1996 Summary of Mineral Activity in Utah

By R.L. Bon, R.W. Gloyn, and D.E. Tabet

The value of Utah's mineral production in 1996 is estimated to be $2.2 billion, a decrease of $197 million from 1995. This still makes 1996 the second-highest year in total mineral value output. Contributions from each of the major industry segments are: base metals, $960 million (43 percent of total); coal, $500 million (23 percent of total); industrial minerals, $433 million (19 percent of total); and precious metals, $326 million (15 percent of total).

The growth in Utah's mineral valuation by industry segment for 1994-1996 is shown in figure 1. Compared to 1995, the 1996 values of: (1) base metal production declined $238 million, (2) coal production increased $21 million, (3) industrial mineral production increased $4 million, and (4) precious metal production increased $16 million. Prices decreased for most base metals (beryllium, copper, and magnesium) and coal in 1996 while precious metal prices were mixed; silver prices increased while gold prices decreased. Industrial mineral prices increased modestly for some commodities and declined for other commodities.

MINERAL INDUSTRY OUTLOOK

The outlook for 1997 continues to be favorable. Utah has established record-level and near-record-level production and valuation in each industry segment for the past three years. Total mineral production will remain relatively high in 1997 but only coal is expected to set a new production record. The value of mineral production statewide has increased substantially over the past three years, due mostly to a rise in metal prices. Operator surveys indicate that in 1997, base-metal and precious-metal production will decline slightly while industrial mineral production is expected to make modest gains. Production will continue to increase in some industrial mineral commodities, such as gypsum, salt, phosphate, cement, limestone, and sand and gravel, and will remain level in most other commodities. The demand for most industrial minerals largely depends on local and regional economies where the products are consumed. Due to a strong economy in Utah and neighboring states, the market for many industrial minerals will continue to expand. Coal prices are expected to remain near their current lows for the coming year.

The value of precious metals is expected to decline modestly in 1997 due to declining production levels from nearly all producers. USMX's Goldstrike mine in Washington County completed heap-leaching operations and closed in 1996. American Barrick’s Mercur mine in Tooele County is beginning to curtail its operation due to reserve depletion and will produce substantially less each year until the operation closes in 1999. Kennecott's Bingham Canyon mine in Salt Lake County, which produces more than half of Utah's precious metals as a by-product, will produce slightly less gold and silver in 1997 while Kennecott’s Barneys Canyon mine in Salt Lake County is scheduled to produce more gold.

MINE AND EXPLORATION PERMITS

Mine Permits

During 1996, the Utah Division of Oil, Gas and Mining (DOGM) received nine Regular Mine permit applications (2 hectares or 5 acres and larger disturbance) and 35 new Small Mine permit applications (less than 2 hectares or 5 acres disturbance). Five applications were made to change from Small Mine to Regular Mine status. These numbers represent an increase of three Regular Mine permit applications and a decrease of one Small Mine permit application compared to 1995. Several Small Mine permits have been issued to operators who plan to expand to a Regular Mine permit once exploratory and initial development work has been completed. These new mines will increase the total number of producing operations and will have a modest effect on the total value of production.

In December 1996, DOGM sent 410 annual report questionnaires to active large and small mine operators. By mid-February, 249 reports had been received by the division. Of the mines reporting, 43 large mines, 12 coal mines, and 53 small mines reported production. Several reporting mines produced more than one commodity.

Active Regular Mine permits can be subdivided into the following categories: base metals (4), precious metals (4), coal (12), and industrial minerals (50).

Exploration Permits

Mineral exploration statewide increased moderately compared to 1995. Thirty-two Notices of Intent (NOI) to explore on public lands were filed with DOGM in 1996, compared to 22 for 1995. The number of new NOIs for 1996, listed by county, included Tooele (7); Beaver (6); Juab (3); Garfield, Millard, Piute, San Juan, and Utah (2); and Box Elder, Grand, Salt Lake, Uintah, Washington, and Weber (1). Twenty-three permits were issued for base- and/or precious-metals exploration while six targeted industrial minerals, two targeted energy minerals, and one targeted gemstones.

NATIONAL RANKINGS

The U.S. Bureau of Mines (BOM) ranked Utah fourth in the nation (up from sixth) in the value of nonfuel minerals produced in 1995. Utah accounted for nearly 5 percent of the U.S. total nonfuel mineral production value. Utah ranked first in beryllium and gilsonite; second in potash and copper; third in gold, magnesium, and molybdenum; fourth in phosphate rock and silver; and sixth in salt. Utah also ranked 14th in coal production.

According to the BOM, between 1985 and 1995 the value of nonfuel mineral production in Utah increased from $313 million to over $1.8 billion (figure 2). The Utah Geological Survey's (UGS) estimate for nonfuel mineral production value for 1996 is $1.7 billion.

BASE- AND PRECIOUS-METAL PRODUCTION

Copper

Copper is the largest contributor to the value of nonfuel minerals in the state. Significant price increases in 1994 and 1995 pushed the value of copper to historic highs and the value of base-metal production statewide to over $1 billion for the first time in 1995. Copper production from Kennecott's Bingham Canyon mine in Salt Lake County decreased slightly in 1996 from 1995 production of about 330,000 tons of copper metal. Since 1990, annual copper production has ranged from a low of 250,000 tons to a high of more than 330,000 tons. With the completion of the modernization and expansion program that began in 1988, Kennecott's copper production has stabilized at a rate slightly higher than 300,000 tons annually.

Magnesium Metal

Magnesium metal was the second-largest contributor to the value of base metals in 1996. Magnesium metal is produced from Great Salt Lake brines by Magnesium Corporation of America (Magcorp) at its electrolytic plant at Rowley in Tooele County. The plant has the capacity to produce 42,000 tons of magnesium metal (99.9 percent purity) annually and is the fourth-largest magnesium plant in the world. Utah magnesium production remained steady in 1996 while prices declined due primarily to increased foreign competition.

Beryllium

Utah continued to be the nation's leading producer of beryllium metal. Beryllium ore (bertrandite) is mined at Brush Wellman's Topaz mine in Juab County and processed with domestic and imported beryl ore (through a separate circuit) at the company's plant a few miles north of Delta in Millard County. In 1996, more than 400,000 pounds of beryllium hydroxide were produced at the Delta plant and sent to the company-owned refinery and finishing plant in Ohio. Production of beryllium hydroxide in 1996 is projected to be similar to 1995 production. The demand for beryllium alloys and beryllium oxide has increased modestly over the past several years as alloys are being introduced into components for the automobile and electronics industries. The demand for beryllium metal has decreased as national defense requirements have declined.

Molybdenum

The sole molybdenum producer in Utah is Kennecott's Bingham Canyon mine, which produced about 20,000 tons of molybdenum concentrate in 1996. The Bingham Canyon mine was one of only 10 molybdenum producers in the United States in 1995. Molybdenum is recovered as a by-product from the milling operation and its production is dependent on the amount of copper ore processed. A strong demand for molybdenum is forecast for 1997.

Iron Ore

The only iron ore production in Utah is from Geneva Steel's operation west of Cedar City in Iron County. The ore is used in Geneva's steel-making facility near Orem, Utah County. In 1996, the company did not produce any iron ore. The change from an open-hearth process to the new Q-BOP process for steel making at the Geneva plant has increased the use of higher iron, lower silica-content taconite pellets from Minnesota and decreased the use of lower iron-content ore from their Cedar City mine over the past several years. The process change has also decreased the use of limestone from the company's Utah County limestone quarry.

Gold and Silver

Gold production statewide in 1996 is estimated to be about 775,000 Troy ounces, 20,000 Troy ounces more than 1995. Gold is produced from four surface mines, three of which are primary producers and one by-product operation. In descending order of production they are: (1) Kennecott's Bingham Canyon mine, (2) Kennecott's Barneys Canyon mine, (3) American Barrick's Mercur mine, and (4) USMX's Goldstrike mine. North Lily Mining Company's North Lily mine-dump leach operation closed in 1996. In 1996, only one mine had an increase over 1995 production and three mines experienced a decrease in production. In 1995, the Bingham Canyon mine was the fourth-largest gold producer in the United States.

The Goldstrike mine in Washington County discontinued mining operations in 1994; however, a small amount of gold was recovered from active leach dumps before the mine closed in mid-1996. The Mercur mine in Tooele County will phase out its mining operation during the next several years due to reserve depletion and will produce at lower levels until mining and leaching are completed.

In 1996, silver production statewide is estimated at about 4.8 million Troy ounces, approximately 700,000 Troy ounces more than in 1995. Silver is produced as a secondary metal by all but one (Barneys Canyon mine) of the primary gold producers and as a by-product metal by Kennecott's Bingham Canyon mine. Kennecott is by far the largest silver producer in the state.

INDUSTRIAL MINERAL PRODUCTION

Industrial minerals continued to be an important contributor to Utah's mineral industry. Major commodities produced include: salt, magnesium chloride, potash (potassium chloride) and sulfate of potash (SOP), sand and gravel, crushed stone, Portland cement, lime, limestone, dolomite, phosphate, gilsonite, common clay and bentonite, and gypsum.

Commodities produced in lesser amounts include fuller's earth, building stone, decorative stone, lightweight aggregate, masonry cement, and gemstones.

Salt, Magnesium Chloride, Potash (Potassium Chloride), and Sulfate of Potash

Salt and brine-derived products are the largest contributors to the value of industrial minerals in Utah. In addition to salt, other brine-derived products include magnesium chloride, potash (potassium chloride) and SOP.

The production of salt and brine-derived products statewide is estimated to be 3.1 million tons in 1996, the same as in 1995. Salt production alone is estimated to be 2.4 million tons in 1996, with most of the production coming from three operators using brine from Great Salt Lake. These operators are, in descending order of production: (1) GSL Minerals, Inc., (2) Morton Salt Company, and (3) Akzo Nobel Salt, Inc. In addition, three other companies produce salt and/or potash from operations not related to Great Salt Lake: (1) Reilly Chemical Company at Wendover in Tooele County, (2) Moab Salt Company near Moab in Grand County, and (3) Redmond Clay and Salt Company near Redmond in Sanpete County (salt only). Potash is produced by two operators, Reilly Chemical Company and Moab Salt Company at their previously mentioned facilities. Potash production is estimated at nearly 175,000 tons in 1996, about 25,000 tons more than 1995 production. The production of industrial salt and other brine-derived products is expected to continue to expand over the next several years. GSL Minerals, the largest SOP producer in North America, plans to double production from the current level of 300,000 tons per year within the next five years. Potash production is expected to remain at its current level.

Sand and Gravel and Crushed Stone

Sand and gravel, and crushed stone are the second-highest value industrial minerals produced in 1996. These materials are produced by commercial operators, and by state, federal, and county agencies in nearly every county in Utah. Due to the large number and diversity of producers, operators are not sent UGS production questionnaires. However, data are compiled by the U.S. Geological Survey. The latest yearly production data show that in 1995 over 19.8 million tons of sand and gravel and 4.8 million tons of crushed stone were produced with a total value of $80.6 million. Mid-1996 data indicated that production has increased slightly above the mid-1995 level.

Portland Cement, Lime, Limestone, and Dolomite

Portland cement and lime were respectively the third- and fourth-highest value industrial minerals produced in 1996. Two operators produce Portland cement in Utah: Holnam, Inc. and Ash Grove Cement Company. Holnam's Devil's Slide plant is east of Morgan in Morgan County, and Ash Grove's Leamington plant is north of Delta in Juab County. The two plants have a combined capacity of more than 1 million tons of cement annually. Both companies have plans underway to increase cement production over the next two years.

Lime usage continues to expand. Continental Lime, Inc., which produces high-calcium lime, and Chemical Lime of Arizona, which produces dolomitic lime, are the two suppliers of calcined limestone (quick lime) and hydrated lime in Utah, with a combined capacity of more than 1 million tons per year. Both operations serve markets in Utah and surrounding states. Continental Lime's plant is in the Cricket Mountains, approximately 35 miles (56 Km) southwest of Delta in Millard County, and is rated

one of the 10 largest lime plants in the United States. Chemical Lime of Arizona's plant is near Grantsville in Tooele County.

Two companies produced less than 100,000 tons of limestone in 1996. In descending order of production they are Cotter Corporation's Papoose mine in San Juan County and Emery Industrial Resources' Cherry Hill Park mine in Utah County. This production compares to over 180,000 tons of limestone produced in 1995 by five operators. Three of the five operators who produced limestone in 1995 were idle in 1996. Limestone is used primarily for reducing flue-stack emissions in electric power generation plants and for aggregate in the construction industry.

Geneva Steel produces about 200,000 tons of dolomite from a quarry located near the southeast end of Utah Lake in Utah County. The majority of the dolomite is used in the blast furnace operation at the Geneva plant while the remainder is crushed to a fine powder and marketed as "rock dust" for use as a coal-dust suppressant in underground coal mines.

Phosphate

Utah's only phosphate operation, SF Phosphates Limited Company's Vernal Phosphate Operation, is 11 miles (18 Km) north of Vernal in Uintah County. SF Phosphates Limited is a partnership comprising Farmland Industries of Kansas City, Missouri and J. R. Simplot, Inc. of Boise, Idaho. The company mines roughly 2.5 million tons of ore annually, which is processed into about 1 million tons of concentrate and transported in slurry form to the company's Rock Springs, Wyoming fertilizer plant via a 90-mile-long (145 km) underground pipeline. The mine operates at a nearly constant annual rate since its product is used exclusively in its company-owned manufacturing facility. Production for 1996 is the highest in the past several years.

Gilsonite

Gilsonite production for 1996 is estimated at about 60,000 tons, the same as in 1995. Gilsonite is an unusual solid hydrocarbon which has been mined in Utah for more than 100 years. The three operations which produce gilsonite are all near the town of Bonanza in Uintah County. In descending order of production they are: (1) American Gilsonite Company's Bonanza mine, (2) Zeigler Chemical and Minerals Company's Zeigler mine, and (3) Lexco, Inc.'s Lexco mine. Gilsonite is used in over 150 products ranging from printing inks to explosives, and is marketed worldwide.

Heavy Clay and Bentonite

More than 280,000 tons of structural clay and more than 40,000 tons of bentonite were produced by five companies in 1996. This is a slight decrease from the nearly 300,000 tons of clay produced in 1995. Bentonite production was essentially the same as last year. In descending order of production the clay-producing companies are: (1) Interstate Brick Company, (2) ECDC Environmental LC, (3) Redmond Clay and Salt Company, (4) Interpace Industries, and (5) Western Clay Company. Clay is used primarily in the manufacture of bricks and as a sealant for open-pit storage of drilling fluids and oil, heap-leach pads in the mining industry, irrigation ditches, and industrial- and municipal-waste landfills.

Bentonite is used primarily as a drilling mud in the oil and gas industry, a pet-waste absorbent, and as a sealant in civil-engineering applications.

Gypsum

Nearly 360,000 tons of gypsum were produced by six companies in 1996, 60,000 tons more than 1995 production. In descending order of production the companies are: (1) U.S. Gypsum Company, (2) Georgia Pacific Corporation, (3) Thomas J. Peck & Sons, (4) D.K. Gypsum Industries, (5) H.E. Davis & Sons, Inc., and (6) Western Clay Company. In 1995, Georgia Pacific Corporation re-opened its wallboard plant, which had been idle since 1992, near Sigurd in Sevier County. The majority of gypsum produced in Utah is used for making wallboard, but several small operators supply raw gypsum to regional cement companies where it is used as an additive to retard the setting time of cement and to the agriculture industry for use in animal feed.

ENERGY MINERALS PRODUCTION

Coal

Utah's coal industry achieved yet another production record in 1996 with a total of more than 27 million short tons, 8 percent above last year's record (figure 3). Coal production came from twelve underground mines operated by six companies in three central Utah counties. Emery County was the leading coal producing county (62 percent), followed by Carbon (22 percent), and Sevier (16 percent) Counties.

Electric utilities remained the largest customers for Utah coal, consuming 69 percent of 1996 production. Pacific Rim exports were the second-largest market, consuming 20 percent, and industrial customers consuming 10 percent. Small amounts of coal also went for residential and commercial sectors. Demand for coal from Asian Pacific-Rim countries and eastern U.S. states has been the driving factor in the increases in Utah coal sales and production while in-state consumption of coal has remained relatively flat since 1992 (figure 4). Coal sales to customers outside the state have grown from roughly 40 percent of the market in 1992 to 55 percent of the market in 1996.

The value of Utah coal sold in 1996 exceeded $500 million (figure 5), at an average price of $18.50 per ton. The average price per ton of coal has been dropping since 1982, but the Utah Office of Energy and Resource Planning forecasts that prices will probably start moving upward after 1997.

Nine of the state's twelve coal mines have, or plan to acquire, longwall mining machines to achieve the necessary productivity to compete in Utah's coal market. The average productivity for Utah coal mines in 1996 was 6.72 tons per miner-hour. This small productivity drop (down from 6.95 tons per miner-hour achieved in 1995) was the result of inclusion of low-productivity development tonnage from Cyprus-Amax Minerals Company's new Willow Creek mine which began producing coal in September 1996. The first longwall panel is scheduled for start-up in the fourth quarter of 1997.

Also in central Utah, Horizon Coal Corporation continues to work on permitting its new Horizon mine near the old Gordon Creek and Blue Blaze mines northwest of Price. Horizon Coal has applied to the U.S. Bureau of Land Management (BLM) for 1,280 acres of federal coal in T. 13 S., R. 8 E., and anticipates that this tract will be offered for sale in 1997.

A major event in the Utah coal industry for 1996 was the sale of Coastal States Energy Corporation's three Utah mines to Canyon Fuel Company, a joint venture between ARCO Coal Company (65 percent) and Itochu Corporation (35 percent). Included in the $615 million sale was Coastal's 9 percent interest in the Los Angeles Export Terminal. Shortly after the sale was completed, Canyon Fuel filed for a lease by application (LBA) for the previously delineated Pines Federal Coal Lease tract to extend the life of its SUFCO mine.

The future of Utah's coal industry suffered a severe blow when President Clinton set aside most of the Kaiparowits coal field by creating the Grand Staircase-Escalante National Monument on September 18, 1996. This development effectively stopped Andalex Resources' plans for its 2.5 to 3.0 million ton-per-year Smoky Hollow mine, which was nearing final state permit approval. Andalex has since withdrawn its mining permit application and has entered into negotiations with the BLM to trade out its Kaiparowits coal lease holdings. PacifiCorp's Energy West Mining subsidiary has also entered into negotiations with the BLM to relinquish its federal leases located at the northern end of the Kaiparowits coal field near the town of Escalante. It is uncertain if there are sufficient federally-owned coal resources elsewhere in Utah which BLM could trade should these two companies seek similar tonnages of coal within the state.

Uranium

Although no uranium mines were active in Utah in 1996, there are indications of a modest revival of the uranium industry in southeastern Utah. U.S. Energy, Inc. has applied to the Nuclear Regulatory Commission (NRC) to change the status of its 1,000 short-ton-per-day (stpd) Shootaring Canyon uranium mill in Garfield County from standby to operational. Approval is expected by mid-1997 with production to start soon afterwards. Initial feed will be from stockpiled ore at the mill site (94,000 short tons [st] of 0.125 percent U_3O_8), and mined ore at the Tony M mine (170,000 st at 0.16 percent U_3O_8). U.S. Energy also plans to begin mining at the Tony M mine in Garfield County and at the Velvet mine in San Juan County. The company began dewatering the Velvet shaft in 1996, but needed to remove radium and uranium from the mine discharge water before continuing.

Energy Fuels Nuclear, Inc. operated the White Mesa mill south of Blanding for about six months in 1996. The first milling campaign was from January to February using stockpiled ore from mines in northern Arizona. Approximately 40,000 st of ore containing about 300,000 pounds of U_3O_8 were milled. The second milling campaign was from May to August using alternate feed (CaF_2 filter fines from uranium enrichment). Approximately 4,000 st were processed and 200,000 pounds of U_3O_8 recovered.

The sale of Energy Fuels Nuclear, Inc. to International Uranium Holding Corporation is proceeding and should be finalized by Spring 1997. The bankruptcy court has approved the purchase of Energy Fuels Nuclear, Inc.'s assets and the NRC has recommended renewal of Energy Fuel's license and its

transfer to the new owner. The mill and properties will be operated by International Uranium Corporation (USA). The company plans several "alternate feed" milling campaigns covering four to five months at the White Mesa mill beginning late Spring 1997, after the sale is finalized. The company also hopes to start mining ore from some of its properties in Utah, Colorado, and Arizona in late 1997.

BASE- AND PRECIOUS-METALS EXPLORATION ACTIVITY

Mineral exploration for base and precious metals in Utah showed some improvement over 1995 but still remained at relatively modest levels. The Utah Division of Oil, Gas and Mining received 31 new NOIs in 1996. Nearly 70 percent of these were for precious metals, mostly in Tooele, Beaver, and Millard Counties; about 10 percent were for base metals. In addition to the new NOIs, exploration was also done in areas previously permitted, such as the Oquirrh Mountains in Salt Lake and Tooele Counties, the Tintic district in Juab and Utah Counties, and near Milford in Beaver County. Although most exploration took place in a few well-known mining districts, many of the new exploration areas are more scattered throughout the state (figure 6). In addition to precious metals, targets for base metals included skarn, porphyry, breccia pipe, sedimentary copper deposits, and lead-zinc-silver limestone replacement deposits.

Oquirrh Mountains

There was substantial exploration activity in the Oquirrh Mountains in Salt Lake, Tooele, and Utah Counties by Barrick Mercur Mines, BHP Minerals, Kennecott Utah Copper, and ASARCO.

Barrick Mercur Mines conducted an aggressive drilling program in 1996 that included 75 drill holes totaling 51,000 feet (15,544 m) around the soon-to-be-closed Mercur mine in Tooele County. Approximately 18,000 feet (5,486 m) of drilling was done on targets within the mine area. The remaining drilling tested other sediment-hosted gold targets in the Mercur district that included South Mercur (Sunshine area), Lion Hill north of the mine, and West Dip along the range front west of the mine. Although the drilling intersected scattered gold mineralization, no minable reserves were developed.

BHP Minerals drilled seven holes ranging in depth from 400 to 700 feet (122-213 m) in the West Dip area, west of the Mercur mine. The target was sediment-hosted gold in the Mississippian upper Great Blue Limestone adjacent to high-angle faults under alluvial cover. Results were discouraging and no further work is planned.

Kennecott Utah Copper drilled 43 exploration holes totaling about 42,000 feet (12,800 m) in the Oquirrh Mountains. Twenty-eight drill holes were directed at exploration for sediment-hosted, disseminated gold deposits in the pediment areas adjacent to the range, and 15 were directed at copper prospects in the Ophir and Rush Valley (Stockton) mining districts. No new ore reserves were delineated. Kennecott's 1997 exploration program in the Oquirrh Mountains will include additional drilling in the Ophir and Rush Valley districts and at a copper prospect in Settlement Canyon, 6 miles (10 km) southwest of the Bingham Canyon mine.

ASARCO drilled four holes with a total footage of nearly 3,000 feet (914 m) on their Porter Hollow prospect in the northern Oquirrh Mountains. Results were equivocal and the project is currently on hold.

Tintic Area

Exploration continued in the Tintic district of Utah and Tooele Counties by several companies including Chief Consolidated Mining Company, Centurion Mines Corporation, and Tintic Utah Metals LLC.

A substantial amount of work was done at the Burgin mine in the East Tintic district by Tintic Utah Metals LLC on behalf of the joint venture partnership among Chief Consolidated Mining Company (50 percent), Akiko Gold Resources, Ltd. (25 percent), and Korea Zinc Company (25 percent). Since exploration began in 1994 the joint venture has: (1) rehabilitated the Apex shaft to provide access to the 1,050-foot (320-m) level, (2) driven approximately 3,000 feet (914 m) of new drifts and cross-cuts for underground drill stations, and (3) drilled 41 underground holes with a total footage of more than 18,000 feet (5,486 m). Of the 41 holes drilled to date, over half encountered lead, zinc, and silver mineralization and seven contained minable gold values. One of the best drill holes intersected 92 feet (28 m) of ore assaying 18.8 ounces/ton silver, 24 percent lead, and 6.7 percent zinc. Nearly all of the exploration work has been directed toward extending the limits of the Main Burgin ore body downdip to the west and northwest. Drilling has confirmed the downdip and western extension of the ore body to the equivalent of the 1,600-foot (488-m) level, 250 to 300 feet (76-91 m) below the lowest existing workings.

The most recent reserve calculations (April 1996) indicate 1.5 million st (1.36 Mt) of proven and probable ore at an average grade of 16.5 ounces/ton silver, 21 percent lead, and 6.7 percent zinc. Additional underground drilling is planned, including work on the relatively untested south and southwest extensions of the Main Burgin ore body.

Thyssen Mining Construction of Canada, Ltd. is preparing a mine feasibility study scheduled to be completed by April 1997. If project financing is subsequently obtained, then mine planning, construction, and development could begin almost immediately with production scheduled to begin as early as mid-1999. Tintic Utah Metals anticipates annual production of 315,000 st (286,000 Mt) of ore over a minimum five-year mine life, yielding 4.6 million ounces of silver, nearly 119 million pounds (54.5 Kt) of lead, and 22 million pounds (9.8 Kt) of zinc per year.

Chief Consolidated Mining Company continued to explore other properties it holds in the East Tintic district outside of the Burgin joint venture. In June 1996 shareholders of South Standard Mining Company approved the merger of South Standard into Chief Gold Mines, Inc., a wholly owned subsidiary of Chief Consolidated Mining. Chief Gold Mines ultimately plans to rehabilitate the Trixie shaft and initiate an underground drilling program to confirm and increase gold reserves. The earliest start date would be late 1997. The mine was last operated in 1992 by Sunshine Mining Company.

Chief Consolidated also continued work in the Main Tintic district on the Plutus and Chief ore zones. The Chief No. 2 shaft has been rehabilitated to the 1,600-foot (488-m) level and nearly 5,000

feet (1,524 m) of drifts have been rehabilitated. Rehabilitated drifts have reached the Chief No. 1 shaft and are close to the Eagle and Bluebell shafts on the Plutus ore zone, and the Gemini shaft on the Gemini ore zone. Eight to ten underground holes have been drilled to date (December 1996) totaling nearly 3,000 feet (914 m). Five of the holes were drilled in the Plutus stope located between the Chief No. 1 and Chief No. 2 shafts. The drilling will target lead-zinc-silver mineralization along the Plutus zone between the 1,400 and 1,800 foot (427-549 m) levels. No ore-grade mineralization has been encountered to date. Additional underground drilling is planned for 1997 and a six-person crew will continue to rehabilitate the underground workings. The area was last explored by ASARCO during the early to mid-1980s.

Centurion Mines Corporation conducted exploration on its properties in the Main Tintic district but have not yet announced results.

Milford Area

Cortex Mining and Exploration Company continued exploration in the Rocky Range district north of Milford in Beaver County. Cortex drilled three holes of a proposed 10-hole program in late 1996 before bad weather halted drilling. The holes were drilled on a coincident magnetic and IP (induced polarization) anomaly north of the Valley deposit. The initial drilling encountered low-grade copper skarn but no ore grade mineralization. The remaining seven holes are scheduled to be drilled in Spring 1997. The target is copper-magnetite skarn mineralization representing a northern extension of the Valley deposit. The Valley deposit has probable ore reserves of 44.5 million st (40.4 Mt) at 1.27 percent copper at depths of 800 to 3,000 feet (244-914 m).

Centurion Mines Corporation was active in and around their O.K. mine in the Beaver Lake district northwest of Milford. Centurion conducted a significant amount of drilling in the immediate mine area and the southeastern extension. There are now more than 110 “ore development drill holes” on the property according to company personnel. The 1996 drilling substantially increased the reserves of the property. Although Centurion has not formally announced the new reserve estimates, they estimated reserves to be 10 to 11 million st (9 to 10 Mt) of 0.45 to 0.55 percent copper containing “more than 8 million pounds of recoverable copper.” The previous announced reserves (July 1996) were 5.3 million st (4.8 Mt) of 0.48 percent copper. The reserve estimates include both in-place ore and ore in existing mine dumps.

In August 1996, Centurion applied to the state for a Large Mine permit for an open-pit, heap-leach operation with a solvent-extraction, electrowinning plant. All mining permits should be approved by mid-Spring 1997. The plant will operate at an initial rate of 1,000 stpd, later increasing to 3,000 stpd. At full production, the mine should produce from 8 to 10 million pounds of cathode copper per year over a minimum 10-year mine life. Centurion anticipates that copper production will begin in the last quarter of 1997. Initial feed will be from existing dumps which average 0.40 percent copper. The property will be operated by Dotson Mining Company, a wholly owned subsidiary of Centurion Mines Corporation.

ASARCO completed their exploration program on the Jarloose precious metal property southeast of Milford after drilling six holes in 1995. They subsequently dropped the property.

Other Areas

Exploration continued in other areas in Utah including: (1) southeastern Utah for sediment-hosted copper; (2) northwestern Utah for sediment-hosted gold in the Silver Island district and precious metal vein deposits in the Gold Hill (Clifton) district; (3) west-central Utah for porphyry copper in the West Tintic district, stockwork gold-copper in the Dugway district, sediment-hosted gold in the Kings Canyon area, and lode gold in the Desert Mountain district; and (4) southwestern Utah for sediment-hosted gold in the Goldstrike and Washington districts and skarn gold-copper in the Washington district.

Southeastern Utah

Summo Minerals Corporation continued pre-production work at its Lisbon Valley copper project in San Juan County. Summo increased ore reserves at the property based on late 1995 drilling; current reserves are 46.5 million st (42.2 Mt) of ore at an average grade of 0.436 percent copper with an overall strip ratio of 2.36 in three designated mine areas. Several revised feasibility studies have been completed which assume an annual production of 40 million pounds/year (18.1 Kt) of cathode copper over an eight- to ten-year mine life. The current ore body has not been completely delineated; further exploration may find additional reserves.

Summo has completed a substantial part of the mine permitting process. The BLM has reviewed the draft Environmental Impact Statement (EIS) and the final EIS is expected to be released in early 1997. The state has issued air quality and water rights permits and bonding requirements have been established.

Summo has secured project financing and has entered into agreements with Min-Corp/TIC for engineering and facilities construction, and with Brown & Root for contract mining. Construction is scheduled to begin in Summer 1997 with initial cathode copper production starting in early 1998.

Americomm Resources Corporation sampled and mapped outcrops along the Lisbon fault northwest of the Summo holdings. The sampling results were discouraging and the property was returned to the vendor.

A number of other companies are also exploring for “leachable” sediment-hosted oxide copper deposits in southeastern Utah.

Northwestern Utah

BHP Minerals evaluated more than 3 square miles (5 km^2) in the Silver Island district north of Wendover in Tooele County for sediment-hosted gold deposits in Pennsylvanian-Permian- aged limestones. BHP drilled five holes ranging in depth from 400 to 750 feet (122-229 m). Results were discouraging; the best drill hole intercept was 20 feet (6 m) of 250 parts per billion gold. No further work is planned.

American Consolidated Mining and Clifton Mining Company continued work on their properties in the Gold Hill (Clifton) district in western Tooele County. They began construction of a 500 stpd

gravity-floatation mill, drilled 12 reverse-circulation (RC) holes totaling 3,000 feet (914 m) on the "Clifton Shears" prospect (Herat mine area), and subsequently drove a 660-foot-(200-m) long adit. Current measured reserves for the prospect are 400,000 st (363,000 Mt) of ore at an average grade of 10 ounces/ton silver, 0.025 ounces/ton gold, and 4 percent lead. The mill is scheduled to be operational by mid-1997 and will process "Clifton Shears" ore. The companies will conduct underground drilling and complete 2,500 feet (762 m) of additional drifts in 1997.

West Central Utah

Gold Standard, Inc. drilled 26 holes with an average depth of 250 feet (96 m) on its Dugway property in western Tooele County. The target was a gold-pyrite stockwork in quartzite below a highly brecciated, low-angle fault. Results were discouraging even though several drill intercepts of 2 to 3 parts per million gold were found. Some copper mineralization was also found associated with the gold mineralization; the best intercept was 30 feet (9 m) of 0.5 percent copper. Gold Standard subsequently dropped the property.

BHP Minerals entered into a joint venture agreement with Centurion Mines Corporation to explore the "Little Bingham" copper prospect in the West Tintic district in Juab County. Initial work consisted of mapping, geochemical sampling, and geophysical surveys to identify drill targets in the pediment south and west of the exposed "Little Bingham" prospect. Three holes were drilled in 1996 with a total footage of 3,190 feet (972 m). One drill hole (96-3) intersected altered, sulfide-bearing quartz monzonite with "elevated copper and molybdenum values." Additional exploration and drilling are planned for 1997.

Orion Gold International acquired an option on the Coyote Knolls precious metal property north of Delta in Juab County. The target is gold-silver mineralization associated with brecciated pebble dikes in rhyolite. Recent trenching and sampling along strike indicated precious metal values averaging 0.125 ounces/ton gold and 21.0 ounces/ton silver over a 135-foot (41-m) zone. Additional trenching and surface sampling is planned for 1997. In addition, Orion is conducting a ground magnetometer survey over a previously known airborne magnetic anomaly to better define possible copper-gold skarn targets. Up to 1,200 feet (366 m) of drilling is planned in 1997 to test both targets.

Centurion Mines Corporation drilled several holes on its properties in the Kings Canyon area of western Millard County. Drill hole CKC 96-10 on the Knolls prospect west of Boobs Canyon intersected 10 feet (3 m) of ore assaying 0.615 ounces/ton gold and 2.3 ounces/ton silver at 250-260 feet (76-79 m), and 10 feet (3 m) assaying 0.112 ounces/ton gold at 270 to 280 feet (82-85 m). These grades are significantly higher than those found at the other prospects in the area and may represent a slightly different style of mineralization. Centurion plans to both offset and deepen drill hole CKC 96-10.

Orion Gold International holds the option agreement with Crown Resources, Inc. on its Kings Canyon property. The property contains a gold resource of 220,000 ounces using a 0.01 ounce/ton cut off. In 1996 Orion assigned 50 percent of their interest to Phoenix Gold Resources. No exploration work was done on the property in 1996 but as many as 10 holes are planned to be drilled in late 1997.

Southwestern Utah

Bull Valley LLC is looking for a joint venture partner to explore the Goldstrike district in Washington County for deeper, higher grade, structurally controlled gold mineralization. The property includes land previously leased to USMX, Inc. by Permian Exploration as well as additional properties acquired by Tenneco Minerals.

In September 1996, Cominco and Preussag purchased the Apex gallium-germanium mine from Hecla Mining Company. No exploration or development drilling is planned in 1997.

Royal Gold continued exploration in the Indian Peak Range of western Beaver County. They drilled 11 RC holes totaling 6,090 feet (1,846 m) on the Blue Jay property. Some weak anomalous gold and base metal intercepts were found. The targets are sediment hosted, disseminated gold and gold-copper skarn in Cambrian limestone. Royal Gold also drilled six RC holes totaling 3,630 feet (1,100 m) on the Indian Peak property about 5 miles (8 km) north of the Blue Jay. Anomalous gold and associated pathfinder element values were found including a 30-foot (9 m) intercept averaging 0.01 ounces/ton gold. Additional drilling is planned for 1997.

Figure 1. Utah mineral valuation--gross value estimate, 1994 to 1996.
Data source: Utah Geological Survey

Figure 2. Utah nonfuel minerals valuation, 1985 to 1995.
Data source: U.S. Bureau of Mines

Figure 3. Utah coal production, 1986 to 1996.
Data source: Office of Energy and Resource Planning

Figure 4. Utah coal sales by destination, 1988 to 1996.
Data source: Office of Energy and Resource Planning

Figure 5. Utah coal valuation, 1986 to 1996.
Data source: Office of Energy and Resource Planning

Figure 6. Major base- and precious-metals exploration areas (shaded) in Utah during 1996.
Data Source: Utah Geological Survey

Figure 1.

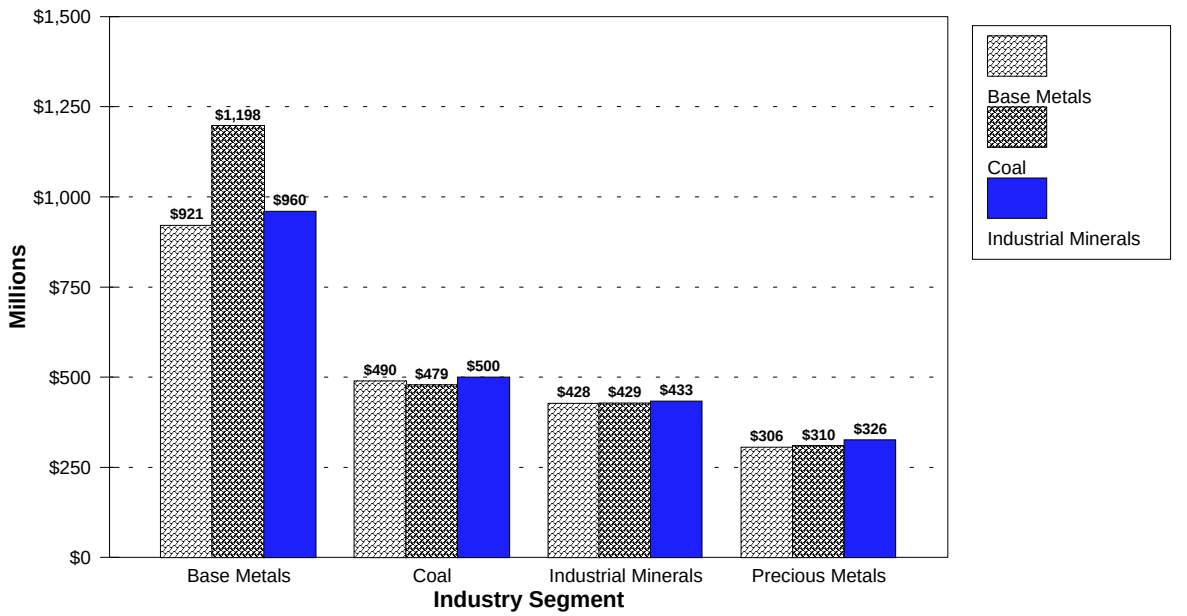

$1,500
$1,250
$1,000
$750
$500
$250
$0
Millions
$921
$1,198
$960
$490
$479
$500
$428
$429
$433
$306
$310
$326
Base Metals
Coal
Industrial Minerals
Precious Metals
Industry Segment
Base Metals
Coal
Industrial Minerals

Figure 2.

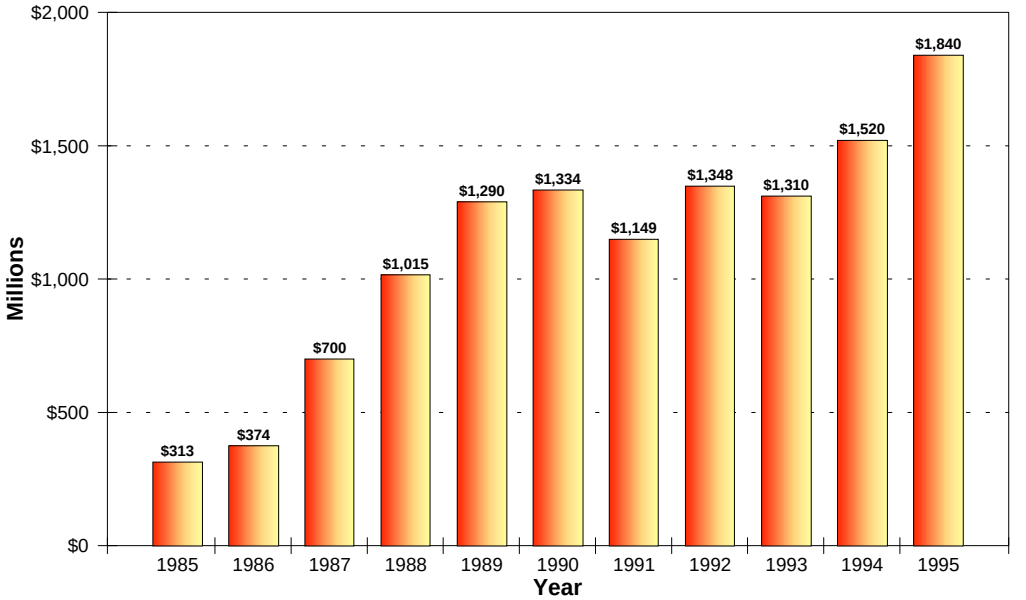

$2,000
$1,500
$1,000
$500
$0
Millions
$313
$374
$700
$1,015
$1,290
$1,334
$1,149
$1,348
$1,310
$1,520
$1,840
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
Year

Figure 3.

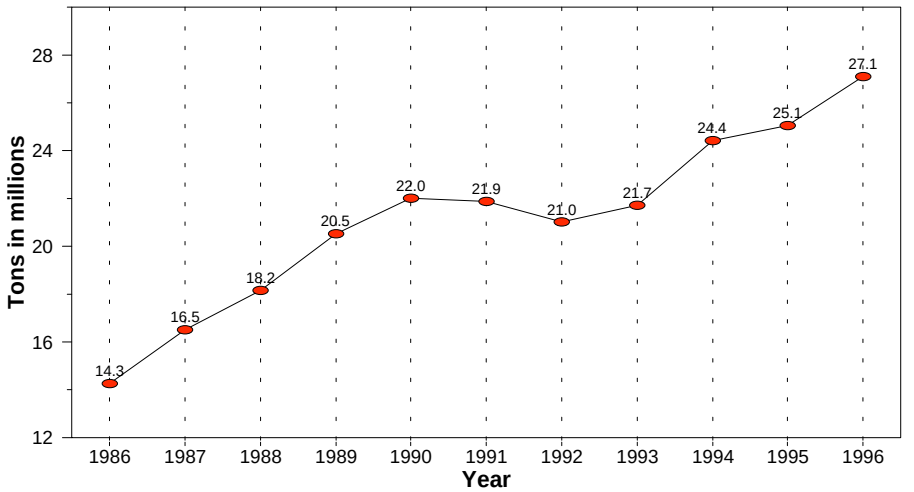

Tons in millions
28
24
20
16
12
14.3
16.5
18.2
20.5
22.0
21.9
21.0
21.7
24.4
25.1
27.1
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Year

Figure 4.

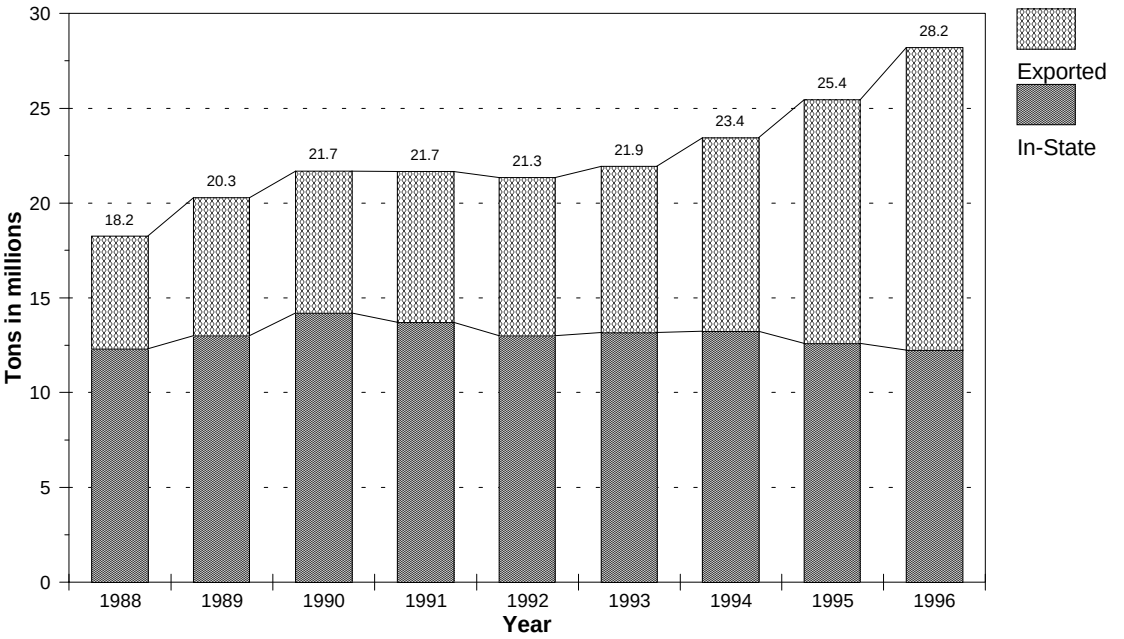
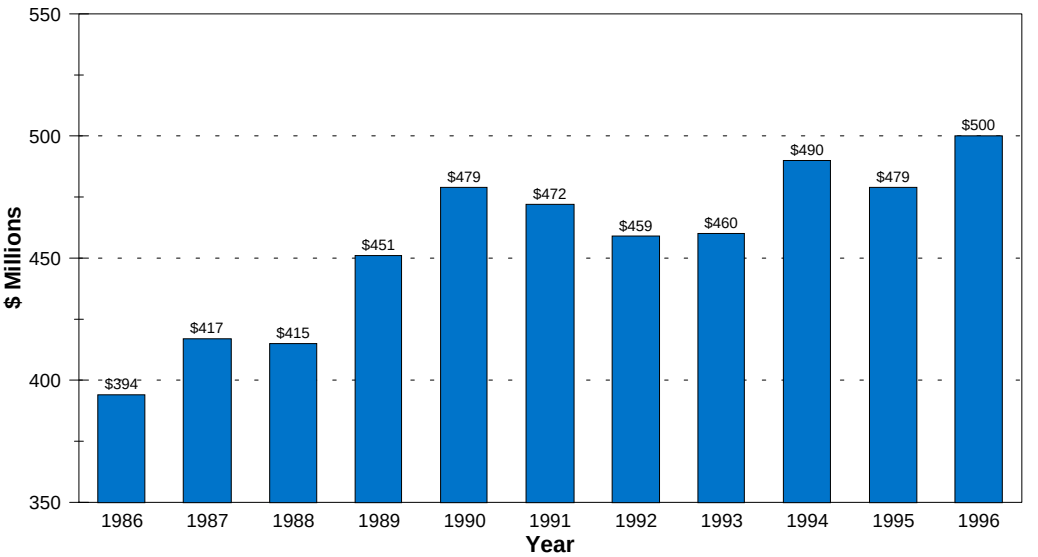

30
25
20
15
10
5
0
Tons in millions
18.2
20.3
21.7
21.7
21.3
21.9
23.4
25.4
28.2
1988
1989
1990
1991
1992
1993
1994
1995
1996
Year
Exported
In-State

Figure 5.


550
500
450
400
350
$ Millions
$394
$417
$415
$451
$479
$472
$459
$460
$490
$479
$500
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Year

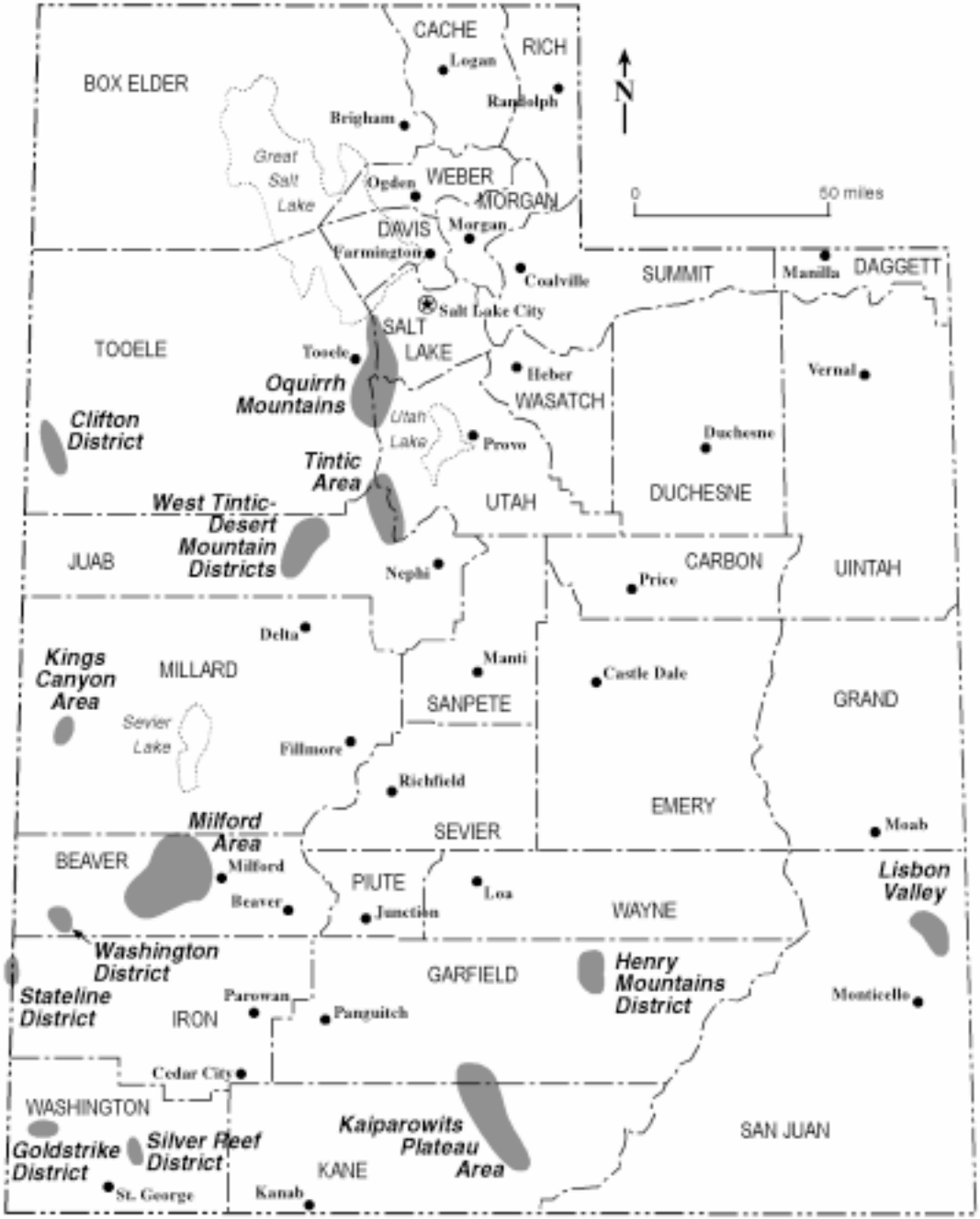

CACHE
RICH
BOX ELDER
Logan
Randolph
Brigham
N
Great Salt Lake
Ogden
WEBER
MORGAN
0
50 miles
DAVIS
Morgan
Farmington
Coalville
SUMMIT
Manilla
DAGGETT
Salt Lake City
SALT LAKE
TOOELE
Tooele
Heber
Vernal
Oquirrh Mountains
WASATCH
Clifton District
Utah Lake
Provo
Duchesne
Tintic Area
West Tintic-Desert Mountain Districts
UTAH
DUCHESNE
JUAB
Nephi
CARBON
UINTAH
Price
Delta
Kings Canyon Area
MILLARD
Manti
Castle Dale
SANPETE
GRAND
Sevier Lake
Fillmore
Richfield
EMERY
Milford Area
SEVIER
Moab
BEAVER
Milford
PIUTE
Loa
Lisbon Valley
Beaver
Junction
WAYNE
Washington District
Stateline District
GARFIELD
Henry Mountains District
Parowan
IRON
Panguitch
Monticello
Cedar City
WASHINGTON
Kaiparowits Plateau Area
SAN JUAN
Goldstrike District
Silver Reef District
KANE
St. George
Kanab

Figure 6.