THE MINERAL INDUSTRY OF

IRAN

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Iran remained the world's fourth largest producer of crude oil, averaging about 3.63 million barrels per day (Mbbl/d) in 1998. Petroleum continued to provide the bulk of this Middle Eastern nation's foreign exchange despite the 35% drop in Iranian crude oil prices during 1998 that followed a 32% decline in crude oil prices during 1997. The loss of projected revenue required serious Government budget revisions and focused the nation on the need for a more diversified economy; Iran has the potential for a significantly diversified mineral industry. Commercial production of mineral and metal commodities included aluminum, cement, chromite, copper, fertilizers, gypsum, iron, lead, petrochemicals, steel, stone, and zinc.

Although inflation was high, it dropped to 14.5% in 1998 compared with 17.3% in 1997 and about 50% in 1995. High foreign debt obligations restricted the availability of foreign exchange for imports and other Government spending. The gross domestic product of this country of about 62 million people was estimated to be $100.3 billion in 1998, down from $102.0 billion in 1997 (World Bank, September 22, 1999, Iran—Islamic Rep. at a glance, accessed October 25, 1999, via URL http://www.worldbank.org/data/countrydata/countrydata.html).

Government Policies and Programs

In 1995, Conoco Inc. of the United States had been forced to divest its interest in the contract to develop the offshore Sirri A and E structures under a March 14, 1995, U.S. Presidential Executive order banning U.S. companies from undertaking oil development projects in Iran (Brower, 1998). In 1996, the U.S. Government enacted the Iran-Libya Sanctions Act, proscribing any company (American or foreign) from exceeding a $20 million per year investment or trading limit with Iran (Barry Schweid, Associated Press, U.S. examines Iran energy deal, accessed on March 3, 1999, at URL http://biz.yahoo.com/apf/990302/energy_dea_1.html). Threatened U.S. sanctions initially dampened international enthusiasm for mineral industry projects in Iran; however, in January 1998, the European Union lifted its ban on ministerial contacts with Iran, and European nations began to reestablish official relations (Middle East Economic Digest, 1998g). In March, National Iranian Oil Co. (NIOC) proposed to contract out about 100 oil and gas projects to international companies. In May, the U.S. Government waived sanctions against the international consortium developing the offshore South Pars gasfield (Middle East Economic Digest, 1998e). The waiver encouraged non-U.S. oil companies to reevaluate their interest in the proposed Iranian oil and gas opportunities.

For several years, the Government has been privatizing state-run mineral enterprises, primarily the smaller operations. In July 1998, the NIOC offered contracts on 42 oil and gas sector projects to international companies. Ventures included onshore and offshore exploration, oilfield and gasfield development, redevelopment of war-damaged fields, and secondary and tertiary recovery work, as well as work on natural gas liquids plants, natural gas pipelines, and upgrading oil refineries. Although Iran has offered foreign companies limited opportunities to engage in offshore projects since 1988, this scheme opened the onshore to international companies for the first time since the 1979 Iranian revolution (Middle East Economic Digest, 1998d; Tippee, 1998).

These proposed contacts were based on a "buy-back" scheme under which the contract winners would develop the project for a contract-specified rate of return for a specified period after recovering initial investment from the project's output. The Government tailored the buy-back contracts to conform with article 153 of the Iranian Constitution that prohibited foreign control over natural resources (Corzine, 1998; Corzine and Allen, 1998). The new mining law came into effect in June 1998.

Trade

Petroleum supplied more than 80% of hard currency revenues in the Iranian calendar year 1376 that ended on March 20, 1998. Revenue from oil and gas exports was about $15.5 billion. (Middle East Economic Digest, 1998f). Other mineral exports have recently accounted for about 3% of export revenues (Iran News, August 22, 1999, Imports exceeded $14b last year, accessed October 14, 1999, at URL http://www.salamiran.org/Media/IranNews/990822.html). In 1998, exporters of products other than petroleum were authorized to use their hard currency earnings to import essential goods. Previously, exporters were required to surrender foreign earnings at the official rate of 3,000 rials per U.S. dollar (Journal of Commerce, 1998).

Structure of the Mineral Industry

The overall management of the minerals sector is under the auspices of the Ministry of Mines and Metals. The Ministry's

[1]Deceased.

authority covers all mining, smelting, and refining industries except oil and gas, which are under the Ministry of Petroleum. The state owns the major companies in the minerals sector; however, the private sector controls most of the estimated 2,700 operating mines (Iran News, August 21, 1999, Iranian mining industry is privately run, Semnani, accessed October 14, 1999, at URL http://www.salamiran.org/Media/IranNews/9908021.html).

In 1998, NIOC underwent an organizational restructuring. A new subsidiary, Khazar Exploration and Production Co., was formed to operate in the disputed Caspian region.

Commodity Review

Metals

Aluminum.—Primary aluminum production was, for the most part, derived from the 120,000-metric-ton-per-year (t/yr)-capacity Iranian Aluminium Company plant in Arak. During 1998, aluminum ingot production was about 10% higher than production during the Iranian year 1376. Construction continued at the 110,000-t/yr-capacity Al-Mahdi aluminum smelter at Bandar Abbas, which was operating at less than 10% of its capacity (Middle East Economic Digest, 1998b). Also under construction was a 280,000-t/yr-capacity alumina refinery at Jajarm, about 480 kilometers (km) northeast of Tehran. Bauxite was to be sourced from a mine near Jajarm and supplemented by imported bauxite from Guinea.

Copper.—China National Non-Ferrous Metals Co. was building a $106 million copper smelter in Khatounabad, 20 km from the Sar Cheshmeh copper complex in Rafsanjan in southeastern Iran, for National Iranian Copper Industries Co. (NICICO). The 80,000-t/yr-capacity Khatounabad smelter was expected to import copper concentrates from Chile supplemented by production from the new open pit Meyduk Mine (Mining Journal, 1998). The mine at Meiduk, 120 km northwest of Sar Cheshmeh, was under development with the assistance of a subsidiary of Finland's Outokumpu Oyj. NICICO reported reserves at Meyduk of 140 million metric tons (Mt) grading 0.8% copper (National Iranian Copper Industries Co., [undated], Meyduk copper complex, accessed October 15, 1999, at URL http://www.nicico.com/meyduk.html). NICICO also was studying the proposed mining of the Songun copper deposit, a 660-Mt resource grading 0.7% copper, about 600 km northwest of Tehran (National Iranian Copper Industries Co., undated, Songun copper complex, accessed October 15, 1999, at URL http://www.nicico.com/songun.html).

In 1997, NICICO inaugurated a heap-leach operation at Sar Cheshmeh to process about 27 Mt of copper oxide ores averaging 0.61% copper that had been stockpiled since the mine opened. The leachate was processed in a solvent extraction-electrowinning plant capable of producing 14,000 t/yr of copper cathode (National Iranian Copper Industries Co., undated, Leaching, accessed October 15, 1999, at URL http://www.nicico.com/leaching.html). NICICO also proposed to increase sulfide ore processing at Sar Cheshmesh by expanding the concentrator plant's capacity from 13.4 million metric tons per year (Mt/yr) to 26.8 Mt/yr and doubling the smelter's capacity to 200,000 t/yr (Mining Journal, 1998).

The Ehya Sanaye Khorasan Co. of Iran was evaluating the rehabilitation of the Taknar copper mine, which has been closed since 1979.

Gold.—Union Itok International AG of Switzerland, a joint venture of Iran Itok Engineering and Technology Co. of Iran and Union Mining NL of Australia, applied for copper and gold exploration licenses in Kerman and East Azarbayjan Provinces and for gold exploration licenses in the Dib Rostam area. Zarcan Minerals Inc. of Canada was exploring for gold on the Agh Darreh prospect in northwestern Iran and the Baluchestan project in southeastern Iran.

Iron and Steel.—Affiliated companies of the state steel company National Iranian Steel Co. (NISCO) began looking for new markets as domestic demand for steel dropped off in 1998. Sales to eastern Asia also were depressed as the Asian financial crisis continued. Eurofer, the European steel-trading group, alleged that Iran significantly increased its steel exports to Europe. Mobarakeh Steel Co., however, claimed that its exports to Europe had, in fact, dropped (Metal Bulletin, 1998). In 1998, Mobarakeh inaugurated the seventh stand in its hot strip mill and continued the expansion of its 2.9-Mt/yr steel plant to 4 Mt/yr.

Lead and Zinc.—Most of the nation's lead and zinc production was derived from three mines—Angouran, Irankouh, and Kushk. Most lead and zinc companies exported concentrate; however, there was metal produced at the 40,000-t/yr-capacity lead smelter at Angouran. This output was supplemented by secondary lead recovery estimated to be about 10,000 t/yr. A 7,000-t/yr-capacity zinc smelter, also at Angouran, started up in 1997, and a 27,000-t/yr-capacity zinc smelter was under construction at the Kushk Mine, near Yazd (Mining Journal, 1999).

Titanium.—Union Itok was negotiating for an exploration license for the Kahnook titanium prospect in southern Iran.

Industrial Minerals

Iran produced a wide variety of industrial minerals and mineral-based commodities, including barite, cement, clays, chemical fertilizers, gypsum, lime, phosphate, salt, dimension stone, and sulfur. Limestone deposits suitable for cement production were located close to major cities. In 1998, Iran's cement manufacturers continued to expand the country's production capacity. Hornuzgan Cement Co. was building a second 1-Mt/yr-capacity line at its plant, and the Ehdas San'at Co. had eight cement plants under construction.

More than 1.8 Mt of chemical fertilizer was produced at the Khorassan Petrochemical Complex in the year ending March 20, 1998. Ammonia was produced at the 330,000-t/yr-capacity Khorassan Petrochemical Complex, the 660,000-t/yr-capacity Razi Chemical Complex, and the 432,000-t/yr-capacity Shiraz

nitrogenous fertilizer plant (Middle East Economic Digest, 1998a; Arab Petroleum Research Center, 1999, p. 147-149; Iran News, August 5, 1998, Iran plant raises urea output to 47,700 tons per month, accessed October 15, 1999, at URL http://www.salamiran.org/Media/IranNews/980805.html).

Iran was a significant producer of ceramic tile, with a reported production capacity of more than 50 million square meters. Dimension stone quarries produced granite, marble, and travertine. The Government sought to expand exportation of tile and stone to the international market (Iran News, July 16, 1998, Tile industry faces grave danger, accessed October 15, 1999, at URL http://www.salamiran.org/Media/IranNews/980716.html; Iran News, August 11, 1998, Iran quarries 7.5 m tons of stone annually, accessed October 15, 1999, at URL http://www.salamiran.org/Media/IranNews/980811.html).

Mineral Fuels

Natural Gas.—Highlights of the 1998 exploration season included the discovery of 952 billion cubic meters of gas, 135 km south of Shiraz (Middle East Economic Digest, 1998g).

Pars Oil and Gas Co., a NIOC subsidiary, was appointed operator of Phase 1 of the offshore South Pars natural gas development project, succeeding state-owned Petroleum Development and Engineering Co. Under construction were onshore gas treatment plants, gas pipelines, and port facilities for condensate and sulfur exports expected to be generated by Phases 2 and 3 of the South Pars gas project. The Total S.A. of France (40%), the open joint-stock company Gazprom of Russia (30%), and Petronas Carigali Sdn. Bhd. of Malaysia (30%) consortium projected that gas production from Phases 2 and 3 would start in 2001 and eventually reach a rate of 57 million cubic meters per day of natural gas (Oil & Gas Journal, 1998).

Petroleum.—In 1998, Iranian oil production reportedly had dropped to an average of 3.63 Mbbl/d, partially in response to the Organization of the Petroleum Exporting Countries' announced production quota reductions of March and June. In 1997, Iran had produced an average of 3.66 Mbbl/d (U.S. Department of Energy, [undated], Table 1.1a—World crude oil production (including lease condensate), 1990-present, International Petroleum Monthly, accessed October 27, 1999, at URL http://www.eia.doe.gov/emeu/ipsr/t11a.txt). In 1998, new production came on-line with the startup of the Sirri A Field by a Total and Petronas joint venture. Initial oil production from the Sirri E Field was expected on-line in early 1999.

Rehabilitation work continued in the Karanj and the Parsi fields where gas injection facilities were under construction. Many of Iran's mature fields suffered from pressure-maintenance problems and increasing water production (Arab Petroleum Research Center, 1999).

In December 1998, a joint venture was formed by Lasmo Petroleum Development BV, the Royal Dutch/Shell Group, and NIOC to explore the southern Caspian Sea. In the Gulf, the Agip Division of Eni S.p.A. of Italy and the Elf Aquitaine Group of France were authorized to redevelop the offshore Doroud 1 and 2 Fields. NIOC calculated that the Doroud project would increase production by 145,000 barrels per day (bbl/d) (Middle East Economic Digest, 1998c). Development of the Balal prospect, about 110 km southwest of Lavan Island, was assigned to the joint venture of Premier Oil plc of the United Kingdom (75%) and Bow Valley Energy Ltd. of Canada (25%). In September 1998, Premier had replaced Bakrie Minorak Petroleum of Indonesia, which had withdrawn from the Bow Valley venture in January.

The country's nine existing oil refineries were operated by the National Oil Refining and Distribution Co. (NORDCO). Capacity of the Bandar Abbas refinery was to approach 232,000bbl/d after it overcame startup problems, pushing the NORDCO's throughput capacity past 1.5 Mbbl/d.

Infrastructure

Major investments are required for further development of the nation's infrastructure. There are 158,000 km of highway, about 7,300 km of railroad, and 904 km of navigable waterways in the country. Pipelines for crude oil total 5,900 km; petroleum products, 3,900 km; and natural gas, 4,550 km. Crude oil is exported from the Cryus, the Kharg Island, the Lavan Island, the Ras Bahregan, and the Sirri Island terminals. Refined products were exported through the Abadan and the Bandar Mahshar terminals on the Shatt al-Arab waterway.

In March, international oil companies operating in Central Asia signed an oil swap agreement with Iran. This alternative export option for crude oil from Central Asia was initiated in July when Dragon Oil plc of Ireland began delivery of 7,200 bbl/d to Neka, Iran, in return for NIOC delivering an equivalent amount of Iranian light crude available at an Arabian Gulf port. Monument Oil and Gas plc of the United Kingdom also signed an oil swap agreement with NIOC, as a way to market proposed oil production from Turkmenistan. Iran proposed to build a 392-km, 350,000-bbl/d oil pipeline connecting Neka to the crude oil pipeline in Tehran to facilitate oil swaps with Central Asian countries (Petroleum Economist, 1998).

Total installed electricity generating capacity exceeded 23,000 megawatts (MW). Most of this capacity is attributed to natural-gas-fired thermal powerplants (Knott, 1999). New electricity-generating plants coming on-line in 1998 included two 125-MW gas turbine generators at the Khoy powerplant and a 200-MW unit at the Martyr Montazeri powerplant in Isfahan. The two new 100-MW steam units at the Qom powerplant increased the generating capacity at Qom to 714 MW. Combined-cycle powerplants with a total electricity generating capacity of 6,000 MW were under construction in 1998 as were eight hydroelectric powerplants with a total projected electricity generating capacity of 8,000 MW (Iran News, August 6, 1998, Bitaraf—Eight hydroelectric power stations under construction, accessed October 15, 1999, at URL http://www.salamiran.org/Media/IranNews/980806.html).

Outlook

Iran could diversify its industrial base to reduce its reliance on the oil sector. By increasing nonoil exports and producing

domestically many goods that it now imports, Iran could dampen the cyclic nature of its oil-based economy. Expansion of the mineral industry can be expected as trends favoring privatization and foreign investment continue.

The metals sector offers the most promising avenue for diversification. Here, Iran has a number of comparative advantages, such as low labor costs and, when developed, abundant energy from natural gas. In terms of steel production, there are sizable if relatively low-grade iron ore deposits, and domestic supplies of coking coal and limestone could support the development of a significant steel industry.

Iran's geographic position also offers opportunities as a potential export route for crude oil from Central Asia.

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Major Sources of Information

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TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1994	1995	1996	1997 e/	1998 e/
METALS						
Aluminum:						
Bauxite, gross weight		68,000	148,000	150,000	150,000	260,000
Metal, primary ingot		116,200	119,400	80,100	92,300	88,000
Arsenic, orpiment and realgar, concentrates e/		500	500	500	492	500
Chromium, chromite, mine output, concentrate (48% to 50% Cr_2O_3):						
Gross weight		354,100	371,100	130,220	168,984 3/	170,000
Cr_2O_3 content e/		173,500	181,840	63,800	82,800	83,000
Copper:						
Mine output:						
Ore mined (1% to 1.2% Cu):						
Gross weight	thousand tons	12,400	13,150	14,150	14,200	14,500
Cu content e/		100,040 3/	120,000	120,000	117,300	115,000
Concentrate (29% to 35% Cu):						
Gross weight e/		360,000	325,000	320,000	320,000	320,000
Cu content		117,900	102,200	107,600 e/	108,000	108,000
Metal:						
Smelter output, blister/anode		131,800	106,100	99,100	99,000	100,000
Refined output, cathode		90,200	90,400	99,200	103,300	105,000
Gold, mine output, Au content 4/	kilograms	723	630	640	684 3/	822
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	8,690	9,080 e/	9,850	12,750	12,300
Fe content e/	do.	4,300	4,500	4,800	6,300	6,000
Metal:						
Pig iron	do.	1,883	1,532	1,867	2,053 3/	2,050
Direct-reduced iron	do.	2,861	3,301	3,778	4,380 3/	4,400
Ferrochromium		7,150	11,900	10,500	11,450 3/	13,745 3/
Ferrosilicon e/		--	10	20	20	20
Steel, crude, ingots and castings	thousand tons	4,498	4,696	5,415	6,322 3/	5,600
Lead:						
Mine output, concentrate (56% to 60% Pb):						
Gross weight e/		30,000	30,000	30,000	37,000	38,000
Pb content		18,300	15,900	15,700 e/	18,200	19,000
Refinery output, includes secondary		51,300	45,200	46,900	49,400	47,000
Manganese, mine output, (30% to 35% Mn):						
Gross weight		96,115	99,332	100,000	135,000	190,000
Mn content e/		30,757	32,000	32,000	40,000	60,000
Molybdenum, mine output, concentrate (56% Mo): e/						
Gross weight		1,200	1,600	1,600	1,800	1,800
Mo content		670	560	560	600	600
Silver, mine output, Ag content e/		60	60	60	60	60
Zinc:						
Mine output, concentrate (50 to 55% Zn):						
Gross weight e/		146,000	290,000	152,000	132,000	160,000
Zn content		73,000	145,100	76,300	76,500	80,000
Metal		--	--	--	14,000	23,000
INDUSTRIAL MINERALS						
Asbestos: e/						
Concentrate, (3% to 8% marketable fiber)		80,000	65,000	65,000	86,200	86,000
Marketable fiber		4,500	4,500	4,500	4,300	4,300
Barite e/		139,000	150,000 3/	150,000	181,174 3/	180,000
Boron, borax e/		500	500	500	420	420
Cement, hydraulic e/	thousand tons	16,000	16,300	18,350 r/	19,250 r/	19,000
Clays:						
Bauxite and refractory clays e/		220,000	220,000	220,000	215,000	215,000
Bentonite		71,759	54,789	85,000	105,300 3/	115,000
Other: e/						
Industrial clays		300,000	250,000	300,000	350,000	450,000
Kaolin		265,591 3/	250,000	350,000	510,000	600,000
Total		565,591 3/	500,000	650,000	860,000	1,050,000
Diatomite e/		90	90	90	90	90
Feldspar		75,000	80,000 e/	106,000	125,000 3/	125,000

See footnotes at end of table.

TABLE 1--Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1994	1995	1996	1997 e/	1998 e/
INDUSTRIAL MINERALS--Continued						
Fluorspar, fluorite		22,204	20,163	20,000 e/	20,000	20,000
Gemstones, turquoise e/	kilograms	5,000	5,000	5,000	5,000	5,000
Gypsum	thousand tons	8,430	8,230	8,570	8,900	9,750
Industrial or glass sand (quartzite and silica) e/		950,000	1,000,000	1,000,000	1,000,000	1,000,000
Lime e/	thousand tons	650	650	650	650	700
Magnesium compounds e/		45,000	55,000	55,000	55,000	55,000
Mica e/		3,000	3,000	3,000	3,000	3,000
Nitrogen:						
N content of ammonia		696,200	715,400	882,000	879,800 3/	1,034,000
N content of urea		400,000	421,800	552,900	610,500 3/	800,000
Perlite e/		6,000	6,000	6,000	6,000	6,000
Pigments, mineral, natural iron oxide e/		2,500	2,500	2,500	2,500	2,500
Pumice and related volcanic materials e/		200,000	200,000	200,000	200,000	150,000
Salt		1,050,000	936,000	1,000,000 r/ e/	1,180,000 r/	1,450,000
Sodium compound, caustic soda e/		15,000	15,000	15,000	15,000	20,000
Stone: e/						
Construction and building, crushed, n.e.s.	thousand tons	4,800	4,800	4,800	4,800	4,300
Dimension and decorative:						
Granite	do.	20	20	20	20	40
Marble:						
Blocks	do.	4,500	4,500	4,500	4,500	6,000
Crushed	do.	450	450	450	450	500
Slabs	do.	50	50	50	50	100
Travertine:						
Blocks	do.	500	500	500	500	800
Crushed and slabs	do.	70	70	70	70	100
Total	do.	5,590	5,590	5,590	5,590	7,500
Dolomite	do.	200	243 3/	200	200	200
Limestone	do.	28,000	28,000	32,000 r/	33,000 r/	33,000
Strontium, celesite e/		20,000	20,000	20,000	20,000	20,000
Sulfates, natural: e/						
Aluminum potassium sulfate (alum)		12,000	12,000	12,000	12,000	12,000
Sodium sulfate		280,000	280,000	315,000 3/	480,000	480,000
Sulfur: e/						
Byproduct of petroleum and natural gas		830,000	840,000	840,000	850,000	850,000
Byproduct of metallurgical processing, S content of acid		50,000	50,000	50,000	50,000	50,000
Total		880,000 3/	890,000	890,000	900,000	900,000
Talc e/		18,000	20,000	20,000	20,000	20,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand tons	1,720	1,640	1,840	1,750	1,810
Coke e/	do.	700	700	700	800 r/	700
Gas, natural:						
Gross	million cubic meters	61,000	79,600	86,000	89,000	94,000
Dry	do.	28,200	36,600	39,077	43,000	45,000
Natural gas plant liquids e/	thousand 42-gallon barrels	23,500 3/	23,500	23,500	22,000	22,000
Petroleum:						
Crude	do.	1,325,000	1,329,700	1,345,390	1,337,360 3/	1,325,000
Refinery products: e/						
Liquefied petroleum gases	do.	23,000 3/	24,000	23,000 r/	24,000	24,000
Motor gasoline	do.	51,500	54,425 3/	54,400 r/	54,500	55,000
Jet fuel	do.	9,200 3/	9,000	10,200 r/	10,000 r/	10,000
Kerosene	do.	34,400	36,000	35,800 r/	36,000	37,000
Distillate fuel oil	do.	107,600 3/	104,828 3/	108,800 r/	109,000 r/	110,000
Residual fuel oil	do.	103,000	93,367 3/	98,600 r/	98,000 r/	100,000
Other	do.	35,800 3/	45,000	64,200 r/	64,000 r/	64,000
Total	do.	364,500	366,620	395,000 r/	395,500 r/	400,000

e/ Estimated. r/ Revised.

1/ Table includes data available through October 28, 1999.

2/ Data are for Iranian years ending March 21 of that stated, except data for natural gas, plant liquids, and petroleum, which are for Gregorian calendar years.

3/ Reported figure.

4/ Includes gold recovered from the Mouteh gold mine and from the Sarcheshmeh copper complex.