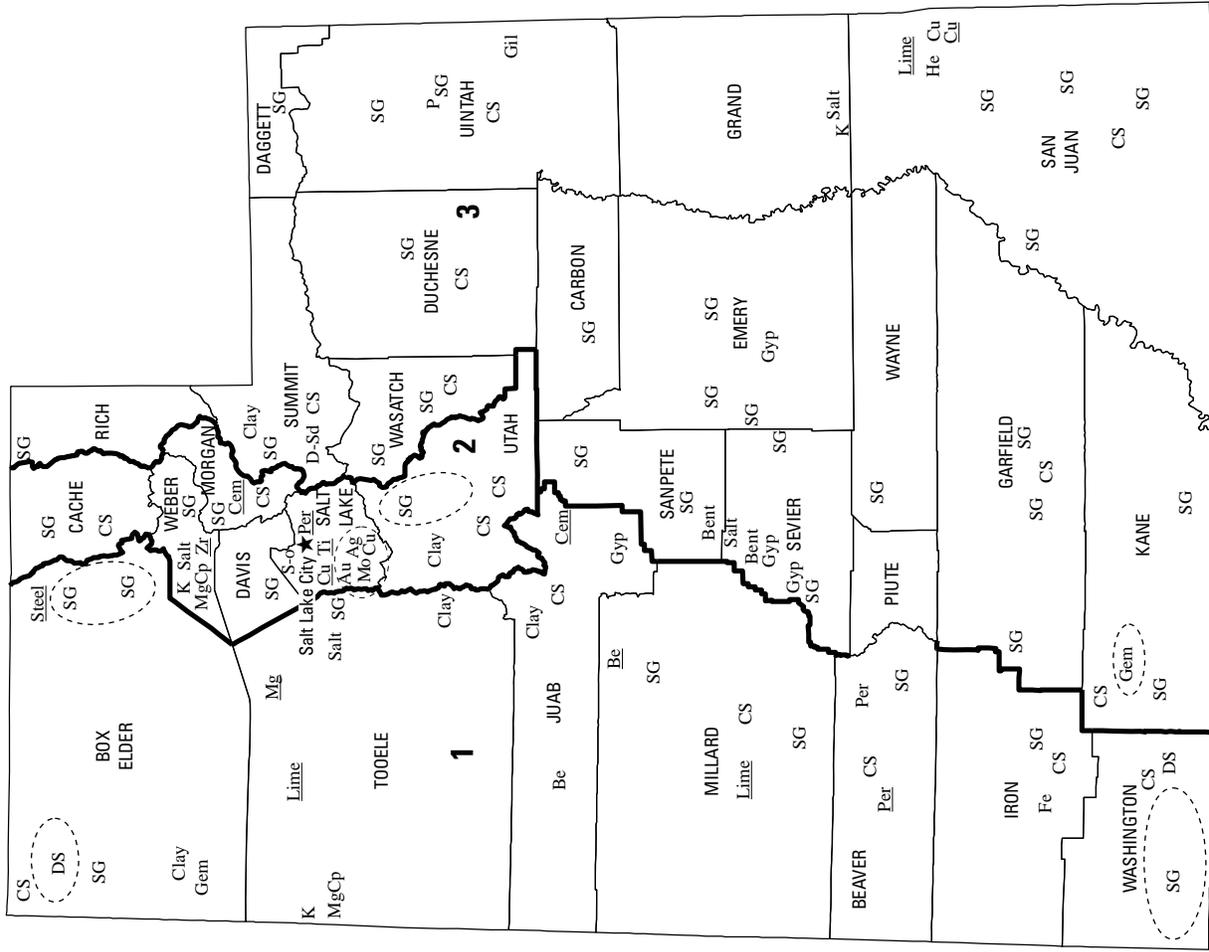




2007 Minerals Yearbook

UTAH [ADVANCE RELEASE]

UTAH



LEGEND

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

MINERAL SYMBOLS (Major producing areas)

- | | | | |
|------|-------------------------|-------|-------------------------------------|
| Ag | Silver | D-Sd | Dimension sandstone |
| Au | Gold | Fe | Iron |
| Be | Beryllium | Gem | Gemstones |
| Be | Beryllium plant | Gil | Gilsonite |
| Bent | Bentonite | Gyp | Gypsum |
| Cem | Cement plant and quarry | Gyp | Gypsum plant |
| Clay | Common clay | He | Helium |
| CS | Crushed stone | K | Potash |
| Cu | Copper | Lime | Lime plant and quarry |
| Cu | Copper plant | Mg | Magnesium metal plant |
| DS | Dimension stone | MgCp | Magnesium compounds |
| | | Mo | Molybdenum |
| | | P | Phosphate rock |
| | | Per | Perlite plant |
| | | 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 |



Source: Utah Geological Survey/U.S. Geological Survey (2007).

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 2007, Utah's nonfuel raw mineral production was valued¹ at \$3.88 billion, based upon annual U.S. Geological Survey (USGS) data. This was a \$130 million, or 3%, decrease from the revised State's total nonfuel mineral value of \$4.10 billion in 2006, which was up \$1.21 billion, or up almost 43%, from that of 2005. The State remained 4th in rank among the 50 States in total nonfuel mineral production value and accounted for 5.6% of the U.S. total value.

Metals accounted for more than 75% of Utah's nonfuel mineral production value, of which copper, molybdenum, and gold (descending order of value) accounted for about 94%. The State's total nonfuel mineral production value declined owing to a \$49 million, \$38 million, and \$2 million, respectively in the value of copper, gold, and silver production. Copper production fell significantly owing to mining lower grades of ore. Gold and silver had moderate decreases in production, but the unit value of each rose significantly (individual values withheld—company proprietary data). Substantial increases took place in the production values of phosphate rock, magnesium metal, lime, and potash for a total increase of \$173 million (individual values withheld—company proprietary data).

In 2007, Utah continued to be the only State to produce beryllium concentrates and magnesium metal. The State was second in the quantities production of copper, molybdenum concentrates, and potash produced, 3rd in gold and magnesium compounds, and 4th in silver. Utah rose to 3rd from 5th in bentonite production, dropped to 6th from 5th in salt production, and remained 10th in the production of lime. Additionally, the State was a producer of significant quantities of construction sand and gravel, portland cement, crushed stone, common clays, and gemstones (gemstones 13th based upon value).

The Utah Geological Survey² (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 and development work increased in Utah during the year owing to the continuing dramatic rise in world

¹The 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 2007 USGS mineral production data published in this chapter are those available as of June 2009. 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>.

²Kenneth Krahelec, 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.

mineral commodity prices from 2001 to near-record highs in 2007. Most exploration efforts in Utah were focused on copper, gold, molybdenum, silver, uranium, and zinc. Base metals had another strong year, supported by near record metal prices. The Bingham Canyon Mine produced exceptional profits, and the Lisbon Valley Mine produced copper ore during the entire year. Another copper operation near Milford was poised to begin production in 2008, and exploration was ongoing in numerous other districts across the State. The information in this section is largely derived from numerous individual company Web sites and press releases.

Kennecott Utah Copper Corporation's (KUC) Bingham Canyon Mine earned \$1.6 billion in 2007, down slightly from a record \$1.8 billion in 2006, on increased prices of copper, gold, silver, and strong molybdenum prices. Bingham remained the United States second largest producer of copper and molybdenum. KUC was in the fourth year of an aggressive development program with current efforts concentrated on extending the mine life from 2017 to 2036. Alternatives studied include additional open pit laybacks and/or various underground options. Exploration efforts included drilling 38 diamond holes totaling 29,000 meters (m). Significant results included expansion of the known molybdenum and copper-gold mineral resources. Development work at Bingham Canyon included reexcavation of the North Ore Shoot shaft collar, which was buried by the canyon dump, and construction of a horseshoe-shaped drainage tunnel from near the bottom of the pit to the north and west. Brownfield exploration work continued at Bingham Canyon with induced polarization (IP) surveying and geochemical sampling southwest of the pit on West Mountain. This work resulted in the recognition of a large phase IP anomaly with coincident copper-gold surface geochemical anomalies. Exploration drilling on this anomaly is planned for 2008.

Lithic Resources Ltd. acquired the Crypto zinc skarn in the Fish Springs mining district of western Juab County in 2005. Cyprus Minerals Company, the previous owner, had estimated a shallow oxide resource of 2.8 million metric tons (Mt) averaging 7.0% zinc and a deep sulfide resource of 5.4 Mt averaging 8.8% zinc. In 2007, Lithic began a 10,000-m core drilling program aimed at confirming and expanding the zinc resource at Crypto. There were five holes completed for a total of 1,300 m of drilling in 2007. Zinc sulfide intercepts of 17.3 m grading 27.3% zinc and 30 m grading 17.93% zinc had minor copper occurrences. Inland Explorations Ltd. formed in 2006 specifically to conduct base-metal exploration in Utah, aggressively pursued a grassroots exploration program and acquired four properties—Dugway, Dunes (Sand Mountain), Keg, and Thompson Knoll. The most advanced target is a copper-gold-lead-silver-zinc carbonate-hosted replacement deposit on the southwest flank of the Dugway District. Inland has performed a detailed aeromagnetic survey, collected

240 surface rock-chip samples, and drilled 1,140 m in four preliminary diamond holes. Surface samples have assayed up to 2.9% copper, 12.8 parts per million (ppm) gold, 14.6% lead, 168 ppm molybdenum, 285 ppm silver, and 10.9% zinc. Mineralization at Dugway is associated with high magnetic susceptibilities and a 3-D magnetic model will be used to delineate drill targets in 2008. The target at the Keg property is a porphyry-skarn deposit. Surface rock-chip samples assay up to 4.7% copper, 0.6 ppm gold, 3.8% lead, 0.26% molybdenum, 123 ppm silver, and 0.5% zinc. Geophysical surveys completed included a detailed aeromagnetic survey over 85 square kilometers (km²), a spontaneous potential/resistivity survey over 3.6 km², and one 5.5 kilometers (km) long IP line. Results of geophysics and surface geochemistry indicated several coincident anomalies. A drilling program was scheduled to begin in 2008. Thompson Knoll lies in the Confusion Range of west-central Utah. The targets are both base- and precious-metal skarns and sediment-hosted gold similar to that in the adjoining Kings Canyon deposit. Geophysical surveys completed included a detailed ground magnetic survey covering 20 km² and several IP lines (16-line km). The ground magnetic survey defined a sizable magnetic high representing a buried intrusive. Surface samples indicated that the intrusive is associated with base- and precious-metal mineralization, with assays up to 0.8 ppm gold, 2.2% lead, 50 ppm molybdenum, 16 ppm silver, and 0.4% zinc. Combined magnetic and IP/resistivity results suggested a possible skarn target and an area of silicification and gold mineralization. Drilling is expected on both of these targets in 2008. A fourth property at Dunes is a base- and precious-metal massive sulfide replacement target associated with gently dipping structures. There were 26 surface samples assayed up to 1.3% copper, 1.3 ppm gold, 1.4% lead, 318 ppm silver, and 0.3% zinc. Geophysical surveys in progress included ground magnetic lines and IP lines.

Palladon Iron Corp. acquired the Iron Mountain property (formerly Comstock-Mountain Lion), an open pit mine that hosts an estimated resource of 16 Mt averaging 52% iron. The iron ore occurs as massive replacement-skarn deposits adjacent to Miocene laccoliths. In 2007, Palladon drilled a series of condemnation and water monitoring holes 558 m at the future mill site and installed a power substation. The company was expected to construct a plant with a 2-million-metric-ton-per-year (Mt/yr) mill/concentrator. Startup problems continued throughout 2007 as Lisbon Valley Mining Co. attempted to reach full production. Recovery of copper from the pads had been substantially slower than anticipated. Despite efforts to increase production, the operation continued to produce less than expected. Mining was expected to end in early 2008. Ore containing approximately 16,000 t of copper had been placed on the leach pads by the time mining was halted. Leaching of this material was expected to continue for the next 1 to 3 years. In 2007, production was about 9,000 t of copper.

Copper mineralization at Lisbon Valley occurs as disseminated and fracture-controlled copper in Cretaceous sandstones along the nose of a salt-cored anticline. Exploration by Lisbon Valley in 2007 focused on evaluating the Flying Diamond deposit and Stateline resource, discovered at depth a few miles southeast of their open pit operation. Drilling in 2007

included 16 new holes totaling 1,290 m. These holes were laid out in northeast-trending fence patterns perpendicular to the ore-controlling east splay of the Lisbon Valley fault, and helped define a mineralized zone approaching 3,050 m long by about 152 m wide and about 15 m thick with grades of approximately 0.4% copper. In October, exploration drilling was suspended owing to problems at the mining operation (Constellation Copper Corp., 2007). Western Utah Copper Co. controlled about 37,200 hectares (ha) in the Milford area and has been actively exploring the Rocky and Beaver Lake mining districts for the past several years. The districts host seven partially defined copper skarn and breccia pipe deposits. Current proven ore reserves total approximately 2.2 Mt averaging 1.38% total copper with possible gold-silver credits. In 2007, Western obtained a large mine permit from the Utah Division of Oil, Gas and Mining, stripped overburden from the Hidden Treasure copper skarn, and began construction of a 2,270-metric-ton-per-day (t/d) flotation mill.

Quaterra Resources, Inc. acquired about 1,300 ha of patented and unpatented mining claims covering the Southwest Tintic porphyry copper system. The property hosts a resource of approximately 360 Mt of 0.33% copper and 0.01% molybdenum. Quaterra was expected to start drilling in 2008. Kennecott Exploration Company's Stockton porphyry copper deposit, about 16 km southwest of Bingham, was acquired by Geoinformatics Exploration, Inc. Stockton hosts an estimated resource of approximately 172 Mt at 0.41% copper and 0.14 ppm gold beginning at a depth of about 225 m. The best previous hole was 277 m averaging 0.39% copper and 0.13 ppm gold. Geoinformatics continued drilling at Stockton (Geoinformatics Exploration, Inc., 2007). Chief Consolidated Mining Co. applied for permits to renew operations at the Burgin Mine (lead-zinc) in the East Tintic District. RTM Exploration and Holdings LLC controlled about 777 ha of sediment-hosted copper-molybdenum prospects in the Uinta Basin. Great Western Minerals Group Ltd. acquired interest in 17,100 ha of rare-earth-bearing heavy-mineral sand deposits in western Juab County. Unico, Inc. continued work on the Deer Trail Mine, a gold-zinc-lead mine, near Marysvale in central Utah. The construction of a titanium sponge plant adjacent to U.S. Magnesium LLC's magnesium facility on the west shore of Great Salt Lake was expected to add incremental demand for magnesium and was expected to begin a new era in metal processing in the State.

Near record prices for precious metals during 2007 significantly increased the level of gold and silver exploration activity in Utah. These efforts were largely focused in the eastern Basin and Range Province of western Utah. Grand Central Silver Mines, Inc. drilled 13 reverse circulation holes totaling 5,260 m on a 46-ha tract on the western fringe of the Bingham mining district in 2006–07. The best drill intersection was 7.6 m of 2.06 ppm gold. A National Instrument (NI) 43–101 technical report was pending. Maestro Ventures Ltd. acquired the Kings Canyon sediment-hosted gold property in southwestern Millard County. The property was explored in the early 1990s, primarily by Crown Resources Corp. The property contains several gold zones with the largest defined resource holding about 6.2 Mt averaging 1 ppm gold. Maestro completed

463 m of confirmatory core drilling in a five-hole program. The best hole (KCC07-02) cut an interval of 15.5 m averaging 1.02 ppm gold (Maestro Ventures Ltd., 2007). Copper King Mining Corp. initially acquired about 486 ha of mostly patented mining claims in the Drum (Detroit) mining district; historically one of the largest gold producing districts in Utah. Copper King later acquired an additional 445 ha of unpatented claims in the district through the merger with Western, giving Copper King a large land package including some previously defined small gold resources. Dumont Nickel, Inc. continued exploration efforts in the Gold Hill mining district in southwestern Tooele County. The Rattler project, a sediment-hosted gold system on the northwestern portion of Dumont's property, was tested with five holes totaling 233 m in 2007. The best hole cut 16.8 m of calcareous siltstone averaging 0.23 ppm gold (Dumont Nickel, Inc., 2007). The Keg project is another silver property acquired by Cordex and Columbus Gold. This 405 ha property covers an area of stockwork quartz veining in a window of quartzite surrounded by Tertiary volcanic rocks and alluvium. Mapping, sampling, and a ground magnetic survey have been completed and an excavator trenching program was planned for spring 2008 (Andy Wallace, President, Cordex Exploration Company, written commun., February 2008). The Silver Dome property in the southern Fish Springs District had never been drilled tested. The 2,023-ha property was acquired by Cordex Exploration Co. for Columbus Gold Corp. (Columbus Gold Corp., 2007). Silver mineralization at Silver Dome is hosted in flat-lying Ordovician sandstones. Initial work has identified mineralization, typically assaying from 15 to 100 ppm silver, in a zone measuring 1,000 m by 100 m along the edge of post-mineral cover. The target at Silver Dome was bulk-minable silver mineralization amenable to open pit development. Several lines of IP were completed in 2007, and a NI 43-101 report was being prepared. Permitting was in progress for a 27-hole drilling program to begin in May 2008 (Andy Wallace, President, Cordex Exploration Company, written commun., February 2008). Newmont Mining Corp. staked about 145 claims in the Stateline gold-silver district of Iron County. Miranda Gold Corp. staked about 190 claims on the Lookout Pass sediment-hosted gold property in southeastern Tooele County. In 2007, Astral Mining Corp. controlled about 997 ha in the Gold Springs District of Iron County.

The dramatic rise in the price of uranium since 2001 substantially influenced exploration and development activity in Utah. Historically, Utah has been the third-ranked uranium-producing State in the United States. The majority of the uranium work has focused on the Colorado Plateau near La Sal where the Pandora Mine was the first to reopen (Gloyn and others, 2005). The mill accepted ore from other companies for toll milling. Denison Mines Corp. owns the White Mesa uranium mill near Blanding, the Pandora Mine, and the Henry Mountains mining complex. These properties were acquired from International Uranium Corporation in late 2006. In 2007, the 1,800-t/d dual-circuit (uranium-vanadium) White Mesa Mill continued processing alternate feed nuclear waste materials, while ore from the Pandora Mine was trucked to the mill and stockpiled. The company began a \$21 million upgrade to the mill, which was expected to produce more than 1.36 million kilogram (kg) of triuranium octaoxide (U_3O_8) and 2 metric tons

per year (t/yr) of vanadium pentoxide (V_2O_5) by 2010. The mill is expected to switch from alternate feed waste material to ore in early 2008. In 2007, Pandora produced approximately 33,000 t of ore, which was shipped about 110 km south to the White Mesa Mill. Reserves at the Pandora Mine were estimated to be about 263,000 t at 0.22% U_3O_8 . Denison Mines' Henry Mountains Complex (Tony M Mine and Bullfrog) properties in the Shootaring Canyon District host the largest identified uranium resource in Utah, which is estimated to be about 2.9 Mt averaging 0.28% U_3O_8 and an existing stockpile of 200,000 t of 0.138% U_3O_8 . The mine was rehabilitated while the final permits for the mining operation were pending from the U.S. Bureau of Land Management. Mining was scheduled to resume in 2008, and production was expected to ramp up to about 9,100 t per month (Denison Mines Corp., 2007). Energy Fuels, Inc. explored and rehabilitated historical uranium mines. The Whirlwind Mine, on Beaver Mesa along the Utah-Colorado border about 45 km northeast of Moab, was scheduled to begin producing in 2008 (Energy Fuels, Inc., 2007). While much of the underground mining takes place in Utah, the portal and surface facilities are 1.6 kilometers (1 mile) to the east in Colorado. The Whirlwind resource is reportedly about 149,000 t of ore averaging 0.20% U_3O_8 and 0.66% V_2O_5 . Energy Fuels anticipated mining 180 t/d. Energy Fuels acquired the 284-ha Hecla Shaft property, near La Sal in 2007. The Energy Queen Mine reportedly has an estimated resource of 161,000 t of ore averaging 0.22% U_3O_8 and 0.86% V_2O_5 , and an existing 229-m lined shaft. Rehabilitation was underway for a 180 t/d operation starting in 2008. Uranium One, Inc. acquired the uranium assets of the U.S. Energy Corp. in 2006 and Energy Metals in 2007. The properties included the Velvet property, holding 210,000 t averaging 0.43% U_3O_8 in the Lisbon Valley District, the Frank M resource with 1.36 Mt averaging 0.12% U_3O_8 in the Shootaring Canyon District, the San Rafael property with 587,000 t averaging 0.16% U_3O_8 in the Green River area, and the Sahara Mine holding 99,000 t averaging 0.23% U_3O_8 in the San Rafael River uranium district. Uranium One also owns the Shootaring Canyon (Ticaboo) uranium mill in the Henry Mountains District. This 680-t/d mill was re-permitted for operation.

Commodity Review

Industrial Minerals

Industrial minerals production was at an alltime high with an estimated value of \$921 million. Industrial minerals were the second-largest contributor to the value of minerals produced in Utah in 2007. Industrial minerals production was the only segment of Utah's mineral industry to show an increase in value. The value of industrial minerals increase substantially during the previous 10 years, increasing from \$534 million in 1998 to \$921 million in 2007, a 72% increase. Mineral commodities that have realized the majority of these gains include crushed stone, lime, magnesium chloride, portland cement, phosphate rock, potash, salt, sand and gravel, and sulfate of potash. These mineral commodities account for 89% of the total value of Utah's industrial minerals segment. Other mineral commodities

produced, in descending order of value, include gilsonite, expanded shale, gypsum, common clay, bentonite, and kaolinite. While the overall value of industrial minerals reached a record high in 2007, several mineral commodity groups, including clay and bentonite, phosphate, portland cement, and expanded shale, experienced lower values owing to lower production and/or lower commodity price.

Cement.—Portland cement and lime were the third-largest contributors to the value of industrial minerals produced in 2007, about \$2 million (1%) less than in 2006. Two operators produced portland cement in Utah: Ash Grove Cement Co. and Holcim, Inc. Ash Grove's Leamington plant and mine are located east of Lynndyl in Juab County and Holcim's Devils Slide plant and quarry are located east of Morgan in Morgan County. The companies have produced a combined capacity of more than 1.4 Mt/yr of cement. In addition to limestone, Ash Grove Cement mined a modest amount of shale and sandstone that were used in the manufacture of cement.

Clay.—More than 434,000 t of common clay and approximately 57,000 t of bentonite were produced by 10 companies in 2007. Statewide, there were 23 active mine permits held by common clay, bentonite, and high-alumina clay operators in 2007. Many of these mines operate intermittently. The two largest producers of common clay were Interstate Brick Co. and Interpace Industries Inc. (a brick producer). Redmond Minerals, Inc. and Western Clay Co. produce bentonite from pits located in central Utah. Lone Star Mining produces high-alumina clay from a pit in Beaver County. More than 75% of all common clay is used in the manufacture of brick. Bentonite was used as a sealant in many civil engineering applications, as a pet-waste absorbent (litter-box filler), as a component of oil and gas drilling fluids, and as a binder in foundry molds. High-alumina clays were only used in the manufacture of portland cement.

Gilsonite.—Gilsonite production for 2007 was estimated to be about 77,000 t, a slight increase above 2006 values. 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 of the gilsonite mines are located in southeastern Uintah County. The three companies that produced gilsonite, in descending order of production, are American Gilsonite Co., Lexco, Inc., and Zeigler Chemical and Minerals Co. Gilsonite production has increased modestly during the past several years.

Gypsum.—Production from five companies was about 370,000 t of gypsum in 2007, about 97,000 t less than in 2006. In descending order of production, the three largest producers were U.S. Gypsum Company, Sunroc Corporation (a subsidiary of Clyde Companies Inc.), and Georgia Pacific Gypsum. Georgia Pacific Gypsum and U.S. Gypsum operated the only two wallboard plants in Utah. Both plants are near the town of Sigurd in Sevier County. Statewide, there were six active gypsum mines in 2007. Most of the gypsum produced was used for making wallboard, but several operators supplied raw gypsum to regional cement companies where it was used as an additive to retard the setting time of cement, and to the agricultural industry for use as a soil conditioner. The decreased

production of gypsum was likely related to the downturn of the housing industry.

Lime.—Lime production was about 5% higher in 2007 than in 2006. There were two suppliers of lime in Utah, Graymont Western U.S., Inc., which produced dolomitic quicklime and high-calcium quicklime, and Chemical Lime Co., which produced dolomitic quicklime and hydrated dolomitic lime. 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 was one of the 10 largest lime plants in the United States. The addition of a fifth kiln (permitted in 2007) to Graymont's Cricket Mountain plant, will add about 420,000 t/yr of capacity. Chemical Lime's plant is about 13 km northwest of Grantsville in Tooele County. Statewide, DOGM lists permits for 34 active limestone operations including 18 large mines and 16 small mines. Other uses of limestone included construction as well as flue-gas desulfurization in coal-fired powerplants. A small amount of limestone was also crushed to a fine powder and marketed as "rock dust" to the coal mining industry.

Phosphate Rock.—Simplot Phosphates, LLC was Utah's only phosphate producer. The company's phosphate operation is 18 km north of Vernal in Uintah County. The mine produced ore that was processed into phosphate concentrate. The concentrate was transported in slurry form to the company's Rock Springs, WY, fertilizer plant via a 144-km underground pipeline.

Salt.—Brine-derived products, including salt, were the second-largest contributors to the value of industrial-mineral production in Utah during 2007, with a combined value of \$247 million, about \$14 million (6%) more than in 2006. In addition to salt, brine-derived products include magnesium chloride and potash (potassium chloride and potassium sulphate). One company (North Shore Limited Partnership) produced a small amount of concentrated magnesium 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 3.26 Mt in 2007, slightly less than in 2006. In addition to salt, brine-derived products include magnesium chloride and potash [potassium chloride and sulfate of potash (SOP)]. Salt production was estimated to be 2.49 Mt in 2007, slightly more than 2006, with most of the production coming from three operators processing brine from the Great Salt Lake. The three largest operators are, in descending order of production, 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—Reilly Chemical Company at Wendover in Tooele County (salt and potash), Moab Salt, LLC near Moab in Grand County (salt and potash), and Redmond Minerals, Inc. near Redmond in Sanpete County (rock salt). In the past 5 years, Redmond Minerals increased production significantly as the result of an aggressive marketing campaign.

Sand and Gravel, Construction, and Stone, Crushed.—Sand and gravel and crushed stone (including limestone and dolomite) were the largest contributors to the value of industrial minerals produced in Utah during 2007, with an estimated

value of \$359 million, about \$66 million (23%) higher than in 2006. These materials were produced in nearly every county by commercial operators as well as county, State, and Federal agencies. Because of the large number of operations (approximately 140 active pits and quarries), the UGS does not send production questionnaires to this group. Production data are compiled by the USGS, and based on preliminary 2007 data, the USGS estimated that 2007 production was 45.1 Mt of sand and gravel with a value of \$261 million, and 13.3 Mt of crushed stone with a value of \$98.2 million. Crushed stone production includes raw materials for both lime and cement plants. This was a 6.4% increase in sand and gravel production and a 5% decrease in the production of crushed stone compared with 2006.

Shale, Expanded, and Perlite.—Utelite, Inc. was the only company to produce lightweight “expanded” products from shale for use primarily in the construction and building industries. Mine production was about 181,000 t in 2007, a slight increase from that of 2006. Utelite’s shale mine and plant is 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 plant and mine were shut down in mid-2006 and remain inactive.

Metals

Base-metal production, with an estimated value of \$2.83 billion, was the largest contributor to the value of minerals produced in 2007. In descending order of value, those metals were copper, molybdenum, magnesium, and beryllium. The 2007 base-metal value was about \$58 million (2%) less than 2006, and was the first decrease in base-metal value since 2002. Precious-metal production, valued at \$322 million, included gold (85% of total value) and silver (15% of total value). Precious-metal values were \$79 million (20%) lower than those in 2006—the first decrease in precious-metal value since 2003. Kennecott Utah Copper Corporation’s Bingham Canyon mine, located about 32 km southwest of Salt Lake City in Salt Lake County, was the State’s major producer of copper, gold, and silver, and its sole producer of molybdenum. The combined value of minerals produced from the Bingham Canyon Mine in 2007 was about 63% of the total value of all minerals produced statewide. Kennecott is in the fourth year of aggressive mine development at the Bingham Canyon Mine.

Beryllium.—Utah continued to be the Nation’s sole producer of beryllium concentrates. Brush Resources Inc. has a beryllium (bertrandite) mine in Juab County. Ore and imported beryl can be processed through parallel circuits at the company’s plant a few miles north of Delta in Millard County. The product (beryllium hydroxide) is then sent to the company-owned refinery and finishing plant in Elmore, OH, where it is converted into beryllium metal, alloys, and oxide. The company reported mining approximately 58,000 t gross weight of bertrandite ore in 2007, in addition to processing about 1,100 t of imported beryl ore. The company’s Monitor pit was expected to close in 2008, and production was to begin at the new Fluro-Roadside pit. In 2005, Brush Engineered Materials, Inc. (the parent company) was awarded a \$9 million contract by the U.S.

Department of Defense under the Defense Production Act, Title III Program. The contract was for the engineering and design of a new facility for the production of primary beryllium, the feedstock material used to produce beryllium metal products. The new facility, to be owned and operated by Brush Engineered Materials, was to be located at an existing plant site in Elmore, OH. The company anticipated that the design and engineering would be completed and construction could begin in 2008. Additional funding would be required prior to construction, which would take 2 to 3 years (Brush Engineered Materials Inc., 2008). Shedd (2008) estimated that about 50% of beryllium use is in computer and telecommunications products, and the remainder is used in aerospace and defense applications, appliances, automotive electronics, industrial components, and other applications.

Copper.—Copper was the largest contributor to the value of nonfuel minerals in Utah. The value of copper produced rose to a near alltime high, and the value of base-metal production also rose to nearly \$2.83 billion. The Bingham Canyon Mine produced about 211,000 t of copper in 2007, compared with the 268,000 t produced in 2006. However, Rio Tinto stated that smelter and refinery production was 21% higher in 2007 compared with that in 2006 when major scheduled maintenance was undertaken on the smelter (Rio Tinto, 2008, p. 13). The Lisbon Valley copper mine, located 72 km southeast of Moab in San Juan County, began operating in December 2005, but the solvent extraction–electrowinning (SX-EW) circuits did not startup until April 2006. The plant produced about 9,100 t of copper in 2007. Production was expected to decrease in 2008 to reduce costs. Mining was curtailed, but leaching was to continue until the ore pad has been depleted.

Gold and Silver.—Gold production in 2007 was estimated to be about 12,400 kg (400,000 troy ounces), about 3,100 kg (100,000 troy ounces) less than in 2006. Gold is produced from two surface mines owned by Kennecott Corporation—one primary producer (Barneys Canyon Mine) and one byproduct operation (Bingham Canyon Mine)—both located in Salt Lake County. Several other small mines in the State are known to produce minor amounts of gold and silver, but production is not reported or included in the above totals. The Barneys Canyon Mine exhausted its economic ore reserves in late 2001 and ceased mining, but was to continue to produce gold from its heap-leach pads at a much reduced rate into mid-2008, when those pads were expected to be depleted. Silver was also a byproduct metal from the Bingham Canyon Mine. Silver production was about 110,000 kg (3.6 million troy ounces) in 2007 compared with more than 130,000 kg (4.2 million troy ounces) in 2006.

Magnesium.—Magnesium metal was the third largest contributor to the value of base metals in 2007. Magnesium metal was produced from the Great Salt Lake brines by U.S. Magnesium, at its electrolytic plant at Rowley in Tooele County. The plant’s annual capacity is 43,000 t of magnesium metal (99.8% purity). It was the only active primary magnesium processing facility in the United States. Magnesium production in 2007 was moderately higher than that in 2006. Average magnesium metal prices increased from \$3.09/kg in 2006 to \$4.41/kg in 2007 (Kramer, 2008).

Molybdenum.—Molybdenum was the second largest contributor to the value of Utah's base-metal production in 2007. Kennecott's Bingham Canyon Mine produced about 14,900 t of coproduct molybdenum in 2007, compared with 16,000 t produced in 2006. Rio Tinto reported that production of molybdenum was 11% lower than in 2006 owing to lower ore grade and high limestone levels in the ore body (Rio Tinto, 2008, p. 13). The decreased production of molybdenum was largely offset by a 26% increase in molybdenum metal prices during the year. The USGS reported that the Bingham Canyon Mine was one of five domestic copper mines to recover molybdenum as a byproduct and that the total U.S. mine output of molybdenum in concentrate decreased slightly in 2007 (Magyar, 2008).

Environmental Issues and Other Activities

The U.S. Department of Energy and the State of Utah agreed in 2005 to move the 10.8 Mt of uranium mill tailings (Atlas mill) located along the Colorado River near Moab. The tailings were estimated to average about 100 ppm uranium and 400 ppm vanadium (Don Metzler, Moab Federal project director, U.S. Department of Energy, oral commun., 2007). The tailings were expected to be moved 48 km north to a site near Crescent Junction. Disposal cell construction at Crescent Junction was not expected to begin before 2009.

A book and compact disc combination was published in 2007 titled "Central Utah—Diverse geology of a dynamic landscape," UGA Publication 36. The CD contains five papers on mineral resources, including articles on the Covenant oilfield, Farnham Dome oilfield, central Utah thrust belt exploration play, uranium production at Marysvale, and mining districts of the Marysvale volcanic field. An annotated bibliography of Utah tar sands and related information was published by the Utah Geological Survey as Open-file Report 503 (Gwynn and Hanson, 2007). Bryce Tripp (2007) authored a paper on the "Utah Industrial Rocks and Minerals—Geology, Mining, and Recent Developments" that was published in the Colorado Geological Survey's Resource Series 46 (on CD). These publications provide new information on the mineral resources of Utah and have been made available through the Utah Department of Natural Resources map and bookstore at <http://mapstore>.

utah.gov/. Additional geographic information system data are available to the public at <http://geology.utah.gov/databases/index.htm> and <http://agrc.its.state.ut.us/>.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN UTAH^{1,2}

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral		2005		2006		2007	
		Quantity	Value	Quantity	Value	Quantity	Value
Beryllium concentrates	metric tons	2,780	NA	3,830	NA	3,810	NA
Clays, Common		478	6,710	526	10,700	531	10,400
Gemstones, natural		NA	235	NA	238	NA	240
Salt		2,250	132,000	2,350 ^r	149,000	2,470	135,000
Sand and gravel, construction		33,900	149,000	42,400 ^r	204,000 ^r	45,100	261,000
Stone, crushed		8,570	52,100	14,000 ^r	89,100 ^r	13,300	98,200
Combined values of cement (portland), clays (bentonite), copper, gold, gypsum (crude), helium (Grade-A), lime, magnesium compounds, magnesium metal, molybdenum concentrates, perlite [crude (2005-06)], phosphate rock, potash, silver, stone (dimension sandstone)							
		XX	2,460,000	XX	3,560,000	XX	3,370,000
Total		XX	2,800,000	XX	4,010,000 ^r	XX	3,880,000

^rRevised. NA Not available. XX Not applicable.

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

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

TABLE 2
UTAH: CRUSHED STONE SOLD OR USED, BY TYPE¹

Type	2006			2007		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone	14 ^r	8,330 ^r	\$49,900 ^r	14	6,350	\$46,300
Traprock	1	1	8	3	21	128
Sandstone and quartzite	10	778 ^r	5,270	10	210	2,250
Volcanic cinder and scoria	2	17	313	3	24	467
Miscellaneous stone	9 ^r	4,830 ^r	33,600 ^r	11	6,650	49,100
Total	XX	14,000 ^r	89,100 ^r	XX	13,300	98,200

^rRevised. XX Not applicable.

¹Data 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 2007, BY USE¹

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Riprap and jetty stone	W	W
Other coarse aggregate	133	832
Coarse aggregate, graded, other	W	W
Fine aggregate (-¾ inch):		
Screening, undesignated	W	W
Other fine aggregate	223	1,700
Coarse and fine aggregates:		
Graded road base or subbase	W	W
Crusher run or fill or waste	W	W
Other coarse and fine aggregates	70	421
Other construction materials	72	590
Agricultural:		
Poultry grit and mineral food	W	W
Other agricultural uses	15	409
Chemical and metallurgical:		
Cement manufacture	2,380	17,600
Lime manufacture	W	W
Flux stone	W	W
Special, mine dusting or acid water treatment	W	W
Unspecified: ²		
Reported	5,640	41,400
Estimated	3,800	28,000
Total	13,300	98,200

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

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

²Reported and estimated production without a breakdown by end use.

TABLE 4
UTAH: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2007, BY USE AND DISTRICT^{1,2}

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1½ inch) ³	--	--	W	W	--	--	--	--
Coarse aggregate, graded ⁴	--	--	W	W	--	--	--	--
Fine aggregate (-¾ inch) ⁵	--	--	W	W	--	--	--	--
Coarse and fine aggregate ⁶	--	--	576	3,030	--	--	--	--
Other construction materials	64	525	8	65	--	--	--	--
Agricultural ⁷	W	W	W	W	--	--	--	--
Chemical and metallurgical ⁸	W	W	W	W	--	--	--	--
Special ⁹	--	--	W	W	--	--	--	--
Unspecified:¹⁰								
Reported	5,240	40,900	11	43	17	103	366	309
Estimated	3,400	25,000	253	1,900	131	967	--	--
Total	9,720	74,500	3,030	22,400	148	1,070	366	309

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

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

²No production for District 4.

³Includes riprap and jetty stone and other coarse aggregate.

⁴Includes other graded coarse aggregate.

⁵Includes screening (undesignated) and other fine aggregate.

⁶Includes crusher run or fill or waste, graded road base or subbase, and other coarse and fine aggregates.

⁷Includes poultry grit and mineral food and other agricultural uses.

⁸Includes cement and lime manufacture and flux stone.

⁹Includes mine dusting or acid water treatment.

¹⁰Reported and estimated production without a breakdown by end use.

TABLE 5
UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007,
BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	4,950	\$44,300	\$8.97
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	41	407	9.93
Asphaltic concrete aggregates and other bituminous mixtures	1,630	10,400	6.37
Road base and coverings ³	9,100	50,600	5.56
Fill	7,940	32,800	4.13
Snow and ice control	42	212	5.05
Other miscellaneous uses ⁴	33	225	6.82
Unspecified:⁵			
Reported	6,790	37,600	5.54
Estimated	14,600	84,300	5.79
Total or average	45,100	261,000	5.79

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

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement).

⁴Includes railroad ballast.

⁵Reported and estimated production without a breakdown by end use.

TABLE 6
 UTAH: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products ²	396	3,650	4,230	38,300	286	2,390
Asphaltic concrete aggregates and other bituminous mixtures	W	W	894	5,240	W	W
Road base and coverings ³	1,400	7,200	5,030	29,900	2,280	12,200
Fill	1,140	4,460	6,210	26,200	535	2,090
Other miscellaneous uses ⁴	84	1,570	19	91	371	2,330
Unspecified: ⁵						
Reported	2,270	13,100	3,830	21,200	479	2,940
Estimated	5,080	29,500	6,230	35,700	3,250	19,000
Total	10,400	59,400	26,400	157,000	7,200	40,900
	Unspecified districts					
	Quantity	Value				
Concrete aggregate (including concrete sand) ²	73	423				
Asphaltic concrete aggregates and other bituminous mixtures	339	1,590				
Road base and coverings ³	396	1,350				
Fill	57	95				
Other miscellaneous uses ⁴	--	--				
Unspecified: ⁵						
Reported	209	414				
Estimated	--	--				
Total	1,070	3,870				

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

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

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement).

⁴Includes snow and ice control and railroad ballast.

⁵Reported and estimated production without a breakdown by end use.