ANNUAL BULLETIN OF MINING AND GEOLOGY

Mongolia 2016

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General notes

Abbreviations:

bln	billion (abbreviation only used in tables)
ha	hectare (abbreviation only used in tables
kg	kilogram
mln	million (abbreviation only used in tables)
MNT	Mongolian currency "tugrik"
MRAM	Mineral Resources Authority of Mongolia
NSO	National Statistical Office of Mongolia
t	metric tonne (1000 kilogram)
ths	thousand (abbreviation only used in tables)
$	US dollar (US$)

Conventions:

Metric units are used throughout the text

For converting MNT to US$, the average annual conversion rate of 1968 MNT for $1 for the year 2015 has been used (National Statistical Office, Monthly Bulletin December 2015)

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1 INTRODUCTION

The past five years have been a tumultuous time in the global mining sector. The majority of commodity prices declined steadily, investments in the mining sector declined, mining companies reviewed their strategies and adapted to harsh conditions by mainly cutting costs and laying off staff; in some sectors low-costs miners increased their production while high-cost miners had to fold up, and mergers were common across the sector.

Worldwide, exploration budgets of the major companies suffered cuts. Junior companies, essential to the replenishment of mineral resources, are craving for capital.

Mongolia was not spared from these global events.

Since about 2007 commodity prices rose and peaked in 2012/2013 and after a short period of ups and downs started to drop steadily.

The purpose of this report is to provide policymakers, stakeholders in the mineral resources sector and the broader public with information on the situation and developments in the Mongolian minerals sector. It contains information on the commodity market, mineral resources, reformation of procedures for gaining a license, official statistics of geology, detailed descriptions of minerals and taxation and fees for the sector.

The Mineral Resources Authority of Mongolia (MRAM) is subordinate to the Mining Ministry and it is the implementing agency of the Government of Mongolia. Its purpose is to support the administration of the mineral resources sector in assisting the formulation of development policies, provide information to stakeholders and other interested parties, create a favorable environment in implementing policy guidelines and increasing investment in the mining sector. MRAM provides services related to exploration and mining licenses in order to implement the governing Minerals Law. The Mineral Resources Authority works in concert with other government agencies in all environmental matters related to mining.

This report provides the latest facts, figures, statistics and changes in the administrative and legal environment of the Mongolian mining and

geological sector. It describes the Mongolian situation, but at the same time looks at the developments on a global scale.

The mining sector is the main pillar of economic growth and development in Mongolia. In recent years, the mining sector has contributed to approximately 20% of the GDP, approximately 60% to the industrial output and about 80% of total exports.

The data for 2015 quoted from NSO is preliminary.

Numbers presented for the collective mining and quarrying sector include coal, lignite, peat, crude petroleum, metal ores, and other mining and quarrying (such as construction materials, ornamentation and dimension stones, clays, etc).

2 STATISTICAL INFORMATION

2.1 Summary data on Mining and Geology Sector

Among the key responsibilities of MRAM are the granting and administration of exploration and mining licenses, the recording of mine production, and to carry out state funded exploration. Key Data for these activities are summarized in Table 1.

Categories	Units	Volume
1 Licenses (2015)		
Number of valid licenses		3329
Number of mining licenses		1494
Number of exploration licenses		1835
Valid licensed area (2015)	mln ha	13.9
Mining licensed area	mln ha	1.3
Exploration licensed area	mln ha	12.6
Licensed area of Mongolian territory (2015)	%	8.9
Mining licensed area	%	0.8
Exploration licensed area	%	8.1
2. Production of main metallic and industrial minerals commodities (2015)		
Copper concentrate	ths t	1,334.7
Molybdenum concentrate	t	5,207
Gold (note: gold contained in copper concentrate not included)	kg	14,556.2
Fluorspar concentrate	ths t	230.8
Iron ore	ths t	6,173.4
Zinc concentrate	ths t	89.6
Lead concentrate		no information

table continued

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Categories	Units	Volume
3. Main minerals export (2015)		
Copper concentrate	ths t	1,477.8
Iron ore and concentrate	ths t	5065.1
Molybdenum ores and concentrate	ths t	5
Gold (note: gold contained in copper concentrate not included)	t	11.3
Flourspar ore and concentrate	ths t	280.3
Lead ores and concentrate	t	403.5
Zinc concentrate	ths t	84.1
Tungsten ores and concentrate	t	1,703.3
4. Coal, thermal and metallurgical (2015)		
produced	mln t	23.97
sold	mln t	22.125
exported	mln t	14.426
5. Expenditure on geological survey work conducted at expense of the state budget	bln MNT	9.3
6. Geological exploration work conducted at the expense of license holders	bln MNT	157.2
7. Compliance of approved MRAM budget revenue plan	%	118.9

Table 1 Summary data of mining sector. Sources: Numbers 1, 4, 5, 6 and 7 from MRAM. Number 2 and 3 from NSO

2.2 Contribution of the Mining Sector to the National Economy

The mining sector, apart from agriculture and construction, is one of the pillars of the Mongolian economy. The contribution of the mining sector to the key economic parameters are shown in Table 2 below.

	2013	2014	2015
annual increase GDP (%), const prices, MNT	11.7	7.8	2.3 (e)
share of mining in GDP, MNT real (%)	16.8	26.0	
share of mining in industrial output (%), MNT (including petroleum)	68	68.5	67
share of mine products in export (%), US$	81.9	82.9	78.8
employment, mining sector (%)	2.2	2.1	1.9

Table 2: Share of mining in selected economic and social indicators. Sources: NSO, or calculated from NSO data; 2015: preliminary results. (e): estimated by WB[1]

2.3 Mining and Exploration Licenses

Exploration licenses

Exploration licenses are either obtained via application or tender bids. Tenders are announced for expired licenses, surrendered licenses, revoked licenses or state funded survey areas.

726 exploration licenses were newly granted by December 2015, so that at the end of the year all in all 1835 exploration licenses were registered.

Mining licenses

Mining licenses can be acquired by transformation of exploration to mining licenses by the owner of the exploration license, by trading, or taking part in a tender process.

At the end of 2015, 984 entities held 1815 mining licenses.

1 World Bank Group: Mongolia Economic Update, November 2015

2.3.1 Licenses by Commodity and Area Coverage

At the end of 2015, the total area of Mongolia for which valid licenses had been issued was 13.9 million hectares. Most mining licenses have been issued for gold and construction material (Figure 1), while areawise licenses for gold and coal predominate (Figure 2).

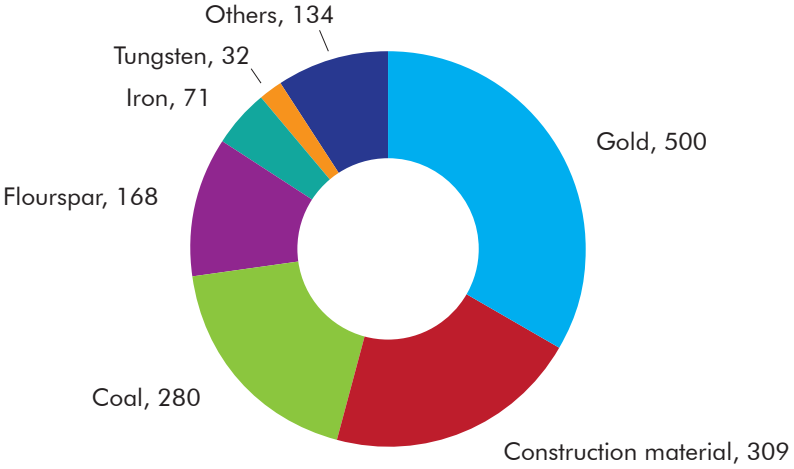


Figure 1: Number of mining licenses by mineral type, at the end of 2015

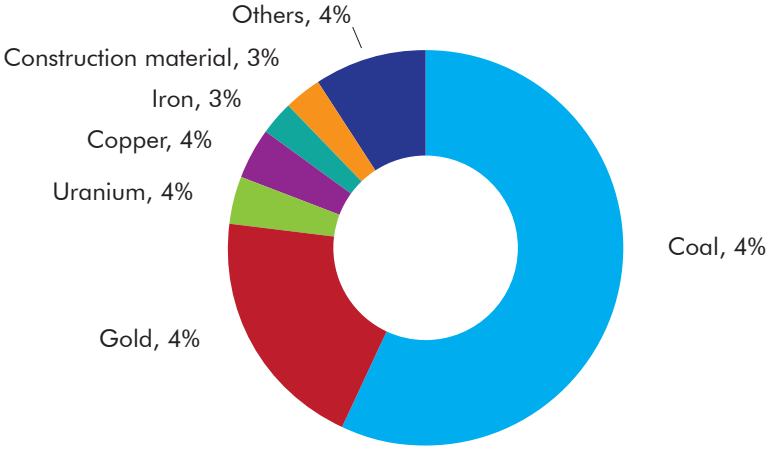
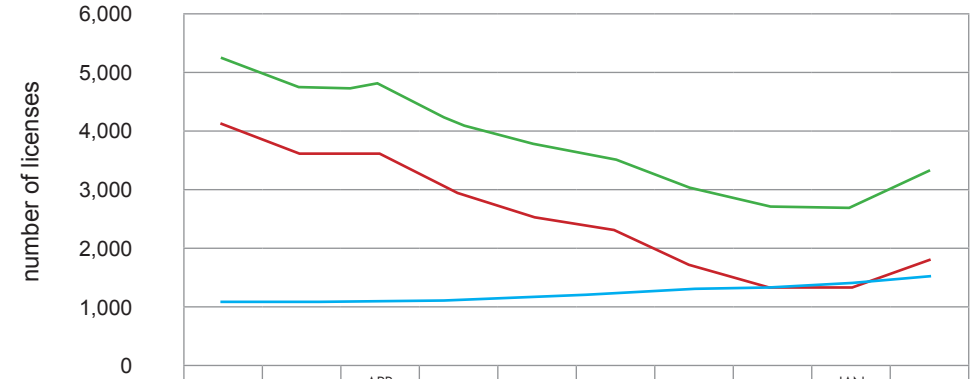


Figure 2: Percentage of areas covered by licenses by mineral type

2.3.2 License Holders (exploration and mining)

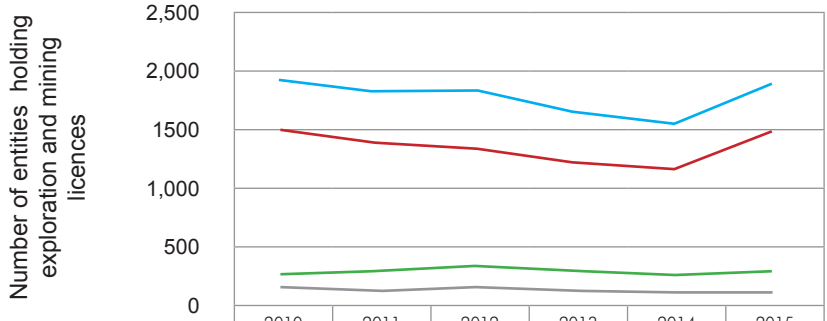
As of 31 December 2015, the total number of issued licenses was 3329, consisting of 1494 mining and 1835 exploration licenses (Figure 3). The notable increase of exploration licenses is due to the suspension of a moratorium which had blocked the issuance of exploration licenses from April 2010 until January 2015 (Figure 3).



	2008	2009	APR 2010	2010	2011	2012	2013	2014	JAN 2014	2015
Mining	1,091	1,085	1,105	1,158	1,198	1,237	1,301	1,391	1,396	1,494
Exploration	4,111	3,659	3,657	2,979	2,572	2,303	1,717	1,345	1,295	1,835
Total	5,202	4,744	4,762	4,137	3,770	3,540	3,018	2,736	2,691	3,329

Figure 3: Annual dynamics of total licenses from 2008 until 2015.

As of December 2015, 1899 entities held 3329 mining and exploration licenses. Of these 1899 entities, 1488 were Mongolian, 287 were foreign, and 124 were joint venture investments. Compared to 2014, the number of licenses held by local companies increased by 27%; joint venture financed licenses and foreign-owned licenses increased by 6 % each (Figure 4).



	2010	2011	2012	2013	2014	2015
Total	1907	1840	1824	1655	1557	1899
Mongolian investors	1493	1401	1337	1226	1170	1488
Foreign investors	264	291	330	295	270	287
Joint venture investments	150	148	157	134	117	124

Figure 4: Origin countries of license holders from 2010 to 2015

Figure 3 and Figure 4 show that the number of exploration licenses increased when at the beginning of 2015 the moratorium on the suspension of license granting was lifted. This is most notable for licenses applied for by Mongolian licenses holders. The increase of licenses held by Mongolian entities increased by 22%, while the increase of licenses financed by foreign and joint venture investors by 6.3% and 6 %, respectively when compared to 2014.

Table 3 of below shows the countries of origin of the license holders, divided into Mongolian, single foreign-owned and joint foreign-owned.

	Number of licenses	Percent
Total number of licenses	**3174**	**100 %**
Licenses owned by Mongolian entities	**2306**	**72.7%**
Licenses owned by single-country foreign entities	**579**	**18.2%**
China	205	6.6%
Virgin Islands	142	4.5%
Singapore	47	1.5%
Republic of Korea	19	0.6%
Canada	19	0.6%
Russia	9	0.4%
Hong Kong	22	0.7%
Australia	11	0.3%
USA	7	0.2%
Luxembourg	41	1.3%
Bermuda	5	0.2%
Netherlands	27	0.9%
Malaysia	4	0.1%
Kazakhstan	1	0.0%
Barbados	4	0.1%
Belize	1	0.0%
Bulgaria	4	0.1%
Germany	1	0.0%
Ukraine	1	0.0%
Switzerland	3	0.1%
New Zealand	1	0.0%
India	3	0.1%
Japan	2	0.0%

table continued

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	Number of licenses	Percent
Licenses owned by joint foreign entities	289	9.1%
Mongolia, China	92	2.9%
Mongolia, Russia	49	1.6%
Mongolia, Republic of Korea	21	0.7%
Mongolia, Virgin Islands	11	0.3%
Mongolia, Singapore	21	0.7%
Mongolia, Japan	10	0.3%
Mongolia, Germany	5	0.2%
Mongolia, Great Britain	6	0.2%
Mongolia, Czech Republic	5	0.2%
Australia, Mongolia	7	0.2%
Kazakhstan, Mongolia, Netherlands	5	0.2%
Mongolia, Luxembourg	2	0.1%
Mongolia, Hong Kong, Japan	5	0.2%
Macao, Mongolia, Hong Kong	1	0.0%
Mongolia, USA, Virgin Islands, Republic of Korea	1	0.0%
Mongolia, Bulgaria	3	0.1%
Mongolia, Virgin Islands, Luxembourg	1	0.0%
Mongolia, Canada	5	0.0%
Mongolia, Canada, China	1	0.0%
Mongolia, Russia, Ukraine	1	0.0%
Mongolia, Poland	1	0.0%
Mongolia, Hungary	1	0.0%
Mongolia, Hong Kong	4	0.1%
USA, China	1	0.0%
Belarus, Great Britain	1	0.0%
Virgin Islands, Singapore	3	0.1%

table continued

continuation of table

	Number of licenses	Percent
Luxembourg, Seychelles	1	0.0%
Russia, Republic of Korea	1	0.0%
Russia, China	1	0.0%
Singapore, Hong Kong	1	0.0%
Singapore, China	1	0.0%
Mongolia, France	21	0.7%

Table 3: Composition of license holders by country origin (31 December 2015)

2.4 Exploration and Geological Survey Work

2.4.1 State Funded Geological and Exploration Work

In 2015, 11.3 billion MNT was allocated from the state budget for various geological works. Of this, 82.3% of the allocated budget was utilized. Compared to 2014, the budget had increased by 1.3 billion MNT or 13 % (Table 4).

	2012	2013	2014	2015
1. Planned	4.0	7.2	10.0	11.3
2. Actual	3.9	6.8	9.2	9.3

Table 4: State funded geological and survey work (bln MNT, 2012 - 2015)

Two major mapping programs were underway which produced maps at a scale of 1:50 000 and 1: 200 000. These mapping programs are outlined below:

1:50 000 scale geological mapping and prospecting program:

By the end of 2015, 35.7 % of the total territory of Mongolia had been

geologically mapped at a scale of 1:50 000. The maps have been prepared in digital form. This is an increase of 4.6% compared with 2014. According to the Government of Mongolia, 40% of the total territory will be mapped by 2016.

1:200 000 scale geological mapping program:

98% of the country was mapped at a scale of 1:200 000 by the end of December 2015, an increase of 16.4% over 2014. The mapping program schedule specifies that by the end of 2016, the entire country will be covered with maps of this scale.

2.4.2 Geological and Exploration Work Conducted by Companies

In 2014, 157.2 billion MNT of private funding was spent on geological exploration by license holders. This was a 9.2% increase compared to the amount spent in 2013 (Table 5). At the time of writing, no information was available on the expenditure of 2015.

	2012	2013	2014	2015
Annual expenditures (million MNT)	323970	142647	157219	no information

Table 5: Geological and survey work conducted by private funding, in millions MNT

Most of the expenditure was for drilling, processing of minerals, geological studies and laboratory analysis.

The top companies in regard to exploration expenditure are shown in Table 6 below.

Company	Mineral type	Province	Area, ha	expenditures MNT	expenditures $
Kogegobi	uranium	Dornod	17783.99	17,915,723,576	9,103,564
Ejbalei	Cu, Au	Dornod	412.46	5,559,505,020	2,824,966
Oyut-Ulaan	Au, Cu	Omnigobi	6647.05	4,437,763,021	2,254,972
Nadmin	Cu, Au	Dornogobi	22307.11	4,286,459,960	2,178,090
FVSC	Cu	Gobi-Altai	183145.4	3,591,165,256	1,824,788
AGM mining	Cu, Au	Omnigobi	8010.74	3,524,252,380	1,790,788
OGCHL	Au, Ag, Cu	Gobi-Altai	2000.03	3,192,669,450	1,622,300
Millenium storm	Cu, Au	Tuv	11801.37	3,074,523,115	1,562,266
Sonin khad	iron	Tuv	5337.5	2,937,699,000	1,492,741

Table 6: list of companies spending the most money on exploration in 2015. $-values calculated with average of monthly exchange rates (1968 MNT equal $1) , taken from NSO, Monthly Bulletin November 2015

2.5 Mining and Minerals Data

2.5.1 Mineral Resources/Reserves and Mine Production

At the end of 2015, about 23 registered mines were in operation. Apart from the registered mines, about 423 small scale mines operating as partnerships were active.

There are about 105 plants for processing and concentrating minerals other than coal.

The amount of the most important metals and minerals registered in The National Registry of Reserves and approved by the Professional Minerals Counsel at the end of 2015 are listed in Table 7.

Mineral type	unit	Metal/minerals contained in geological reserves (categories A+B+C)
Gold /hard rock/	kg	2,548,396
Gold /placer/	kg	228,177
Copper (without copper in polymetallic deposits)	ths t	60,654,700
Iron	ths t	1,822,434 (ore reserve, not contained iron)
Coal	mln t	38,522,035
Lead	ths t	2,073
Zinc	ths t	6,172
Rare Earth Elements (RE_2O_3)	t	2,985,326
Tungsten	t	437,500
Uranium (oxide)	t	180,152
Fluorspar	mln t	47,842,740
Phosphorite	mln t	54,053,200

Table 7: Registered geological reserves[2] (A+B+C categories) of metals, fluorspar and rare earth elements by the end of 2015. (Source: MRAM statistics).

2 For description of mineral resources and reserves classification, see chapter 3.1.3

By the end of 2015, the gross output of the mining and quarrying sector reached 5,857,982 million MNT ($2,976.6 million) at the yearly nominal price. This illustrates an 8.4% decrease from 2014 but is still 12.3 % higher than in 2013 (Table 8).

Sector	Year	mln MNT
Total of industrial sector	2013	7,676,475
	2014	9,338,184
	2015	8,714,463
Mining and quarrying	2013	5,216,895
	2014	6,396,724
	2015	5,857,982

Table 8: Total gross industrial output and contribution of mining sector at current prices (MNT). Source: National Statistical Office of Mongolia[3].

The mineral production, export volumes and export values are shown in Table 9. Depending on the property of the ore feed of the concentrator plant, the metal contents of concentrates may vary.

			Production	Export	
Commodity	units	Year	volume	volume	value
Copper concentrate	ths t, ths t, ths $	2012	517.9	574.3	838,579.3
		2013	803.0	649.8	948,951.0
		2014	1,080.4	1,378.1	2,573,621.8
		2015	1,334.7	1,477.8	2,280,135.3
Coal (bituminous and lignite)	ths t, ths t, ths $	2012	28,561.0	20,915.5	1,901,773.5
		2013	29,163.6	18,373.1	1,122,204
		2014	24,927.1	19,499.0	849,039.5
		2015	24,148.9	14,472.7	555,926.7

table continued

3 http://www.1212.mn/statHtml/statHtml.do?orgId=976&tblId=DT_NSO_1100_001V1&language=en&conn_path=I3

continuation of table

			Production	Export	
Commodity	units	Year	volume	volume	value
Iron ore and concentrate	ths t, ths t, ths $	2012	12,112.1	6,415.9	532,508.8
		2013	11,135.9	6,724.5	654,333.0
		2014	10,260.5	6,324.4	446,363.7
		2015	6,173.4	5,065.1	227,199.7
Crude petroleum oil	Barrel, barrel, ths. $	2012	3636	3,568.0	336,053.1
		2013	5,128.9	5,243.8	515,455.6
		2014	7,405.3	6,885.1	634,611.4
		2015	8,769.3	8,135.2	387,217.3
Gold	kg, kg, ths $	2012	5,995.0	2.8	122,293.8
		2013	8,904.4	7.6	309,826.5
		2014	11,503.8	10	405,244.3
		2015	14,556.2	11.3	420,567.8
Zinc ore and concentrate	ths t, ths t, ths $	2012	119.1	140.9	130,830
		2013	104.1	130.9	119,084.6
		2014	93.2	99.4	113,167.3
		2015	89.6	84.1	101,658.5
Fluorspar ore and concentrate	ths t, ths t, ths $	2012	641.6	428.9	102,507.3
		2013	238.1	338.1	83,265.4
		2014	374.9	313.9	71,516.3
		2015	230.8	280.3	65,539.1
Molyb-denum concentrate	t, ths t, ths $	2012	3,933.9	4.3	38,173.7
		2013	3,732.1	4	29,479.4
		2014	4,054.0	4	35,136.6
		2015	5,207.0	5	29,473.8

Table 9: Production and export of major metals, coal (thermal and metallurgical coal) and crude oil. Mineral commodities which contribute less than 3 % to the annual budget are not included. Source: NSO, Monthly Bulletin of Statistics, December 2015.

With the goal of making annual copper and molybdenum concentrate production comparable over the years, the National Statistical Office publishes the production of concentrates with a calculated copper and molybdenum content of 35 % and 47 %, respectively. These numbers are shown in Table 10.

	2015	2014	2013	2012	2011
Copper concentrate with 35 %, ths t	890.7	712.00	533.30	347.60	347.40
Molybdenium concentrate with 47 % , t	5,207.0	4,054.00	3,869.20	4,050.20	4,163.10

Table 10: Production of copper and molybdenum concentrate, recalculated with copper contents of 35 % and molybdenum contents of 47 %, respectively. Source: MONSYS[4]

In the year 2014, copper passed coal in its export value and became the strongest foreign currency earner in the minerals sector. Gold export value increased very strongly, because in 2014 the government reduced the royalty for gold sold to the Mongol Bank (Central Bank) from formerly 5% to 2.5%.

Iron, zinc and fluorspar export values and production volumes have decreased in recent years. Molybdenum which is a coupled product to copper, mined at the Erdenet Mining Corporation, has held its ground at a production of about four to five thousand tonnes/year.

2.5.2 Mineral Exports

The annual values of export volumes and values of the major minerals from 2012 to 2015 are detailed in Table 9 of section 2.6.1

NSO reports that that the export of "mineral products" amounted to $3,678 million in 2015 and $4,791 million in 2014 - a decrease of 23% (Note: The sum of all exported mineral commodities in 2015 shown in

4 http://www.1212.mn/statHtml/statHtml.do?orgId=976&tblId=DT_NSO_1100_006V1&language=en&conn_path=I3

Table 11 adds up to $3,694 million. This is probably owed to the fact that Table 11 contains minor mine products which are not captured by the NSO commodity group termed "mineral products". Crude petroleum oil ($387 thousand) is not included in the statistics).

Exports of the four products coal (lignite plus bituminous coal), copper concentrate, iron ore and concentrate and crude oil have a weight of nearly 74% of total exports and 85% of mining exports.

The total export turnover in 2015 amounted to $4,669.5 million. The mining sector contributed 78.8 % ($3,678 million) to the total export. Not included are exports of further processed mining products, such as jewelry, cathode copper and copper alloys.

The share of the individual countries to the total export for the years 2014 and 2015 are shown in Table 11 below. In 2015 China received 87 % of all mineral exports by value, followed by the UK, Switzerland and Russia ranked 2, 3, and 4 accordingly. In 2014, China's share in Mongolia's mineral export was 89 %.

China's dominating role as an importer of mineral commodities is owed to the fact that basically all coal and iron ore and iron concentrate, zinc, and lead concentrate, and crude oil are directed to China. The UK and Switzerland import gold, while Russia's main importing commodity is fluorspar.

Apart from gold, the revenues for all mineral products decreased from 2014 to 2015 (Table 11). As the lead concentrate production started in 2014, no tendency may be described.

		China	India	Japan	Kyrgystan	Mexico	Republic of Korea	Russian Federation	Singapore	Switzerland	UK	Ukraine	Others	Sum $
bituminous coal	2014	847,173.2					3.6	1,423.7			7,071.0			855,671.5
	2015	532,308.7					90.1	5,980.4	9,576.3		7,071.1			555,026.6
Molybdenum ores and concentrate	2014	26,360.1					7,862.8	1,024.8					429.5	35,677.2
	2015	18,058.2			505.8		10,909.8							29,473.8
Fluorspar ores and concentrate	2014	32,572.5					155.8	37,424.8				47.3	1,316.0	71,516.4
	2015	28,587.1			1,098.6		720.7	35,023.9			5.3	33.6	69.9	65,539.1
Zinc ore and concentrate	2014	113,167.3												113,167.3
	2015	101,658.5												101,658.5
Copper concentrate	2014	2,560,729.3											12,892.5	2,573,621.8
	2015	2,258,079.6		7,706.8				14,348.9						2,280,135.3
Iron ore and concentrate	2014	446,363.6												446,363.6
	2015	216,881.7							10,318.0					227,199.7
Gold	2014									25,268.5	379,965.7		10.1	405,244.3
	2015		859.4							104,297.6	315,410.6			420,567.6
Tungsten ore and concentrate	2014	19,588.6												19,588.6
	2015	13,671.8												13,671.8
Lead ore and concentrate	2014	424.3												424.3
	2015	436.9												436.9
Sum of 2015 export		3,169,682.5	859.4	7,706.8	1,604.4	0.0	11,720.6	55,353.2	19,894.3	104,297.6	322,487.0	33.6	69.9	3,693,709.3

Table 11: Value (thousand US$) of major mineral product exports by receiving countries, 2014 and 2015. Compiled from data provided by NSO (Monthly Bulletin, December 2015.

2.5.3 Mining Investment

The mining sector received its biggest share of investment in the years 2011 and 2012, when mineral commodity prices were at their peak. Compared to other sectors, mining and quarrying received the lion share of investment. Table 12 shows the amount of investment in MNT in the mining sector and as a percentage of the total investment.

	Total investment, mln MNT	Investement in the mining and quarrying sector, mln MNT	Share of mining in total (%)
2009	2,146,150.80	487,007.10	22.7
2010	3,845,809.10	1,761,698.50	45.8
2011	8,387,871.30	5,195,486.50	61.9
2012	9,395,798.60	4,694,465.40	50
2013	6,577,869.70	3,031,533.60	46.1
2014	5,528,411.70	799,447.80	14.5

Table 12: Total investment, investment in mining and quarrying sector, and share of mining from 2009 to 2014.
Source: MONSYS[5], Investment by division (2015 data not available at time of print)

On May 18, 2015, representatives of the Mongolian government and Rio Tinto signed the Oyu Tolgoi Underground Mine Development and Financing Plan. It is the objective of the Plan to provide a stable economic-political environment for the massive investment which is necessary to develop the underground section at the Oyu Tolgoi copper-gold mine.

5 http://www.1212.mn/statHtml/statHtml.do?orgId=976&tblId=DT_NSO_0901_002V1&language=en&conn_path=I3

In December 2015, the Canadian company Turquoise Hill Ltd., who runs the Oyu Tolgoi mine announced that it had secured a financing package of US$4.4 billion from an international banking consortium for the underground development. After much political instability which has been seen in Mongolia over the last few years, the international investors' community is cautiously eyeing the progress and implementation of the underground mine development.

2.5.4 Mining Sector Employment

The labor force in the mining industry was the highest in the year 2013 (Table 13). The decreasing trend is related to reduced production and exploration activities.

	2012	2013	2014	2015
economically active population (ths)	1151	1198	1207	1215
employment in industrial sector	61661	73014	71565	65987
employment in mining and quarrying sector	19217	26705	25263	22973
share of mining in industrial sector (%)	31.2	36.6	35.3	34.8

Table 13: Share of employed in the mining and quarrying sector in total workforce and industrial sector (data compiled from NSO, Monthly Bulletins I to XII, 2015).

2.5.5 Taxes, Fees and Royalties in the mining sector

Mining companies are subjected to fees and taxes which may either be collected by the local government at the provincial or district level, or by the central government. These dues are:

- Personal Income Tax
- Corporate Income Tax
- Value Added Tax
- Real Estate Tax (Immovable Property Tax)
- Tax for diesel, autofuel and fuel
- Motor Vehicle Tax
- Water Consumption Tariff

- Land Use Fee
- Road Tolls
- Amount of Air Pollution
- Emission of Carbon Dioxide by Motor Vehicles
- Import Duty
- Customs Duties
- Excise Tax
- Fees for the Employment of Foreign Specialists
- Royalty

The Minerals Law (Article 47) provides that the holder of a mining license must pay a standard royalty calculated on the basis of the total sales value of the minerals extracted. The standard royalty rates are 2.5% for coal sold in Mongolia as well as for commonly occurring minerals sold in Mongolia and 5.0 % for all other minerals i.e. coal sold abroad, commonly occurring minerals sold abroad and minerals that are not commonly occurring, either sold in Mongolia or abroad.

In 2010, Mongolia introduced a sliding royalty system with the intention to incentivize processing of the raw mine outputs. The Surtax Royalty Component is applied according to the depth of processing. The royalty system also takes into account the current market prices of the mineral commodities. The royalty system of selected Mongolian metallic and industrial mineral products is outlined in Table 14 below.

Types of Minerals	Unit of Measure-ment	Reference Products	Future Market Price (USD)	Surtax Royalty Rates in %, based on the Degree of Processing		
				Ore	Concen-trate	Product
Copper	Tonne	Copper (pure metal)	0-5000	0.00	0.00	0.00
			5000-6000	22.00	11.00	1.00
			6000-7000	24.00	12.00	2.00
			7000-8000	26.00	13.00	3.00
			8000-9000	28.00	14.00	4.00
			9000 and above	30.00	15.00	5.00
Gold[6]	Ounce	Gold (chemically pure)	0-900			0.00
			900-1000			1.00
			1000-1100			2.00
			1100-1200			3.00
			1200-1300			4.00
			1300 and above			5.00
Zinc	Tonne	Zinc (pure metal)	0-1500	0.00	0.00	0.00
			1500-2000	1.00	0.80	0.40
			2000-2500	2.00	1.60	0.80
			2500-3000	3.00	2.40	1.20
			3000-3500	4.00	3.20	1.60
			3500 and above	5.00	4.00	2.00
Molybdenum	Tonne	Molyb-denum	0-35000	0.00	0.00	0.00
			35000-40000	1.00	0.80	0.50
			40000-45000	2.00	1.60	1.00
			45000-50000	3.00	2.40	1.50
			50000-55000	4.00	3.20	2.00
			55000 and above	5.00	4.00	2.50
Iron	Tonne	Iron ore	0-60	0.00	0.00	0.00
			60-70	1.00	0.70	0.40
			70-80	2.00	1.40	0.80
			80-90	3.00	2.10	1.20
			90-100	4.00	2.80	1.60
			100 and above	5.00	3.50	2.00

table continued

6 gold being sold to the Mongol Bank enjoys a favorable royalty. Since 2006, the royalty payment for gold was a base of 5% plus a surcharge which, depending on the LME price of gold, ranges from 0 to 5%. Gold sold to the Mongol Bank is charged a flat royalty of 2.5 %.

continuation of table

Types of Minerals	Unit of Measure-ment	Reference Products	Future Market Price (USD)	Surtax Royalty Rates in %, based on the Degree of Processing		
				Ore	Concen-trate	Product
Tungsten	Tonne	Tungsten concentrate	0-25000	0.00	0.00	-
			25000-30000	1.00	0.80	
			30000-35000	2.00	1.60	
			35000-40000	3.00	2.40	
			40000-45000	4.00	3.20	
			45000 and above	5.00	4.00	
Fluorite	Tonne	Fluorite ore and fluorite concentrate	0-80	0.00	0.00	-
			80-90	1.00	0.90	
			90-100	2.00	1.80	
			100-110	3.00	2.70	
			110-120	4.00	3.60	
			120 and above	5.00	4.50	
Fluorite flotation concentrate	Tonne	Fluorite flotation concentrate	0-200	-	0.00	-
			200-230		0.70	
			230-260		1.40	
			260-290		2.10	
			290-320		2.80	
			320 and above		3.50	
Tin	Tonne	Tin	0-17000	0.00	0.00	0.00
			17000-18000	1.00	0.80	0.50
			18000-19000	2.00	1.60	1.00
			19000-20000	3.00	2.40	1.50
			20000-21000	4.00	3.20	2.00
			21000 and above	5.00	4.00	2.50
Lead	Tonne	Lead (pure metal)	0-1500	0.00	0.00	0.00
			1500-1800	1.00	0.80	0.40
			1800-2100	2.00	1.60	0.80
			2100-2400	3.00	2.40	1.20
			2400-2700	4.00	3.20	1.60
			2700 and above	5.00	4.00	2.00

table continued

continuation of table

Types of Minerals	Unit of Measure-ment	Reference Products	Future Market Price (USD)	Surtax Royalty Rates in %, based on the Degree of Processing		
				Ore	Concen-trate	Product
Non-processed coal	Tonne	Coal	0-25	0.00	-	-
			25-50	1.00		
			50-75	2.00		
			75-100	3.00		
			100-125	4.00		
			125 and above	5.00		
Processed coal (dry and wet pro-cessing)	Tonne	Coal	0-100	-	0.00	-
			100-130		1.00	
			130-160		1.50	
			160-190		2.00	
			190-210		2.50	
			210 and above		3.00	
End products (semi-coke, coke, gas, liquid fuel, coal chemical products)	Tonne	Coke	0-160	-	-	0.00
			160-190			0.50
			190-210			1.00
			210-240			1.50
			240-270			2.00
			270 and above			2.50
Silver	Ounce	Silver (chemically pure)	0-25	-	-	0.00
			25-30			1.00
			30-35			2.00
			30-40			3.00
			40-45			4.00
			45 and above			

Table 14: Royalty scheme applied to Mongolian mine products for selected metallic and industrial minerals

3 MINERAL ECONOMIC INFORMATION ON THE MINING AND MINERAL SECTOR

3.1 Deposits, Reserves and Resources Classification

3.1.1 Categorization of Mineral Deposits

In this section, references are made to mineral reserves and resources registered in Mongolia. It is essential to briefly outline the general concept of "mineral deposits" as defined in the Mongolian mining legislation, and then to explain the classification system of reserves and resources. Key terms used in the Minerals Law are outlined below:

- A "Mineral deposit" as defined in the Minerals Law of Mongolia are mineral concentrations where the quality and proven reserve is economically feasible to mine by production methods. The reserves of mineral deposits are registered by the Minerals Counsel (also called Professional Reserves Counsel) in the National Registry of Reserves which is maintained at MRAM.
- The Minerals Law of Mongolia distinguishes between: 1) deposits of strategic importance, 2) deposits of common minerals, and 3) deposits of conventional minerals
- "Mineral deposit of strategic importance" means a deposit whose scope may have a potential impact on national security, economic and social development of the country at the national and regional level or that is producing or has the potential of producing more than five (5) percent of the total Gross Domestic Product in a given year.
- "Common mineral deposits" are abundant sediments and rock concentrations that might be used as construction material

"Conventional mineral deposits" are all those mineral concentrations except which do not meet the criteria of "mineral deposits of strategic importance" or "common mineral deposits".

3.1.2 Mineral Deposits of Strategic Importance

Two appendices to the State Great Khural (Parliament) Decree No.27 of 2007 cover the issue of strategically important deposits in Mongolia. The first list contains 15 deposits which have already been accepted as strategically important while the second refers to another 39 deposits from which additional deposits of strategic importance may be selected after further evaluation. In January 2015, the gold deposit of Gatsuurt was included in the list of strategic deposits. Gatsuurt is located in a forested river basin, an area in which mining is prohibited. To facilitate the utilization of the mine, it was declared a deposit of strategic importance. The 15 strategic mineral deposits are shown in Figure 5 and briefly described in Table 15.

The 2014 amendments to the Minerals Law address an important issue concerning the utilization of mineral deposits of strategic importance. The amendments provide an option for the Government either to exercise its right to either take an equity interest in such deposits (34 to 50 %, depending on several parameters) or to impose a special royalty in lieu of such interest. The location and mineral types of the deposits of strategic importance are shown in Figure 5.

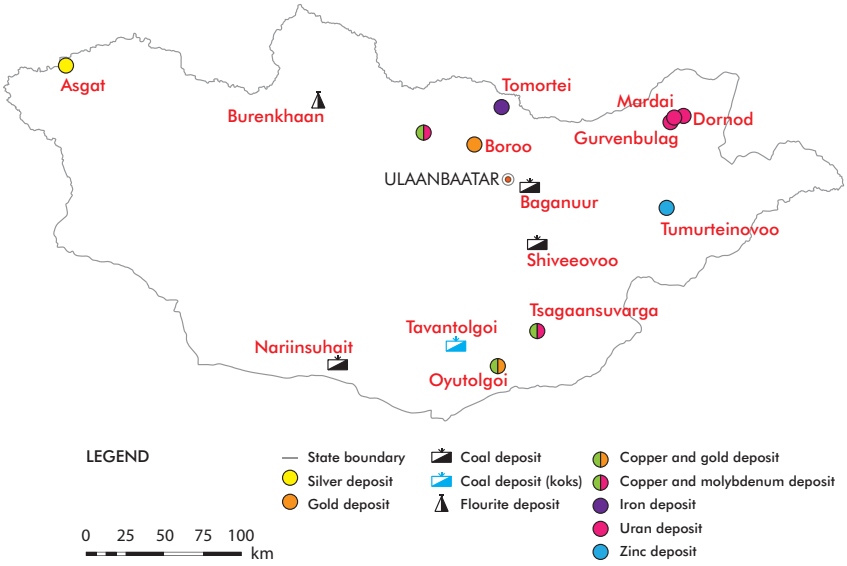


Figure 5: Location of 15 strategic deposits.

A brief description of the ore deposits of strategic importance follows in Table 15 below:

Deposit name	Type of mineral	ore accumulation, grade, contents	remarks
Tavan Tolgoi	Bituminous coal	6,420 million tonnes of coal, of which 1.4 bln tonnes are coking coal quality	Mine managed by SOE Erdenes TT
Nariin Sukhait	Bituminous coal	Reserve estimates range from 125 to 380 million tonnes	Three independent mining companies in coal field. Located 55 km from the Chinese border
Baganuur	Brown coal	600 million tonnes coal	in operation since 1978. Currently produces 40 % of local coal consumption
Shivee Ovoo	Brown coal	646.2 million tonnes coal	in operation since 1990. Plan: mine-mouth Power Plant for export of electricity to China
Mardai	Uranium	1,104 tonnes at 0.119% U3O8	None of these deposits has been active in past years. License disputes and complicated regulatory and legal environment cause complications.
Dornod	Uranium	28,868 tonnes at 0.175% U3O8	
Gurvan Bulag	Uranium	16,073 tonnes at 0.152% U3O8	
Tumurtei	Iron	229.3 million tonnes at 51.15% Fe	one of largest iron ore deposits in Mongolia. Owned by State.
Oyu Tolgoi	Copper, gold	Measured plus indicated resources: 2.2 billion t ore, 21.2 million t Cu, 772.9 t Au (from 2014 Technical Report)	In production since 2013. Owned by Turquoise Hill Res. and Mongolian State.
Tsagaan Suvarga	Copper, molybdenum	proved reserves: 16 million tonnes of oxide ore, 250 million tonnes primary sulphide ore containing 1.6 million tonnes of Cu and 66,000 t of Mo	License held my Mongolyn Alt Corp. Promising object.

table continued

continuation of table

Deposit name	Type of mineral	ore accumulation, grade, contents	remarks
Erdenet	Copper, molybdenum	1.2 billion tonnes at 0.51% Cu and 0.012% Mo	In operation since 1978. Russian-Mongolian joint operation. Annual production about 530 ths t Cu concentrate, 3 ths t Mo concentrate
Burenkhaan	Phosphorite	192.24 million tonnes at 21.1% P2O5	environmental restrictions could be problematic
Boroo	Gold	24.5 million tonnes of ore at 1.6 g/t Au (about 39 t of Au)	ore exhausted; from 2004 to 2012, about 56 t of Au were produced
Tomortein Ovoo	Zinc	7.7 million tonnes at 11.5% Zn	Mined by Tsairt Minerals.
Asgat	polymetallic deposit (silver)	6.4 million tonnes of ore with 351.08g/t Ag	Infrastructure problematic
Gatsuurt	gold, hard rock, open pit project	measured and indicated resources estimated at 398,000 ounces (12.4 t) of Au	Mining license held by Centerra Gold. Negotiations between owner and State make little progress.

Table 15: Short description of ore deposits of strategic importance. Reserves estimated at commencement of production.

3.1.3 Classification of Reserves and Resources

Mineral wealth is commonly reported as reserves or resources and subdivided according to the degree of the accuracy with which the size and quality of the deposit was investigated, and the modifying factors which may impede or bar the economic extraction of the ore.

Mongolia has its own system of reporting Mineral Reserves and Mineral Resources, and for this reason published figures on mineral resources and mineral reserves from Mongolia are more often than not misinterpreted and misunderstood. The same numbers are by some authors, experts or analysts called “reserves”, by others “resources”, and again as “resources

plus reserves"[7]. Evaluations of deposits and comparisons between national mineral wealth demand comparable systems and for this reason, the Mongolian classification system and its differences with internationally applied systems is illuminated below.

In many Western mining jurisdictions, mining reserves are a mining company's assets. Within the general reserve classification applied in Western mining jurisdictions, there are two subsets: proved and probable. A proved reserve amount is assumed to be as close as possible to what mining will actually produce given current scientific knowledge and technical methods[8]. Probable reserves indicate a lesser degree of certitude of recovery, but not to such a degree as to warrant a resource classification.

Metal estimates other than reserves are either classified as either measured, indicated or inferred resources, depending on the level of confidence of their investigation.

The classification presently imposed by the Mining Ministry divides mineral resources and reserves into groups (resources, geological reserves and economic reserves) according to the depth of their investigation (feasibility or pre-feasibility study, geological, exploration, prospecting works) and on the basis of the mining technical, processing, economic, market, legal, environmental, social, governmental and other factors which may affect their economic extraction.

Table 16 presented below is an unofficial translation of the currently applied classification system. The purpose of the translation is to solely provide an understanding of the mineral resources classification applied in Mongolia.

7 Since democratization in 1991, the once Russia-oriented mineral reserves classification has undergone several changes. Mongolia became a member of CRIRSCO in October 2014.

8 Since reserve calculations include things like commodity price, average ore grade, cut-off ore grade, and processing rate, it is easy to see that an ore body can be bigger or smaller over time depending on these and other variables.

Main stages and accuracy of minerals survey	Survey goals and object	Mineral Abundance Assessment			
		Reserves and Resources Classifications and Categories			Economic evaluation type
		Resource status	Reserve & resource categories	Abbreviation symbol	
Geological survey	Geological formation, mineralized point and occurrence survey	Assessed mineral potential (resources)	Possible, Probable (Resources)	P3 P2	Geological assessment
Prospecting	Conducting exploration works for minerals occurrence		Proved (Resources)	P1 (C)	Mineral resources, geological and economical assessment
Exploration	Estimation of resources and reserves categories	Geological reserves[9]	Inferred, Indicated Measured	C B A	Pre-feasibility study
	Determining in detail commercial reserves in deposits and mines	Economic (commercial) reserves	Probable Proved	B', A'	Feasibility study and production design

Table 16: Unofficial translation of the currently applied Mongolian reserves and resources classification scheme.

9 for the geological reserves (categories A, B, C) their economic extractability has not been ascertained; they represent the volume of a well investigated ore deposit determined at the pre-feasibility level, regardless of its ascertained viability to be economically extracted. They should not be equated with "reserves" as defined by JORC or NI43-101 codes.

Care should be taken to read reserves and resources estimates published on Mongolian deposits. In many archived reports the sum of classes A, B and C is reported as "reserves" without an explanation of how the word reserves is being used. These A+B+C reserves, however are not a company's asset, because their economic extractability has not been ascertained; they represent the volume of a well investigated ore deposit determined at the pre-feasibility level, regardless of its ascertained viability to be economically extracted. Table 16 shows that from the "geological reserves" of the categories A, B and C the economic reserves (B', A') are estimated.

The terms resources and reserves as used in Mongolia cannot be put on a level with reserve or resource classes estimated by JORC or NI43-101 methods. A conversion requires the input of a qualified person with extensive knowledge of both systems. It needs to be made clear that the reserve figures used in this booklet do not conform to the term "reserves" as used under the JORC or CIM code, they are denominated "geological reserves A+B+C". It is these geological reserves, from which the economically validated reserves are estimated.

3.2 Mineral Resources and Commodities

3.2.1 Gold

As of 2015, there are 115 hard rock deposits in addition to 672 placer deposits with 2,776.5 tonnes of geological reserves A+B+C registered and approved.

Gold prices experienced a steady decline from the beginning of 2013 and now are about 1,100 $/oz (Figure 6). Nevertheless, exploration for gold suffered the least budget cuts, because gold mining does not require high up-front capital, the risks are moderate and fuel costs which make up a major cost component for the Mongolian gold mines, are low.

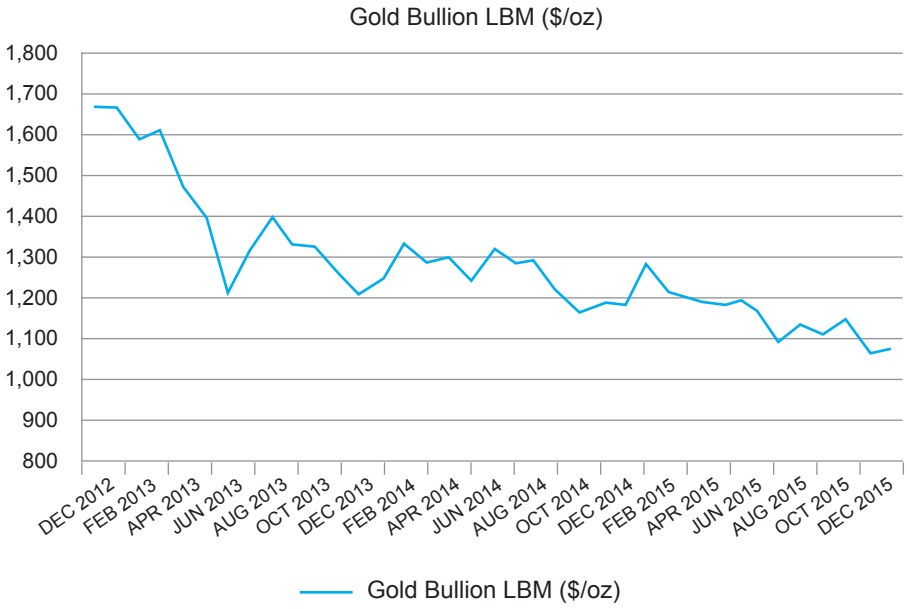


Figure 6: Development of gold prices over the past three years (LBM, London)

Gold is mined from hard rocks and placer deposits. Gold produced by license holders must be submitted to the State Assaying Agency, which melts the gold into bars and determines its gold content. The laboratory then returns the gold to the miner and informs MRAM of the assay results.

Gold which is contained in copper concentrate does not enter the production statistics. In 2014, the copper concentrate exported by the huge Oyu Tolgoi Copper-gold mine contained about 20 t of gold, which is much more than the production of the registered gold mines.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
production, t	25.09	22.56	17.47	15.18	9.80	6.04	5.70	6.00	8.90	11.50	14.56
export, t	23.8	15.40	11.60	22.10	10.90	5.10	2.58	2.80	7.60	10.00	11.30
export, ths $	331,410.60	270,105	234,874	599,883	308,473	178,339	109,778	122,294	309,827	405,244	420,568

Table 17: Annual production and export of gold from 2006 to 2015 Source: NSO, http://www.1212.mn/

In recent years, gold production saw some ups and downs which are clearly attributable to changes in the royalty scheme. Gold production and export were highest in 2005 (Table 17). The royalty tax then was 2.5%. Amendments made to the Minerals Law in 2006 raised the royalty to 10% (5% base royalty and a surcharge royalty of up to 5%, depending on the LME gold price), leading to a pronounced decline in production, sales to the Mongol Bank, and export. In 2014 the Mongolian Government was set to enhance the gold production and sales to the Mongol Bank. New amendments made to the Minerals Law introduced a reduced royalty for gold sales to the Mongol Bank. Since 2014, gold sold to the Mongol Bank has been charged a flat royalty of 2.5% resulting in increased production and export.

3.2.2 Copper

The global picture

In the modern era, increasing use of copper is linked to the increasing use of electricity. In addition to being an excellent electrical conductor, copper is ductile enough to be drawn into wire and beaten into sheets without fracturing. It is therefore used to produce electrical cables and electrical equipment. Copper and its alloys are also widely used in plumbing

components, building construction as well as in industrial machinery. An average car contains more than 20 kg of copper and suburban homes have around 200 kg of copper. Demand for copper is often viewed as a leading indicator of global economic health.

Global world reserves are estimated at around 700 million t of copper metal (only land-based reserves, not taking into account the huge resources on the ocean floors); mine production in the year 2014 amounted to 18,700 thousand t. Major mining countries are Chile, China, Peru and the USA (USGS, 2015)[10]. About 80 % of copper supply comes from the so-called "porphyry copper deposits".

Historic copper prices hovered around 2,000 $/t in the pre-2003 years, and in the short time from 2004 until 2011 increased to peak at an annual average of 8828 $/t. Since 2011, prices have steadily decreased. The development of average annual copper prices from 2000 to 2015 is shown in Figure 7.

In December 2015, the cash price of Grade A copper decreased by 26% on a year-on-year basis (LME: 6368 $/t in December 2014; 4705 $/t in December 2015).

10 USGS, Mineral Commodity Summary, Copper 2015

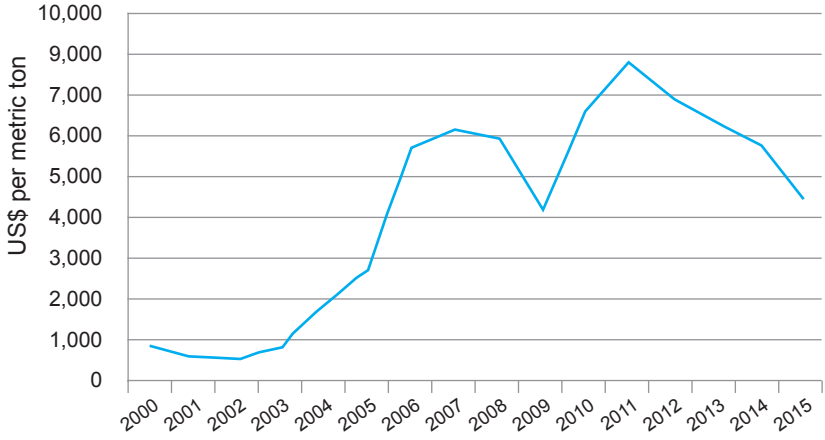


Figure 7: Nominal copper prices from 2000 until 2015 (Source: The World Bank, Commodity markets[11])

The Mongolian situation

Mongolia has an abundance of copper. At present there are 1180 copper occurrences and 61 deposits holding 60.7 million tonnes of copper contained in geological reserves (categories A, B and C). Mongolia hosts about 8% to 9% of the global copper reserves. Applying information provided by Statista, New York[12], and the USGS (2015)[13], Mongolia takes 4th place in the world ranking of copper reserves, behind Chile, Australia, and Peru.

At the end of 2014, there were a total of 9 valid mining licenses, covering an area of 39018.57 hectares; or 3.6% of the total licensed area.

The annual production, export volume and export value are shown in Figure 8.

11 http://www.worldbank.org/en/research/commodity-markets Annual Data XLS Link

12 http://www.statista.com/statistics/273637/copper-reserves-by-country/

13 Mineral Commodity Summary, Copper 2015

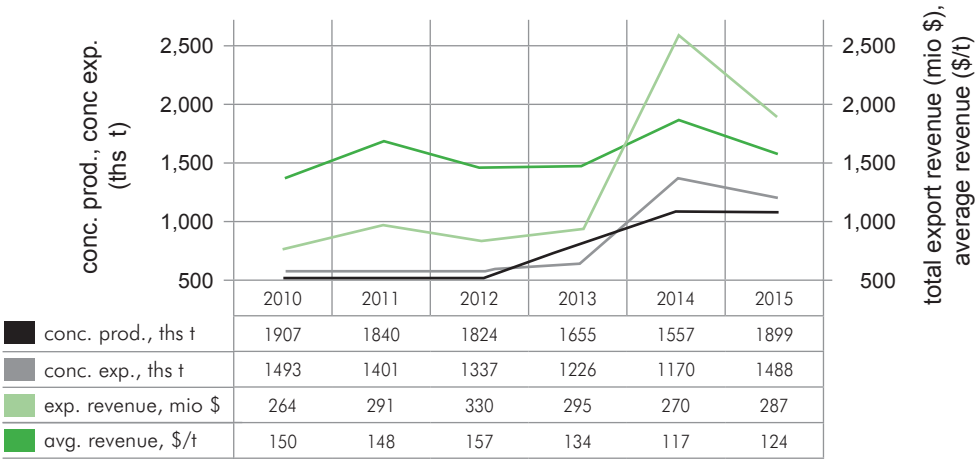


Figure 8: Annual production and export of copper concentrate from 2010 to 2015.

Two large open pit mines are operating in Mongolia, these are (Figure 9):

The **Erdenet Mining Corporation** (EMC), a Mongolian-Russian joint venture which is located in the northern part of the country (Erdenetiin ovoo deposit, see Figure 9). EMC mines a porphyry copper deposit and commenced operating in 1978.

Reserves of EMC deposit are about 1.2 bln t at 0.51 % Copper and 0.012 % Molybdenum. The annual production is around 26 million t of ore with an average grade of 0.54 % Cu. In past years, the company produced about 515,000 to 530,000 t of copper concentrate (24 % Cu) and 4,500 t of molybdenum concentrate (47 to 50 % Molybdenum)

The **Oyu Tolgoi LLC** (OT) owns the Oyu Tolgoi porphyry copper-gold mine which comprises several ore bodies in South Gobi Province in the southern part of the country (Figure 9). OT is a joint venture owned 34 % by the Mongolian government and 66 % by the Canadian Turquoise Hill Resources Ltd.

OT started production and export of copper concentrate in 2013 and produced its one millionth ton of concentrate by February 2015. In 2015, the mine produced about 190,000 tons of copper and 220,000 ounces of gold contained in the concentrate. The mine expects to produce 175,000 to 195,000 tons of copper and 210,000 to 260,000 ounces of gold in concentrates for 2016. The concentrate also contains payable amounts of

silver. OT is in the process of planning the development of underground mining.

Processed products and by-products related to copper mining

Since 1997, Mongolia produced and exported refined copper. Two companies, Erdmin Ltd. and Achit Ikht Co., produce cathode copper by leaching oxidized dump material and electrolytic precipitation (SX-EW process). In 2015, Mongolia exported 12,400 t of refined copper and realized revenues of $66.7 million (NSO, Monthly Bulletin December 2015).

An interesting spin-off of the copper mining is the rare metal rhenium. At the end of 2014, the company Shim Technology started the processing of molybdenum concentrate to produce molybdenum oxide and rhenium. The company aimes to produce 2,500 t of molybdenum oxide and 800 kg of rhenium annually, once it reaches design capacity.

With the steadily increasing production of copper concentrate, other trace elements contained in the concentrate could become economically interesting. Attention should be given to the presence of the chemical elements tellurium, rhenium, selenium and the PGMs (Platinum Group Metals). Selenium is a non-metal which may replace sulfur in the copper minerals, while rhenium, tellurium and the PGMs belong to the metals and are associated with copper minerals, mainly chalcopyrite. These elements are "high-value low volume commodities" with low transport costs per unit and therefore could be delivered to distant buyers.

Figure 9: Location of copper mines and deposits.

Several promising copper deposits and exploration projects are underway (see Figure 9). Most advanced is the development of the **Tsagaan Suvarga** deposit in the South Gobi Province. Detailed exploration work started in 2001, and at the present time the project is in the development stage. Resources have been estimated by international standards (NI43-101 and JORC) and amount to 250 million t of primary sulfide ore containing 1.6 million t of copper and 66,000 t of molybdenum. The sulfide ore body is capped by an oxidized ore zone. The planned production capacity of the open pit mine is 14.6 million t of ore which will yield about 310,000 t of copper and 4,000 t of molybdenum per year. The property is owned by the Mongolian company Mongolyn Alt (MAK) which at this stage is dealing with the financial matters and off-take contracts.

3.2.3 Iron

The global picture:

For decades and up to about 2005, iron ore prices have hovered around 15 US$/t. Around 2010, they peaked at around 180 US$/t and along an up-and-down trend prices decreased to reach about 40 US$ in late 2015. These marked price changes have been brought about by supply/demand dynamics as well as by a change in the pricing system. Long-term contracts progressively gave ground to spot sales.

The majority of iron ore and steel market analysts predict that the downward trend will extend well into 2016 because the increasing outputs of the low cost producers cannot be balanced by the dropping out of high cost producers. Furthermore, the recovery of the Chinese steel market is not around the corner and iron ore stocks along the trade and production chain are high and will delay revival of the iron ore market.

Iron ore imports are dominated by China (820 million t, or 61 % of global imports), followed far behind by Japan (136 million t or 10 % of global imports), South Korea (63.4 million t or 4.7 % of global imports) and Germany (40.9 million t or 3 % of global imports).

The main exporting countries are Australia (613.4 million t or 45% of global exports), Brazil (329.6 million t or 24.5 % of global exports) and South Africa (62.8 million t or 4.7 % of global exports).

The Mongolian situation:

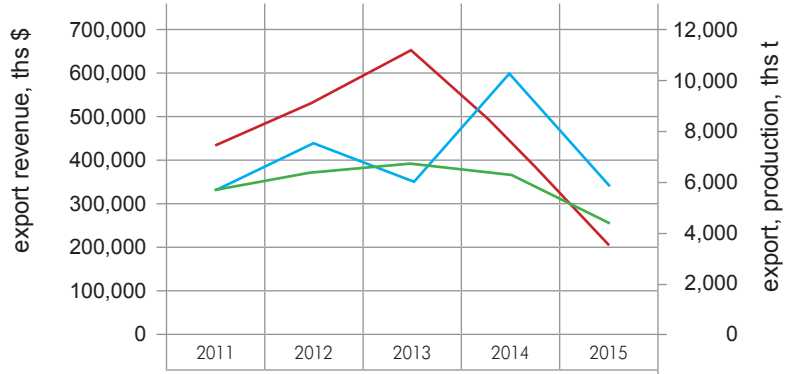
By 2014, there were 71 valid mining licenses, covering an area of 31,848.01 hectares or 3% of the total licensed area. However, only a few

of the deposits are of economic interest.

Approved iron resources are at 1.8 billion tonnes (see chapter 2.5.1) and will most likely increase in the future. The iron content of the deposits ranges from 16 to 56 %. The iron ore deposits are of metasomatic origin and the majority of the deposits comprise several steeply dipping, closely spaced ore bodies which are usually clearly defined in their structure and forms.

Mongolia's biggest iron ore exporter is the Bold Tumur Eruu Gol Mine in Selenge Aimag in the Northeast of the country near the Russian border. The deposit of the Eruu Gol mine has an estimated geological resource (categories A+B+C) of 174 million t of iron ore and has been mined for almost ten years now.

Mongolia became an iron ore exporter in 2005, and its export steadily increased until 2013. Since then, export decreased by volume and value. The annual production, export volume and export revenues are shown in Figure 10. Because of low grades and the presence of sulfur, exported iron ore and concentrate is generally of a low quality, but because of the high demand due to increasing steel production in China, especially up until three years ago, nearly all low quality products were imported by China, in particular to the steel mills in Northern China.



	2011	2012	2013	2014	2015
conc. exp., ths t	437,328	532,509	654,333	446,364	202,488
exp. revenue, mio $	5,678	7,561	6,011	10,261	5,899
avg. revenue, $/t	5,753	6,416	6,725	6,324	4,346

Figure 10: Annual production and export of iron ore and concentrate from 2011 to 2015 (Source: various Monthly Bulletins, NSO)

Mongolia exports run of mine ore and concentrate prepared by multi-stage low- or medium level magnetic separation. Only a few plants employ wet magnetic separation. Most concentrates contain about 62 % iron.

Prices for Mongolian iron ore are border prices on DAF terms (delivery at frontier) which include transport from the mine to the border.

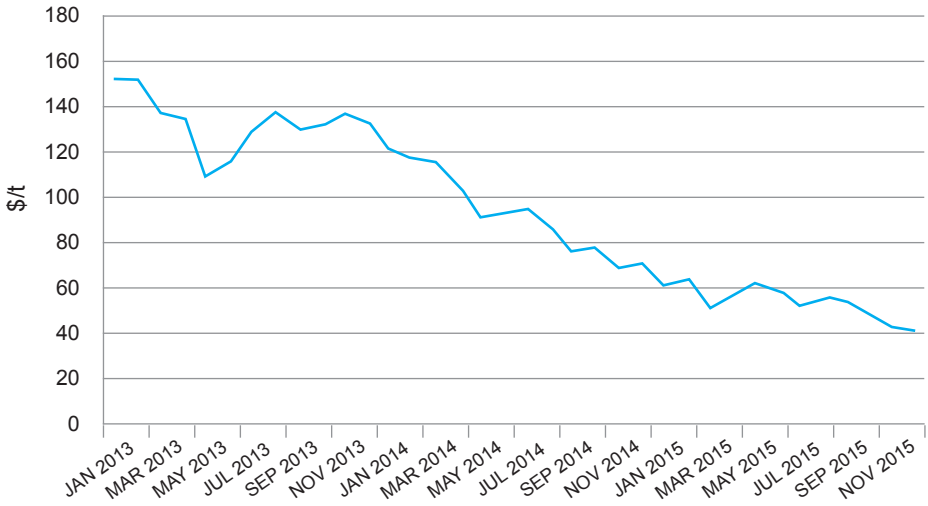


Figure 11: Price development of iron ore, 62% Fe, China import, CFR (Source: SNL, Metals and Mining Information Service).

The price decrease shown in Figure 11 corresponds well with the realized average annual revenues/t for Mongolian iron ore and concentrate, which are (calculated from Figure 10):

2013: 97.3 $/t

2014: 70.6 $/t

2015: 46.6 %/t.

In 2013 a total of 13 companies mined iron ore in Mongolia. Because of the depressed price and lack of demand, in 2015 only about half a dozen iron ore mines were continuously operating and many were temporarily put on care and maintenance.

3.2.4 Lead and Zinc

In Mongolia, one lead and one zinc mine are in operation. Apart from these, several ore accumulations which qualify as deposits are presented (Figure 12).

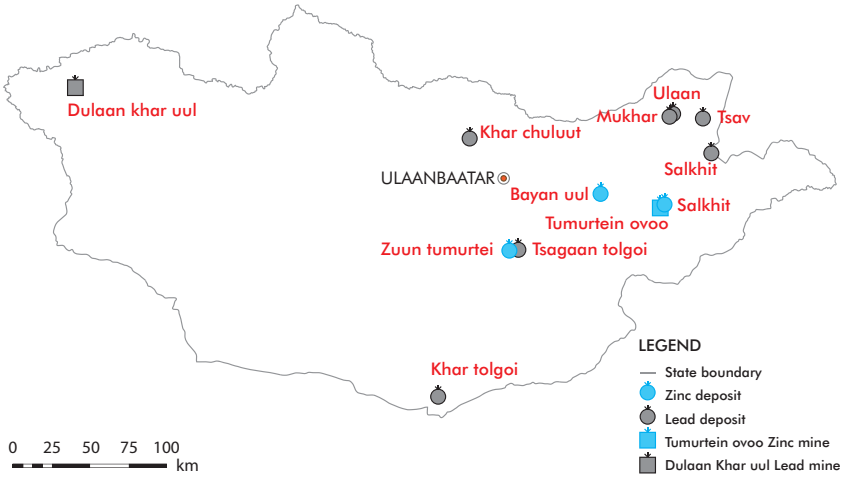


Figure 12: Location of operative lead and zinc mines and deposits.

The price development of lead and zinc traded at the London Metal Exchange in the past three years is shown in Figure 13 below.

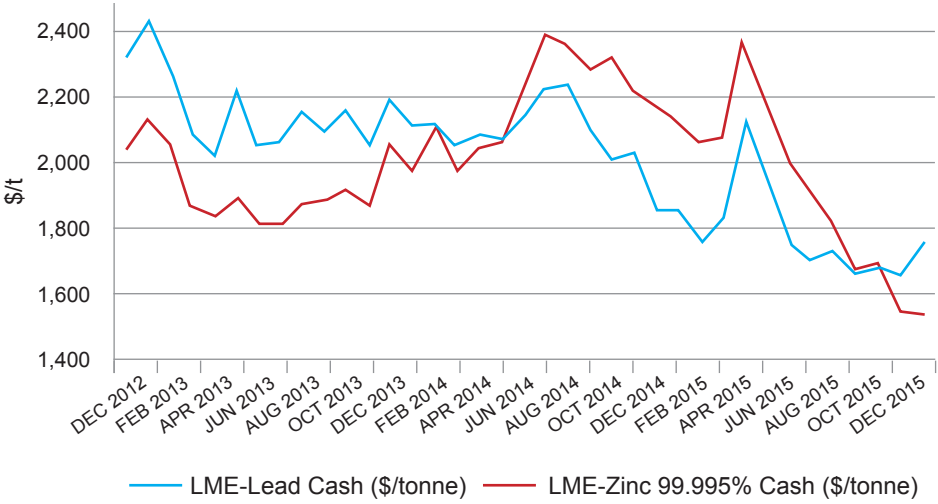


Figure 13: Monthly averaged metal quotations for lead and zinc, LME, 2013 to 2015

Lead

By 2014, 18 lead deposits were approved and 158 occurrences registered. Geological reserves (categories A+B+C) were around 2.08 million tonnes.

Lead concentrate is produced in the Dulaan Khar Uul lead-zinc mine in the Northwest of the Country, in the Bayan-Ulgii province (Figure 12). The mine is owned and operated by the Uyshengming Mining, a Chinese company. The company started production in the first half of 2014. A mine life of 16 years, an annual production capacity of around 300,000 thousand t of ore which yields about 11,500 t of zinc and 3,500 t of lead has been predicted. Silver and cadmium are by-products.

In 2014 and 2015, Mongolia exported 529.9 and 403.5 tonnes of lead concentrate, respectively.

Zinc

By the end of 2015, 110 zinc occurrences and 24 deposits, holding 6.2 million tonnes in categories A+B+C were registered. Two licensees hold six licenses for zinc exploitation, covering an area of 4057.25 hectares.

Tsairt Minerals LLC, a Chinese-Mongolian joint company, is the only zinc

miner with its own concentrator. The Chinese partner is NFC (China Non-ferrous Metal Industry's Foreign Engineering and Construction Co., Ltd). The company produced and exported its first zinc concentrate in 2005.

When German geologists explored the deposit, it contained 70 million t of ore with an average grade of 13.7 % Zn in the reserve B+C category, equivalent to 1,034 thousand t of zinc metal. The deposit is of metasomatic origin, with the zinc mineralization finely disseminated in rocks of Permian age.

The grade of the run of mine ore varies between 8 to 14 % zinc, cut-off grade is about 3%. The concentrate contains about 50 % zinc.

The annual production and export of zinc concentrate are shown in Table 9.

3.2.5 Tungsten and Tin

Tungsten occurs in vein type deposits, stockworks and greisen type deposits. Placer deposits are subordinate and in these, tungsten is mainly a co-product of tin mining.

ELSNER et al. (2011)[14] compiled the major tungsten deposits according to grade and tonnage. Many of the deposits are small by international standards, but it appears that the potential of tungsten in Mongolia remains to be fully investigated.

In 2014, Mongolia exported 1,519.6 t of tungsten ore and concentrate, valuing $19,588.6 thousand. The figures for 2015 are: export volume 1,703.3 t, export value $13,671.8 thousand.

3.2.6 Fluorspar

The current global demand for fluorspar is 6.0–6.5 million tonnes per year. Fluorspar is commonly sold as three commercial categories:

a) **Metallurgical spar**, used as a flux in steel making;

b) **Acid spar**, used as feedstock in fluorine based chemicals, represents the largest share of the global fluorspar market by volume, with current demand being around 3.8 million tonnes per year, and commands the

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highest price per tonne The two primary uses of acid-spar are:

- The manufacture of Aluminum Fluoride (AlF3) which is used as a flux in the aluminum manufacturing process.
- The manufacture of Hydrogen Fluoride (HF) with the largest use of the HF being the manufacturer of refrigerant gases

c) **Ceramic grade fluorspar;** Quality specifications of this category are variable and range from metallurgical to acid spar specifications.

As with most mineral commodities, in the years 2004/2005 the price of fluorspar started to increase, to reach its peak in 2011, from whence the price contracted again. The fluorspar market is segmented in several regional markets, each of them with their different characteristics and prices.

From information published by the USGS (Mineral Commodities Summary, fluorspar), Mongolia ranks 3rd in the list of fluorspar miners.

As of 31 December 2015, there were 165 fluorspar deposits approved and 158 occurrences registered totaling approximately 47.8 million tonnes of CaF_2 in geological reserves (categories A+B+C). The amount of fluorspar and fluorspar concentrate production and export is shown in Table 18. The Mongolian export statistics do not differentiate between the various commercial grades. Handpicked lump ore sold as metallurgical spar goes under the name of "fluorspar", while a flotation concentrate with a grade of CaF_2 ranging from 95 to 97 % is rated as "concentrate".

			Production	Export	
Commodity	units	Year	volume	volume	value
Fluorspar ore and concentrate	ths t, ths t, ths $	2012	641.6	428.9	102,507.30
		2013	238.1	338.1	83,265.40
		2014	374.9	313.9	71,516.30
		2015	230.8	280.3	65539.1

Table 18: Production and Export of fluorspar ore and concentrate, Mongolia, 2012 to 2015

3.2.7 Coal

Mongolia hosts 160 coal deposits and 276 (lignite coal-192, bituminous coal-84) occurrences in 15 basins. The estimated coal resources (classes A+B+C +P1+P2+P3 according to Mongolian system) are approximately

173.3 billion tonnes, while the geological reserves (A+B+C) are 36.6 billion tonnes as of 2015. Mongolian coal resources account for 10% of globally known coal resources. Eastern Mongolia is abundant in brown coal. Coking or hard coal is predominant in the central, eastern and mountainous regions in the west.

Mongolian Coal Quality Classification

The Ministry of Mining prepared a coal quality classification for Mongolian coal, which was approved by the Mongolian Agency for Standardization and Metrology (MASM) in 2014. The classification is derived from coal trade qualities as applied in the USA, Australia, Russia and China and thus facilitates finding quality-based prices for coal exported from Mongolia. The coal quality classification takes into account: total moisture, volatile matter, caking index, Y-index (a measure of the quantity of plastic mass) swelling properties, carbon content and vitrinic reflectance.

Thermal Coal

Lignite coal (brown coal according to the Mongolian coal classification) is classified as thermal coal and it is the main commodity for Mongolia's national heating and power generation. Coking coal and non coking bituminous coal are exported.

Use of Thermal Coal in Mongolia

Coal generates 80% of local electric energy requirements and 90% of the heating supply.

The energy sector policies promote extending, renovating and constructing infrastructure in the future. It is forecast that electricity consumption will reach 3350 MW requiring an estimated 16.1 million tonnes of coal by 2024.

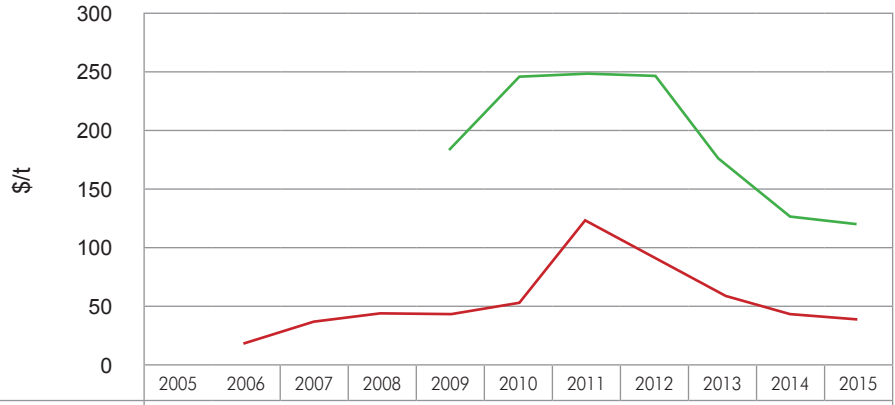
Metallurgical Coal

Insignificant amounts of metallurgical coal are used by the domestic iron and steel industry. Metallurgical coal is almost entirely exported to China as washed or raw coking coal or semi-coking coal.

Trends of Coal Price

The price of coal for the local market is regulated by the Government of Mongolia and is related to the quality of the coal. In 2015, mines were paid from 21,060 to 30,000 MNT/t.

Prices for exported coal products follow, in a broad way, the price development of the international coking coal prices (Figure 14). Around 2006, prices rose slowly but steadily to reach a short-lived peak in 2008, followed by a brief price slump during the global financial prices from 2009 to 2010 (not visible in the annually summarized data of Figure Figure 14, and then climaxed again in 2011 from whence a long-lasting price decrease started. Nominal prices today are still higher than before the 2006-to-2011 high-price period.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MNG border price (bituminous coal)		19.18	35.55	44.29	43.05	52.79	124.01	91.52	61.35	43.56	38.47
CHN, harbar, FOB (primary coking coal)					185	245	248	246	173	127	120

Figure 14: Average Mongolian export coking coal prices compared to primary coking coal imports at main Chinese harbors (Sources: Mongolian border price calculated from NSO data, compiled from various bulletins; Chinese harbor prices from www.sxcoal.com).

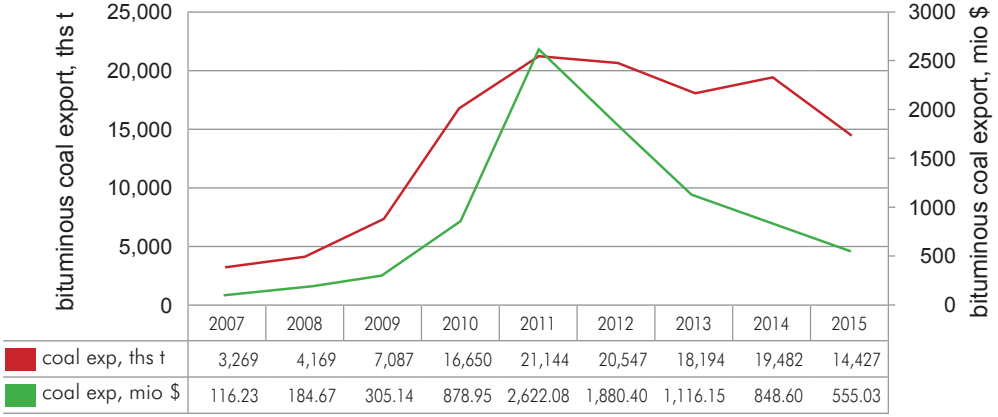
Coal Output and Trade

The aggregated mine output of thermal and metallurgical coal from 2012 to 2015 is shown in Table 18. The figures for coking coal include semi-coking coal, which constitutes about 25% of the output.

Coal type	2012	2013	2014	2015
Coking coal, ths t	22,504.3	2,5039	15,891.4	18,895.7
Bituminous thermal, ths t	2,316.5	906.7	1,553.1	1,242.4
Lignite, ths t	6,318.3	7,394.8	7,004.7	7,007.9
Total, ths r	31,139.1	33,340.5	24,449.2	24,146

Table 18: Output of thermal and metallurgical coal from 2012 to 2015 (Source: Coal Department, MRAM)

Export volumes and values from 2007 to 2015 are shown in Figure 15. Exported coal comprises almost entirely bituminous coal and includes only minor amounts of brown coal (lignite). The "bituminous coal" rank comprises about 10% washed coal, 38% raw coking coal, 39% semi-coking coal and 13% thermal coal (non-coking bituminous coal). From the export volumes and export values, average revenues per tonne of the mixed coal export can be calculated which are shown in Figure 14 above. This average revenue for the Mongolian coal export broadly follows the trend of the coking coal price, FOB China.



	2007	2008	2009	2010	2011	2012	2013	2014	2015
coal exp, ths t	3,269	4,169	7,087	16,650	21,144	20,547	18,194	19,482	14,427
coal exp, mio $	116.23	184.67	305.14	878.95	2,622.08	1,880.40	1,116.15	848.60	555.03

Figure 15: Export of coal (volume and value). Constructed from several Monthly Bulletins (NSO).

Because of the different rail gauge of the Mongolian and Chinese rail systems, coal is stockpiled at the border from where it is picked up by the buyer. Coal prices are border prices, mostly negotiated on shortterm contracts between seller and buyer.

Coal export is directed towards the steel industry in northern China. The economic slowdown of the Chinese economy and the resulting contraction of the steel production caused a pronounced decrease of coal export from Mongolia. Coupled with the drastic decrease of prices for coking (metallurgical) coal, the revenues generated from coal exports have been continuously contracting in recent times (see Figure 15).

Note: Coal production data collected from MRAM and NSO may slightly differ, because not all companies provided their production reports to MRAM on time.

4 MRAM NEWS

Opening of new land tracts for minerals exploration.

In January 2015, and then again in June, new land was opened for geological exploration (Figure 16). Now 9.67 hectares, or 6.12 % of the Mongolian land surface are available for mineral exploration. The granting of 726 new exploration licenses in 2015 has been attributed to making new terrain accessible for geological work.

Integrated Data Management System (IMS)

Amendments to the Minerals Law of Mongolia require adaptations to be made to the Computerized Minerals Cadastre System of MRAM.

MRAM is preparing an on-line reporting system to submit the annual plans and production reports which are required from license owning companies.

The design and programming of these two IMS modules is carried out by the MRAM-BGR Technical Cooperation Project and will be operational in 2016.

Monthly Statistics in MRAM Webpage

Monthly statistics of the minerals sector in the Mongolian and English language can be found by referring to the MRAM website (www.mram.gov.mn).

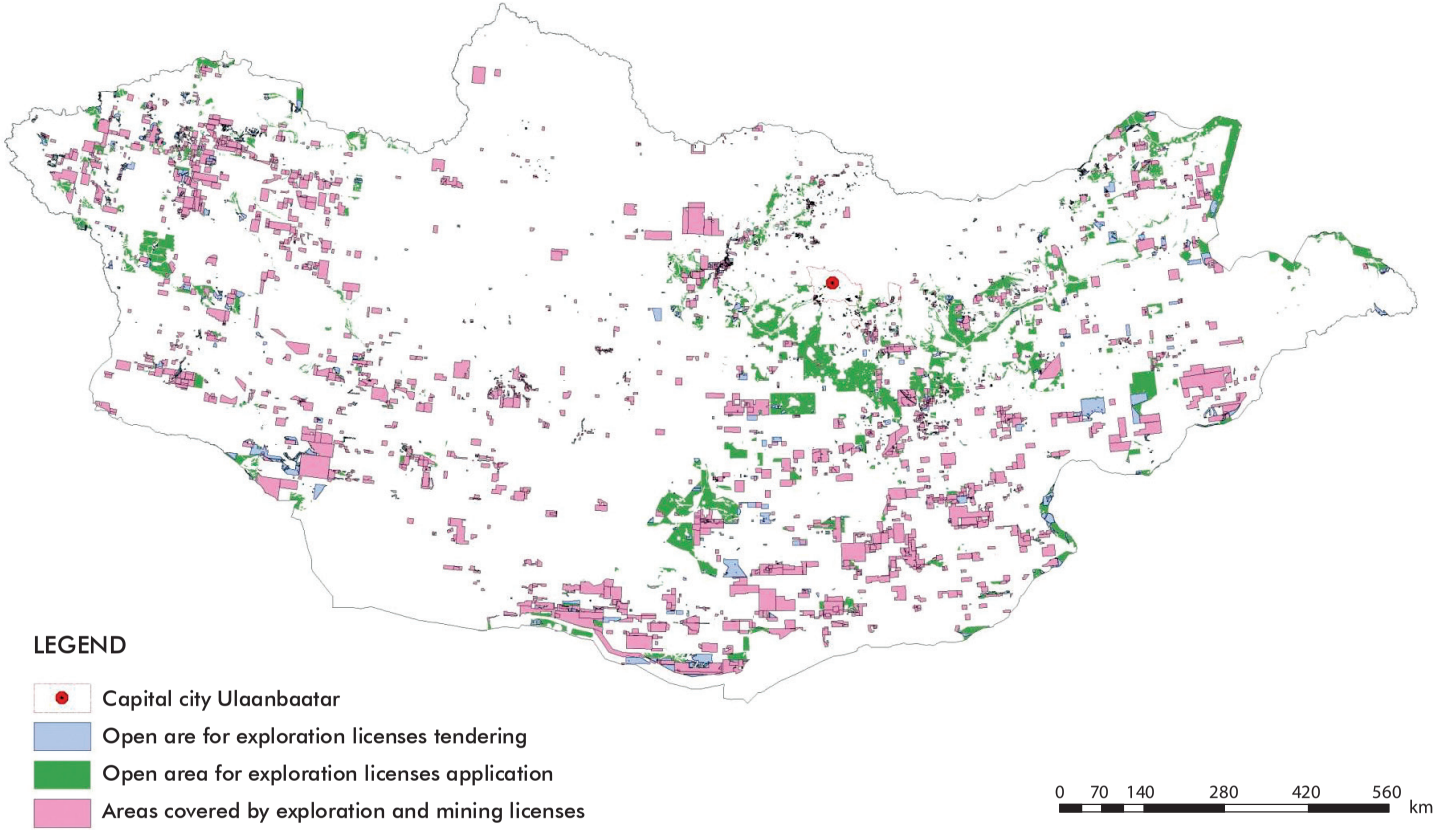


Figure 16: Map of Mongolia showing the areas covered with valid licenses (exploration plus mining), and areas which are open for acquiring licenses by either application or tendering.

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