



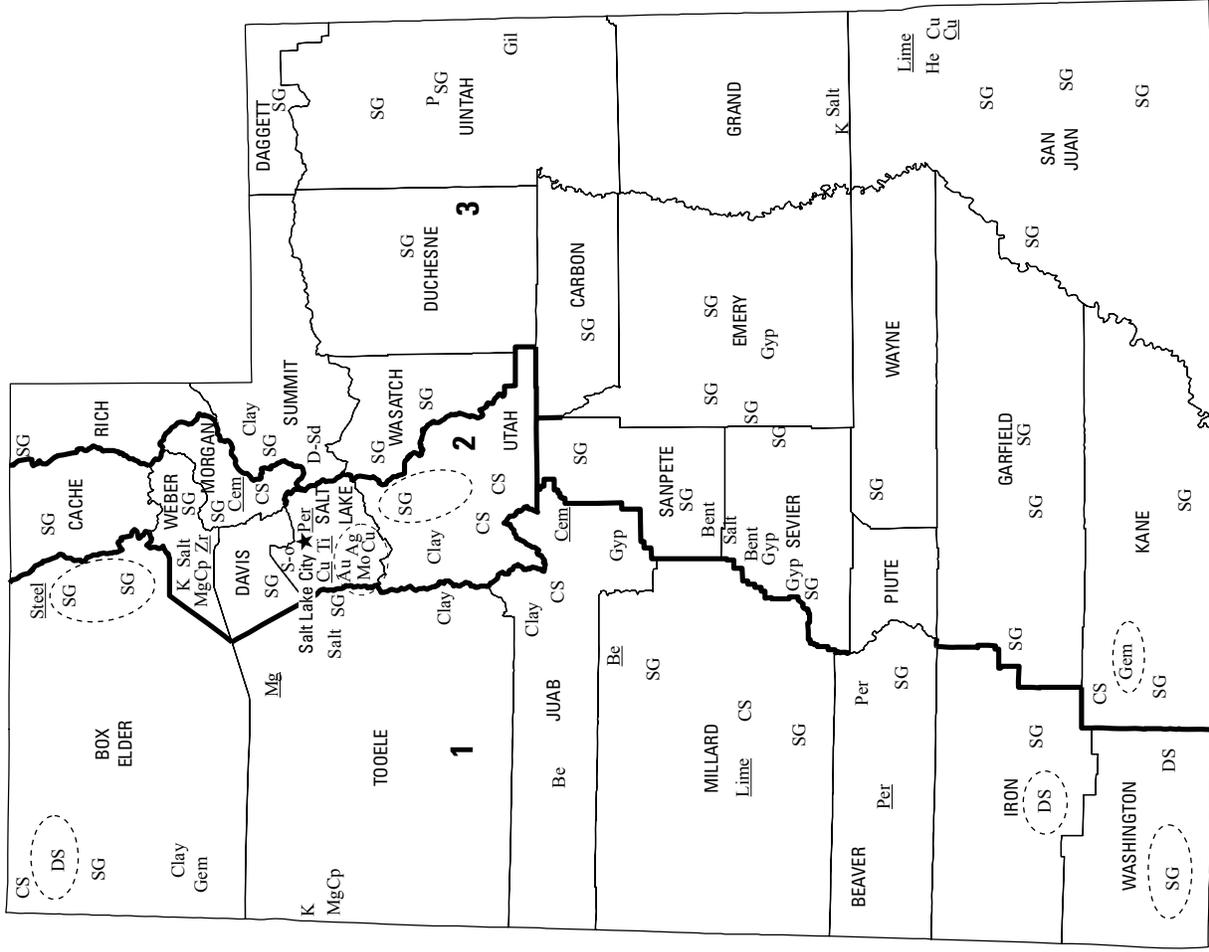
# 2006 Minerals Yearbook

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UTAH

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# UTAH



## LEGEND

- County boundary
- ★ Capital
- City
- 1— Crushed stone/sand and gravel district boundary

## MINERAL SYMBOLS (Major producing areas)

- |      |                 |       |                                     |
|------|-----------------|-------|-------------------------------------|
| Ag   | Silver          | D-Sd  | Dimension sandstone                 |
| Au   | Gold            | Gem   | Gemstones                           |
| Be   | Beryllium       | Gil   | Gilsonite                           |
| Be   | Beryllium plant | Gyp   | Gypsum                              |
| Bent | Bentonite       | Gyp   | Gypsum plant                        |
| Cem  | Cement plant    | He    | Helium                              |
| Clay | Common clay     | K     | Potash                              |
| CS   | Crushed stone   | Lime  | Lime plant                          |
| Cu   | Copper          | Mg    | Magnesium metal plant               |
| Cu   | Copper          | MgCp  | Magnesium compounds                 |
| DS   | Dimension stone | Mo    | Molybdenum                          |
|      |                 | P     | Phosphate rock                      |
|      |                 | Per   | Perlite                             |
|      |                 | Per   | Perlite                             |
|      |                 | Salt  | Salt                                |
|      |                 | SG    | Construction sand and gravel        |
|      |                 | S-o   | Sulfur (oil)                        |
|      |                 | Steel | Steel plant                         |
|      |                 | Ti    | Titanium metal plant                |
|      |                 | Zr    | Zirconium metal plant               |
|      |                 | ○     | Concentration of mineral operations |



Albers equal area projection

# THE MINERAL INDUSTRY OF UTAH

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Utah Geological Survey for collecting information on all nonfuel minerals.

In 2006, Utah's nonfuel raw mineral production was valued<sup>1</sup> at \$3.96 billion, based upon annual U.S. Geological Survey (USGS) data. This was an \$1.16 billion, or more than 41%, increase from the State's total nonfuel mineral value of \$2.80 billion in 2005, which was up \$850 million, or up almost 44%, from that of 2004. The State rose to 4th from 5th in rank among the 50 States in total nonfuel mineral production value and accounted for 6% of the U.S. total value.

Metals accounted for nearly 80% of Utah's nonfuel mineral production value, and copper, molybdenum concentrates, and gold (descending order of value) accounted for about 95% of the State's entire metal value. In 2006, substantial increases in the production values of copper, gold, and construction sand and gravel—up more than \$1 billion, more than \$100 million, and \$34 million, respectively—led the State's increase in nonfuel mineral production value. Each of the three had relatively moderate increases in production, and the first two had substantial increases in their average annual unit values, the largest being in copper followed by gold. The smallest was a 9% increase in the average unit value of construction sand and gravel (table 1).

Other mineral commodities with significant increases in value in 2006 were silver and salt, up more than \$17 million each, portland cement and potash, up about \$13 million each, crushed stone, up by nearly \$8 million, and common clays, up by \$4 million. The largest decreases in value took place in molybdenum concentrates and magnesium metal, down about 10% each. The production of both mineral commodities moderately increased, but significant decreases also took place in the average unit values of each. Smaller yet significant decreases also took place in the values of bentonite and phosphate rock. Although on a much smaller scale than that of the leading nonfuel mineral commodities, a moderate increase in bentonite production resulted in a 50% decrease in its value for the year (table 1).

In 2006, Utah continued to be the only State to produce magnesium metal and beryllium concentrates (descending order of value), and it remained first in State ranking in the quantity of molybdenum concentrates produced; second in copper, gold, potash, and magnesium compounds (in descending order of value); 4th in silver, phosphate rock, and crude perlite; and fifth in bentonite. Utah rose to 5th from 6th in salt production and to 10th from 12th in the production of lime. Additionally, the State was a producer of significant quantities of construction sand

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2006 USGS mineral production data published in this chapter are those available as of March 2008. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

and gravel, portland cement, crushed stone, common clays, and gemstones (gemstones 13th based upon value).

The Utah Geological Survey<sup>2</sup> (UGS) provided the following narrative information. UGS production data were based upon its surveys, estimates, and information gathered from company annual reports. These data may differ from some USGS annual production figures, which were based upon USGS company surveys and estimates.

## Exploration and Development Activities

Mineral exploration statewide increased in 2006. During 2006, the Utah Division of Oil, Gas and Mining (DOG M) received 5 large mine permit applications, 41 new small mine permit applications, and 35 notices of intent to explore on public lands. More than 6,000 new Federal unpatented mining claims were recorded in 2006. The Utah School and Institutional Trust Lands Administration generated record revenues in fiscal year 2006.

### *Bingham District*

Kennecott Utah Copper Corporation's (KUC) Bingham Canyon Mine earned a record \$1.8 billion in 2006 as a result of increased copper, gold, and silver prices and a continued strong molybdenum price. KUC produced a record quantity of molybdenum in 2006 and also increased copper and gold production as a result of the mining of higher-grade ores. The company was in the third year of a program to expand mine reserves with efforts during 2006 focused on extending the mine life beyond the year 2017. As part of the expansion program, alternatives under consideration included various underground mining options or the laying back of additional overburden at the open pit operation.

Development work at Bingham Canyon included an upgrade of the molybdenum recovery circuit and the commissioning of a pebble crushing unit. Other major work during the year included the initial driving of a horseshoe-shaped drainage tunnel from near the bottom of the pit to a location southwest of the pit.

KUC continued its brownfield exploration at Bingham Canyon including substantial efforts at examining high-grade molybdenum areas, copper porphyry roots, and skarn zones below the currently defined pit. These efforts included more than 30,000 meters (m) of development drilling completed in 2006 (Michael Penick, Geological Services Superintendent, KUC, written commun., February 2007). Plans for 2007 included the re-excavation of the North Ore Shoot shaft collar, which was buried by previously mined material.

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<sup>2</sup>Kenneth Krahulec, Geologist, and Roger Bon, Industry Outreach Specialist, of the Utah Geological Survey authored the text of the State mineral industry information provided by that State agency.

Kennecott Exploration Co. continued its exploration of the Stockton porphyry copper system about 16 kilometers (km) southwest of Bingham Canyon. Kennecott performed detailed geologic mapping, geochemical sampling, a gravity survey, a three-dimensional induced polarization survey, a ground magnetic survey, and digital mapping of the 56 km of underground development. The company also conducted exploratory drilling, completing three new core holes totaling about 1,700 m (Joey Wilkins, company official, KUC, written commun., March 2007).

### ***Fish Springs District***

In 2006, Lithic Resources Ltd., Vancouver, British Columbia, Canada, completed an aerial magnetic survey of the Crypto zinc skarn in the Fish Springs mining district of western Juab County, and an aerial photographic description of the general property area. Lithic had acquired the Crypto property in 2005. Cyprus Amax Minerals Company had explored the property in 1993 and had estimated that a shallow oxide resource of 2.8 million metric tons (Mt) averaging 7% zinc and a deep sulfide resource of 5.4 Mt averaging 8.8% zinc existed at Crypto. Lithic planned to conduct a 10,000-m drilling program in 2007, the main objective of which would be to expand the current zinc resource estimates of the Crypto deposit (Chris Staargaard, President, CEO, Lithic Resources Ltd., written commun., February 2007).

Studies to define silver mineralization at the Silver Dome property, 760 hectares (ha) of land south of the Crypto zinc skarn, were carried out in 2006. The property is controlled by Columbus Gold Corporation, Vancouver, British Columbia, Canada. Mineralization at Silver Dome occurs in flat-lying, Ordovician, calcareous sandstones as fine-grained, argentiferous galena, both disseminated and along high-angle structures. During 2006 initial mapping identified widespread silver mineralization. Sampling of the mineralization yielded grades of up to 2.7 kilograms per metric ton (79 troy ounces per short ton) of silver. Columbus Gold has targeted the identification of a bulk-minable silver zone amenable to open pit development (Columbus Gold Corporation, 2007). More detailed geologic mapping, sampling, and trial geophysical surveys were planned to further delineate mineralization on the property.

### ***Gold Hill District***

Dumont Nickel Inc., Toronto, Ontario, Canada, continued its exploration efforts in the Gold Hill mining district in southwestern Tooele County. During the year, four reverse circulation (RC) holes were drilled in the Kiewit gold zone, seven RC holes were drilled in the Kiewit West target, and an additional seven shallow holes were drilled in the Cane Springs property. In late 2006, Dumont discovered a sediment-hosted gold system, the Rattler project, in the northwestern portion of its Gold Hill properties. The company planned to include drill testing of the Rattler project in its 2007 exploration program (Dumont Nickel Inc., 2006).

### ***Gold Springs District***

Astral Mining Corporation, Vancouver, British Columbia, Canada, drilled 10 RC holes totaling about 1,800 m on a low-sulfidation, epithermal, gold-silver quartz vein swarm at its Gold Springs property. The Gold Springs mining district is located on the Nevada-Utah border in southwestern Utah. The best intersect contained 6.1 m of 7.2 parts per million (ppm) gold and 29 ppm silver at a depth of 26 m. A 1,500-m core-drilling program was planned for 2007 at Gold Springs (Astral Mining Corporation, 2006).

### ***Iron Springs District***

In 2006, Palladon Iron Corporation (a subsidiary of Palladon Ventures Ltd., Salt Lake City) digitized the drilling exploration data accumulated at the Iron Mountain project by its former owner, Geneva Steel. In addition, Palladon began engineering and metallurgical studies for a new mill and concentrator, refurbished a ball mill system, demolished all of the existing structures on the mill site, and constructed an interchange track with the Union Pacific Railroad for shipping ore to a port in California for processing in China. Palladon had acquired the Iron Mountain property in 2005. The property, formerly the Comstock-Mountain Lion open pit operation, hosts an estimated resource of about 30 Mt averaging 47% iron (Palladon Ventures Ltd., 2006).

### ***Kings Canyon Area***

Maestro Ventures Ltd., Vancouver, British Columbia, Canada, acquired the Kings Canyon sediment-hosted gold property in southwestern Millard County. The property had been explored in the early 1990s, primarily by Crown Resources. The property reportedly contains several gold zones including a potential resource containing about 6.2 Mt, averaging 1 ppm gold (Palladon Ventures Ltd., 2007).

### ***Lisbon Valley District***

Constellation Copper Corporation, Denver, CO (through its wholly owned subsidiary Lisbon Valley Mining Company LLC) completed construction at its new open pit, heap-leach, solvent extraction-electrowinning (SX-EW) copper operation in 2006. The SX circuit was commissioned in March and the first EW cathodes were produced in April. Startup problems in the operation were encountered throughout the remainder of the year as efforts continued toward full production. Copper cathode production was 5,300 metric tons (t) in 2006. However, by yearend, production was increased to about 900 metric tons per month. Copper at Lisbon Valley occurs as disseminated and fracture-controlled mineralization in Cretaceous sandstones along the nose of a salt-cored anticline.

Exploration by Lisbon Valley during 2006 focused on evaluating the Flying Diamond deposit, located southeast of the open pit operation. Drilling tests in 2006 expanded on the

original 13 holes drilled in 2005 and included 24 core holes totaling about 2,800 m and 23 rotary holes totaling an additional 4,300 m. The average mineralized intercept was about 18 m thick with grades near 0.35% copper. Seismic surveying also was performed during the year in an area around Flying Diamond to help define the ore-controlling structure (Gary Parkison, vice president, Exploration and Development, written commun., March 2007).

### **Milford Area**

In 2006, Western Utah Copper Company (WUCC) focused its exploration efforts on definition drilling at the Candy B and Hidden Treasure deposits. Proven ore reserves in these deposits total about 2.2 Mt averaging 1.38% copper with a total resource estimated to be 36 Mt averaging a similar grade of copper. Upon further development of these deposits, WUCC planned an open pit mining operation, wherein the copper would be recovered by a column flotation, acid vat leaching, and electrowinning. During the year, WUCC continued its preparation of the plant site for construction of the operating facilities. WUCC controls more than 40,500 ha of land in the Milford area and has been actively exploring the Rocky Range and Beaver Lake mining districts for the past several years. These districts host seven partially defined copper skarn and breccia pipes containing byproduct gold and silver.

## **Commodity Review**

### **Industrial Minerals**

Industrial minerals production was the second-leading contributor to the value of Utah's minerals produced in 2006. The value of industrial minerals has grown substantially during the past 10 years. Commodities that realized the majority of the gains during this period included cement, construction sand and gravel, crushed stone, lime, magnesium chloride, phosphate rock, potash, and salt. These commodities accounted for 89% of the total value of Utah's industrial minerals segment in 2006. Other important mineral commodities produced during the year, in descending order of value, included gilsonite, expanded shale, common clay, bentonite and kaolinite, and gypsum. While the overall value of industrial minerals reached a record high, several commodities or commodity groups, including expanded shale and perlite, phosphate rock, and salt and other brine-derived products (magnesium chloride and potash) were lower in production value as a result of a decrease in production and/or declining commodity prices in 2006.

**Cement.**—Holcim, Inc. and Ash Grove Cement Company produced portland cement in the State during 2006. Holcim's Devils Slide Mine and plant are located east of Morgan in Morgan County, and Ash Grove's Leamington Mine and plant are east of Lynndyl in Juab County. Both plants operated at or above design capacity in 2006. In addition to limestone, Ash Grove mined a modest amount of shale and sandstone that was used in the manufacture of cement.

**Common Clay and Bentonite.**—Nearly 291,000 t of common clay and approximately 74,000 t of bentonite were

produced by eight companies in 2006. Statewide, there were 19 active mine permits held by clay and/or bentonite operators in 2006. Many of these mines were operated intermittently. The two leading producers of common clay in 2006 were Interstate Brick and Interpace Industries Inc. Two companies (Western Clay Company and Redmond Minerals Inc.) produced bentonite from pits located in central Utah. In addition, Atlas Minerals began development of a high-alumina specialty clay (halloysite) mine in Juab County. More than 75% of all common clay is used in the manufacture of brick. Bentonite is used as a sealant in many civil engineering applications, as a pet-waste absorbent (litter-box filler), as an additive in oil and gas drilling fluids, and as a binder in foundry molds. High-alumina clays are used in the manufacture of cement and in numerous specialty applications including the field of nanotechnology.

**Sand and Gravel, Construction, and Stone, Crushed.**—Sand and gravel and crushed stone (including limestone and dolomite) were the third-leading contributors to the value of industrial minerals produced in Utah during 2006, with an estimated value of \$219 million, about 12% higher than in 2005. These materials were produced in nearly every county in Utah by commercial operators as well as Federal, State, and county agencies. Because of the large number of operations (approximately 140 active pits and quarries), the UGS did not send production questionnaires to this group. However, production data for 2006, as compiled by the USGS, showed production of 38 Mt of sand and gravel with a value of \$183 million, and 9.9 Mt of crushed stone with a value of \$59.8 million. Sand and gravel production increased by 12% and crushed stone production increased by 15% in 2006 compared with that of 2005. Crushed stone production includes the raw material for both lime and cement plants.

**Expanded Shale and Perlite.**—Two companies, Harborlite Minerals Corp. (formerly Basin Perlite Company), a subsidiary of World Minerals Inc., Santa Barbara, CA, and Utelite, Inc. produced lightweight "expanded" products from shale and perlite for use primarily in the building and construction industries. World Minerals is owned by Imerys Performance Minerals, a French international company. Perlite production was about 390,000 cubic meters (m<sup>3</sup>) in 2006, a slight increase from that of 2005. Utelite's shale mine and plant are east of the town of Wanship in Summit County. Harborlite Mineral's perlite mine is about 40 km north and east of the town of Milford in Beaver County, and the plant is located in Milford. The Harborlite Mine and plant were shut down in mid-2006 and remained inactive at yearend.

**Gilsonite.**—Gilsonite production in 2006 was estimated to be about 73,000 t, unchanged from that of 2005. Gilsonite is an unusual solid hydrocarbon that has been mined in Utah for more than 100 years. Gilsonite is marketed worldwide for use in more than 150 products ranging from printing inks to explosives. All the gilsonite mines are located in southeastern Uintah County. The three companies that produced Gilsonite were, in descending order of production, American Gilsonite Company, Ziegler Chemical & Minerals Company, and Lexco, Inc.

**Gypsum.**—Five companies produced about 467,000 t of gypsum in 2006, about 75,000 t more than in 2005. In descending order of production, the three largest producers were

Georgia-Pacific Gypsum LLC, U.S. Gypsum Co., and Sunroc Corporation (a subsidiary of Clyde Companies Inc.) Georgia-Pacific and U.S. Gypsum operate the only two wallboard plants in Utah. Both plants are near the town of Sigurd in Sevier County. The Georgia-Pacific plant, which closed in 2002, reopened in 2006 and was operated on a full-time basis. Statewide, there were 14 permitted gypsum mines; 5 were listed as active and 9 were listed as inactive. Most gypsum produced in Utah was used for making wallboard, but several operators supplied raw gypsum to regional cement companies where it was used as an additive to control the setting time of cement, and to the agricultural industry where it was used as a soil conditioner.

**Lime and Limestone.**—Lime production was about 10% higher in 2006 than in 2005. Graymont Western U.S., Inc., produced dolomitic quick lime and high-calcium quick lime. Chemical Lime of Arizona, Inc. also produced dolomitic quick lime and hydrated dolomitic lime. The combined production capacity of these two companies was about 0.9 million metric tons per year (Mt/yr). Both operations served markets in Utah and surrounding States. Graymont Western's plant is in the Cricket Mountains, approximately 56 km southwest of Delta in Millard County, and is one of the 10 leading lime plants in the United States. Chemical Lime's plant is about 13 km northwest of Grantsville in Tooele County.

Statewide, DOGM lists 35 active limestone operations including 17 large mine and 18 small mine permits. Total limestone production reported was 3.20 Mt in 2006. Other uses of limestone include construction, and flue-gas desulphurization in coal-fired powerplants. A small amount of limestone is also crushed to a fine powder and marketed as "rock dust" to the coal mining industry.

**Phosphate Rock.**—Simplot Phosphates LLC is Utah's only phosphate producer. The company's phosphate operation is 18 km north of Vernal in Uintah County. The mine produces in the range of 2.7 to 3.6 Mt/yr of ore, which is processed into 0.9 to 1.8 Mt of phosphate concentrate. The concentrate is transported in slurry form to the company's Rock Springs, WY, fertilizer plant via a 144-km underground pipeline.

**Salt, Magnesium Chloride, and Potash.**—Brine-derived products, including salt, were the second-leading contributors to the value of industrial-mineral production in Utah during 2006, having a combined value of \$233 million, 11% less than in 2005. The decrease in value was attributed to the lower production of all of these mineral commodities. In addition to salt, brine-derived products include magnesium chloride and potash [potassium chloride and sulfate of potash (SOP)]. North Shore Limited Partnership produced a small quantity of concentrated brine that was used as an ingredient in mineral food supplements. The statewide production of salt and other brine-derived products, excluding magnesium metal, was estimated to be 3.42 Mt in 2006, about 0.96 Mt less than in 2005.

Three companies processing brine from Great Salt Lake provided most of the State's salt production. These three companies, in descending order of production, were Great Salt Lake Minerals Corporation, Cargill Salt Company, and Morton International. In addition, three other companies produce salt

and/or potash from operations not located on Great Salt Lake. These included Intrepid Potash - Wendover LLC at Wendover in Tooele County (salt and potash), Intrepid Potash - Moab LLC near Moab in Grand County (salt and potash), and Redmond Minerals, Inc. near Redmond in Sanpete County (rock salt). Redmond Minerals has increased production significantly during the past 5 years.

## *Metals*

**Beryllium.**—Utah continued to be the nation's sole producer of beryllium concentrates. Brush Resources Inc. operated a beryllium (bertrandite) mine and processing plant in Delta, Juab County, during the year. Bertrandite ore and imported beryl were processed at the company's plant several kilometers north of Delta in Millard County. The product, beryllium hydroxide, was then sent to the company-owned refinery and finishing plant in Ohio, where it was converted into beryllium metal, alloys, and oxide. Brush reported mining approximately 53,000 t of ore in 2006, in addition to purchasing about 45,000 t of beryl ore from the National Defense Stockpile. The company's Hogsback Mine was closed in 2006 and overburden removal at the new Fluro-Roadside pit was expected to begin in early 2007 (Brush Wellman Inc., 2007).

It was estimated that about 45% of beryllium use was in computer and telecommunications products. The remainder was used in aerospace and defense applications, appliances, automotive electronics, industrial components, and other applications (Shedd, 2007).

**Copper.**—Copper was the leading contributor to the value of nonfuel minerals in Utah. Substantial price increases from 2003 through 2006 raised the unit value of copper to an alltime high, and the value of base-metal production statewide to a record of nearly \$2.9 billion. Refined copper production from KUC's Bingham Canyon Mine decreased in 2006 to approximately 218,000 t from approximately 232,000 t in 2005 (Rio Tinto, 2007).

**Gold and Silver.**—Refined gold production in 2006 was estimated to be about 14,000 kg [462,000 troy ounces (oz)], a 25% increase from the 11,500 kg (369,000 oz) produced in 2005 (Rio Tinto, 2007). Gold is produced from two surface mines owned by Kennecott Corporation: one primary producer (Barneys Canyon Mine) and one byproduct operation (Bingham Canyon Mine) are both located in Salt Lake County. Several other small mines in the State produce minor amounts of gold and silver, but production is not reported here nor included in the above totals. The Barneys Canyon Mine exhausted its ore reserves in late 2001 and ceased mining, but was to continue production of gold from its heap-leach pads at a much reduced rate into 2007, when those pads were expected to be depleted. Silver byproduct recovered from the Bingham Canyon Mine netted 0.13 million kg (4.15 million oz) of refined silver in 2006, about 17% higher than in 2005 (Rio Tinto, 2007).

**Magnesium.**—Magnesium metal was the third-leading contributor to Utah's value of base metals in 2006. Magnesium metal was produced from Great Salt Lake brines by US Magnesium, LLC at its Rowley electrolytic plant in Tooele County. The plant's annual capacity was 43,000 t of magnesium

metal (99.8% purity). It is the only primary magnesium processing facility in the United States. Magnesium production in 2006 was higher than that in 2005. Average magnesium metal prices declined from \$2.71 per kg in 2005 to \$2.53 per kg in 2006 (Kramer, 2007).

**Molybdenum.**—Molybdenum was the second-leading contributor to the value of Utah's base-metal production in 2006. KUC's Bingham Canyon Mine produced about 16,800 t of coproduct molybdenum in 2006, about 8% more than in 2005 (Rio Tinto, 2007). The increased production of molybdenum was largely offset by a 35% drop in molybdenum metal prices during the year. The Bingham Canyon mine was the second leading of nine molybdenum-producing mines in the United States in 2006. The USGS reported that the U.S. mine output of molybdenum in concentrate increased by 4% in 2006, compared with a 35% increase in 2005 (Magyar, 2007).

### *Mineral Fuels and Related Materials*

**Uranium.**—The dramatic rise in the price of uranium during the past several years has had a substantial impact on exploration and development activity in Utah. Historically, Utah has been the third most important uranium-producing State. The majority of Utah's uranium property acquisition and work has focused on the Colorado Plateau (Gloyn and others, 2005).

In late 2006, Denison Mines Inc., Toronto, Ontario, Canada, acquired International Uranium Corp., Vancouver, British Columbia, Canada, and all of its assets in Utah including the White Mesa uranium mill, the Pandora Mine, and the Henry Mountains Complex. The resulting company, Denison Mines Corp., then began a \$15 million upgrade to the mill, which was expected to produce more than 1,330 t of triuranium octaoxide ( $U_3O_8$ ) and 2,000 t of vanadium pentoxide ( $V_2O_5$ ) by 2010.

Denison also resumed mining at the Pandora Mine in the eastern La Sal District, becoming the first productive uranium mine in the State since the early 1990s. Production in 2006 totaled about 1,100 t of ore. The ore from the Pandora Mine was to be shipped about 110 km south to the White Mesa mill near Blanding and stockpiled until mill conversion work was completed in early 2008 (Jon Showalter, Denison Mines, personal commun., March 2007).

Denison Mines' Henry Mountains Complex (Tony M Mine and Bullfrog property) in the Shootaring Canyon district is thought to host the largest known uranium resource in Utah, estimated to be about 4.9 Mt averaging 0.22%  $U_3O_8$ . Mining permits from DOGM for this operation were pending at yearend. Mining at the Henry Mountains Complex was scheduled to resume in 2007.

Mesa Uranium Corp. and Universal Uranium Ltd., each based in Vancouver, British Columbia, Canada, continued drill programs at their interlocking properties in the Lisbon Valley mining district. Mesa completed the drilling of 10 holes with a total depth of 8,100 m, intersecting strongly anomalous uranium mineralization in two holes. Mesa also drilled three additional holes on their adjoining North Alice property, intersecting anomalous uranium and copper mineralization in two of these holes (Mesa Uranium Corp., 2006, 2007). Universal drilled 12 holes totaling 9,400 m in 2006, intersecting anomalous uranium

mineralization in six of the holes. In a second exploration phase, Universal drilled eight holes totaling 6,200 m with another 10 holes planned for 2007 (Universal Uranium Ltd., 2006).

Several companies acquired property containing known uranium resources during the year. Energy Metals Corp., Vancouver, British Columbia, Canada, acquired the Velvet property, with 210,000 t of ore averaging 0.43%  $U_3O_8$  in the Lisbon Valley district; the Frank M property with 1.36 Mt of ore averaging 0.12%  $U_3O_8$  in the Shootaring Canyon district; and the San Rafael property with 587,000 t of ore averaging 0.16%  $U_3O_8$  in the Green River area. The San Rafael property is a joint venture with Vancouver-based Magnum Uranium Corp., which also controls three other uranium properties in Utah.

Vancouver-based SXR Uranium One, Inc. acquired the uranium assets of U.S. Energy Corp., Riverton, WY, including the Shootaring Canyon uranium mill in the Henry Mountains area and several Utah uranium prospects. The mill was being re-permitted for operation. U.S. Energy's Utah properties include the Sahara Mine with 99,000 t of ore averaging 0.23%  $U_3O_8$  in the San Rafael River uranium district (SXR Uranium One, Inc., 2007).

Trigon Uranium Corp., Golden, CO, acquired a volcanic-hosted uranium property in the Central Mining Area near Marysville. Historical drilling data indicate a resource estimated to be about 680,000 t averaging 0.075%  $U_3O_8$  (Trigon Uranium Corp., 2006).

## **Government Programs and Activities**

### *Federal Government*

**Environmental Issues.**—The U.S. Department of Energy and the State of Utah agreed in 2005 to move the 10.5 Mt of uranium mill tailings located along the Colorado River near Moab. The tailings, estimated to average about 100 ppm uranium and 400 ppm vanadium, will be moved 48 km north to a site near Crescent Junction, Utah. Cleanup operations and revegetation peripheral to the Moab tailings location were completed in 2006. Construction of the disposal cell at Crescent Junction was not expected to begin before 2009.

Reclamation at the Midvale slag Superfund site along the Jordan River was completed during the year, allowing for mixed-use development of the site to begin. The development, to be named Bingham Junction, was expected to include 48 ha of houses, apartments, retail, and office space with an associated 4.5 ha of wetland.

### *State Government*

**Environmental Issues.**—DOGM continued its program of closing abandoned mines. The program has already closed an estimated 6,000 to 7,000 mine openings. Four new mine closing projects involving another 1,000 openings are planned for 2007. The projects include the Gold Hill District, the Mammoth section of the Tintic District, the San Rafael Swell, and the Star District.

A consortium of Snowbird Ski Resort, Tiffany & Co., Trout Unlimited, and the U.S. Environmental Protection Agency,

teamed up to reclaim the abandoned Pacific Mine in the American Fork District. The cleanup, which had been delayed under certain regulations in the 1971 Clean Water Act, was completed under a special Good Samaritan variance from the Act.

Shaw Environmental, Inc. mined approximately 202,000 m<sup>3</sup> of limestone from its Lime Peak quarry in the Tintic District. This stone was then planned to be used for rip rap in the remediation of historical mine dumps near the town of Eureka.

**Utah Geological Survey Publications.**—The following publications provide new information on the mineral resources of Utah. These publications and others are listed on the UGS Web site at <http://geology.utah.gov/> and are available for purchase at the DNR Map and Bookstore. Additional free geographic information system (GIS) data on Utah are available for download at <http://agrc.its.state.ut.us/>.

Mining Districts of Utah, edited by Roger Bon, Robert Gloyn, and Gerald Park, was released on compact disk (CD) as Utah Geological Association (UGA) Publication 32. The CD contains more than a dozen papers on the history, production, and geology of individual Utah mining districts, including most of the largest districts: Bingham, Lisbon Valley, Park City, Spor Mountain, Stockton, and Tintic. Also included are ancillary papers on the history of metal prices and mining in Utah.

A collection of reprints, Uranium/Vanadium Publications of the UGS, was released as UGS Open-File Report 462. This CD contains 14 publications totaling 1,418 pages and 14 plates. Included in this collection is the most complete publication (Uranium-Vanadium Occurrences of Utah) on uranium in Utah.

Another collection of reprints, Selected Lead and Zinc Publications of Utah, compiled by Ken Krahulec was released as UGS Open-File Report 466. The CD contains 10 papers totaling 759 pages, including a 1976 report on lead and zinc in Utah that is the most comprehensive work to date on the subject.

Geology of Northwestern Utah, UGA Publication 34, is a CD edited by Kimm Harty and David Tabet. The CD contains five papers on mineral resources, including articles on the Dugway mining district; Vipont Mine in the Ashbrook District; travertine at Aragonite; Mountain City District; and limestone, dolomite, and silica occurrences of northwestern Utah.

Other recent publications from the UGS on minerals and energy resources include (1) Coal Resource Map of Utah (Map 226DM), (2) The Available Coal Resource for Eight 7.5-minute Quadrangles in the Alton Coalfield, Kane County, Utah (Special Studies 118), (3) Utah Oil Shale Database (Open-File Report 469), and (4) History and Mineral Resource Characterization of Sevier Lake, Millard County, Utah (Miscellaneous Publication 06-6). In addition, gilsonite resources and mining in the Uinta Basin were reported (Tripp and White, 2006).

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TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN UTAH<sup>1,2</sup>

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2004		2005		2006		
	Quantity	Value	Quantity	Value	Quantity	Value	
Beryllium concentrates	metric tons	2,210	NA	2,780	NA	3,830	NA
Clays:							
Bentonite		73	W	W	W	W	W
Common		443	5,600	478	6,710	526	10,700
Gemstones, natural		NA	235	NA	235	NA	238
Salt		2,250	107,000	2,250	132,000	2,810	149,000
Sand and gravel, construction		29,800	125,000	33,900	149,000	38,000	183,000
Stone, crushed		8,030	45,100	8,570 <sup>r</sup>	52,100 <sup>r</sup>	9,860	59,800
Combined values of cement (portland), copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, molybdenum concentrates, perlite (crude), phosphate rock, potash, silver, stone (dimension sandstone), and values indicated by the symbol W		XX	1,660,000	XX	2,460,000	XX	3,560,000
Total		XX	1,950,000	XX	2,800,000 <sup>r</sup>	XX	3,960,000

<sup>r</sup>Revised. NA Not available. W Withheld to avoid disclosing company proprietary data. Withheld values included in "Combined values" data. XX Not applicable.

<sup>1</sup>Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 2  
UTAH: CRUSHED STONE SOLD OR USED, BY KIND<sup>1</sup>

Kind	2005			2006		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone	12 <sup>r</sup>	3,620 <sup>r</sup>	\$19,900 <sup>r</sup>	12	4,700	\$28,000
Dolomite	3	2,890	15,800	2	3,630	21,900
Traprock	--	--	--	1	1	8
Sandstone and quartzite	6	1,350	11,900 <sup>r</sup>	10	780	5,270
Volcanic cinder and scoria	2	28	189	2	17	313
Miscellaneous stone	7 <sup>r</sup>	691 <sup>r</sup>	4,320 <sup>r</sup>	4	730	4,230
Total	XX	8,570 <sup>r</sup>	52,100 <sup>r</sup>	XX	9,860	59,800

<sup>r</sup>Revised. XX Not applicable. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 3  
UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
<b>Construction:</b>		
Coarse aggregate (+1½ inch):		
Riprap and jetty stone	W	W
Other coarse aggregate	W	W
Fine aggregate (-¾ inch):		
Screening, undesignated	W	W
Other fine aggregate	W	W
Coarse and fine aggregates:		
Graded road base or subbase	W	W
Crusher run or fill or waste	W	W
Other coarse and fine aggregates	W	W
Other construction materials	34	596
<b>Agricultural:</b>		
Limestone	W	W
Other agricultural uses	W	W
<b>Chemical and metallurgical:</b>		
Cement manufacture	W	W
Lime manufacture	W	W
Flux stone	W	W
Sulfur oxide removal	W	W
Other miscellaneous uses and specified uses not listed	9	24
<b>Unspecified:<sup>2</sup></b>		
Reported	4,070	25,100
Estimated	1,700	9,800
Total	5,730	34,900
Grand total	9,860	59,800

W Withheld to avoid disclosing company proprietary data; included in "Grand total."

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Reported and estimated production without a breakdown by end use.

TABLE 4  
UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2006, BY USE AND DISTRICT<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
<b>Construction:</b>								
Coarse aggregate (+1½ inch) <sup>3</sup>	--	--	W	W	--	--	--	--
Fine aggregate (-¾ inch) <sup>4</sup>	--	--	W	W	--	--	--	--
Coarse and fine aggregate <sup>5</sup>	W	W	W	W	--	--	--	--
Other construction materials	33	591	1	5	--	--	--	--
<b>Agricultural<sup>6</sup></b>								
	W	W	--	--	--	--	--	--
<b>Chemical and metallurgical<sup>7</sup></b>								
	W	W	W	W	--	--	--	--
Other miscellaneous uses	--	--	9	24	--	--	--	--
<b>Unspecified:<sup>8</sup></b>								
Reported	81	1,060	3,550	21,600	20	121	416	2,320
Estimated	770	4,400	630	3,800	260	1,600	--	--
Total	3,780	23,600	5,380	32,100	283	1,720	416	2,320

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>No production for District 4.

<sup>3</sup>Includes riprap and jetty stone and other coarse aggregate.

<sup>4</sup>Includes screening (undesignated) and other fine aggregate.

<sup>5</sup>Includes crusher run or fill or waste, graded road base or subbase, and other coarse and fine aggregates.

<sup>6</sup>Includes agricultural limestone and other agricultural uses.

<sup>7</sup>Includes cement and lime manufacture, flux stone, and sulfur oxide removal.

<sup>8</sup>Reported and estimated production without a breakdown by end use.

TABLE 5  
 UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006,  
 BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	2,180	\$12,400	\$5.71
Plaster and gunite sands	54	388	7.19
Asphaltic concrete aggregates and other bituminous mixtures	1,020	7,210	7.06
Road base and coverings <sup>2</sup>	6,630	34,200	5.16
Fill	4,740	16,700	3.52
Snow and ice control	36	141	3.92
Railroad ballast	20	76	3.80
Other miscellaneous uses	60	300	5.00
Unspecified: <sup>3</sup>			
Reported	10,000	49,000	4.89
Estimated	13,200	62,800	4.75
Total or average	38,000	183,000	4.82

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes road and other stabilization (cement).

<sup>3</sup>Reported and estimated production without a breakdown by end use.

TABLE 6  
 UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2006, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand) <sup>2</sup>	W	W	W	W	337	2,800
Asphaltic concrete aggregates and other bituminous mixtures	W	W	W	W	318	1,750
Road base and coverings <sup>3</sup>	1,930	10,400	2,280	12,400	1,860	9,250
Fill	560	1,420	3,240	13,100	100	202
Snow and ice control	26	101	1	3	9	37
Railroad ballast			17	52	3	25
Other miscellaneous uses	701	5,240	1,710	9,210	--	--
Unspecified: <sup>4</sup>						
Reported	2,840	14,400	6,380	32,100	392	1,720
Estimated	3,270	15,700	7,850	37,200	2,110	9,980
Total	9,320	47,200	21,500	104,000	5,130	25,800
	Unspecified districts					
	Quantity	Value				
Concrete aggregate (including concrete sand) <sup>2</sup>	--	--				
Asphaltic concrete aggregates and other bituminous mixtures	253	1,340				
Road base and coverings <sup>3</sup>	557	2,100				
Fill	839	2,000				
Snow and ice control	--	--				
Railroad ballast	--	--				
Other miscellaneous uses	--	--				
Unspecified: <sup>4</sup>						
Reported	426	822				
Estimated	--	--				
Total	2,080	6,260				

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes plaster and gunite sands.

<sup>3</sup>Includes road and other stabilization (cement).

<sup>4</sup>Reported and estimated production without a breakdown by end use.