Mineral Resources

Geologists' Paradise

■ Ust-Kamenogorsk's lead smelter is the largest in Kazakhstan. **Upper right:** Galena (lead sulfide) crystals. **Lower right:** The head of the refining shop at Kazzink JSC Turarbek Azekenov, the largest gold producer in Kazakhstan, shows a gold ingot.

With minerals from A to Z, Central Asia is rich in variety, number, and size of mineral deposits. Arsenic, bauxite, boron, bismuth, copper, chromium, iron, lead, manganese, mercury, salt, silver, titanium, tungsten, uranium, and zinc are just a few of the minerals found in significant quantity. In addition, countries of the region hold some of the world's largest shares of some of these minerals—chromium, gold, and uranium among them.

A Rich Mineral Mix

KAZAKHSTAN

Although its petroleum industry powers economic growth, Kazakhstan's economy depends heavily on mineral production. It is the largest producer of minerals in the region, with extensive reserves of a broad range of industrial minerals and metallic ores and a thriving metallurgical sector. In 2004, mineral extraction accounted for roughly a third of Kazakhstan's gross domestic product. The overall production value of metal and other ores increased more than four and five times, respectively, during 2000–2004.

Kazakhstan is a world leader in reserves of coal, chromite, lead, zinc, and uranium (for coal and uranium, see Energy Resources chapter). In 2005, Kazakhstan's production of ferrous minerals included bauxite, chromite, copper, iron, lead, manganese, and zinc ores; its metallurgical sector produced such metals as beryllium, bismuth,

Production of Mineral Commodities in Kazakhstan, 2005
(Metric tons unless otherwise specified)

Commodity	Production volume
Metals	
Aluminum: bauxite	4,800,000[e]
Arsenic trioxide	1,500
Cadmium, metal	2,000[e]
Chromite	3,579,000
Copper, mine output, Cu content	402,000
Gold: refined (kilograms)	9,788
Iron and steel: Iron ore, Fe content	9,300,000[e]
Lead: Pb content	44,000
Manganese ore, crude ore, gross weight:	2,207,700
Molybdenum, concentrate, Mo content	230
Nickel, Ni content of laterite ore	193
Rhenium (kilograms)	8,000
Silicon	95,000
Silver, mine output, Ag content (kilograms)	832,000[e]
Titanium sponge	19,000
Vanadium, Va content	1,000
Zinc, mine output, Zn content	400,000[e]
Industrial Minerals	
Asbestos, all grades	355,000[e]
Barite	120,000[e]
Boron (thousand metric tons)	30
Cement	3,974,800
Clays, kaolin	70,000
Gypsum	820,000
Phosphate rock, gross weight	230,000[e]

[e]Estimated.
Source: US Geological Survey. 2005. *Minerals Yearbook*. http://minerals.usgs.gov/minerals/pubs/myb.html

Mineral Deposits of Central Asia

1:10 000 000

200 100 0 200

Kilometers

N

55°0'E

75°0'E

50°0'N

40°0'N

RUSSIAN FEDERATION

KAZAKHSTAN

UZBEKISTAN

TURKMENISTAN

KYRGYZ REPUBLIC

TAJIKISTAN

AZERBAIJAN

IRAN

AFGHANISTAN

PEOPLE'S REPUBLIC OF CHINA

Petropavlovsk
Kostanai
Pavlodar
Oskemen
ASTANA
Karaghandy
Oral
Aktobe
Atyrau
Aktau
Kyzyl Orda
Almaty
Taraz
BISHKEK
Karakol
Shymkent
Talas
Naryn
TASHKENT
Namangan
Jalalabat
Gulistan
Andijan
Fergana
Osh
Khudzand
Urgench
Dashkhovuz
Balkanabat
Bukhara
Navoi
Djizzak
Samarkand
Karshi
Turkmenabad
ASHGABAT
Mary
Termez
DUSHANBE
Kulyab
Kurgan-Tyube
Khorog

Caspian Sea
Aral Sea
Lake Zaisan
Lake Balkhash
Lake Issyk-Kul

Ishim
Irtysh
Nura
Syrdaryu
Ili
Chui
Syr Darya
Naryn
Karakum Canal
Amu Darya
Pyandzh
Emba
Ural

National capital
Provincial/oblast capital
International boundary
Rivers and canals

Deposits

Energy materials
- Coal
- Uranium

Ferrous metals
- Chromium
- Iron

Nonferrous metals
- Aluminum
- Copper, lead, zinc
- Gold

Industrial minerals
- Phosphorite

Boundaries are not necessarily authoritative.

Data sources:
Map of Central Asia and Kazakhstan, scale 1: 2,500,000, Ministry of Geodesy and Cartography of the Republic of Uzbekistan, Tashkent, 1995

Projection: Lambert Conformal Conic
Datum: WGS 1984

GIS/Cartography:
V. Sibagatulin,
GIS-Service Ltd., Kyrgyz Republic, 2009

■ **Above left:** Smelting pots of antimony, one of many rare minerals found in the Fergana Valley, at the Kadamjai Antimony Complex in Kadamjai, Kyrgyz Republic. **Above right:** The Tarsunzade aluminum smelter in Tajikistan.

cadmium, copper, ferroalloys, lead, magnesium, rhenium, steel, titanium, and zinc. Industrial mineral and nonferrous mineral products included alumina, arsenic, barite, gold, molybdenum, phosphate rock, tungsten, and uranium.

Although the government maintains ownership of a substantial number of mineral production enterprises, there is also significant foreign ownership. The basis for this, as well as development of the mineral sector in general, is Kazakhstan's Constitution and body of laws and regulations that permit and govern private sector access to mineral rights.

KYRGYZ REPUBLIC

Gold dominates Kyrgyz Republic's mineral sector. This is because of the Kumtor gold mine, brought on line in 1997 by a Canadian mining company in one of Central Asia's biggest single foreign investments. Located deep in the Tien Shan mountains, Kumtor is reported to be one of the world's largest gold mines. In 2005, gold accounted for about one-tenth of Kyrgyz Republic's gross domestic product, and a third of its exports. Gold is found elsewhere as well; a government inventory in 2003 listed 19 primary and secondary gold deposits, with 15 deposits already having development licenses.

The Kyrgyz Republic produces other minerals also. Molybdenum and uranium are produced at the Kara-Balta mining and metallurgical complex, and mercury at the Hyderkhan kombinat. Barite, basalt, beryllium, bismuth, facing stone, rare earth elements, tin, and wolfraum (tungsten) are also mined. However, no mineral affects the economy like gold, making the country susceptible to the vagaries of the gold market. Before independence, mercury and antimony metal production topped the country's mineral sector. Opportunities for these and Kyrgyz Republic's other minerals invite investment.

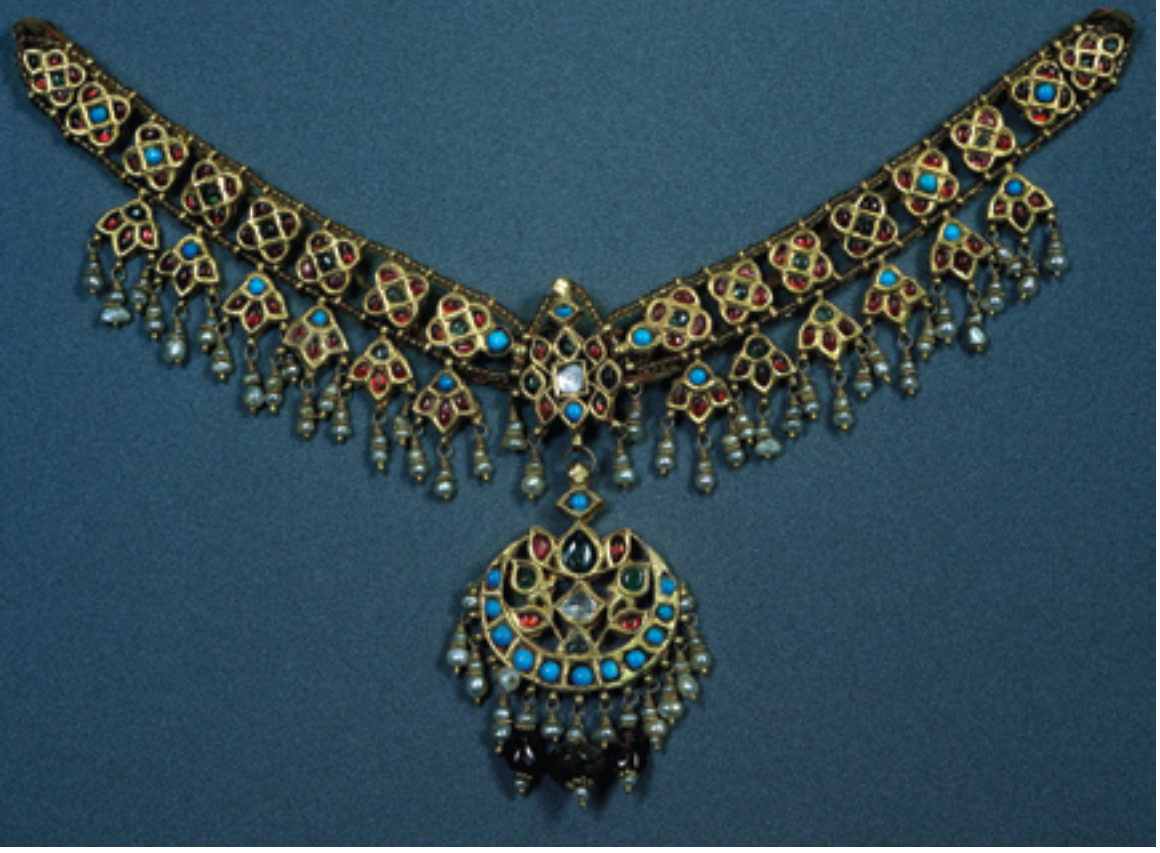
Production of Major Mineral Commodities in the Kyrgyz Republic, 2005
(Metric tons unless otherwise specified)

Commodity	Production
Metals	
Antimony:	
Mine output, Sb content	10
Metal and compounds	500
Gold (kilograms)	16,700
Mercury:	
Mine output, Hg content	200
Metal	250
Molybdenum, mine output, Mo content	250
Industrial Minerals	
Cement	975,100
Fluorspar, concentrate	4,000
Kaolin	400,000[e]
Lime, dead-burned	9,500
Rare earths	NA
Salt	1,100[a]

[e]Estimated, NA = Not available.
Source: US Geological Survey. 2005. *Minerals Yearbook*. http://minerals.usgs.gov/minerals/pubs/myb.html

TAJIKISTAN

Due to its mountainous terrain, much of Tajikistan's mineral potential is in hard-to-reach places. Nevertheless, hundreds of mineral deposits have been explored. Tajikistan's deposits of antimony, boron, lead, and zinc occupied a leading place among reserves found in the former Soviet Union. Other minerals include bismuth, cadmium, copper, gallium, germanium, indium, iron, lead, molybdenum, mercury, salt, selenium, tellurium, thallium, and tungsten. The country is a significant producer of gold, and its Bol'shoy Konimansur deposit in the north is reported to contain one of the largest silver deposits in the world. In all, Tajikistan is said to be currently mining more than 70 types of deposits. The greatest mineral enterprise is the Tajik aluminum smelter (TadAz) in Tursunzade. With a production capacity of more than 500,000 tons, it ranks among the world's largest smelters and provides significant export revenue.



Upper left: Gold necklace from Bukhara, Uzbekistan, studded with precious stones. **Upper middle:** The Chimkent Industrial Union "Fosfor" in Kazakhstan is the largest phosphorus plant in the world, producing 70% of all the former Soviet Union's phosphorus. **Upper right:** Metalwork artisan works on a piece at Saifuddin Caravanserai, a crafts development center in Bukhara, Uzbekistan. **Lower:** Gypsum deposits in the beautiful Koytendag caves, Turkmenistan.

Production of Mineral Commodities in Tajikistan, 2005
(Metric tons unless otherwise specified)

Commodity	Production
Metals	
Aluminum, primary	379,630
Antimony, Sb content of concentrate	2,000
Gold (kilograms)	3,000
Lead, Pb content of concentrate	800
Mercury, Hg content of concentrate	30
Silver, Ag content of concentrate (kilograms)	5,000[e]
Industrial Minerals	
Cement	253,100
Fluorspar	9,000
Gypsum	8,300[r]
Nitrogen, N content of ammonia	45,000[e]

Note: Tajikistan produces other mineral commodities for which information is inadequate to derive estimates, thus not included in the list.
[e]Estimated. [r]Revised.
Source: US Geological Survey. 2005. *Minerals Yearbook*. http://minerals.usgs.gov/minerals/pubs/myb.html

Production of Mineral Commodities in Turkmenistan, 2005
(Metric tons unless otherwise specified)

Commodity	Production
Industrial Minerals	
Bentonite	50,000
Bentonite powder	250
Bischofite	100
Bromine (kilograms)	150,000
Cement	450,000
Ferrous bromide, 51% Br	85
Gypsum	100,000
Iodine	270,000
Lime	16,000
Nitrogen, N content of ammonia	85,000
Salt	215,000
Sodium sulfate	60,000
Sulfur	9,000

Note: In addition to the commodities listed, Turkmenistan produces other mineral commodities for which information is inadequate to derive estimates.
Source: US Geological Survey. 2005. *Minerals Yearbook*. http://minerals.usgs.gov/minerals/pubs/myb.html

TURKMENISTAN

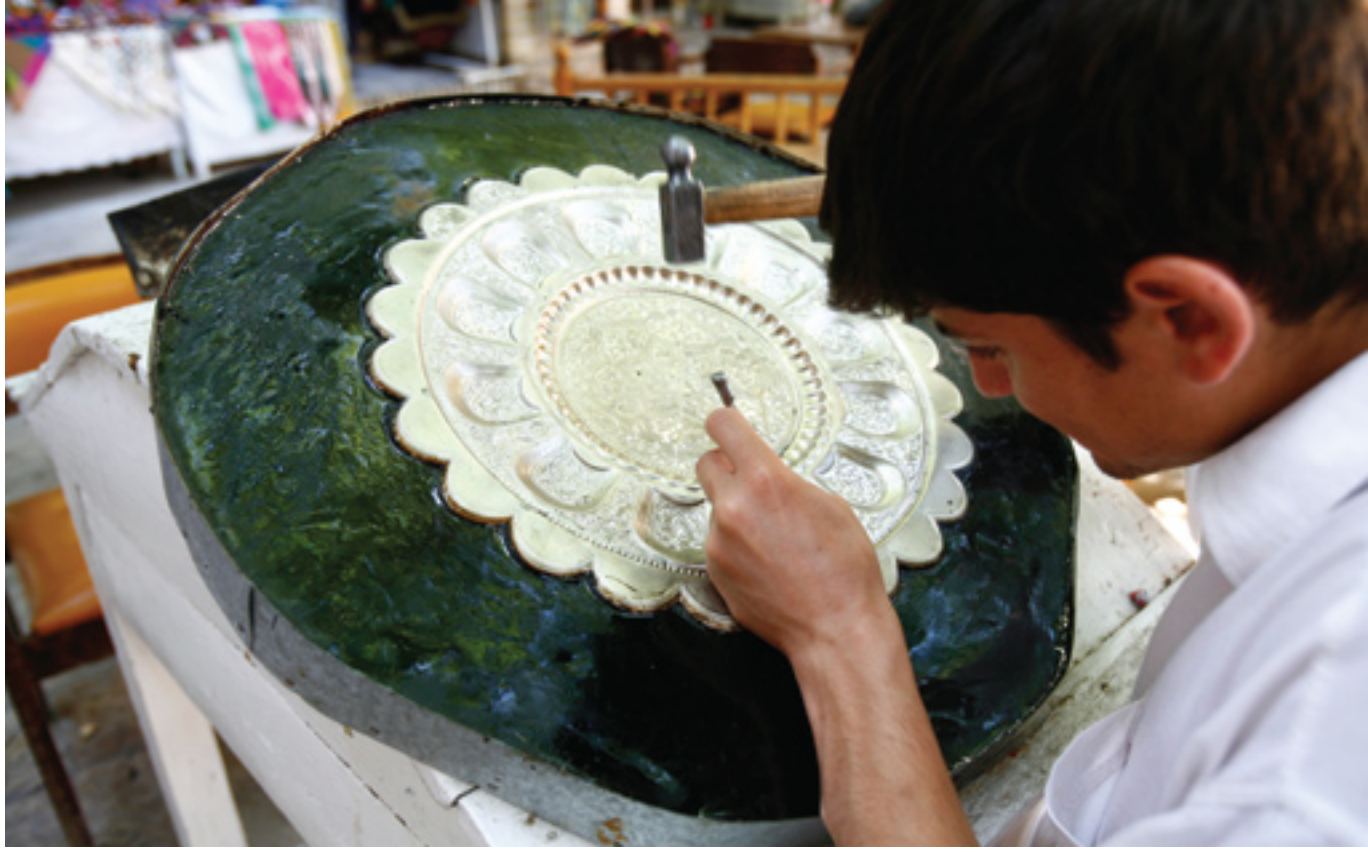
In addition to its substantial oil and gas reserves, Turkmenistan has a broad range of industrial mineral resources that are unevenly dispersed throughout the country. There are more than 150 nonfuel mineral deposits, including barite, bentonite, carbonate material for soda production, celestite, kaolin, marble onyx, mineral salts, natural pigments, and sulfur. Also reported is a host of construction materials, such as facing stone, filling stone, raw materials for cement, and gypsum.

In 2005, all mineral production entities were still state owned. Development of deposits was undertaken by enterprises under the jurisdiction of the state and its ministries. However, the state has recently allowed some foreign involvement through joint-venture arrangements.

UZBEKISTAN

Uzbekistan is a world leader in reserves as well as in the production and export of gold and uranium. It is an important producer and processor of other ores as well, and counts more than 2,800 deposits, containing over 100 types of minerals. Detailed exploration has occurred in more than 100 deposits, leaving much left to explore. Ferrous minerals in production include copper, iron, lead, manganese, and zinc. Production of nonferrous minerals, the leading mineral sector in production, includes bauxite, gold, molybdenum, silver, tungsten, and uranium. Industrial minerals include cement, clays, feldspar, graphite, iodine, nitrogen, phosphate rock, and sulfur.

Two of the largest enterprises in the country are mining and metallurgical-producing complexes: Almalyk complex, which handles copper, gold, lead, and zinc; and the gold- and uranium-producing Navoi complex. Although the state



Production of Mineral Commodities in Uzbekistan, 2005
(Metric tons unless otherwise specified)

Commodity	Production
Metals	
Aluminum, secondary	3,000
Copper, mine output, Cu content	100,000
Gold (kilograms)	90,000
Molybdenum, mine output, Mo content	500
Rhenium (kilograms)	NA
Silver, mine output (kilograms)	83,000
Steel, crude	607,253
Zinc, metal, smelter, primary	30,000
Industrial Minerals	
Cement	5,068,000
Clays, kaolin	5,500,000
Feldspar	4,300
Graphite	60
Iodine (kilograms)	2,000
Nitrogen, N content of ammonia	850,000[e]
Phosphate rock, gross weight	430,000
Sulfur:	
By-product, metallurgy	170,000
Sulfuric acid	740,500

[e]Estimated, NA = Not available.
Source: US Geological Survey. 2005. *Minerals Yearbook*. http://minerals.usgs.gov/minerals/pubs/myb.html

dominates the mining industry and holds monopolies on some minerals, private investment is permitted and has taken the form of joint ventures with the government. In 2004, the share of enterprises that were privately owned topped 90% in the construction material, and ferrous and nonferrous metallurgy sectors.

Impacts of Mineral Extraction

Mining operations can significantly affect the environment. Damage depends mostly on topographical conditions, means of extraction, and soil characteristics. The earth's soil and topography largely evolved through a slow and complex series of changes; biota have adapted accordingly.

World leaders in gold deposits

Throughout history, no mineral has enjoyed more universal value or appeal than gold. It is as precious for its beauty as it is as a hedge in troubled markets. Gold is a leading export of both the Kyrgyz Republic and Uzbekistan, and is mined in Kazakhstan and Tajikistan as well. The region's largest deposits are in the middle and southern Tien Shan gold belt in the Kyrgyz Republic and Uzbekistan. Other major deposits are found in the Makmal gold mining complex and the Sary-Dzhasskiy, Soltan-Sary, and Terek-Sayskiy gold mines.

Uzbekistan's open pit Muruntau gold mine in the Central Kyzylkum area contains one of the largest deposits in the world. Other significant gold deposits are located in the nearby Amantaytau goldfields, and the Zarmitan field in Samarkand. In 2006, Uzbekistan ranked among the world's top 10 gold producers.

Gold ore.

Mineral extraction can unsettle long-established environmental balances within the earth and on its surface. Improper processing and transport of minerals, and poor storage and disposal of mineral waste add to the damage.

Mineral extraction in Central Asia during the Soviet era has caused significant damage to the region. Areas have been scarred by open pit mining and waste has accumulated at the dumps of mining complexes. Problems of safe storage of waste are exacerbated in the Kyrgyz Republic and Tajikistan by natural disasters, such as landslides and earthquakes, which are common occurrences.

Large amounts of uranium waste exist in Central Asia as a consequence of over 50 years of uranium ore mining and processing enterprises after the Second World War. Uranium tailing wastes exceed 100 million tons in the Kyrgyz Republic, Tajikistan, and Uzbekistan, while about 13% of Kazakhstan's territory is contaminated by radionuclides. Dump sites of radioactive waste continue to be sources of radiation and there remains the risk that radiation contamination will spread beyond existing contaminated sites.