

THE MINERAL INDUSTRY OF

IRAN

By Bernadette Michalski

Although petroleum continued to provide the bulk of the country's foreign exchange, supplying 83% of hard currency revenues in the Iranian calendar year that ended on March 20, 1998, Iran has the potential for a significantly diversified mineral industry. The country remained the world's fourth largest producer of crude oil averaging more than 3.66 million barrels per day (Mbb/d). Crude oil prices dropped by as much as 40% in the last one-half of the Iranian calendar year and required serious budget revisions and reemphasis of the need for a more-diversified economy. Other commercial mineral and metal outputs included aluminum, chromite, copper, gypsum, iron and steel, and lead and zinc.

Government Policies and Programs

The Government's second 5-year plan, covering Iranian calendar years 1995-96 through 1999-2000, includes a progressive liberalization of the economy with heightened private sector participation. At least 2,400 state-owned companies, including 30 in the petroleum, petrochemical, steel, and power sectors, are to be privatized. Foreign investment in all nonoil industrial projects totaled \$782 million in the first 3 years of the plan. The Government has authorized \$700 million to be raised from abroad by the Iranian steel sector and \$400 million by the copper sector in the 1998-99 Iranian year.

During the second 5-year plan, subsidies on petroleum were to be substantially reduced from \$10 billion at the close of the first 5-year plan to \$5 billion at the close of the second plan. Subsidies on domestic consumption of petroleum, however, were estimated to be \$11 billion in 1997-98 in spite of 25% increases in consumer prices for petroleum products in each of the last 3 years (Arab Petroleum Research Center, 1998).

In November 1997, Iran's parliament ratified a new mining bill, presenting guidelines for mineral exploration and exploitation. The bill includes outlines of required qualification standards for applicant companies and describes the mechanism for securing foreign financing under buy-back programs.

Production

Expansion activities at the Gol-e Gohar iron ore mine accounted for increased production. Iran also is a significant producer of industrial minerals, ranking as the world's third largest producer of gypsum, mainly from the mines in the Semnan region about 200 kilometers (km) east of Tehran. During the past 4 years, crude oil production has been relatively stable, approaching 3.7 Mbb/d with sustainable capacity near 3.8 Mbb/d. (See *table 1*.) Onshore fields produced 3.2 Mbb/d, and

offshore, 0.5 Mbb/d. Output was running at more than one-half the peak rate reached in the mid-1970's, when production exceeded 6 Mbb/d and the sustainable capacity approached 7 Mbb/d.

Trade

Export revenues for the Iranian calendar year 1996-97 were \$22.5 billion, including \$19.3 billion from oil and gas exports. In Iranian year, 1997-98, oil export revenues dropped to an estimated \$15 billion (Arab Petroleum Research Center, 1998). Revenues from metal exports alone were reported to be \$80.5 million in the first one-half of the year. As Iran fell further behind on its largely short-term debt, it renegotiated payment schedules with its major debtholders. Debt service repayment absorbed more than one-third of Iran's oil earnings.

Structure of the Mineral Industry

The overall management of the minerals sector was under the auspices of the Ministry of Mines and Metals. The Ministry's authority covers all mining, smelting, and refining industries except oil and gas, which were under the Ministry of Petroleum.

The Government announced the offering for privatization of at least 30 companies directly or indirectly related to the mining industry.

Commodity Review

Metals

Aluminum.—Primary aluminum production was, for the most part, derived from the reconstructed 120,000-metric-ton-per-year (t/yr)-capacity Iranian Aluminium Company plant in Arak. The plant is scheduled for 70,000-metric-ton (t) capacity expansion in the near future.

The Almahdi Aluminum Corp., a joint venture between the Ministry of Mines and Metals (60%) and the International Development Corp. of Dubai (40%), brought the Al-Mahdi aluminum smelter on-stream. Originally scheduled to come on-stream in 1994, the 110,000-t/yr-capacity aluminum smelter at Bandar Abbas began production in 1997 at a cost of \$1.6 billion. The eventual capacity will be 220,000 t/yr, which is anticipated by 2000.

Chromium.—Several small chromite deposits associated with ophiolite belts are being exploited in the southern region of the Kerman province. In 1997, these mines yielded 282,000 t of run

of mine ore. About one-half of the output was consumed by the Faryab Mining and Chrome Smelting Co. ferroalloy refinery near Bandar Abbas.

Copper.—A new copper smelter was being built in Khatounabad, 20 kilometers (km) from the Sar Cheshmeh copper complex in southeastern Iran. The China National Non-Ferrous Metals Co. was commissioned to build the \$106 million copper smelter with a capacity of 80,000 t/yr. Iran was expected to pay for about \$17 million of the cost through copper exports to China.

A new open-pit copper mine at Meiduk 120 km northwest of Sar Cheshmeh, was under development with the assistance of Outomec, a subsidiary of Finland's Outokumpu Oy. The economic reserves of the deposit vary from 50 million to 125 million metric tons (Mt) depending upon copper prices under consideration. The project includes an on-site concentrator to treat from 3 million to 7 million metric tons per year (Mt/yr) of ore grading about 1.1% copper. The Meiduk Mine is expected to yield about 45,000 t/yr of copper; in concentrate (U.S. Embassy, Stockholm, Sweden, 1997).

Iron and Steel.—The National Iranian Steel Co. (NISCO) plans to construct iron ore beneficiation plants at Choghard and Se Chahun. The iron content of the mined ore is from 24% to 40%, and the grade of concentrate is to be 66%. The plants will have the capacity to produce a total of 3.3 Mt/yr of blast-furnace-grade concentrate for the domestic steelmaking industry at the Isfahan Steel works and for export. Demands of the steel manufacturing industry prompted increased domestic iron ore output to sustain Government-owned steel plants. Iran has four main iron mines—Gol-e Gohar, 55 km southwest of Sirjan, approached 5 Mt of ore output in 1997; Choghard in Bafg, 200 km east of Yazd, produced 4.5 Mt/yr of mill concentrate; and the Samgan Mine, near Afghanistan border about 250 km southeast of Mashed, was undergoing a feasibility study for a planned expansion to 3.4 Mt/yr.

Direct reduction iron (DRI) production was growing at a rapid pace as 12 gas-fueled DRI modules, with a total capacity of 5.84 Mt/yr, were either in operation or were under construction at the Ahwas and the Mobarakeh DRI plants.

Lead and Zinc.—Most of the nation's lead and zinc production was derived from three deposits—Angouran, Irankouh, and Kushk. While most lead and zinc companies exported concentrate, the 40,000-t/yr-capacity lead smelter at Angouran produced lead bar in quantities well below capacity level. A 60,000-t/yr zinc smelter, also at Angouran, started up in 1997. A second zinc smelter, with the capacity of 27,000 t/yr, was proposed for the Kushk Mine, near Yazd.

Industrial Minerals

Iran produces a wide variety of industrial minerals, including cement, clays, dimension stone, gypsum, phosphate, and salt. Suitable limestone deposits for cement production are located close to major cities. Iran's 22 cement manufacturers sustain a combined total capacity of 22 Mt/yr. The largest of these companies is the Teheran Cement Co., with a total capacity of 2.6

Mt/yr from six lines; Kerman Cement Co., with a total capacity of 1.2 Mt/yr; and Fars Cement Co., with a total capacity of 1.0 Mt/yr. The Hornuzgan Cement Co. commissioned a 1-Mt/yr-capacity plant in June 1997 and expects to commission another one of like size in December 1998.

Mineral Fuels

Coal.—The Kerman area Babnizou and Pabedana coal mines, operated by NISCO, supplied about 60% of the Nation's coking coal requirements with the remainder supplied through imports. Development began on a major coal deposit at Tabas, 300 km northeast of Yazd. The underground mine is projected to have a production capacity of 3.5 Mt/yr.

Natural gas.—The Government plans to expand natural gas production to meet growing domestic demand, which has increased by more than 30% since 1992. Natural gas for injection purposes alone is projected to reach 128 million cubic meters per day (Mm³/d) by 2000 compared with 85 Mm³/d in 1997. Iran's most significant exploration project in 1997 was the confirmation of 60 billion cubic meters of gas at the Bibi Hakimeh Field, which will be developed for injection purposes.

In spite of U.S. sanctions legislation, development plans for the South Pars natural gas field progressed as a consortium of Total SA (40%), Gazprom (30%), and Petronas (30%) signed a \$2 billion contract in September 1997 to develop Phases 2 and 3 of the field. When developed, the field is expected to produce 56 Mm³/d of natural gas.

At yearend, a \$190 million, 200-km pipeline with an initial capacity of 4 billion cubic meters per year was opened bringing gas from Turkmenistan's southwestern Korpedzhe Gasfield into Iran's domestic natural gas grid. Iran will benefit from the pipeline because it will reduce the cost of pumping gas from the southern Iranian fields about 1,500 km away (Financial Times, 1998).

Iran has signed an agreement with Turkey for the delivery of natural gas beginning in 1999. Initial shipments will be 2 billion cubic meters per year rising to 10 billion cubic meters per year in 2002.

Petrochemicals.—The National Petrochemical Company reported earnings of \$1.5 billion from petrochemical exports in Iranian year 1996-97. Iran exports only 20% of its petrochemical output but expects to raise that to 70% in 6 years.

The first phase of the 650,000-t/yr-capacity Tabriz Petrochemicals Complex came on-stream in February 1997 with facilities to produce 136,000 t/yr of ethylene, 56,000 t/yr of propylene, 100,000 t/yr of polyethylene, and 55,000 t/yr of benzene. The second phase of the complex is scheduled to come on-stream in 1998 with the capacity to produce 95,000 t/yr of styrene and 80,000 t/yr of polystyrene.

Petroleum.—Crude oil production, including lease condensate, averaged more than 3.66 Mbbl/d, including 0.5 Mbbl/d from offshore fields in 1997. Domestic oil consumption has registered a 40% increase since 1991. Iran's crude oil exports were 2.38 Mbbl/d down from 2.63 Mbbl/d in 1996 owing, in part, to the

startup of the Bandar Abbas refinery in September. By 2000, the National Iranian Oil Co. (NIOC) plans to increase crude oil production capacity to 5 Mbbbl/d, including 1.2 Mbbbl/d from offshore fields. Onshore development work is presently confined to the installation of natural gas injection facilities to improve long-term recovery rates and to maintain pressure in oil reservoirs.

The country's nine existing oil refineries are operated by the National Oil Refining and Distribution Company and have a throughput capacity of 1.44 Mbbbl/d.

Reserves

NIOC increased its estimate of proven oil reserves to 93 billion barrels in 1997 from 88 billion barrels in 1996. Most of the country's liquid hydrocarbon reserves are located in the Southern Province particularly the Luristan-Khuzestan Basin, which contains 90% of total onshore crude oil reserves. Most of the remainder is located in the offshore fields of the Gulf.

Iran's proven gas reserves are 23 trillion cubic meters (Arab Petroleum Research Center, 1998). Iran has 2.6 billion metric tons of copper reserves. (Reuters, September 22, 1997, Iran to privatize some mined to raise funds, accessed September 22, 1997, at URL <http://biz.yahoo.com/finance/97/09/22/70023-z00=1.html>).

Infrastructure

Major investments are required for further development of the nation's infrastructure. Lack of adequate transportation systems and access to power generation hampers mineral-resource development. There are 158,000 km of highway in the country. Pipelines for crude oil total 5,900 km; for petroleum products, 3,900 km; and for natural gas, 4,550 km. Total installed electricity generating capacity exceeded 21,000 megawatts (MW) in 1997. Most of this capacity is attributed to thermal power plants. Hydroelectric power station capacity is 2,500 MW. It is expected to double to 5,000 MW by 2000 when 3 plants now under construction are scheduled for completion.

Outlook

Iran must diversify its industrial base to reduce its reliance on the oil sector, to increase nonoil exports, and to produce domestically many goods that it now imports. 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 abundant energy from natural gas when it is developed. 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 landlocked crude oil of Central Asia.

References Cited

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- Financial Times, 1998, Turkmen gas energizes new political momentum: Financial Times [London], January 12, p. 8.
- U.S. Embassy, Stockholm, Sweden, 1997, Investment activity in the Iranian copper industry: U.S. Department of State Telegram 005308, September 20, 3 p.

Major Sources of Information

Geological Survey of Iran

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

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/
METALS					
Aluminum:					
Bauxite, gross weight	100,000 e/	68,000 r/	148,000 r/	150,000 r/	150,000
Metal, primary ingot	109,190	116,200 r/	119,400 r/	80,100 r/	92,300
Arsenic, orpiment and realgar, concentrates e/	500	500	500	500	492
Chromium, chromite, mine output: Concentrate (48% to 50% Cr₂O₃):					
Gross weight	124,300 r/	354,100 r/	371,100 r/	130,220 r/	168,984 3/
Cr ₂ O ₃ content e/	56,250 r/	173,500 r/	181,840 r/	63,800 r/	82,800
Copper:					
Mine output:					
Ore mined (1% to 1.2% Cu):					
Gross weight thousand tons	10,800	12,400	13,150	14,150 r/ 3/	14,200
Cu content	86,600	100,040	120,000 e/	120,000	117,300
Concentrate (29% to 35% Cu):					
Gross weight e/	290,000	360,000	325,000	320,000	320,000
Cu content	86,600	117,900	102,200 r/	107,600 e/	108,000
Metal:					
Smelter output, blister/anode	85,000	131,800 r/	106,100 r/	99,100 r/	99,000
Refined output, cathode	84,900	90,200	90,400	99,200 r/	103,300
Gold, mine output, Au content kilograms	417	723	630 r/	640 r/	684 3/
Iron and steel:					
Ore and concentrate:					
Gross weight thousand tons	9,870	8,690	9,080 e/	9,850 r/ 3/	12,750
Fe content e/ do.	4,800	4,300	4,500	4,800 r/	6,300
Metal:					
Pig iron do.	1,961	1,883	1,532	1,867 3/	2,053
Direct-reduced iron do.	1,631	2,861	3,301	3,778	4,380 3/
Ferrochromium	--	7,150 r/	11,900 r/	10,500 r/	11,450 3/
Ferrosilicon e/	--	--	10	20	20
Steel, crude, ingots and castin; do.	3,672	4,498	4,696	5,415	6,322 3/
Lead:					
Mine output, concentrate (56% to 60% Pb):					
Gross weight	22,000	30,000	30,000 e/	30,000 e/	37,000
Pb content	14,700 r/	18,300	15,900	15,700 e/	18,200
Refinery output, includes secondary	52,000	51,300	45,200	46,900 r/	49,400
Manganese, mine output, (30% to 35% Mn):					
Gross weight	75,978	96,115 r/	99,332 r/	100,000 r/	135,000
Mn content e/	24,320 r/	30,757 r/	32,000 r/	32,000 r/	40,000
Molybdenum, mine output, concentrate (56% Mo): e/					
Gross weight	1,200	1,200	1,600	1,600	1,800
Mo content	700	670	560	560	600
Silver, mine output, Ag content e/	60	60	60	60	60
Zinc, mine output, concentrate (50 to 55% Zn):					
Gross weight e/	154,000	146,000	290,000	152,000	132,000
Zn content	77,000	73,000 r/	145,100 r/	76,300 r/	76,500
INDUSTRIAL MINERALS					
Asbestos: e/					
Concentrate, (3% to 8% marketable fiber)					
Marketable fiber e/	80,000 e/	80,000	65,000 e/	65,000	86,200
Barite	4,500	4,500	4,500 r/	4,500	4,300
Borax e/	226,377	139,000 r/ e/	150,000 r/	150,000	181,174
Boron, borax e/	500	500	500	500	420
Cement, hydraulic e/ thousand tons	16,000	16,000	16,300	16,500	15,200
Clays:					
Bauxite and refractory clays e/					
Bentonite	220,000	220,000	220,000	220,000	215,000
Other:	53,667	71,759 r/	54,789 r/	85,000 r/	105,300 3/
Industrial clays e/					
Kaolin	250,000	300,000	250,000	300,000	350,000
Total	227,650 r/	265,591 r/	250,000 e/	350,000 r/ e/	510,000
Diatomite e/	477,650 r/	565,591 r/	500,000 e/	650,000 e/	860,000
Feldspar	85 3/	90	90	90	90
	76,873 3/	75,000	80,000 r/ e/	106,000 r/ 3/	125,000 3/

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996 e/	1997 e/
INDUSTRIAL MINERALS--Continued					
Fluorspar, fluorite e/	10,000	22,204 r/	20,163 r/	20,000 r/	20,000
Gemstones, turquoise e/ kilograms	5,000	5,000	5,000	5,000	5,000
Gypsum thousand tons	7,799	8,430	8,230	8,570 3/	8,900
Industrial or glass sand (quartzite and silica) e/	932,000 3/	950,000	1,000,000 e/	1,000,000	1,000,000
Lime e/ thousand tons	650	650	650	650	650
Magnesium compounds e/	49,424 3/	45,000	55,000	55,000	55,000
Mica e/	1,224 3/	3,000	3,000	3,000	3,000
Nitrogen:					
N content of ammonia	722,500	696,200	715,400	882,000 r/	879,800 3/
N content of urea	387,100	400,000 r/	421,800	552,900	610,500 3/
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/	185,000 3/	200,000	200,000	200,000	200,000
Salt	988,700	1,050,000	936,000	1,000 e/	1,180
Sodium compound, caustic soda e/	15,000	15,000	15,000	15,000	15,000
Stone:					
Construction and building, crushed, n.e.s. e/ thousand tons	4,500	4,800	4,800	4,800	4,800
Dimension and decorative: e/					
Granite do.	30	20	20	20	20
Marble:					
Blocks do.	3,200	4,500	4,500	4,500	4,500
Crushed do.	400	450	450	450	450
Slabs do.	20	50	50	50	50
Travertine:					
Blocks do.	300	500	500	500	500
Crushed and slabs do.	60	70	70	70	70
Total do.	4,010	5,590	5,590	5,590	5,590
Dolomite do.	173	200 e/	243	200	200
Limestone do.	26,000	28,000 e/	28,000 e/	28,000	28,000
Strontium, celestite e/	20,000	20,000	20,000	20,000	20,000
Sulfates, natural:					
Aluminum potassium sulfate (alum) e/	12,000	12,000	12,000	12,000	12,000
Sodium sulfate	280,000 3/	280,000	280,000	315,000 r/ 3/	480,000
Sulfur: e/					
Byproduct of petroleum and natural gas	750,000	830,000	840,000	840,000	850,000
Byproduct of metallurgical processing, S content of acid	50,000	50,000	50,000	50,000	50,000
Total	800,000	880,000 3/	890,000	890,000	900,000
Talc	18,000	18,000 e/	20,000 e/	20,000	20,000
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	1,665	1,720	1,640 r/ 3/	1,840 r/ 3/	1,750
Coke e/ do.	600	700	700	700	700
Gas, natural:					
Gross million cubic meters	60,000	61,000	79,600 r/	86,000 3/	89,000
Dry do.	27,100	28,200	36,600 r/	39,077 r/	43,000
Natural gas plant liquids thousand 42-gallon barrels	23,300	23,500	23,500 e/	23,500 e/	22,000
Petroleum:					
Crude do.	1,332,000	1,325,000	1,329,700	1,345,390 r/	1,337,360 3/
Refinery products: e/					
Liquefied petroleum gases do.	20,000	23,000 3/	24,000	24,000	24,000
Motor gasoline do.	50,000	51,500	54,425 r/ 3/	54,500	54,500
Jet fuel do.	8,000	9,200 3/	9,000	9,000	9,000
Kerosene do.	32,000	34,400	36,000 r/	36,000 r/	36,000
Distillate fuel oil do.	100,000	107,600 3/	104,828 r/ 3/	108,000 r/	108,000
Residual fuel oil do.	100,000	103,000	93,367 r/ 3/	95,000 r/	95,000
Other do.	40,000	35,800 3/	45,000 r/	43,000	43,000
Total do.	350,000	364,500	366,620 r/	369,500 r/	369,500

e/ Estimated. r/ Revised.

1/ Table includes data available through October 1, 1998

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.