



2010 Minerals Yearbook

MONGOLIA

THE MINERAL INDUSTRY OF MONGOLIA

By Susan Wacaster

Mongolia sits on the northern edge of the Precambrian Siberian Craton and is part of the Central Asian Orogenic Belt, which contains many lithotectonic terranes that were accreted during Paleozoic and lower Mesozoic times. The entire country has been mapped geologically at a scale of 1:200,000 and has been structurally divided into Precambrian microcontinent massifs, Paleozoic fold belts and intermontane basins, and upper Paleozoic to lower Mesozoic volcanic provinces. Other important structures include intrusive complexes, Upper Cretaceous to Miocene platform cover, and Cenozoic tectonic blocks that contribute to the present landscape and mineralized exposures. About 25% of Mongolia's territory has been mapped geologically at a scale of 1:50,000 and explored for mineral occurrences (Elsner and others, 2011, p. 52–58; Mineral Resources Authority of Mongolia, 2011a, b).

Mongolia has large proven reserves of coal, copper, fluor spar, and gold. In 2010, Mongolia was estimated to be the world's third ranked producer of fluor spar after China and Mexico, producing both acid and metallurgical grades. There are more than 600 deposits and occurrences of fluorite in Mongolia, mostly of epithermal or hydrothermal origin, which can be divided into two groups by their genetic relationship to magmatic rocks; one group related to volcanic rocks, and the other to plutonic rocks. The country's fluor spar production, although significant, accounted for only about 5.5% of the estimated world total (Elsner and others, 2011, p. 5; Miller, 2011).

In 2010, Mongolia's economy benefitted from increasing global prices for some mineral commodities, external demand for coal and iron ore, and investment in mining, including construction at Ivanhoe Mines Ltd. of Canada's Oyu Tolgoi property—a world class copper and gold project scheduled to start commercial production in 2013. Economic growth in China, which was Mongolia's primary trading partner, led to increased Mongolian mineral exports. Economic growth in Mongolia was reportedly supported by an agreement with the International Monetary Fund (IMF) through which Mongolia received commitments of \$184 million in budget support from IMF development partners. Higher commodity prices and cash advances connected with the Oyu Tolgoi project contributed to a 55% increase in Government revenue. The Government raised public sector wages by 30%, and inflation accelerated to nearly 13% by yearend. Unemployment decreased throughout the year but was still at 8.6% by yearend (Beecher and others, 2011, p. 1–2).

Minerals in the National Economy

According to the National Statistical Office of Mongolia, preliminary estimates of the 2010 gross domestic product (GDP) (at current prices) indicated a year-on-year increase of 25.3% compared with that of 2009, or a 6.1% increase in the

GDP (at constant prices, with 2005 as the base year) compared with a 1.3% contraction in 2009. That growth was attributed primarily to increases in wholesale and retail trade and the construction and transportation sectors. Compared with that of 2009, increases of 11.3% and 6.3%, respectively, were recorded in the manufacturing sector and mining and quarrying sectors (National Statistical Office of Mongolia, 2010, p. 14; World Bank, The, 2011, p. 7).

According to the World Bank's quarterly economic update for Mongolia, the value of the mining sector, as a percentage of the GDP, increased by about 3% year-on-year in the last quarter of 2009 and by the same amount in the first and third quarters of 2010, but there was almost no growth in the second quarter of 2010, and a 2% contraction in the fourth quarter, all of which appeared to correlate with GDP trends for the same periods. The report also presents results of the sector's production on a 12-month moving average basis to control for seasonality and indicates that production increased from the end of 2009 until about November 2010, when it slowed, but that into the spring of 2011, production had picked up again with 10.6% year-on-year growth compared with only 1.4% year-on-year growth for the same period in 2009 (World Bank, The, 2011, p. 7).

By March 2011, Mongolia's fiscal surplus increased to 2.5% of the GDP compared with a 5% deficit in March 2010. That growth was attributed to mineral royalties, which more than tripled after the rate on some mineral commodities increased from 5% to 15%, as well as to an 82% increase in customs duties, an 80% increase in the value-added tax, and a 28% increase in the corporate income tax. Together, these increases would reportedly counter the repealed windfall profit tax [a 68% tax that had been applied to revenues from prices exceeding base prices of \$2,600 per metric ton for copper and \$850 per troy ounce for gold] (Ivanhoe Mines Ltd., 2006; World Bank, The, 2011, p. 12).

In May 2010, it was reported that investment firm Rodman & Renshaw LLC of New York and the Mineral Resources Authority of Mongolia had signed a memorandum of understanding to form a partnership to aid the development of Mongolia's mining sector. Objectives of the agreement were to enhance Mongolian companies' abilities to finance mining projects and increase access to outside capital sources, and facilitate the transparent flow of information and knowledge regarding the mining sector in general (Rodman and Renshaw LLC, 2010).

Foreign investment in mining increased by 49% to about \$1.1 billion in 2010 compared with \$750 million in 2009. The amount of foreign investment dollars received by Mongolia began to increase significantly in 2007 when the amount increased by 246% compared with that of 2006 to \$437 million. It was around that time that major construction was being completed at Oyu Tolgoi and the project was expected to come online in 2007. It was also at that time that a revised Minerals Law was approved by the Mongolian Parliament and conflicts began to arise about the distribution of ownership.

Nonetheless, development continued, and investment dollars continued to flow into the country for Oyu Tolgoi as well as for coal development and other projects in the country (Mineral Resources Authority of Mongolia, 2011b, p. 23).

Government Policies and Programs

Mineral resources in Mongolia are the property of the state. The Minerals Law of Mongolia regulates the prospecting and exploration for, and the mining of, minerals within the country's territory. Numerous laws, guidelines, and procedures govern the prospecting, exploration, and mining of minerals, and include the Constitution of Mongolia, the Environmental Protection Law, the Land Law, the National Security Law, the Subsoil Law, and the Water and Forest Law, among others.

Investment agreements are made jointly between the investor and the Mongolian cabinet. Investment agreements can be concluded if a mining license holder undertakes to invest \$50 million during the first 5 years of a mining project. For larger amounts, the Government may establish an investment agreement with the mining license holder for terms of 10, 15, or 30 years when the amount of investment is, respectively, between \$50 million and \$100 million, \$100 million and \$300 million, or greater than \$300 million (Mineral Resources Authority of Mongolia, 2011b).

Production

In 2010, coal production increased to about 25.2 million metric tons (Mt), or by 92% compared with that of 2009. The increased production was owing in part to the continued increase in sales and exports from South Gobi Energy Resources Ltd. of Canada's Ovoot Tolgoi Mine, which was commissioned in 2008. Gold production decreased by 38% to about 6,000 kilograms (kg) in 2010. Gold production had decreased steadily since at least 2006, which was partly owing to some older mines processing lower grades and (or) reaching the end of their production life as new projects were approaching development. Production of acid-grade fluorspar increased by about 22% to 141,000 metric tons (t) and production of iron ore more than doubled. At the end of 2010, the country reported that it had stockpiles of about 108,000 barrels of crude petroleum, 2,700 t of copper concentrate, 31 t of molybdenum concentrate, and 97 t of copper metal (table 1; National Statistical Office of Mongolia, 2010, p. 117).

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities. Most mining facilities in Mongolia are state owned. Of about 4,100 licenses issued in the country as of the end of 2010, 2,900 were for exploration or prospecting and more than 1,000 were for mining or excavation. By investment share, 70% of the license holders were domestic enterprises and 30% were joint ventures with foreign investment enterprises. In 2010, there were approximately 16,300 known employees in the mining and quarrying sector, which was a 7% increase compared with the number in 2009. Of that total, 5,200 worked in the mining of coal and lignite and the extraction of peat, 400 worked in the

extraction of crude petroleum and natural gas, 8,700 worked in the mining of metal ores, and 2,000 worked in other mining and quarrying enterprises. According to the Mongolia stock exchange, mining companies accounted for 28% of the total companies listed on the exchange in 2010 (National Statistical Office of Mongolia, 2010, p. 22; Mineral Resources Authority of Mongolia, 2011b, p. 23; World Bank, The, 2011, p. 23).

Mineral Trade

In 2010, the value of exports from Mongolia increased by 54% to \$2.9 billion, and that of imports to Mongolia increased by 53% to about \$3.3 billion, which resulted in a trade deficit of \$400 million compared with a deficit of \$229 million in 2009. China was the leading recipient of Mongolian exports, in terms of value, and accounted for about \$2.4 billion (compared with \$1.4 billion in 2009), or 82% of the total, followed by the United States and Canada, which, combined, accounted for about 10% of the total, or \$149 million and \$141 million, respectively. The value of exported (unspecified) mineral products increased by 77% to \$2.3 billion compared with \$1.3 billion in 2009 (National Statistical Office of Mongolia, 2010, p. 74–77).

The volume of Mongolian copper exports changed little in 2010, but their value increased by greater than 50% to \$770.6 million as 567,000 t of copper concentrate was exported compared with 587,000 t valued at \$502.0 million in 2009. China imported virtually all of Mongolia's copper concentrate in both years. In 2010, 2.8 Mt of refined copper and copper alloys was exported from Mongolia compared with 2.3 Mt valued at \$11.9 million in 2009.

In 2010, 376,200 t of fluorspar valued at \$63.2 million was exported from Mongolia compared with 314,000 t valued at \$48.2 million in 2009. China imported ore and concentrate valued at \$13.6 million compared with \$14.0 million in 2009, and Russia imported ore and concentrate valued at \$44.6 million compared with \$27.9 million in 2009. China and Russia accounted for 92% of Mongolia's fluorspar exports.

Mongolia exported about 4,800 t of molybdenum ores and concentrate valued at \$52.0 million compared with 6,700 t valued at \$50.3 million in 2009. Of that amount, China received ore and concentrate valued at \$21.8 million compared with \$35.6 million in 2009, and the Republic of Korea received ore and concentrate valued at \$26.9 million compared with \$13.0 million in 2009. Molybdenum exports to China and the Republic of Korea accounted for 94% of Mongolia's total molybdenum exports in 2010. In 2010, Mongolia exported 5.1 t of gold valued at \$178.3 million compared with 10.9 t valued at \$308.4 million in 2009. Canada received gold valued at \$141 million compared with \$147 million in 2009 and the United Kingdom received gold valued at \$37 million compared with \$115 million in 2009. Canada and the United Kingdom accounted for all of Mongolia's gold exports in 2010 (National Statistical Office of Mongolia, 2010, p. 77–79).

In 2010, Mongolia exported 3.5 Mt of iron ore valued at \$251 million compared with 1.6 Mt valued at \$88.8 million in 2009; about 120,000 t of zinc concentrate valued at \$134 million compared with 150,700 t valued at \$122.5 million in 2009;

about 16.6 Mt of coal valued at \$877.6 million compared with 7.1 Mt valued at \$303.3 million in 2009; and about 2.1 million barrels (Mbbbl) of crude petroleum valued at \$154.9 million compared with 1.9 Mbbbl valued at \$115.6 million in 2009 (National Statistical Office of Mongolia, 2010, p. 77–79).

In 2010, Mongolia imported \$759 million worth of (unspecified) mineral products compared with \$570 million in 2009; \$203 million worth of base metals and articles thereof compared with \$164 million in 2009; \$60 million of articles of asbestos, cement, glass and glassware, plaster, and stone compared with \$52 million in 2009; and \$1.3 million worth of jewelry, natural or cultured stones, and precious metal compared with \$832,900 in 2009 (National Statistical Office of Mongolia, 2010, p. 84).

Commodity Review

Metals

Copper and Gold.—Voyager Resources Ltd. of Australia acquired 100% of the Argalant copper gold project in Mongolia. The project is located approximately 900 kilometers (km) west of Ulaanbaatar. Mineralization was identified at the Ovoot, Gozgor, and Tshiot deposits. Sampling of the quartz sulfide veins of the Gozgor prospect returned values of up to 191 grams per metric ton gold. By spring 2011, the company had entered into an agreement with an unnamed Mongolian company to acquire up to 80% of the Khul Morit copper project in the Gobi region of Mongolia. The deposit is located in the Edrene Island Arc Terrain, which hosts a number of mineralized porphyry systems, including Oyu Tolgoi. Voyager planned to complete 10,000 meters of exploratory drilling in 2011 with the goal of outlining a significant copper porphyry system (Voyager Resources Ltd., 2010, 2011).

In 2010, Centerra produced about 3,500 kg (reported as 111,139 troy ounces) of gold at Boroo. Boroo began commercial production in March 2004 and produced 47,000 kg (about 1.5 million troy ounces) of gold, primarily from disseminated sulfide veins. By November 2010, mining ceased at Boroo, but the operation continued to mill stockpiled ore. The company's Gatsuurt project is located 35 km from the Boroo Mine, and a road connecting the two properties was completed in 2010. The project had been scheduled to start operations in 2010, but commissioning had been delayed because of uncertainty regarding the Water and Forest Law that had been implemented in 2009 (Centerra Gold, Inc., 2011).

The Oyu Tolgoi mining complex was owned by Ivanhoe Mines Ltd. of Canada (66.6%), the Government of Mongolia (34%), and Rio Tinto plc of the United Kingdom (which was expected to increase its ownership in Ivanhoe to 49% from 22.4% by late 2012). At the end of 2010, estimated reserves and resources included proven and probable reserves of 4.68 Mt of contained copper and about 333,000 kg (reported as 10.7 million troy ounces) of contained gold in the Southern Oyu zone, 7.8 Mt of contained copper and about 165,000 kg (5.3 million troy ounces) of contained gold in the Hugo north zone as well as total measured and indicated resources of 5.7 Mt of contained copper and 156,000 kg (5.0 million troy ounces).

of contained gold for both the Hugo North and the Southern Oyu deposits combined. In May 2010, Ivanhoe released an integrated development plan with estimated production of at least 544,000 t of copper and 650,000 troy ounces of gold every year for the first 10 years of operation and as much as 800,000 t of copper and 1.1 million troy ounces of gold for a single peak year of production. The operation was expected to start up in 2013 (Ivanhoe Mines Ltd., 2010a, p. 1–4; 2010b, p. 1–7, 14–20, 314; Marketwire.com, 2010; Rio Tinto plc, 2010).

Industrial Minerals

Rare Earths.—According to the Mineral Resources Authority of Mongolia, there are four known rare-earth deposits in Mongolia (as well as a number of occurrences that have no commercial value, as they are either very low grade or very small). These include the Tzagann Chuluut placer deposit in Hentiy Aymag (contains 758 t of monazite); the Khalzan Burged rare-earth and metals deposit in Hovd Aymag (the primary ore minerals are bastnaesite, columbite, elpidite-armstrongite, pyrochlore, and zircon with numerous secondary ore minerals); the Mushgai Khudag rare-earth deposit in the Omnogovi Aymag (at least 17 ore bodies, including carbonatitic ore and phosphatic ore in which the main rare-earth minerals are apatite, bastnaesite, parasite, perrierite, and synchysite); the Lugin Gol deposit in the Dornogovi Aymag, which is a nepheline syenite complex with carbonatitic veins (the rare earths are primarily associated with synchysite and rarely parasite; accessory minerals include sulfides of copper, iron, lead, manganese, molybdenum, and zinc) (Elsner and others, 2011, p. 248–262).

Mineral Fuels and Related Materials

Coal.—Coal production nearly doubled in 2010 compared with that of 2009 to about 25 Mt. Mongolia began exporting coal in 2003 when about 6 Mt was produced annually, and production increased steadily since that time. According to the Mineral Resources Authority of Mongolia, coal exports were expected to increase to about 50 million metric tons per year by 2015 based upon the current transportation infrastructure. If infrastructure developments take place faster than planned, that volume would likely increase, provided that demand remains high. The country's coal resources were estimated to be 162.3 billion metric tons (Gt) based solely upon currently explored deposits. The coal sector was planning to develop its refining potential so that it could discontinue exporting primarily raw coal, and would export refined coking coal instead (Mineral Resources Authority of Mongolia, 2011b, p. 15).

Mongolia's still unexploited Tavan Tolgoi coal deposit contained a reported 6.5 Gt of coking coal. In 2010, the Government canceled the auction of an estimated \$2 billion stake in Tavan Tolgoi. By the spring of 2011, reports were released stating that the initial public offering (IPO) by Erdenes MGL (the Mongolian state-owned company that controlled the deposit), would take place by the end of 2011 or in early 2012. Erdenes reportedly planned to retain ownership of 50% of the project and would distribute 10% of the shares to Mongolian citizens, 10% to Mongolian companies, and 30%

to the IPO (Chinese Stock Information, 2010; Fidelity.com, 2011).

Uranium.—There were at least one-half dozen uranium projects in development in 2010. China National Nuclear Corp. (CNNC) International Ltd.'s wholly owned Gurvanbulag uranium project was expected to start production in 2012. In the spring of 2010, CNNC International had applied for mining licenses, and exploration had resumed after a 2009 suspension of the company's exploration licenses was lifted (China National Nuclear Corporation International Ltd., 2010, p. 7).

Outlook

The mining industry in Mongolia is expected to grow and develop in the near future, not only because of the large mineral endowment in the country but also because of its proximity to, and trade with, China, which is expected to sustain its growing demand for mineral commodities. In 2010, at least one-half dozen metals projects were in the prefeasibility or feasibility stage for production of copper, gold, molybdenum, silver, and uranium. Several of these projects were expected to be commissioned by sometime in 2013, including Oyu Tolgoi. Although mining investment in Mongolia had been directed primarily towards coal, copper, and gold, the country also has significant industrial mineral deposits that could be developed more quickly as a means for relatively near-term economic stimulus, provided that there is sufficient transportation infrastructure. The eventual development of the Tavan Tolgoi coal deposit would be a significant step in growing the country's coal and industrial minerals sector. Mongolia faces challenges to develop the mining sector responsibly, not only in terms of the environment and industry practices, but also economically in order to avoid a widening trade deficit and inflation that could be the result of rapid economic growth associated with the mining sector.

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TABLE 1
MONGOLIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2006	2007	2008	2009	2010
Cement, hydraulic thousand metric tons	141	180	270	235	323
Coal, unspecified do.	7,885	9,560	9,692	13,164	25,246
Copper:					
Mine output, Cu content	129,693	130,160	126,796	129,800	124,985
Metal, refined	2,618	3,007	2,587	2,470	2,746
Fluorspar:					
Acid grade thousand metric tons	138	131	116	115	141
Submetallurgical and other grade do.	255	250	219	344	259
Total do.	393	381	335	459	400
Gold, mine output, Au content ³ kilograms	22,561	17,473	15,184	9,803	6,037
Iron ore:					
Gross weight do.	180	265	1,387	1,380	3,203
Iron content do.	116	170	888	883	2,050
Lime, hydrated and quicklime do.	60	43	55	43	50
Molybdenum, mine output, Mo content	1,404	1,978	1,780	2,140	2,198
Petroleum, crude thousand 42-gallon barrels	369	913	1,174	1,870	2,181
Salt, mine output	1,154	1,143	1,176 ^r	1,402 ^r	1,861
Silver, mine output, Ag content ⁴ kilograms	28,000 ^e	28,100 ^e	28,890	29,321 ^r	28,710
Steel, crude	70,000	80,400	81,400	50,100 ^r	64,200
Stone, crushed thousand metric tons	134 ^r	144 ^r	103 ^r	123 ^r	101
Tungsten, mine output, W content	85	245	142	39	20
Zinc, mine output, Zn content	54,850	77,350	143,600 ^r	141,500	112,600

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through June 30, 2011.

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

³Reported raw gold production but excludes gold contained in copper concentrate.

⁴Based on 55 grams per metric ton of silver in copper concentrate.

Sources: Mineral Resources Authority of Mongolia (2006–2009); National Statistical Office of Mongolia (2007–2010).

TABLE 2
MONGOLIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2010

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities ¹	Annual capacity ^c
Calcium oxide		Qinhua MAK Naryn Sukhait LLC (Mongolia-China joint venture)	316 km from Ulaanbaatar at the Olon Ovoot station of the Trans Mongolia railway	50
Cement		Khutul Cement and Lime Factory	Darhan, Darhan-Uul Aymag	500
Coal		Baganuur Joint Stock Co. (Government, 75%, and public, 25%)	Baganuur Mine, Tov Aymag	3,000
Do.		Government, 95%, and public, 10%	Shivee Ovoo Mine, Dundgovi [Middle Gobi] Aymag	2,000
Do.		SouthGobi Energy Resources Ltd. (Ivanhoe Mines Ltd., 80%)	Ovoot Tolgoi Mine, Omnogovi [South Gobi] Aymag	3,000
Do.		MAK Mongolyn Alt Group, 100%	Eldev Mine, Dornogovi Aymag, 300 km southeast of Ulaanbaatar	500
Do.		do.	Naryn Sukhait Mine, Omnogovi [South Gobi] Aymag, 900 km southwest of Ulaanbaatar	3,000
Do.		Qinhua MAK Naryn Sukhait LLC (Mongolia-China joint venture)	Naryn Sukhait Mine and infrastructure	1,500
Copper, Cu in concentrates		Samsung Corp., 51%, and Erdenet Mining Corp. (Mongolia-Russia joint venture), 49%	Erdenet Ovoo open pit mine and processing plant, Bulgan Aymag, 225 km northwest of Ulaanbaatar	490
Copper, Cu in cathodes		Erdenet Mining Corp. (Mongolia-Russia joint venture), 51%, and Strand Holdings Ltd., 49%	Erdmin solvent extraction-electrowinning plant	3
Gold	kilograms	Centerra Gold, Inc., 100%	Boroo operation; 110 km northwest of Ulaanbaatar	11,000
Do.	do.	Mongolrosvetmet LLC	Zaamar placer gold operation, Tov Aymag, 240 km southwest of Ulaanbaatar	2,000
Do.	do.	Erdes Holding LLC	Placer deposits in Selenge Aymag, 230 km north of Ulaanbaatar	NA
Fluorspar		Mongolrosvetmet LLC	Bor-Undur Mine and processing plant, Hentiy Aymag, 310 km southeast of Ulaanbaatar; 2 underground and 3 open pit mines	450
Do.		do.	Urgen Mine, Dornogovi Aymag, 525 km from Ulaanbaatar	120
Limestone		MAK Mongolyn Alt Group, 100%	14 km from the Olon Ovoot station of the Trans Mongolia railway	NA
Molybdenum, Mo in concentrates	metric tons	Erdenet Mining Corp. (Mongolia-Russia joint venture)	Erdenet, Bulgan Aymag	3,000
Steel		Darkham metallurgy plant	Darhan, Darhan-Uul Aymag	100
Tungsten	metric tons	A state-owned company	Hovd Gol area, Bayan-Olgii Aymag	150
Zinc, Zn in concentrates		Tsait Minerals Co. Ltd. (China-Mongolia joint venture)	Sukhe Bator, Suhbaatar Aymag	70

^cEstimated. Do., do. Ditto. NA Not available.

¹Abbreviations used for units of measure in this table include the following: km—kilometer.