

# MONGOLIA

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Mongolia has a wide variety of mineral resources. The geologic surveys and preliminary investigations, which were conducted by the joint exploration team of the Government and the Governments of the former Soviet Union and other member countries of the Council for Mutual Economic Assistance from 1965 to 1990, identified about 30 minerals in Mongolia. The identified mineral resources were asbestos, bismuth, clays, coal, copper, diamond, fluorite, gemstones, graphite, gold, gypsum, lead, limestone, magnesium, molybdenum, nickel, petroleum, phosphate, platinum-group metals, rare earths, salt, sand and gravel, silica, silver, talc, tin, tungsten, uranium, zeolite, and zinc.

According to the Mineral Resources Authority of Mongolia (MRAM), more than 300 mineral deposits have been studied and evaluated. These deposits included more than 100 alluvial and hard rock gold deposits, 60 salt deposits, more than 50 coal deposits, 50 tin deposits, 40 fluorite deposits, 10 tungsten deposits, 7 polymetallic (bismuth, lead, silver, and zinc) deposits, 7 iron ore deposits, 4 uranium deposits, and 2 copper-molybdenum deposits. Most of the identified large-size deposits of coal, copper, fluorite, and molybdenum had been developed since the early 1980's. As of 1998, about 88% of the country had been geologically mapped at a scale of 1:200,000 and about 11% at a scale of 1:50,000; 12% had not been mapped. More than 20% of the country's landmass had been licensed for exploration and exploitation (Mineral Resources Authority of Mongolia, January 3, 2000, Mineral resources program—Long-term program of the Government of Mongolia, accessed June 5, 2000, at URL <http://www.mram.mn/pro.htm>).

In the past 10 years, only coal, copper, fluorite, gold, and molybdenum were produced in significant quantities, and clays, gypsum, limestone, salt, silica, tin, tungsten, and zeolite were produced in small quantities. The Russians had produced petroleum during the 1950's and 1960's and uranium between 1989 and 1993. Production of crude petroleum in small quantities resumed in 1998, and uranium mining was expected to be revitalized in the next 2 to 3 years by the Government with foreign joint-venture partners.

The Mongolian Government had enacted a new mining law and a new foreign investment law in 1997 to encourage local investors and to attract foreign companies to participate in exploration and development of the country's mineral resources. Among the mineral resources with potential for development, gold resources were identified in the Zamar District along the Tuul River between Bulgan and Tov Aymags, the Khumul District of Khentii Aymag, the Ereen (Tavt) District of Bulgan Aymag, and the Tsagaan Tashir Uul District of Bayankhongor Aymag; gold and copper, in the Tsagaan Suvarga, the Shutten, and the Olon Ovoot areas of the South Govi; bismuth and silver, in the Asgat area of Bayan-Olgii Aymag; lead and zinc, in the Tumurtin Ovvo area of Sukhbaatar Aymag, the Ulaan District of

Dornod Aymag, and the Tsav District of Dornod Aymag; rare earths, in the Lugiin Gol area of Omnogov Aymag; coking coal, in the Tavan Tolgoi area of Omnogov Aymag; and uranium, in the Nemer-Mardai Gol of Dornod Aymag (Krouchkin and Trifonov, 2000, p. 34-45).

BHP Minerals International Exploration Inc., which obtained licenses from the MRAM to explore for copper and gold in the South Gobi Desert, reported the discovery of a porphyry copper deposit at its concession area of Oyu Tolgoi. Between 1996 and 1998, the company had completed 19 holes of diamond drilling in two phases with encouraging results and started the third-phase of exploration in fall 1998 (Mining Journal, 1998).

According to the Ministry of Agriculture and Industry (MAI), in 1999, the Government completed exploration in eight small districts in Uvs Aymag of northwestern Mongolia and had resulted in the discovery of several platinum-group metal deposits. The resources in the areas were estimated to contain about 22.7 metric tons (t) of platinum-group elements (Mining Journal, 1999a).

In May 1999, the MRAM, the Metal Mining Agency of Japan (MMAJ), and the Japan International Cooperation Agency signed a 2-year agreement for the MMAJ to conduct a satellite image analysis and a geochemical survey over a 200,000-square-kilometer area in north-central Mongolia beginning in June 1999. According to the agreement, the selected areas cover the northern regions of Arkhangay, Bulgan, Khuvsul, and Zavkhan and target the vein and porphyry types of copper and gold deposits. The MMAJ had conducted three or four similar geologic surveys between 1991 and 1997 in Mongolia but made no significant discoveries of mineral deposits (Metal Bulletin, 1999; Metal Mining Agency of Japan, 2000; Mining Journal, 1999b).

## Production

In 1999, production of minerals included coal, copper, fluorite, gold, gypsum, limestone, molybdenum, crude petroleum, salt, sand and gravel, silica, silver (as a byproduct of copper), and tungsten (table 1). Production of uranium had ceased in 1993 (Mining Annual Review, 1999). Production of coal, copper, fluorite, and molybdenum was by large joint-venture companies, and the rest of the minerals were produced by many small state-owned, joint-venture, and privately owned companies. The output of coal, gypsum, limestone, salt, sand and gravel, and silica was for domestic consumption. Copper, fluorite, molybdenum, and tungsten production, all in the form of concentrate, was for export. Crude petroleum was exported to China. Mined raw gold was shipped to Japan and the United Kingdom for further refining, then reexported back to Mongolia as well as to other countries. Downstream mineral processing included manufacturing cement, lime, and steel (using scrap)

and heap leaching and solvent extraction-electrowinning (SX-EW) refined copper. Cement, lime, and steel were consumed domestically and refined copper was exported. In 1999, Mongolia ranked as the world's fourth largest producer of fluorite.

The mining industry comprised two large Mongolian and Russian joint-venture companies that mined and processed copper, fluorite, gold, and molybdenum; several large state-owned and joint-venture companies that mined coal; and more than 120 medium- and small-sized state-owned, joint-venture, and privately owned companies that mined gold and other minerals, such as coal, gypsum, limestone, crude petroleum, sand and gravel, salt, silica, and tungsten. According to the National Statistical Office of Mongolia, the total number of employees in the mining industry was 17,889 in 1999 compared with 17,060 in 1998 (National Statistical Office, 1999, p. 15).

In 1999, the mining industry continued to play a major role in the industrial sector of the Mongolian economy. The output of the mining industry, which included coal, metallic minerals, and industrial minerals but excluded crude petroleum, accounted for about 50% of the output of the industrial sector. The output of the industrial sector accounted for 32.5% of Mongolia's gross domestic product (GDP) (International Monetary Fund, 2000b, p. 5, 8). In 1999, according to preliminary data released by the International Monetary Fund (2000a), the GDP grew by 3.2%, the rate of inflation was 10%, and the external debt as a percentage of the GDP stood at 87.7% in 1999. The exchange rate was 1,072 togrogs to US\$1.00.

Mongolia was a net exporter of minerals in 1999. Its exports of mineral products accounted for about 40% of total exports, and imports of mineral products accounted for about 20% of total imports. The major mineral exports were gold, crude petroleum, and copper, fluorite, and molybdenum ore and concentrates. The major mineral imports were coal, base metals, and refined petroleum products, such as gasoline, jet fuel, and diesel oil. According to the Government's 1999 trade statistics, exports of copper concentrates were valued at \$111.7 million; refined copper, \$2.4 million; fluorite concentrates, \$12.7 million; and molybdenum concentrates, \$8.5 million. In 1999, Mongolia's total exports were \$335.6 million, and total imports were \$425.8 million (National Statistical Office, 1999, p. 12, 37). In 1999, exports of copper ore and concentrates were 468,300 t, fluorite concentrates, 111,500 t, and molybdenum ore and concentrates, 4,000 t. Copper concentrates were exported to China, the Republic of Korea, and Russia; fluorite concentrates, to China, Germany, and Russia; and molybdenum concentrates, to China and Russia (National Statistical Office, 1999, p. 37-38).

## Commodity Review

**Copper and Gold.**—At Erdenet Mining Corp. (EMC)'s Erdenet Mine, copper production increased by 1% to 126,700 t compared with that of 1998, and molybdenum production increased by 5% to 2,100 t compared with that of 1998. In 1999, the ore output from the mine was 22.3 million metric tons (Mt) grading 0.69% copper. The Erdenet mill produced 361,900 t of copper concentrates grading 35% copper and 4,157 t of molybdenum concentrate grading 50% molybdenum. Following implementation of a program to increase efficiency and to cut production costs, EMC posted a profit of about \$5.4

million in 1999. Reduced costs of transportation, sale, and imported electricity also had a positive effect on the company profitability in 1999 (U.S. Embassy, Ulaanbaatar, Mongolia, 2000).

The Erdmin Co. Ltd. continued operation of its 3,600-metric-ton-per-year (t/yr) SX-EW pilot plant to extract copper from pregnant solution from the mine leach dump near the Erdenet Mine. According to information provided by the Mining Office of the MRAM, Erdmin's SX-EW pilot plant produced 1,545 t of copper cathode in 1999, which was a decrease of 34% compared with 1998 production.

Armada Gold Corp. (AGC), which was the 49% owner and operator of Erdmin's SX-EW pilot plant, announced in August that it had sold its 49% interest in Erdmin to Strand Holdings Ltd. (SHL) of the Cayman Islands for about \$8 million. Under the agreement, SHL would assume AGC's \$5 million liability to Marubeni Corp. of Japan in relation to the guarantee of the project loan for the financing of the phase I pilot plant (Armada Gold Corp., 1999).

Mine production of gold held steady at about 10 t in 1999. According to the MRAM, 99 gold mining companies were operating. A large and growing number of small-scale, low-cost placer gold miners were operating mainly in the mining districts of Sergelen and Zaamar in Tuv Aymag and in the mining districts of Bayangol, Eroo, Khuder, and Mandal in Selenge Aymag in north-central Mongolia.

In Mongolia, 11 regions with gold resources have a total estimated gold resource of about 3,400 t. In 1998, 118 gold mining companies produced about 10 t of gold. Between 1992 and 1997, about 24.5 t of raw gold was shipped overseas to Japan and the United Kingdom for further refining. As part of the Government's Gold-2000 program, the MAI and the Ministries of Finance and of Nature and Environment issued a joint tender in late 1998 for building a 10 t/yr gold refinery in Mongolia (Mongolian National News Agency, January 18, 1999, Headlines—Mongolia has 3,400 tons of estimated gold resources, accessed January 21, 1999, at URL <http://www.mol.mn/news/english/monday.htm>). The joint tender was extended to March 30, 1999. The gold refinery project appeared uncertain by yearend 1999.

Mongolrostsvetmet Corp. (MONROS), which was Mongolia's largest gold producer, operated gold mines mainly in the Tuul riverbed of the Zaamar District and in the Tolgoit area of the Eroo District. The state-owned Erel Co., which was the second largest gold producer, operated gold mines in Bayangol terrace in the Zaamar District. The 90% state-owned Khailaast Co., which was one of the major gold producers that operated in Zaamar District, was privatized through a sealed bid auction by the Government in December 1999 (Engineering & Mining Journal, 2000). Khailaast, which had an output capacity of about 300 kilograms per year (kg/yr) at the Khailaast placer deposit in Zaamar District, produced only 157 kilograms (kg) in 1999 because of financial difficulties. Khailaast also held a mining license in the Bayangol riverbed in the Zaamar District.

Other operating state-owned gold mining companies were Almaas Co., Bayangol Jalga Co., Erdes Co., Ikh Alt Co., Ikh Uvuljuu Co., Jalga Alt Co., Jargalant Co., Khavchuu Alt Co., Mongol-Czech Metal Co., Shijir Alt Co., and Shoroon Ord Co. Other gold mining areas were at Sharin Gol, Havchuu, Ikh Uvuljuu, and Burhant in north-central Mongolia; Mukhar Ereg and Uvur Chuluut in the Bayakhongor area of southwestern

Mongolia; and Bumbat, Nariin Gol, Tsagaan Chulut, and Tosongin Gol, as well as many other placer deposits, along the Tuul River in north-central Mongolia.

As a result of a Government-imposed 10% export tax on gold that began in November 1998, some foreign mining companies shut down their gold mining operations, but the export tax did not have a negative impact on the operations of local gold mining companies, because the local miners must sell all their gold production to the Mongolian central bank (Engineering & Mining Journal, 1999). The two foreign companies that were still active in gold exploration and development in 1999 were Cascadia Mining Inc. and Java Gold Corp. Antigua-and Barbuda-based Cascadia completed its second year of exploration in the north of Khentii Aymag in 1998 and discovered gold mineralization at its Gatzuurt and Yalbag concession areas. Cascadia was expected to spend \$2 million to conduct further exploration in 1999. Canada-based Java Gold brought its recently modified and newly installed gold recovery plant on-stream at its Toson terrace mining license area in the Zaamar District. Ground preparations for extended open pit mining were completed by the company in 1999. Java Gold's exploration of the placer gold deposit at its Tsagaan Chullut II concession area in northeastern Mongolia, however, was suspended in September because of the widespread flooding that resulted from heavy rain and the mechanical failure of the contract drill (Asian Journal of Mining, 1999b).

**Cement.**—Cement production decreased by 4.6% to 104,000 t compared with that of 1998. The cement industry comprised only two cement works in north-central Mongolia. The 100% state-owned Hutul Cement and Lime Co. operated a 500,000-t/yr plant at Hutul in Saikhan, Selenge Aymag. The Hutul plant was virtually shut down from 1992 to 1994 and was reopened in 1995. It produced less than 50,000 t of cement and 49,500 t of lime in 1999. Most of Hutul's cement and lime output was consumed by EMC at the Erdenet complex. The 51% state-owned Arbet Co. Ltd., which operated a 200,000-t/yr plant near Darhan, produced less than 50% of its installed capacity.

**Coal.**—Coal production remained below 5 Mt in 1999. The two major operating coal mines were the Baga Nuur and the Shariyn Gol. The medium-scale operating coal mines were the Aduunchuluun and the Shivee Ovoo. Many small-scale coal mines were operating mainly at Bayanteeg, Hudlun, Mogoingol, Talbulag, and Tevshingobi. Additionally, three metallurgical-grade coal mines were operating at Har Tarvagataj and Nuurshotgor in Uvs Aymag and at Tavan Tolgoit in Omnogov Aymag.

According to the Fuel Department of the Ministry of Infrastructure Development, the Baga Nuur, the Shariyn Gol, and the Shivee Ovoo Mines began implementing their rehabilitation projects in 1999 to improve the efficiency of the country's coal industry. The projects involved introduction of advanced coal mining equipment and technology, new accounting systems, and strict environmental protection measures with financial aid from the World Bank and the Japanese Government and technical assistance from the United States (Asian Journal of Mining, 1999a).

According to the MRAM, of the total coal production of about 5 Mt in 1999, about 29% was bituminous and 71% was lignite and sub-bituminous. Consumption of coal totaled about

5 Mt, of which the thermal powerplants consumed about 4 Mt; industry and construction, 465,000 t; communal housing and public services, 192,000 t; and agriculture and other end users, 136,000 t (International Monetary Fund, 2000b, p. 9).

**Fluorspar.**—Production of fluorspar by MONROS totaled 561,500 t of ore, of which more than 90% was processed into acid- and metallurgical-grade fluorspar concentrate. The total output of fluorspar concentrate decreased in 1999 since poor market conditions caused Russian demand for fluorspar to decline. MONROS operated two fluorspar mines at Berkh and Bor Ondor and a fluorspar concentrator at Bor Ondor in Khentii Aymag. The company also operated two fluorspar mines at Airag, Khajuu Ulaan, and Urgan in Dornogov Aymag. The fluorspar concentrator had the capacity to produce 140,000 t/yr of acid-grade concentrates and 40,000 t/yr of metallurgical-grade concentrates. The concentrator produced three types of acid-grade concentrate with CaF<sub>2</sub> content that ranged from 95% to 97% and impurities of SiO<sub>2</sub> that ranged from 2% to 3%; CaCO<sub>3</sub>, from 1% to 2%; S, 0.05%; and P, from 0.03% to 0.06%. The concentrator also produced eight types of metallurgical-grade concentrate with CaF<sub>2</sub> content that ranged from 75% to 92% and impurities of SiO<sub>2</sub> that ranged from 5% to 20%; S, 0.05% to 0.1%; and P, 0.04% to 0.1%. MONROS was seeking foreign capital to expand the capacity to 155,000 t/yr of acid-grade fluorspar concentrate and 45,000 t/yr of metallurgical-grade fluorspar concentrate by 2000. Most of the concentrates were exported to Russia as raw materials for the Russian chemical, iron and steel, and nonferrous metals industries. Earnings from fluorspar concentrate exports were \$12.7 million in 1999 (National Statistical Office, 1999, p. 37).

**Natural Gas and Oil.**—Production of crude petroleum by SOCO Tamsag Mongolia, Inc. (SOTAMO) from its 19-3 well in block XIX in the Tamsag basin totaled 71,900 barrels in 1999. Under a sale contract signed with China National Petroleum Corp. in 1998, SOTAMO sold and transported crude petroleum from its 19-3 well by truck to the Aershan pipeline terminal in Inner Mongolia. The crude petroleum was then delivered by pipeline and rail car to a refinery at Hohhot, China (Oil & Gas Journal, 1998).

To provide fiscal incentives for oil and gas exploration, the Parliament approved a proposal to exempt equipment and spare parts for oil exploration and extraction and consumer goods and foods used by oil workers from custom duties (U.S. Embassy, Ulaanbaatar, Mongolia, 2000).

To reduce the import reliance on refined petroleum products such as gasoline, jet fuel, diesel, and fuel oil, Oyunii Undraa and Subbo, which were two Mongolian companies, reached an agreement with two unnamed Canadian and Chinese companies to build a 30,000-barrel-per-day oil refinery in the Nalaikh District in 1999. Construction of the \$150 million project was expected to start in June 1999. About 70% of the project cost would be funded by the two foreign companies. The construction labor force will comprise Chinese and Mongolian workers (Mongolian News Agency, May 28, 1999, Oil refinery to be erected in Nalaikh District, accessed June 2, 1999, at URL <http://www.mol.mn/montsame/news/english/friday.htm>).

**Uranium.**—Mongolia stopped uranium production in 1993. Previous uranium mining carried out by the Erdes Mining

Enterprise, which was a joint venture between Mongolia and Russia, was in the Mardai District, Dornod Aymag. Open pit and underground mining operations with the capacity to treat 2 million metric tons per year of ore were developed by Erdes in 1989. According to the International Atomic Energy Agency's estimate, the annual production varied between 104 t and 195 t of uranium from 1989 to 1992. In June 1997, Mongol Erdene Holding (MEH), which was a division of the Mongolian Ministry of Agriculture and Industry, reached an agreement with Priargunskij Mining and Chemical Association (PMCA), which was a division of the Russian Ministry of Atomic Energy, and the Toronto-based World Wide Minerals Ltd. (WWML) to establish Central Asian Uranium Co. Ltd. Central Asian Uranium was owned 58% by WWML, which was the operator, and 21% each by MEH and PMCA (Mining Annual Review, 1999).

WWML had reactivated the open pit uranium mine and completed construction of leach pad no. 1 in mid-1998. According to the company, plans for continued mining and acquisition of additional mining equipment and the leach plant, as well as plans to reopen the underground mine, were delayed as of August 7, 1998. This was because of unfavorable market conditions and a shortfall in corporate capital resulting from a delay in recovering investment from Kazakhstan. Despite the delay, the company indicated that it was still in a position to complete construction of the phase I project in time to deliver uranium under existing sales contracts in 1999. In July 1999, WWML announced that it had formed WM Mining International Ltd. (WMMI) of Denver, Colorado, which was a new mining and marketing unit for its uranium interest. WWML's uranium-related assets included uranium interests in the United States and in Mongolia's Dornod uranium mine. Existing uranium sales agreements were transferred from WWML to WMMI for about \$6.3 million. WMMI indicated that it still planned to continue the previous efforts of WWML to produce up to 1,360,776 kg/yr of uranium concentrate from the Dornod Mine (World Wide Minerals Ltd., 1999).

In June 1999, the Governments of Mongolia and Russia signed an agreement to abolish the protocol on the concession agreement for exploitation of uranium in Mongolia signed between the Governments of Mongolia and the Soviet Union on December 23, 1981. Under the 1999 agreement, the infrastructure and properties, which included buildings of Erdes in the Mardai District, were to be transferred to Mongolia (Mongolia News Agency, June 11, 1999, Concession agreement on Mardai uranium abolished, accessed June 21, 1999, at URL <http://www.mol.mn/montsame/news/english/friday.htm>).

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## Major Source of Information

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## Major Publication

National Statistical Office of Mongolia, Ulaanbaatar:  
 Statistical Bulletin, monthly and Mongolian Statistical  
 Yearbook, annual.

TABLE 1  
MONGOLIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/	1995	1996	1997	1998	1999
Cement, hydraulic thousand tons	109	106	112	109	104
Coal do.	5,019	5,111	4,924 r/	5,057 r/	4,952
Copper:					
Mine output, Cu content e/ 3/	121,900 r/	123,000 r/	124,400	125,400 r/	126,700
Metal, refined	--	--	2,703 r/	2,322 r/	1,545
Fluorspar:					
Acid grade thousand tons	120	130	130	123 r/	108
Submetallurgical and other grade do.	13	37	41	46 r/	46
Total do.	133	167	171	169 r/	154
Gold, mine output, Au content 4/ kilograms	4,504	6,976	8,451 r/	9,531 r/	10,246
Gypsum e/ thousand tons	25	25	25	10	10
Lime, hydrated and quicklime do.	51	55	58	56	50
Molybdenum, mine output, Mo content e/ 3/	1,820 r/	2,200 r/	2,000 r/	2,000	2,100
Petroleum, crude thousand 42-gallon barrels	--	--	--	50 r/	72
Salt, mine output	726	696	1,354	1,400 e/	1,400 e/
Silver, mine output, Ag content e/ 5/ kilograms	19,100	19,300	22,800	19,700 r/	19,900
Steel, crude	22,239	22,605	22,700	16,300	13,100
Tin, mine output, Sn content e/	34	18	10	40	--
Tungsten, mine output, W content e/	34	17	26	35 r/	16 e/
Uranium, mine output, U content e/	-- r/	--	--	--	--

e/ Estimated. r/ Revised.

1/ Table includes data available through June 23, 2000.

2/ In addition to the commodities listed, crude construction materials, such as sand and gravel; varieties of stone, such as limestone; and silica are produced, but available information is inadequate to make reliable estimates of output levels.

3/ Based on 35% Cu and 50% Mo content, respectively, of reported copper and molybdenum concentrates.

4/ Reported raw gold production but excluded gold contained in copper concentrate.

5/ Based on 55 grams of silver per metric ton of copper concentrate.

Sources: National Statistical Office of Mongolia (Ulaanbaatar). Mongolian Statistical Yearbook 1997, p. 183 and p. 185; Statistical Bulletin, December 1999. Mineral Resources Authority of Mongolia, Mining Office, Output of Mineral Commodities (Minerals Questionnaire 1996-99).