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.
Do. do.	do.	Refinery at İzmit	91,000 crude input.
Do. 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	e800.
Do.	do.	Hamitabat Field in Thrace	e205,000.
Do.	do.	Umurca Field in Thrace	e710.
Phosphate rock	Etibank Güneydoğu Anadolu Fosfatları İşletmesi (Etibank, 100%)	Open pit mine at Mazidağı, 30 kilometers northwest of Mardin	125 concentrate.
Silver kilograms	Etibank 100. Yil Gümüş Madeni İşletmeleri Müessesesi Müdürlüğü (Etibank, 100%)	Aktepe Mine near Gümüşköy, 20 kilometers west-northwest of Kütahya	e75,000.
Strontium	Barit Maden Türk A.Ş.	Mine at Akkaya, 120 kilometers northeast of Sivas	e100 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 Kursun Metal Sanayii A.Ş. (ÇİNKUR) (Etibank, 99.91%)	Zinc-lead smelter at Kayseri	30 zinc.

eEstimated.

[1]Turkish private-sector ownership unless otherwise noted.

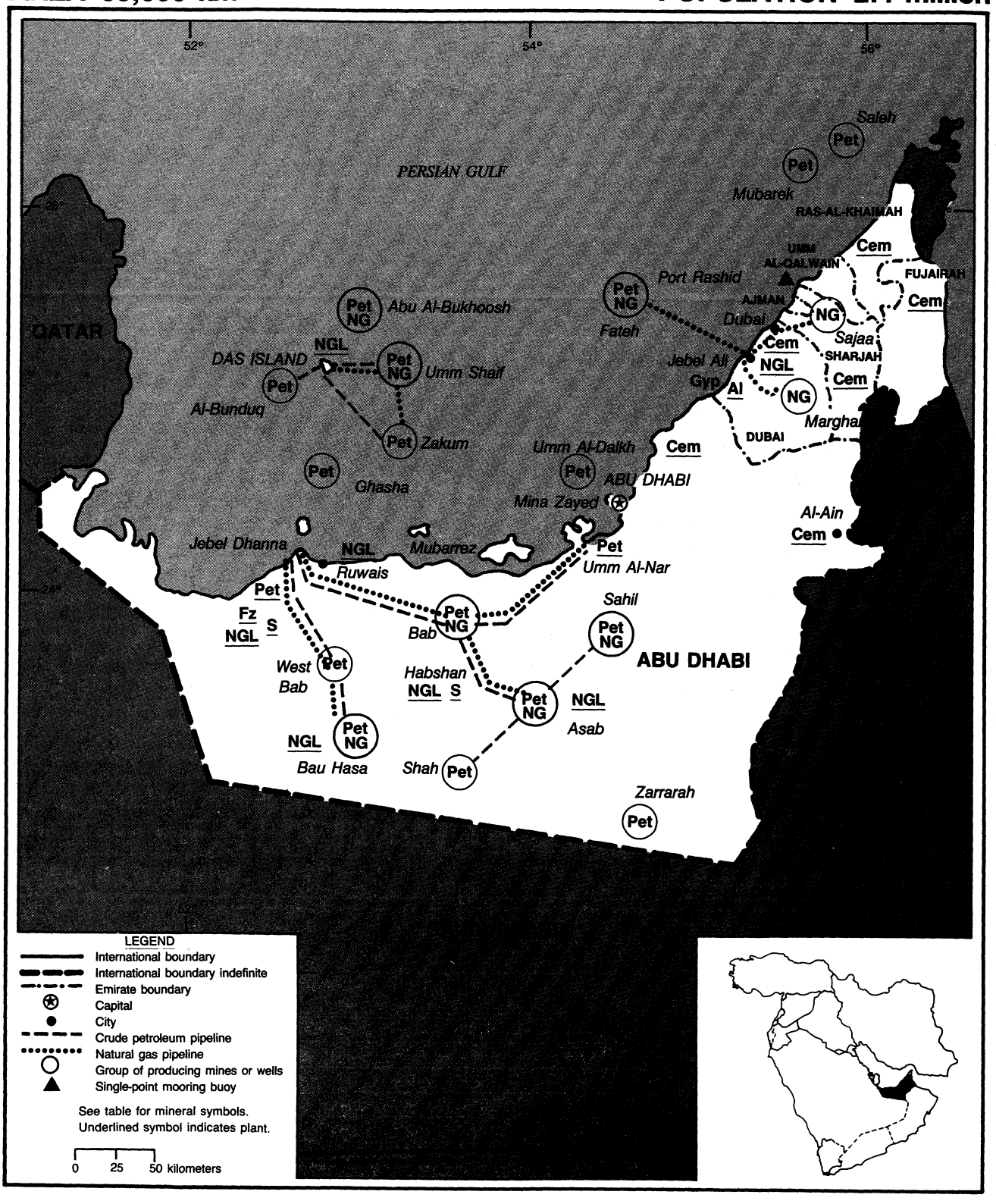
[2]Etibank refers to the 100% Government-owned group administered by Etibank Genel Müdürlügü.

[3]Shares are held by the Public Participation Fund Administration for eventual privatization.

[4]Société des Ciments Français, through Set Group Holding, operates five cement plants that it purchased in 1989 from ÇİTOSAN. The sale, however, has been successfully challenged in court and ruled invalid. Appeals were in progress in 1991. Pending a final ruling, these plants have been assigned in this Table to Ciments Français. A sixth plant is not in dispute.

UNITED ARAB EMIRATES

AREA 83,000 km² **POPULATION 2.4 million**



THE MINERAL INDUSTRY OF

THE UNITED ARAB EMIRATES

By Audie L. King

Despite extraordinary financial obligations and serious banking problems, the United Arab Emirates' (UAE) economy continued to improve during 1991. The UAE suffered through two major crises during the year, but neither the Iraqi invasion of Kuwait and subsequent military operations nor an international scandal involving the Bank of Credit and Commerce International (BCCI), in which prominent UAE officials owned a significant share, stopped economic development. The UAE pledged $5.5 billion[1] to the allied forces and other regional states, and the closure of BCCI may eventually cost Abu Dhabi, one of the Emirates, up to $10 billion.

Fortunately, added income from mineral commodity production provided more than enough money to fund the high costs of both crises and finance a number of development schemes. The country especially benefitted from a bumper year of oil production. With OPEC quotas suspended, the UAE produced an average of 2.4 Mbbl/d and earned an average of $1.1 billion per month. Meanwhile, with the completion of a major expansion project in January 1991, Dubai's aluminum smelter produced a record 239,030 tons of aluminum. Cement manufacturing was the largest nonfuel mineral-based industry. There were plants in most of the Emirates, and limestone was mined in several localities to provide feedstock for the clinker. Cement production capacity continued to be higher than domestic demand, allowing for some exports. The prospect of exporting cement and other materials to help rebuild Kuwait looked promising.

During 1990, the latest year these data were available, the UAE's GDP stood at $34,800 million according to Central Bank estimates. Crude oil and gas production contributed $16,225 million to the economy while the construction and building sector accounted for $2,750 million. The electricity and water sector generated $626 million. In total, the nonfuel sectors contributed $18,568 million or about 53% of the nation's GDP.

In the summer of 1991, a number of large construction contracts were issued in the petroleum and power sectors as Abu Dhabi formally launched a major oilfield expansion program. Many of these engineering contracts were awarded to American companies. The UAE planned to raise the nation's petroleum production capacity to 3 Mbbl/d by 1994. Abu Dhabi also proceeded with plans to expand the processing capacity at Das Island's natural gas liquids plant. A $1.2 billion contract to build a third gas processing train was awarded. Dubai Electric Co. awarded an $844 million contract to build the Jebel Ali G power station.

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 cabinet approved the 1991 Federal budget on August 8, 1991, in which Federal expenditures were scaled back by 17%. The budget tightening was in response to added costs of the Gulf War and lower world oil prices.

Under Abu Dhabi's 4-year plan for 1991 through 1994, $2.6 billion would be spent on the oil sector to raise crude oil production to 3 Mbbl/d, raise oil refining capacity to 300,000 bbl/d, and increase natural gas production to 3.4 billion m^3. In the crude oil sector, $500 million would be spent to increase capacity from 2 to 3 Mbbl/d. The increase would come mostly from further developing the onshore Bab Field and offshore Zakum Fields. A scheme to add a third liquefied natural gas (LNG) train at Das Island and four new 125,000-m^3 tankers would cost $1.6 billion. The budget also allocated $4,827 million to nonfuel-related projects; $1,652 million would be spent on increasing power generation and water desalination capacity. Sanitation, transportation, and communication projects would receive $1,222 million. Funding for these projects, many of which had been needed and anticipated for years, would come from record oil revenues earned during 1990 and 1991. The Gulf War, however, raised defense-related costs and threatened to delay the timely completion of some of the public works projects.

For some time, Dubai has had a public policy to exploit its petroleum as rapidly as possible. Faced with diminishing oil reserves, which by most estimates will be depleted within the next 20 years, the Government of Dubai's main goal has

been to increase the relative importance of its nonfuel sector. Through Dubai's wise allocation of petroleum revenues into income-producing assets, about 60% of Dubai's GDP is already accounted for by the nonfuel sector. Dubai aims to make the Emirate an unavoidable trading hub for the Middle East and the region's most desirable place to set up manufacturing plants. To this end, the Government of Dubai merged the Ports of Rashid and Jebel Ali in May 1991 to form the Dubai Port Authority (DPA). The move was in response to stiffer regional competition. The two ports can now complement one another instead of competing. Forecasts show the volume of cargo in the region dropping steadily in the 1990's as smaller consignments are shipped in larger vessels to fewer ports with reduced frequency. In 1991, however, following the merger, a record quantity of goods passed through the ports of Jebel Ali and Port Rashid. The move strengthened Dubai's position as a regional entrepot, making DPA the world's 19th busiest container port in 1991. The greatest part of DPA's imports were reexported, mostly to Iran and to a lesser extent to other Middle Eastern destinations.

The relative absence of red tape in Dubai also makes it an attractive place to set up business. The Government offers powerful incentives to foreign investors in the Jebel Ali Free Zone, about 30 km south of Dubai, in which they can operate enterprises as 100% owners, pay no income tax, repatriate all profits, and benefit from inexpensive labor and power.

Sharjah set up an industrialized zone, according to the chairman of the Sharjah Chamber of Commerce and Industry. Foreigners will be allowed to set up businesses in any of 13 different economic sectors without a UAE national as a partner or sponsor. The only condition is that a UAE national be appointed as an agent on a fixed salary. Among the categories of businesses included are industrial plants, consulting firms, maintenance and installation, and workshops. It was reported that Russian and European companies had already committed to set up in the new zone. New roads, water systems, power, and telecommunications would be established before the building of new industrial units could begin.

PRODUCTION

In the absence of OPEC quotas, during and following the Gulf War, the UAE produced petroleum at peak capacity. During 1991, it extracted crude oil at a record average exceeding 244,000 bbl/d, up from an average of 212,000 bbl/d during 1990. The SPC acknowledged plans to increase petroleum production capacity to 3 Mbbl/d during the next five years but has made it clear that the UAE would not produce beyond limits that allow for a proper field maintenance program that provides a maximum long-term yield.

On January 22, 1992, the UAE announced that it would reduce petroleum production immediately by 50,000 bbl/d or about 2½% of production. Most of the reduction would come from Abu Dhabi. This was in coordination with similar moves by Saudi Arabia and several other OPEC members. Dubai would continue to produce crude oil at its maximum capacity of about 440,000 bbl/d. This reflects the Dubai Government's strategy to extract as much oil as possible as long as reserves last and to use the funds to increase its nonfuel economic base. Similarly, Sharjah and Ras Al-Khaimah plan to continue producing condensate at 65,000 bbl/d and 1,000 bbl/d, respectively.

Output at Dubai's aluminum smelter increased by 37% in 1991 to a record 239,030 tons, compared with 174,251 tons in 1990. The increase came with the completion of an expansion project that added 70,000 mt/a of capacity to the smelter. By the end of the year, the smelter was producing at a rate that exceeded the new design capacity. *(See table 1.)*

TRADE

Overall, exports for 1990, the latest year these data were available, were up by more than 20% to about $19 billion. Imports also increased by about 15% to about $11.5 billion. Thus, the trade surplus was about $7.5 billion. The United States received 4.4% of the UAE's exports and accounted for 13.5% of the country's imports. Crude oil and petroleum accounted for almost all of the UAE's exports to the United States. Imports from the United States consisted mainly of machinery and manufactured chemical and metal products.

Despite a 15% rise in petroleum production volume during 1991, the oil and gas sector's share of total exports remained at about 79%. An increase in the value of nonfuel exports and a decrease in the average price of petroleum on the world market mostly offset oil and gas sector gains.

The UAE supplied Japan with 20.9% of its total petroleum needs in 1990, the latest date these data were available. This made Japan the UAE's most important trade partner. The UAE exported about 39% of its crude oil production to Japan in 1990, or about 823,500 bbl/d. Other important buyers of the country's crude oil included France, the Federal Republic of Germany, Oman, Singapore, the Republic of Korea, and the United States.

Most of the natural gas produced in the UAE was for domestic consumption. It was used in the country's energy-intensive industries, such as the aluminum smelter in Dubai, the fertilizer plant at Ruwais, and cement plants in nearly all of the Emirates, that owe their existence to the availability of inexpensive power sources. Nearly all of the UAE's exported natural gas went to Japan as LNG. Oil refinery products were shipped mainly to the Far East and to other Middle Eastern countries.

Excluding crude oil exports, Saudi Arabia and other Gulf Cooperative Council members were the most important importers of UAE goods. Reexports, principally to Iran, and to a lesser extent to other neighboring Middle Eastern countries, have been rising in recent years following many years of decline. Reexports to the Far East and India have also risen. The formation of

DPA, Dubai's new combined port authority, has helped the Emirate cope with and encourage increased throughput of container traffic.

Aluminum was an important export for the UAE. Japan, again, was the largest customer, taking 66% in 1991, while Taiwan bought 10% and Thailand 6%. Other important aluminum importers included the Republic of Korea and the United States. The local market absorbed less than 5% of the UAE's aluminum production. Bahrain, Bangladesh, Japan, Kuwait, Yemen, and various African states were the UAE's most important cement customers.

STRUCTURE OF THE MINERAL INDUSTRY

The Governments of the various Emirates have substantial holdings in companies involved in all aspects of the minerals industry. Abu Dhabi, the Emirate richest in mineral wealth, passed a law in 1976 making the Government the sole owner of all petroleum and natural gas found in the Emirate. Adnoc was formed to manage these resources for the Government. It was authorized to form partnerships with foreign companies as long as it maintained at least a 51% interest. The SPC, formed to assume the role of the Abu Dhabi Department of Petroleum and of the directorship of Adnoc, is Abu Dhabi's ranking petroleum authority and holds the ultimate decision-making powers. *(See table 2.)*

COMMODITY REVIEW

Metals

Aluminum.—Dubai Aluminum Co. (Dubal) completed a major development project in mid-January 1991 that added a new potline to its smelter. This is the aluminum smelter's fourth potline and is slightly larger than the original 3, having 144 pots and the capacity to produce 70,000 mt/a of aluminum metal. The new potline uses the same Kaiser-based technology as the rest of the smelter. Since the plant was built in 1977, improvements had raised the capacity for the original three potlines from 135,000 mt/a to 170,000 mt/a. The aluminum smelter's design capacity now stands at 240,000 mt/a; however, shortly after inauguration, production was running at 241,800 mt/a.

Chromium.—Derwent Mining Ltd., an Irish company, entered into a 50-50 joint venture with an Australian firm, Portman Mining Ltd., to mine chromite at a number of locations in Fujairah. The joint venture holds a number of claims in Fujairah with indicated resources of about 200,000 tons of high-grade refractory and metallurgical chromite. The companies expect to spend about $500,000 before they can begin open pit operations to mine the podiform and stratiform deposits. Ore shipments of about 20,000 mt/a to northeast Asia and Europe are expected to begin by the end of 1992.

Industrial Minerals

Phosphate.—Vijay Mallya, an Indian businessleader, has revived plans for the establishment of a phosphoric acid plant in the Jebel Ali Free Zone. The proposed plant would cost an estimated $200 million and would produce phosphoric acid for export to India. Plans for an $86 million phosphoric plant, backed by the Indian Government, fell through because of financing and political difficulties in New Delhi. Responsibility for the new plant would likely go to one of Mallya's companies, Manglore Chemicals and Fertilizers.

Sulfur.—The United Kingdom affiliate of The Ralph M. Parsons Co. (Parsons) of the United States was awarded contracts to carry out work on the sulfur units at Abu Dhabi Gas Liquefaction Co.'s (Adgas) LNG complex at Das Island. The company will expand and refurbish two sulfur recovery units at Das Island. When completed in July 1992, the capacity of each unit will have increased to 550 mt/d, up from the current 460 mt/d. Parsons will also conduct the process design work for a new sulfur recovery unit in conjunction with the construction of a third LNG gas train. The Nation Petroleum Construction Co. was awarded a $12 million contract to build a molten sulfur export terminal at Das Island. Work on the 750-m-long loading berth is scheduled for completion by August 1992.

Mineral Fuels

Natural Gas.—The SPC awarded a major contract to build a third LNG train at Adgas' Das Island Complex to a consortium composed of Japan's Chiyoda Corp. and Consolidated Contractors International Co., a Greek company. The new gas train would produce 2.3 Mmt of LNG per year and effectively double Adgas' annual production capacity. The work was expected to be worth about $1.2 billion and be completed by April 1994, when Japan's Tokyo Electric Power Co. is scheduled to start taking shipments. In June 1991, Adnoc on behalf of Adgas signed a $1.1 billion contract with Japan's Mitsui Engineering and Shipbuilding Co. for the construction of four additional LNG carriers to transport the increased LNG production.

An American firm, Brown and Root Co., was awarded a contract to carry out conceptual design studies on an upgrade of Adnoc's entire onshore gas development program. The project will develop at least three nonassociated gas reservoirs in the Habshan area of onshore Bab Field and set up additional gas processing and distribution facilities. The project, which is due for completion in 1995, is expected to double Adnoc's onshore gas production at a cost of more than $1 billion.

The Bab LNG plant is to be expanded at a cost of $8.5 million from 3.3 Mm^3/d to 4.2 Mm^3/d. The percentage yield of the second gas train at the Bau Hasa LNG plant is to be increased from the present 93% efficiency to 99% at a cost of $30.8 million by Stone and Webster Abu Dhabi, the local affiliate of the American company. Both projects are scheduled for completion by mid-1992.

In early 1992, the Abu Dhabi Marine Operating Co. (Adma-Opco) was

expected to award an engineering procurement and construction contract for development of the Khuff gas reservoir in the offshore Umm Shaif Field. The $350 million project would increase the supply of gas to Adgas' LNG complex at Das Island.

Crescent Petroleum Co. (Crescent) and Dubai Supply Co. signed an agreement to supply natural gas to industrial plants in Jebel Ali beginning in early 1993. About 2.8 Mm^3/d will be supplied from the offshore Mubarek oilfield via an 87-km-long undersea pipeline. The Mubarek Field has gas reserves of 42,000 Mm^3 but so far has only operated as an oil producer. Considering that petroleum output at the Mubarek Field has fallen from a peak of 60,000 bbl/d to only 6,000 bbl/d, Crescent welcomes the opportunity to sell its secondary product. The gas will primarily be used as feedstock for the Jebel Ali power stations. This new supply pattern will allow Dubai Petroleum Co. to use its own gas supplies, now used at the Jebel Ali power stations, to start a gas injection program in 1993.

Petroleum, Crude.—While most of Abu Dhabi Co. for Onshore Oil Operations' (Adco) current development efforts are focused on the natural gas industry, it is also carrying out an ambitious petroleum expansion program. By the end of 1993, Adco hopes to increase its total crude oil production capacity to more than 1 Mbbl/d from the current 825,000 bbl/d. Petroleum expansion will concentrate on the onshore Bab Field where production capacity would increase from 60,000 bbl/d to 200,000 bbl/d. The scheme is expected to cost about $400 million and would be completed in 30 months. Adco would also spend an estimated $100 million to increase capacity at its four smaller onshore fields (Asab, Bau Hasa, Shah, and Sahil) by putting into effect pressure support projects.

The offshore Zakum Development Co.'s plans call for production capacity at the Upper Zakum Field to increase in stages from 320,000 bbl/d to 750,000 bbl/d by 1997.

Adma-Opco plans to begin production at its new offshore Nasr Field in 1992. The field will initially produce 20,000 bbl/d. By 1998, when the field is fully developed, Adma-Opco's total production capacity will have risen by one-third, from 450,000 bbl/d to about 600,000 bbl/d. The project's cost is estimated at about $350 million.

The Bunduq Oil Co. planned to expand the capacity of the offshore Bunduq Field from the current 30,000 bbl/d to between 35,000 bbl/d and 40,000 bbl/d.

International Petroleum Ltd. (IPL) of Dubai and Transworld Energy Ltd. are in a partnership to develop the portion of the Bukha gas and condensate field that lies in Omani waters, situated at the entrance of the Straits of Hormuz. By the end of 1992, three production wells were expected to begin producing a combined total of about 1.1 Mm^3/d of gas, 5,000 bbl/d of condensate, and 800 bbl/d of LNG. IPL and Transworld have contracted with Ras Al-Khaimah to process the raw products. Gas and condensate will be piped 33 km to the Khor Khwair processing plant, in Ras Al-Khaimah, where associated gas from the offshore Saleh Field is currently processed. Ras Al-Khaimah will receive an undisclosed amount of free gas that will go to its local powerplants.

Petroleum, Refined.—Adnoc announced its intentions to expand refining capacity at the Ruwais refinery to between 250,000 and 300,000 bbl/d from its current design capacity of 120,000 bbl/d. The refinery currently operates above its design capacity at 135,000 bbl/d. The front-end engineering design contract for the $1.2 billion Ruwais refinery expansion project is expected to go out for bid in mid-1992. Plans also call for capacity at the smaller Umm Al-Nar refinery to be increased from 70,000 bbl/d to 85,000 bbl/d. By the end of the year, however, the projects still had not been approved by the SPC.

Following the lead of other Middle Eastern oil-producing nations, which had recently purchased foreign refinery capacity, Adnoc proceeded with plans to purchase a 25% interest in the Kudong oil refinery in South Korea. The refinery, Korea's fifth largest, had a capacity of 100,000 bbl/d but would increase to 140,000 bbl/d following work that was already under way. Adnoc wants a stake in the refinery to gain better access to the Korean market. By the end of 1991, Adnoc had not received permission from the Korean Government to proceed with the purchase. Although similar acquisitions had been obstructed in the past, Adnoc was encouraged because the Korean Government had recently allowed the Saudi Arabian company, Saudi Aramco, to take a 35% stake in another of Korea's large refineries.

Reserves

Abu Dhabi's Minister of Petroleum and Minerals Resources announced that the UAE had proven petroleum reserves estimated at 116 billion bbl. Proven natural gas reserves were estimated at 10,000 billion m^3, which was far higher than previous industry estimates of 5,690 billion m^3. The bulk of the UAE's 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.

INFRASTRUCTURE

Increased revenues from sustained high levels of petroleum production throughout 1991 allowed the UAE to proceed with major public works contracts.

Abu Dhabi, Dubai, and Sharjah had their own electricity departments. Ras Al-Khaimah, Ajman, Umm Al-Quwain, and Fujairah received their power from the Ministry of Electricity and Water, which is also responsible for all electrical development in the four Emirates. In 1989, the UAE had an electrical generating capacity of 5590 MW and produced 15 billion kW•h. In an effort to keep up with its expanding population and growing industrial demand, the UAE planned to spend about $2.0 billion in Abu Dhabi on increased power-generating capacity over the next 4 years. About $400 million would go to expand the

generating capacity of the existing Taweelah power station, southeast of Abu Dhabi, from its present capacity of 252 MW to about 450 MW. The construction of another 600-MW powerplant, the Taweelah B powerplant, adjacent to the Taweelah power complex is expected to cost more than $1.6 billion. Plans to expand the Al-Ain power station from 200 MW to 600 MW were put on hold following the Government's decision to divert funds to the Taweelah power complex. The Government of Dubai planned to spend about $844 million over 2 years to construct the Jebel Ali G power station, a 440-MW power station, that would supply electricity to the 100-km^2 industrial Free Zone at Jebel Ali.

Dubai's two ports, Jebel Ali and Port Rashid, were merged to lower operating costs and streamline activities.

The Government of Dubai planned to begin work on a new terminal at the Dubai Airport by 1994. It expects the project to cost as much as $1.5 billion and take about 6 years to complete. Bechtel Group Inc. of the United States designed the master plan in 1990 and will likely act as the project manager.

A 300,000-m^2 air cargo village opened in July 1991 at Dubai International Airport. It was designed to handle 250,000 tons of cargo by the year 1997 but could expand to 450,000 tons if needed. It takes only 3 hours on arrival at the port for merchandise to be unloaded, transported to the airport, and repacked into air containers and pallets ready for airlift. The container village has facilities to ship frozen and chilled goods and hazardous goods, including radioactive items.

Other construction schemes progressed during 1991, including bridge, road, and wharfage projects. There was also an upswing in private construction, especially in hotels and office complexes.

According to Planning Ministry statistics, the labor force in 1990, the latest year these data were available, consisted of 654,511 employees, with 226,000 in the service sector, 113,000 in construction, 62,000 in light industry, and 40,000 in agriculture.

OUTLOOK

The level of the UAE's economic prosperity will continue to fluctuate with world petroleum prices. The relative importance of petroleum to the economy will likely increase as more of the planned petroleum and natural gas production capacity comes on-line in coming years. This, however, will be mostly offset by increased industrial output in the nonfuel sectors. The UAE's economy probably benefitted more from the relative economic stability enjoyed in the Gulf region following the 1988 cease-fire between Iraq and Iran than any other country's. The UAE's trade advantage in the Gulf may erode somewhat as other countries in the region proceed with infrastructural improvements. In the long run, however, the UAE's nonfuel sector may benefit from regional development and an increasingly competitive trade environment among neighboring Gulf countries. The substantial financial burdens sustained in 1991, resulting from the Gulf War and the BCCI bank failure, will likely have little long-term significance.

[1]Where 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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1987	1988	1989	1990	1991
Aluminum, metal, primary ingot		154,832	162,000	168,250	r174,251	239,030
Cement, hydraulic[3]	thousand tons	3,106	3,285	3,387	3,264	3,473
Gas, natural:						
Gross	cubic meters	28,313	27,354	r30,837	30,925	e33,000
Dry	do.	r19,256	18,604	r22,993	r23,786	e24,500
Natural gas plant liquids e	thousand 42-gallon barrels	52,925	47,450	r47,450	r58,400	e60,000
Fertilizer materials:						
Ammonia:						
Gross weight		378,000	361,000	394,000	358,000	347,600
N content		311,000	297,000	324,000	294,500	286,100
Urea:						
Gross weight		529,600	524,000	579,000	496,000	517,000
N content		247,000	244,000	270,000	231,000	241,000
Gypsum e	thousand tons	80	84	87	89	95
Lime e	do.	45	45	45	45	45
Petroleum:						
Crude[4]	thousand 42-gallon barrels	562,465	571,225	715,400	772,700	889,505
Refinery products:						
Liquefied petroleum gas	do.	2,920	2,190	r2,555	3,300	e3,300
Gasoline	do.	9,855	9,855	r10,220	10,800	e10,800
Jet fuel	do.	8,395	8,395	r8,760	9,100	e9,100
Kerosene	do.	4,015	3,285	r2,555	4,400	e4,400
Distillate fuel oil	do.	17,895	18,250	r18,980	19,700	e19,700
Residual fuel oil	do.	16,425	17,155	r18,980	18,100	e18,100
Other	do.	9,855	5,475	r5,840	11,300	e11,300
Total	do.	69,360	64,605	r67,890	76,700	e76,700
Sulfur, byproduct: e						
From petroleum refining		8,000	10,000	10,000	10,000	10,000
From natural gas processing		97,000	100,000	70,000	80,000	64,000
Total		105,000	110,000	80,000	90,000	74,000

eEstimated. rRevised.

[1]Table includes data available through July 21, 1992.

[2]In 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.

[3]Includes white cement.

[4]Includes lease condensate.

TABLE 2

UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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%; Nissho 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 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 gas 1,175 condensate.

TABLE 2—Continued

UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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	Abu Dhabi National Oil Co. (Adnoc) (Government, 100%)	Two processing plants at Habshan, Abu Dhabi	7,300.
Do.	Dubai National Gas (Dugas) (Government, 80%; Canadian Sunningdale Oils Ltd., 20%)	Processing plant at Jebel Ali, Dubai	1,345 gas, 915 natural gas liquids, 425 condensate.
Do.	Ras Al-Khaimah Gas Commission (Government, 100%)	Associated gas from the Saleh oilfield; offshore, Ras Al-Khaimah	570 gas, 60 natural gas liquids, 20 condensate.
Natural gas, million cubic meters	Sharjah Liquefacation 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, 335 condensate.
Do.	Amoco Sharjah Oil Co. (Amoco, 100%)	Nonassociated gas from the Sajaa gasfield; onshore, Sharjah	1,800 gas, 410 natural gas liquids, 1,695 condensate.
Do.	Abu Dhabi Gas Liquefaction Co. (Adgas) (Adnoc, 51%; Mitsui, 22.05%; BP, 16.3%; Total, 8.2%; Mitsui Liq. Gas, 2.45%)	Processing plant at Das Island; offshore, Abu Dhabi	3,350 liquefied natural gas, 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.
Do.	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.

TABLE 2—Continued

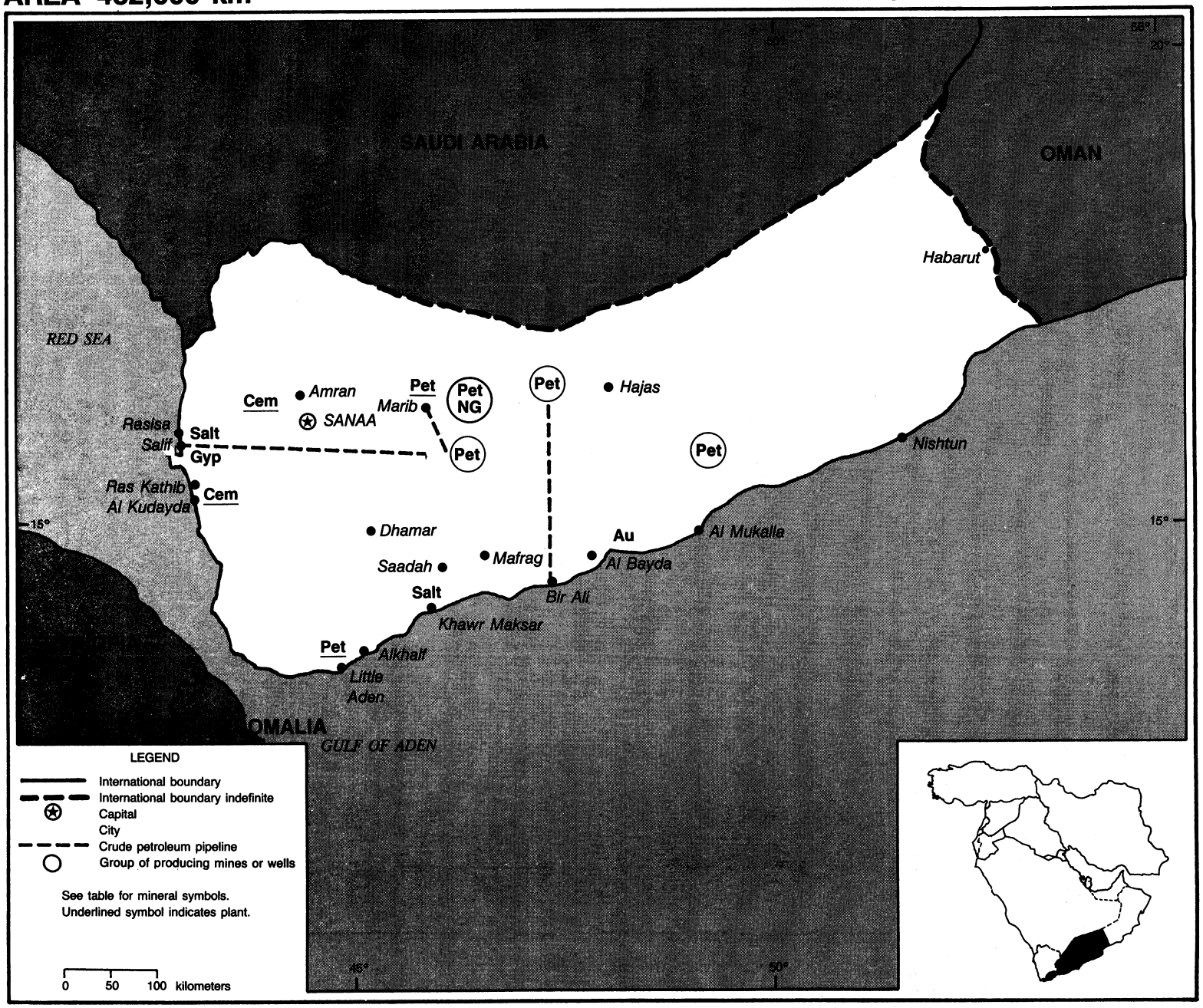
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, crude—Continued thousand barrels	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.

REPUBLIC OF YEMEN

AREA 482,000 km² **POPULATION 14 million**



THE MINERAL INDUSTRY OF THE

REPUBLIC OF YEMEN

By Bernadette Michalski

Until the discovery of commercial petroleum reservoirs in the past decade, the region's mineral industry activity had been confined to the refining of imported crude oil and the production of cement, dimension stone, gypsum, and salt. With the added stability provided by the 1990 merger of The People's Democratic Republic of Yemen and the Yemen Arab Republic, about 30 hydrocarbon exploration concessions covering about 250,000 km^2, one-half of the nation's land mass, were awarded or in negotiation by the close of 1991. The Government realized $436 million in payments from the licenses awarded in 1990-91.

The U.S. Agency for International Development is to provide only about $3 million compared with the $20.5 million planned before the Gulf crisis owing to Yemen's pro-Iraqi sympathy during the Gulf war. The Kuwait Fund for Arab Economic Development has not resumed contacts with Sanaa, putting the future of a number of development projects in question. 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 because the remittances from these very expatriates accounted for 20% of Yemen's foreign exchange earnings. The World Bank estimated that Yemen suffered a loss of $1,800 million in 1991, and a similar amount can be expected in 1992. This estimate takes into account not only the loss of expatriate remittances but also the loss of export revenues. Foreign exchange revenue losses occurred when the embargo on Iraqi and Kuwaiti crude oil forced Yemen to divert the crude oil destined for the export markets to the Aden refinery to satisfy domestic consumption.

GOVERNMENT POLICIES AND PROGRAMS

The Government of the newly formed Republic has focused on creating an investment climate that would encourage private capital to develop the nation's mineral resources. This would stimulate employment and improve the balance of payments by import substitutions and increased export earnings.

A new mining law was enacted in April 1991 that offered incentives to attract international mining companies. The law guaranteed the right of private property and encouraged the development of mineral resources in collaboration or exclusively with the private sector. This new law covered all minerals except precious stones and hydrocarbons. Investment regulations already in effect in 1990 provided that new projects be entitled to a 3-year tax holiday, and provision was made for the remittance of profits and capital abroad. Investors would receive tax and customs exemptions on the importation of machinery, tools, equipment, and building materials. Tax and customs exemptions would also apply to imported raw materials for 3 years commencing from the date of actual operation. In addition, 50% of dividends paid to shareholders or investors would be exempted from tax.

The Constitution of the new Republic was ratified by a popular referendum in May 1991.

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.

PRODUCTION

Mineral production was limited to the extraction and processing of crude oil, gypsum, and rock and brine salt and to the manufacture of cement. Despite recent discoveries of crude petroleum, full development remains dependent on pipeline construction, refinery modernization, and expanded port facilities and storage terminals. The underutilized refinery at Aden processes crude oil for domestic consumption and accepts contract processing. However, contracts from Iraq and Kuwait were negatively affected by the UN embargo. Similar contracts with the former U.S.S.R. were postponed due to the political restructuring of that country. Payment for processing foreign crudes was usually a percentage of the refined output retained for Yemen's consumption. Consequently, the loss of these contracts required that Yemeni crude oil, originally intended for the export market, be diverted to the Aden refinery to satisfy domestic consumption requirements. *(See table 1.)*

TRADE

Petroleum accounted for more than 70% of Yemen's total export earnings. Although favorable prices and increased export volumes throughout most of 1990 improved the new Republic's balance of payments position, the value of imported raw materials and consumer goods continued to exceed export earnings. During and following the 1990-91 Gulf crisis, petroleum exports were reduced by one-half in the last quarter of 1990 and most of 1991 and averaged an estimated 40,000 to 50,000 bbl/d. About one-half of the nation's petroleum exports was

destined for the United States. In 1990, 21,000 bbl/d of crude and unfinished oils and 1,000 bbl/d of distillate fuel oil was delivered to the United States. In 1991, only 19,500 bbl/d of crude oil was exported to the United States. Yemen earned $454.3 million from all petroleum exports in 1991 compared with $538.8 million in 1989. Remittances from expatriate workers in Saudi Arabia and other Gulf countries accounted for 20% of Yemen's foreign currency holdings, which helped to finance imports before the 1990-91 Gulf crisis. However, the occupation of Kuwait by Iraq in August of 1990 forced many workers to return to their homeland, severely curtailing these remittances.

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. Companies have been invited to enter into exploration and production agreements similar to those covering hydrocarbons.

In accord with the provisions of the new mining law, two mineral prospecting permits were awarded in 1991 to Cluff Abela Minerals (Yemen) Ltd. The first covers 3,100 km² in the northern region near Saadah 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 occurrences have been discovered but not evaluated by earlier prospecting efforts.

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 cement works near Mafrag to Rendel Palmer and Tritton of the United Kingdom. The 500,000-mt/a-capacity cement plant was financed by Japan's Overseas Economic Cooperation Fund at $145 million. Completion of this project will elevate the nation's total annual cement production capacity to 1.25 Mmt. Existing plants, the Japanese-built 500,000-mt/a-capacity Amran plant and the 300,000-mt/a-capacity Bajil plant constructed by the former U.S.S.R., were being considered for modernization and expansion.

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.

Stone, Dimension.—Yemen has traditionally produced stone in limited quantities at small quarries near populated areas. Total output paralleled population growth. The Arab Mining Company (ARMICO) of Jordan recommended to the National Company for Industrial and Building Materials the establishment of a marble quarry at Hajas to supply the domestic market. A granite quarry was recommended for Al Bayda with a processing plant at Sanaa to supply both block and finished granite for the export market. ARMICO projected the development cost at $9.5 million.

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, Heijah, and Camaal Fields have an estimated recoverable reserve of 300 Mbbl. The Government accepted the accelerated development program of Canadian Oxy and its joint-venture partners, Pecten Yemen Co., Occidental Peninsula Inc., and Consolidated Contractors International SAL. In addition to gathering facilities, a modular processing unit, and storage facilities, a 160-km-long, 120,000-bbl/d-capacity pipeline will be constructed from the fields to a coastal export terminal near Al Mukalla on the Gulf of Aden. 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. By yearend 1991, one-half of the nation's land mass and some offshore acreage was under license for exploration. *(See table 3.)*

Production.—The Yemen Exploration and Production Co. (YEPC) produced about 200,000 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. With the development of the Eastern Ayyad, Western Ayyad, and Amal Fields, output from the Shabwa region was projected to eventually attain levels of 150,000 bbl/d of low-sulfur crude oil ranging from 35° to 43° API gravity. A 190-km pipeline with three pumping stations to transport the crude oil from Shabwa to a floating storage facility at Bir Ali was opened in 1991. Pipeline capacity was 135,000 bbl/d; however, flowthrough in 1991 did not exceed 30,000 bbl/d. The Gulf of

Aden terminal at Bir Ali will serve to load tankers for crude oil delivery to the domestic refinery at Aden or for delivery to international markets.

Refining.—The Aden refinery is scheduled to undergo a $250 million and a $300 million modernization program, including the installation of new processing units and storage facilities. The refinery now operates at less than 40% of its 160,000-bbl/d capacity. Contract bidders will have to secure their own financing as Yemen's relations with its traditional financiers, Saudi Arabia, Kuwait, and the United Arab Emirates deteriorated during the Gulf crisis.

The 10,000-bbl/d-capacity refinery at Marib operated at full capacity, providing petroleum products for the domestic market.

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 m^3, of which 200 billion m^3 is 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 is 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 freezone authority.

OUTLOOK

The prospect of a sustained rise in oil prices combined with increased production during the coming years should lead to a steady growth in export earnings. Liberalized exploration laws and investment regulations have attracted not only foreign oil companies with development financing but metallic mineral exploration groups as well. The commercial production of hydrocarbons in three separate areas of Yemen encouraged further exploration. The prospect of further commercial finds is a realistic one. However, full-scale commercial production of hydrocarbons and other minerals is at best 5 to 7 years in the future. Another positive aspect of the newly formed Republic is the development of a free-zone Port of Aden, which will enable it to compete as a transshipment center with Dubai and Djibouti, bringing in additional foreign exchange.

In the short term, Yemen's outlook is less favorable. Pro-Iraqi sympathy during the Kuwait occupation jeopardized Yemen's potential for foreign aid. Furthermore, while the merger of the two sovereign Yemeni Governments in 1990 resolved the border disputes between them, common borders with Saudi Arabia and Oman have not been clearly defined. Only a section in the northwestern boundary with Saudi Arabia has been determined by international treaty. These territorial boundaries must be resolved to establish legal ownership and thus permit uncontested mineral development.

OTHER SOURCES OF INFORMATION

Agencies

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 COMMODITIES[1]

Commodity		1987	1988	1989	1990	1991[e]
Cement	thousand metric tons	760	646	700	r828	850
Gypsum	metric tons	50,000	60,000	63,000	r66,000	75,000
Natural gas:						
Gross[e]	million cubic meters	—	—	10,000	20,000	50,000
Liquids	thousand 42-gallon barrels	—	—	4	9	25
Petroleum:						
Crude	do.	7,800	60,390	66,500	r73,000	80,000
Refinery products:						
Gasoline	do.	1,103	2,725	r2,900	r2,900	3,000
Kerosene	do.	1,240	1,275	1,300	1,300	1,300
Distillate fuel oil	do.	9,478	9,530	9,535	9,535	9,600
Residual fuel oil	do.	10,113	10,135	r10,310	r10,400	10,400
Other[e]	do.	1,000	r2,350	r3,100	r3,100	3,100
Total	do.	22,934	26,015	27,145	27,235	27,400
Salt[e]	metric tons	238,000	225,000	230,000	220,000	225,000
Stone, dimension[e]	cubic meters	350,000	350,000	350,000	2410,000	410,000

[e]Estimated. [r]Revised.
[1]Table includes data available through May 1, 1992.
[2]Reported figure.

TABLE 2

REPUBLIC OF YEMEN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1991

(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
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
Do.		Shabwa Petroleum (Government 100%)	Western Ayyad	18,000
Do.		do.	Amal	18,000
Petroleum, products	thousand barrels	Yemen Exploration and Production Co. (Yemen Hunt Oil Co., 51%; Exxon Corp., 49%)	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%)	Khawr-Maksar	80

TABLE 3

REPUBLIC OF YEMEN: ACTIVE HYDROCARBON CONCESSIONS IN 1991

Block	Area in square kilometers	Licensees
1 Amakeen	2,182	Sun Company (United States).
2 Al-Maabar	4,019	Crescent Petrolum Co. Operator (UAE) (Clyde Petroleum (United Kingdom, 20%) C Itoh & Company (Japan, -20%)/Indonesia Petroleum (Japan, -20%).
3 Amiq	2,953	Chevron Corp. (United States).
4 Ayadh	1,993	Nimir Petroleum Co. (Cayman Islands) Saudi Arabian financiers/Arco operator.
5 Jana	2,180	Hunt Oil Co. (United States)/Exxon Corporation (United States)/Total Operator (France)/Kuwait Foreign Petroleum Exploration Co. (Kufpec-Kuwait)/Machinoimport & Zarubezhgeologia Russia.
6 Iryan	1,224	Strake Trading Group (United States)/Plystad (Norway)/Jamjoom (Saudi Arabia) (Concession withdrawn early 1992).
7 Barqa	4,942	The British Petroleum Co., 87.5% (BP)/Furnet Investment, 12.5% (Jeddah-based).
8 Asakir	4,735	do.
9 Al Hajar	4,728	Crescent (Sharjah-based)/British Gas (United Kingdom).
10 East Shabwa	15,827	Total/Kufpec/Union Oil Co. of California (Unocal-United States).
S1 Damis	3,879	Shell Exploration & Development Yemen, Showa Shell, Japan National Oil Corp., Nissho-Iwa, (Japan).
S2	2,808	Occidental Petroleum Co. (United States)/Consolidated Contractors International Co. (Athens-based Lebanan owned).
11 Sirr Hazar	47,217	Elf Petroland.
12 North Sanau	15,940	Tullow Oil (Ireland)/Bin Ham Group (UAE)/Coplex (Yemen)/Pecten (U.S.)/Atlantic Richfield Co. (Arco-United States).
14 Masila	35,548	Canadian Occidental Petroleum/CCC/Pecten/Occidental.
16 Qamar	8,544	Nimir Petroleum Co. (Cayman Islands)
18 Marib al Jawf	10,400	Hunt/Exxon/Yukong(South Korea)/Korean Petroleum Development Corp./Hyundai (South Korea)/Samwhan (South Korea).
20 Upper al Jawf	4,222	International Petroleum Corp. (IPC-Canada)/Phillips Petroleum Co. (United States).
23 Antufash	13,040	British Petroleum.
24 Hodayda	12,955	Hunt Oil Co. (United States).
29 South Sanau	21,634	Nimir Petroleum Co. (Cayman Islands).
30 Habrout	12,083	Petro-Canada.
31 —	—	Lasmo (UK)/Complex.
32 —	—	Clyde/Norsk Hydro (Norway)/Oranje-Nassau Energia (Netherlands)/Ansan Wikfs (Yemen).
33 —	—	Nimir Petroleum Co. (Cayman Islands).

MAP SYMBOLS

Commodity	Symbol
Alunite	Alu
Alumina	Al
Aluminum	AL
Andalusite	And
Antimony	Sb
Arsenic	As
Asbestos	Asb
Asphalt	Asp
Barite	Ba
Bauxite	Bx
Bentonite	Bent
Beryllium/beryl	Be
Bismuth	Bi
Bitumen (natural)	Bit
Boron	B
Bromine	Br
Cadmium	Cd
Calcium/calcite	Ca
Carbon black	CBl
Cement	Cem
Cesium	Cs
Chromite	Cr
Clays	Clay
Coal	C
Cobalt	Co
Columbium (niobium)	Cb
Copper	Cu
Corundum	Cn
Cryolite	Cry
Diamond	Dm
Diatomite	Dia
Dolomite	Ds
Emerald	Em
Emery	E
Feldspar	Feld
Ferroalloys	FA
Ferrochrome	FeCr
Ferromanganese	FeMn
Ferronickel	FeNi
Ferrosilicon	FeSi
Fertilizer	Fz
Fluorspar	F
Gallium	Ga
Garnet	Gt
Gemstones	Gm
Germanium	Ge
Gold	Au
Graphite	Gr
Gypsum	Gyp
Indium	In
Iron and steel	Fe
Iron ore	Fe
Jade	J
Kaolin	Kao
Kyanite	Ky
Lapis lazuli	Laz
Lead	Pb
Lignite	Lig
Lime	Lime
Limestone	Ls
Liquefied natural gas	LNG
Liquefied petroleum gas	LPG
Lithium	Li
Magnesite	Mag
Magnesium	Mg
Manganese	Mn
Marble and alabaster	Marb
Marl	Ma
Mercury	Hg
Mica	M
Molybdenum	Mo
Natural gas	NG
Natural gas liquids	NGL
Nepheline syenite	Neph
Nickel	Ni
Nitrates	Nit
Nitrogen (ammonia plants)	N
Ochre	Oc
Oil sands	OSs
Oil shale	OSh
Olivine	Ol
Opal	Opal
Peat	Peat
Perlite	Per
Petroleum, crude	Pet
Petroleum refinery products	Pet
Phosphate	P
Pig iron	Pig
Pigments, iron	Pigm
Platinum-group metals	PGM
Potash	K
Pozzolana	Pz
Pumice	Pum
Pyrite	Py
Pyrophyllite	Pyrp
Quartz or quartzite	Qtz
Rare earths	RE
Rhenium	Re
Salt	Salt
Sand and gravel	S/Gvl
Sandstone	Ss
Selenium	Se
Sepiolite, meerschaum	Sep
Serpentine	Serp
Shale	Sh
Silicon	Si
Sillimanite	Slm
Silver	Ag
Soapstone	So
Soda ash, trona	NaAsh
Sodium sulfate	$NaSO_4$
Stone	St
Strontium	Sr
Sulfur	S
Talc	Tc
Tantalum	Ta
Tellurium	Te
Thorium	Th
Tin	Sn
Titanium (rutile or ilmenite)	Ti
Titanium dioxide (processed)	TiO_2
Tungsten	W
Umber	Um
Uranium	U
Vanadium	V
Vermiculite	Vm
Wollastonite	Wo
Yttrium	Y
Zinc	Zn
Zircon	Zr

MAP LEGEND

Symbol =	Mine, including beneficiation plants, 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

UNITS OF MEASURE AND ABBREVIATIONS

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

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