1997 Summary of Mineral Activity in Utah

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Summary

The value of Utah's mineral production in 1997 is estimated to be $2.26 billion, making 1997 the second-highest year in total mineral value after 1995. Contributions from each of the major industry segments are: base metals, $949 million (42 percent of total); industrial minerals, $533 million (24 percent of total); coal, $485 million (21 percent of total); and precious metals, $289 million (13 percent of total).

The growth in Utah's mineral valuation by industry segment for 1995-1997 is shown in figure 1. Compared to 1996, the 1997 values of: (1) base metal production declined $11 million, (2) industrial mineral production increased $100 million, (3) coal production decreased $15 million, and (4) precious metal production decreased $37 million. Prices decreased for most base metals (copper, molybdenum, and magnesium), precious metals, and coal in 1997 while industrial mineral prices increased modestly for some commodities and declined for other commodities.

Outlook

The value of mineral production is expected to decline moderately in 1998. Operator surveys indicate that in 1998: base-metal production should remain relatively high, precious-metal production should decline sharply, and coal production should increase as should most industrial mineral commodities. Metal prices for copper, molybdenum, and gold closed the year at multi-year market lows which could significantly affect the value of base- and precious-metal production in 1998 if the trend continues. Production will continue to increase in some industrial minerals, such as gypsum, salt, phosphate, cement, limestone, and sand and gravel, and will remain level in most other commodities. Coal production did not set a new record in 1997 but is expected to establish a new one in 1998. Coal prices are expected to remain near their current multi-year lows.

The value of precious metals is expected to decline moderately in 1998 due to declining production levels from nearly all producers. American Barrick's Mercur mine in Tooele County is in the final phase of operation and will produce only a modest amount of gold until it closes early in 1998. Kennecott's Bingham

Canyon mine in Salt Lake County, which produces more than two-thirds of Utah's precious metals as a byproduct, and Kennecott's Barneys Canyon mine in Salt Lake County will produce substantially less gold in 1998 due to mining lower grade gold- bearing ores.

Mine Permit Summary and Status

During 1997, the Utah Division of Oil, Gas and Mining (DOGM) received five Large Mine permit applications (2 hectares or five acres and larger disturbance) and 33 new Small Mine permit applications (fewer than 2 hectares or five acres disturbance). Three applications were made to change from Small Mine to Large Mine status. These numbers represent a decrease of four Large Mine and two Small Mine permit applications compared to 1996.

In December 1997, 432 annual report questionnaires were sent to all current Large and Small Mine permit holders. By mid-March, 267 reports had been received by the division. Of the mines reporting, 51 large metallic and nonmetallic mines, 12 coal (large) mines, and 80 small metallic and nonmetallic mines reported production. Several reporting mines produced more than one commodity.

The State has 63 active large mine operations (excluding sand and gravel) which are grouped by industry segment as follows: base metals (3), precious metals (2), coal (12), and industrial minerals (46).

Exploration Permits

Mineral exploration statewide has increased slightly compared to 1996. Thirty-four Notices of Intent (NOI) to explore on public lands were filed with DOGM in 1997, compared to 32 for 1996. The number of new NOIs for 1997 listed by county included: Beaver (6); Box Elder (1); Duchesne (2); Garfield (4); Juab (2); Millard (1); San Juan (3); Sevier (1); Summit (1); Tooele (1); Uintah (5); Utah (2); Wasatch (1); and Washington (4). Seventeen permits were issued for base- and/or precious-metals exploration, and eight permits were issued which targeted industrial minerals. Six permits were issued which did not identify their respective targeted commodity.

National Rankings

The U.S. Geological Survey (USGS) ranked Utah seventh in the nation (down from fourth) in the value of nonfuel minerals produced in 1996 (latest year for which production figures are available). Utah accounted for nearly 4 percent

of the U.S. total nonfuel mineral production value. Utah ranked first in beryllium and gilsonite; second in potash, molybdenum, and copper; third in gold and magnesium metal; fourth in phosphate ore, magnesium compounds, and silver; sixth in salt; seventh in bentonite clays; 11th in oil and gas; and 12th in coal (up from 14th in 1996).

According to the USGS, between 1986 and 1996 the value of nonfuel mineral production in Utah increased from $374 million to over $1.8 billion; which was acheived in 1995 (figure 2). Nonfuel mineral production for 1996 is estimated to be $1.56 billion. The Utah Geological Survey's (UGS) estimate for nonfuel mineral production for 1997 is $1.77 billion, $50 million more than 1996.

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 (Utah's sole copper producer) in Salt Lake County increased slightly in 1997 from 1996 production of about 330,000 short tons (st) (300,000 metric tons [mt]) of copper metal. Since 1990, annual copper production has ranged from a low of 250,000 st (227,000 mt) to a high of more than 330,000 st (300,000 mt). 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 st (272,000 mt) annually.

Magnesium Metal

Magnesium metal was the second-largest contributor to the value of base metals in 1997. Magnesium metal is produced from Great Salt Lake brines by Magnesium Corporation of America at its electrolytic plant at Rowley in Tooele County. The plant has a capacity to produce 42,000 st (38,000 mt) of magnesium metal (99.9 percent purity) annually and is the fourth-largest magnesium plant in the world. Utah magnesium production remained at or near capacity in 1997 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 at the company's

plant a few miles north of Delta in Millard County. In 1997, more than 600 st (544 mt) of beryllium hydroxide were produced at the Delta plant and sent to the company-owned refinery and finishing plant in Ohio. Brush Wellman has permitted a new mine (Hogsback) near the Topaz operation which will begin production in 1998. 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.

Molybdenum

The sole molybdenum producer in Utah is Kennecott's Bingham Canyon mine, which produced about 19,000 st (17,230 mt) of molybdenum concentrate (MoS_2) in 1997. The Bingham Canyon mine was one of only 14 molybdenum producers in the United States in 1997. Molybdenum is recovered as a byproduct from the copper milling operation and its production is dependent on the amount of copper ore processed.

Gold and Silver

Gold production statewide in 1997 is estimated to reach a record-high of nearly 800,000 ounces (24,882 kilograms [kg]), 23,000 ounces (715 kg) more than 1996. Gold is produced from three large surface mines, two which are primary producers (Barneys Canyon mine and Mercur mine), and one byproduct operation (Bingham Canyon mine). In descending order of production they are: (1) Kennecott's Bingham Canyon mine, (2) Kennecott's Barneys Canyon mine, and (3) American Barrick's Mercur mine. In 1997, only the Bingham Canyon mine increased production. Several small mines in the state are known to produce minor amounts of precious metals but metal-specific production is not reported, and not included in the above data.

In 1997, silver production statewide was estimated at about 4.8 million ounces (0.15 million kg), the same as 1996. Silver was produced as a secondary metal by American Barrick's Mercur mine, and as a byproduct metal by Kennecott's Bingham Canyon mine. Kennecott is by far the largest silver producer in the state.

Industrial Mineral Production

The industrial minerals segment was the second-largest contributor to the value of minerals produced in 1997. Major commodities produced by group or individual commodity in descending order of value included: (1) salines, including sulfate of potash, salt, potash (KCl), and magnesium chloride; (2) sand

and gravel, and crushed stone; (3) Portland cement; (4) phosphate; (5) lime; (6) gilsonite; (7) clay and bentonite; and (8) gypsum.

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

Brine-derived products including salt are the largest contributors to the value of industrial mineral production in Utah. In addition to salt, other brine-derived products include magnesium chloride, potash (potassium chloride and sulphate of potash [SOP]). The production of salt and other brine-derived products statewide is estimated to be 2.7 million st (2.4 million mt) in 1997, 400,000 st (363,000 mt) less than 1996.

Salt production alone is estimated to be 2.0 million st (1.8 million mt) in 1997, 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) Cargill Salt, Inc. (Formerly 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 (KCl) is produced by two operators, Reilly Chemical Company and Moab Salt Company at their above-mentioned facilities. KCl production is estimated at nearly 170,000 st (154,190 mt) in 1997, about 5,000 st (4,540 mt) less than 1996. The production of salt and brine-derived products is expected to continue to expand over the next several years. GSL Minerals, the largest SOP producer in North America, is in the process of doubling SOP production from the current level of 300,000 st (272,000 mt) per year. Statewide KCl 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 1997. These materials are produced by commercial operators, and by state, federal, and county agencies in every county in Utah. Due to the large number and diversity of producers, operators are not sent UGS production questionnaires. However, data is compiled by the USGS. The latest production data show that in 1997, more than 33.5 million st (30.4 million mt) of sand and gravel, and 6.8 million st (6.2 million mt) of crushed stone were produced with a combined value of $126.2 million. Due to increased highway and airport runway construction usage should expand for the next several years.

Portland Cement, Lime, Limestone, and Dolomite

Portland cement and lime were respectively the third- and fourth-highest value industrial minerals produced in 1997. 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 east of Lynndyl in Juab County. Both companies have recently expanded production capacity and the two plants have a combined capacity of 1.5 million st (1.4 million mt) of cement annually, up from 1 million st (0.9 million mt) in 1996.

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 st (0.9 million mt) 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.

Nine companies quarried 3.4 million st (3.1 million mt) of limestone and dolomite in 1997. Product uses in descending order of production were: (1) cement-1.5 million st (1.4 million mt), (2) lime-1.4 million st (1.3 million mt), (3) industrial burners, and flue gas desulfurization-250,000 st (227,000 mt), and (4) aggregate/other-250,000 st (227,000 mt). Limestone used for the production of cement is quarried by Holnam, Inc. at their Devil's Slide quarry in Morgan County and Poverty Point quarry in Tooele County, and by Ash Grove Cement Company from their Leamington quarry in Juab County. Limestone and dolomitic limestone used for lime production is quarried by Continental Lime Company at their Cricket Mountain quarry (limestone) in Millard County, and by Chemical Lime Company of Arizona at their Grantsville quarry (dolomitic limestone) in Tooele County. Two companies quarry limestone and/or dolomite used in other industrial applications. They are Cotter Corporation's Papoose limestone quarry in San Juan County and Geneva Steel's Keigley limestone and dolomite quarry in Utah County. Limestone from the Papoose mine is used in power plant flue gas desulfurization. The majority of the limestone and dolomite from the Keigley quarry is used in the blast furnace operation at the Geneva steel 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.

Limestone used primarily for aggregate, flue gas desulfurization, and coal mine "rock dust" is produced by Western Clay Company's limestone quarry in

Sevier County, Larson Limestone Company's quarry in Utah County, and by Harper Construction Company's quarry in Salt Lake County.

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 of Farmland Industries of Kansas City, Missouri and J. R. Simplot, Inc. of Boise, Idaho. The company mines roughly 2.5 million st (2.3 million mt) of ore annually, which is processed into about 1 million st (0.9 million mt) of concentrate and transported in slurry form to the company's Rock Springs, Wyoming fertilizer plant via a 90-mile-long (145-km-long), underground pipeline. The mine operates at a nearly constant annual rate since its product is used exclusively in its company-owned fertilizer plant. Phosphate production in 1997 is the highest in the past six years.

Gilsonite

Gilsonite production for 1997 is estimated to be 68,000 st (62,000 mt), 8,000 st (7,300 mt) more than 1996. 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.

Common Clay and Bentonite

More than 160,000 st (145,000 mt) of common clay were produced in 1997, a decrease of 120,000 st (109,000 mt) from 1996. Bentonite production was slightly more than 40,000 st (36,000 mt), the same as in 1996. In descending order of clay production the companies were: (1) Interstate Brick Company, (2) Interpace Industries, (3) Redmond Clay and Salt Company, and (4) Western Clay Company. Common clay is used primarily in the manufacture of bricks. Bentonite is used as a sealant in many civil engineering applications, pet waste absorbent (litter box filler); oil and gas drilling; and as a binder in foundry molds.

Gypsum

Nearly 390,000 st (354,000 mt) of gypsum were produced by seven companies in 1997, 30,000 st (27,200 mt) more than 1996. In descending order of production the companies are: (1) U.S. Gypsum Company, (2) Georgia

Pacific Corporation, (3) Thomas J. Peck & Sons, (4) Western Clay Company, (5) H.E. Davis & Sons, (6) D.K. Gypsum Industries, and (7) Robert Steele. Both U.S. Gypsum Company and Georgia Pacific Corporation operate wall board plants near Sigurd in Sevier County. The majority of gypsum produced in Utah is used for making wall board, 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 as a soil conditioner.

Energy Minerals Production

Coal

Coal production, which had been on the rise for the past five years (1991-1996), totaled 26.4 million st (23.9 million mt) in 1997, 600,000 st (544,000 mt) less than 1996 (figure 3). In 1997, coal production was the second highest in 128 years of recorded production in the state. The highest production was recorded in 1996 with 27.1 million st (24.6 mt) of coal produced. Despite this decrease in production, employment in the coal industry, increased by 0.7 percent from 2,077 to 2,091 workers. Coal production from Carbon County increased by about one million st (0.9 million mt) as both Skyline and Starpoint mines shifted their production from Emery County to Carbon County. Production of coal from Emery County decreased by 2.3 million st (2.1 million mt), while production from Sevier County increased by nearly 750,000 st (680,000 mt) to an all-time high of 4.94 million st (4.48 million mt). More than 25 million st (23 million mt) of coal were produced from federal lands. The value of coal produced was $485 million (figure 4).

The Wasatch Plateau coal field which produced 22.9 million st (20.8 million mt) of coal, was the major coal-producing field in Utah. The only other producing coal field (Book Cliffs) yeilded 3.5 million st (3.2 million mt) of coal. Coal production by county in descending order was Emery, 14.5 million st (13.2 million mt); Carbon, 7.0 million st (6.4 million mt); and Sevier, 4.9 million st (4.4 million mt). Nearly 95 percent of Utah coal was mined from federal lands.

In 1997, 25.43 million st (23.0 million mt) of coal were distributed from mined coal; 2.3 million st (2.1 million mt) less than 1996 (figure 5). Most of this amount, about 2 million st (1.8 million mt), was attributed to a reduction in coal exports to other countries. Major consumers of Utah coal were: (1) consumers within the state, 14.7 million st (13.3 million mt); (2) Pacific Rim countries of Japan, Korea, and Taiwan, 3.5 million st (3.2 million mt); (3) Nevada, 2.6 million st (2.4 million mt); (4) California, 2.0 million st (1.8 million mt); and (5) Tennessee, 1.5 million st (1.4 million mt). Coal consumed by electric utilities in Utah increased by 2.3

million st (2.1 million mt) while coal for electric utility consumption outside of Utah decreased by 2.0 million st (1.8 million mt) tons.

Coal production in Utah should reach an all-time high of 28.9 million st (26.2 million mt) in 1998 and productivity should increase by about 2 percent. Coal prices should increase slightly from their current multi-year low.

The approaching second phase of the Clean Air Act Amendments of 1990 should force the creation of a larger market for high-Btu, low-sulfur coal found in Utah. Global climate change and associated "greenhouse gas" agreements, however, could adversely affect the consumption of coal.

As a result of more efficient mining equipment and practices, and a highly skilled work force, coal productivity is very high in Utah's coal industry. However, in 1997, productivity in Utah coal mines decreased slightly. In 1998 and for the foreseeable future, coal production and productivity should increase.

Uranium

Although no uranium mines were operating in Utah in 1997, the uranium-vanadium industry is undergoing a modest revival in the Colorado Plateau region of southeastern Utah and southwestern Colorado. Some of the revival can be attributed to an anticipated price increase for uranium in 1998, but much activity is due to the high demand and high price for vanadium. Many of the Morrison-hosted deposits in the Colorado Plateau contain from two to greater than five times as much vanadium as uranium.

The sale of Energy Fuels Nuclear, Inc. to International Uranium Holding Corporation (IUHC) was finalized on May 9, 1997. IUHC acquired the 2,000 short-ton-per-day (stpd) (1,800 metric-ton-per-day [mtpd]) White Mesa mill near Blanding in San Juan County, and a number of mines and exploration properties in Utah, Arizona, Colorado, and other states. The acquired properties contained an estimated resource of 55 million pounds (25 million kg) of uranium (U_3O_8) and 62 million pounds (28 million kg) of vanadium (V_2O_5) with much of the resource in the Colorado Plateau of southeastern Utah and southwestern Colorado. The mill and the properties are operated by International Uranium (USA) Corporation (IUC), a subsidiary of IUHC.

During 1997, the White Mesa mill processed alternate feed (not mined ore) from a variety of sources. The alternative feed milling campaign began in June 1997 and is expected to continue until July or August 1998. During 1997, the mill produced slightly more than 600,000 pounds (272,100 kg) of uranium from alternative feeds and expects to produce an additional 50,000 to 60,000

pounds (22,700 to 27,200 kg) of uranium during the second and third quarters of 1998 along with by-product tantalum and niobium concentrates. Alternate feeds processed included 400 st (360 mt) of concentrate residue from the Department of Energy's Nevada test site, 4,000 st (3,630 mt) of potassium diuranate-bearing material from Allied Signal in Illinois, and 16,000 st (14,510 mt) of uranium-tantalum-niobium-bearing industrial byproducts from Cabot Corporation in Pennsylvania.

International Uranium began production from the Sunday mine in Colorado in late 1997 and plans to begin mining from the Rim mine in San Juan County in 1998. Both the Sunday and Rim mines contain substantial amounts of vanadium which is at a nine-year high of almost $7.00 per pound ($15.44/kg) V_2O_5. The Rim mine is scheduled to produce 2,000 st/month (1,800 mt/month) once full production is achieved. Production from both mines should reach 10,000 st/month (9,100 mt/month) which is roughly equivalent to 45,000 pounds (20,400 kg) of uranium (U_3O_8) and 275,000 pounds (124,700 kg) of vanadium (V_2O_5). Ore from the Sunday and Rim mines is being stockpiled at the mill site to be processed beginning in August or September 1998.

With production from its operating mines, purchased ore, and alternate feed, IUC expects to produce 1.0 million pounds (0.45 million kg) of uranium (U_3O_8) and 4.0 million pounds (1.8 million kg) of vanadium (V_2O_5) in 1998, increasing to 1.5 million pounds (0.7 million kg) of uranium and 7.0 million pounds (3.2 million kg) of vanadium in 1999.

In mid-1997, the Nuclear Regulatory Commission (NRC) issued a source materials license to Plateau Resources, a wholly owned subsidiary of U.S. Energy Corporation, allowing resumption of milling operations at the 1,000 stpd (910 mtpd) Shootaring Canyon uranium mill in eastern Garfield County. The mill last operated in 1982. The company began the permitting process, rehabilitated and refurbished the mill including construction of new acid tanks, relining tailings ponds, replacing water lines, and updating electrical and monitoring systems. Mill start-up and testing will begin as soon as the final water-quality permit is issued, hopefully by mid-1998. Initial feed will be from stockpiled ore at the millsite (94,000 st [85,000 mt] of 0.125 percent U_3O_8) and stockpiled ore from the Tony M mine (170,000 st [154,000 mt] of 0.16 percent U_3O_8) which is located near the plant. Subsequent feed will be from mined ore from the Tony M, Velvet, and other mines in San Juan County.

Base- and Precious-Metals Exploration Activity

Mineral exploration in Utah remained at relatively modest levels in 1997. Thirty-four Notices of Intent (NOI) to explore were filed with the Utah Division of

Oil, Gas and Mining in 1997, compared to 32 in 1996, and 22 in 1995. Over 50 percent of the NOIs were for base or precious metals. Thirteen NOIs were principally for precious metals and five NOIs were principally for base metals. Nearly all of the precious-metal NOIs were from individuals or from small- to medium-sized companies. The base-metal NOIs were mostly for porphyry copper or skarn copper. The other NOIs were for uranium-vanadium and industrial minerals including limestone, phosphate, black sands, clay, cinders, and hydrocarbons. Six NOIs did not designate a commodity but four of these were probably targeting precious metals.

Much of the metals exploration was concentrated around several well known mining districts; Stockton, Ophir, Mercur, and Bingham districts in the Oquirrh Mountains; East and Main Tintic districts in the Tintic area; Rocky Range, Beaver Lake, Star, and San Francisco districts in the Milford area; Clifton district in west-central Utah; and Goldstrike and Silver Reef districts in south-central Utah (figure 6). Most of these districts have been active for the past several years. However, a number of new areas scattered throughout the state were explored in 1997, mostly for precious metals.

Oquirrh Mountains

Most exploration in the Oquirrh Mountains in 1997 was done by Kennecott Utah Copper Company who drilled 46 holes totaling 44,228 feet (13,481 m). Twenty-six of these holes were drilled to evaluate a sediment-hosted gold prospect at Sunshine Canyon (South Mercur) at the south end of the range. The objective was to expand the known gold resource hosted in Mercur Series beds downdip from the Overland and Red Cloud mines. The effort was unfruitful. Kennecott's gold resource estimates for the area were 50,000 ounces (1,555 kg) in-place indicated and 50,000 ounces (1,555 kg) in-place inferred at a grade of 0.03 to 0.04 ounces/ton (1.03 to 1.37 g/mt).

Twenty exploration holes were drilled for copper porphyry and copper-gold skarns at Ophir, Stockton, and Settlement Canyon, and at the Fortuna skarn deposit beneath the Bingham mine. No new reserves were delineated outside of the Bingham mine area. Kennecott's planned 1998 exploration program in the Oquirrh Mountains has been curtailed indefinitely.

Kennecott released information on its recent magnetite-copper-gold skarn discovery in the Bingham mine area. The discovery, Fortuna Skarn, is located southeast of the North Ore Shoot deposit on the east side of the Fortuna latite porphyry sill in the lower plate of the Midas thrust. Copper-gold mineralization occurs in garnet skarn, massive sulfide skarn, and iron oxide skarn in the Jordan limestone. Mineralization occurs on both limbs of the overturned Copperton

anticline so multiple ore zones are present. No reserves have been announced, but reported intercepts include 65 feet (20 m) of 4.4 percent copper and 0.096 ounces/ton (3.292 g/mt) gold, and 198 feet (60 m) of 4.0 percent copper and 0.053 ounces/ton (1.817 g/mt) gold.

ASARCO did no work on its properties in the Oquirrh Mountains in 1997.

Silver Eagle Resources is currently looking for companies for joint venture or buy-out of its properties in the Ophir district. These properties were previously leased by Kennecott who returned them to Silver Eagle in late 1997.

Tintic Area

Several companies including Centurion Mines Corporation (now Grand Central Silver Mines, Inc.) and Chief Consolidated Mining Corporation and its joint ventures and subsidiaries (Tintic Utah Metals LLC and Chief Gold Mines, Inc.) explored in the Tintic area of Utah and Juab Counties.

Tintic Utah Metals LLC conducted exploration on behalf of the joint venture partnership of Chief Consolidated, Akiko Gold, and Korea Zinc in the Burgin and Apex mine areas in the East Tintic district. After Akiko Gold dropped out of the partnership in 1997, its interest reverted to Chief Consolidated and the joint venture consisted of Chief Consolidated Mining Company (75 percent) and Korea Zinc Company (25 percent). In late 1997, Thyssen Mining Construction Company signed a letter of intent to acquire 24 percent of the partnership from Chief Consolidated for cash and work commitments. During 1997, the joint venture company drilled an additional 14 underground holes (53 underground holes drilled since 1994) to test the southern and southwestern extensions of the Main Burgin ore body; conducted metallurgical tests directed toward improving zinc recovery and producing cleaner zinc and lead concentrates; and continued mine planning and feasibility studies. Much of the mine planning work involved developing alternative plans for mine dewatering. No additional drilling is planned for the Burgin mine in 1998, and development is on-hold pending results of the metallurgical and dewatering studies. Current reserves for the Burgin mine are 1.5 million st (1.4 million mt) of proven and probable reserves at an average grade of 16.5 ounces/ton (565.7 g/mt) silver, 21 percent lead, and 6.7 percent zinc.

For 1998, the joint venture is planning to test and develop high-grade fissure veins above the water table in the adjacent Apex mine. An aggressive drilling program is planned to test the known veins below the 900 and 1100 levels. Mining from the 1300 level may follow the drilling program. The veins are in west dipping faults in the Tintic Quartzite and previously mined ore averaged 0.1

ounces/ton (3.4 g/mt) gold, 13.7 ounces/ton (469.7 g/mt) silver, 0.4 percent copper, and 2.7 percent lead from ore shoots 3 to 10 feet (0.9 to 3.0 m) thick, 50 feet (15.2 m) wide, and 150 to 200 feet (46-61 m) long (pitch length). The joint venture hopes to develop sufficient reserves for a small 50 to 100 stpd (45-91 mtpd) operation to provide immediate cash flow for further development.

Chief Gold Mines, Inc., a wholly owned subsidiary of Chief Consolidated Mining, has been reviewing information on the geology and gold-silver mineralization in the Trixie mine in the East Tintic district. They believe good potential exists for quartzite-hosted gold-copper fissure ore between the 900 and 1025 levels of the mine. They hope to rehabilitate the Trixie shaft in 1998 and test the potential areas with a modest underground drilling program. If successful in discovering new reserves, production could begin within a year.

Chief Consolidated did only minor exploration in the Main Tintic district. The Chief No. 2 shaft was on stand-by for most of the year; it had been previously rehabilitated to the 1600 level and workings on the 1400 level cleared and rehabilitated. In 1997, Chief drilled several up- angle holes from the 1600 level, testing for lead-zinc-silver ore along the "Plutus ore zone" (eastern part of Mammoth Chief ore zone) with negative results. In 1998, the company plans to continue to rehabilitate the 1600 level south to the American Star claim and to test the projection of the ore zone between the 1400 and 1800 levels.

Royal Silver Mines, Inc. and Centurion Mines Corporation merged in late 1997 to form Grand Central Silver Mines, Inc. Centurion contributed its patented mining properties in the Tintic, Beaver Lake, and West Tintic districts, as well as other exploration properties throughout the state. Royal Silver contributed its patented claims in the Coeur d'Alene district of Idaho, and other claims and exploration properties in the United States, Mexico, Chile, and Argentina.

Most of Centurion's work in the Tintic district in 1997 consisted of creating a computer data base of past information including production, mine workings and geology, underground drilling and sampling, and other geologic, geochemical, and geophysical information. Based on the compilation, they have identified a number of precious metal-rich, polymetallic targets they believe worthy of testing. Most of these targets are in the Main Tintic district near Mammoth. Most exploration will be done by underground drilling and drifting, and will require rehabilitating one or more shafts for access. Grand Central (Centurion) is currently seeking joint venture partners to test these targets. The company is also investigating the possibility of re-opening the Dragon mine for halloysite. The mine is located in the Mammoth area. Little work is planned in 1998 for the several copper-porphyry targets in the southwestern part of the district.

Milford Area

The Milford area of central Beaver County was one of the more active exploration areas in the state in 1997 both in terms of the number of companies exploring and the variety of targets sought. Companies exploring in the area included Grand Central Silver Mines, Nevada Star Resources, Cortex Mining, Horn Silver Mines, West Hills Excavating, and Neary Resources Corporation.

Grand Central Silver Mines through its subsidiary, Dotson Exploration Company, continued exploration and development work on the O.K. mine in the Beaver Lake district. Twenty-five to thirty, 300-foot (90-m), reverse-circulation holes were drilled southeast of the O.K. mine in the "Far East copper oxide" zone in early 1997. The holes confirmed the presence of ore-grade mineralization from the O.K. mine to the Mary I mine; a distance of nearly 4,000 feet (1,200 m). In November 1997, Nevada Star Resources entered into a preliminary agreement to acquire the property, conditional upon the successful financing, construction, and operation of a heap-leach, solvent-extraction, electrowinning plant at the O.K. mine site. Upon finalizing that agreement Grand Central Silver Mines will retain a 12 percent carried interest that can be converted to a 30 percent joint venture working interest.

Nevada Star subsequently acquired the properties held by Cortex Mining in the Rocky Range district to the east. Grand Central Silver holds a 12 percent carried interest in the Cortex property that can be converted to a 30 percent joint venture working interest. The Cortex properties contain both near-surface oxide-sulfide (chrysocolla-malachite-brochantite-covellite-chalcocite), and deeper sulfide (chalcopyrite-bornite) copper mineralization in skarns adjacent to small quartz monzonite plugs.

Minable reserves for the combined Grand Central Silver and Cortex properties are approximately 6.4 million st (5.8 million mt) of 0.74 percent copper. About 3.5 million st (3.2 million mt) are in-ground reserves at the O.K./Mary I deposit in the Beaver Lake district, about 1.5 million st (1.4 million mt) in the Hidden Treasure, Copper Ranch, and Maria mines in the Rocky Range district and the remainder in stockpiles, dumps, and old leach pads.

During 1998, Nevada Star plans to drill the Cortex property to confirm and increase reserves, prepare a bankable feasibility study covering both properties, and finalize project financing. The company hopes to begin plant construction by mid-1998 with cathode copper production beginning in late 1998 to early 1999. Nearly all the required permits have been obtained and others are in the final stages of approval. The plant will initially produce 30,000 pounds (13,600 kg) of cathode copper per day, subsequently increasing to 40,000 pounds

(18,100 kg) of cathode copper per day. Mine life is estimated to be 7 to 10 years.

Horn Silver Mines conducted exploration in the San Francisco-Preuss district for zinc, precious metals, and wollastonite. The company cleared and reclaimed the surface area around the King David shaft in preparation for rehabilitating the shaft to at least the 900 level and accessing the 300, 650, and 900 levels. They also conducted a soil sampling program (540 samples) north and west of Grampian Hill and discovered several anomalous areas with "ore grade" gold values in altered Paleozoic carbonate rocks. Horn Silver started evaluating the large oxidized zinc zone immediately to the west of the main Horn Silver and King David workings. This zone consists of a relatively continuous sheath or crust of hemimorphite and smithsonite in limestone on the west side of the Horn Silver vein. Earlier drilling and sampling suggested that the zone contained about 1 million st (0.9 million mt) of ore containing 23 to 25 percent zinc. The company is investigating the feasibility of converting the zinc into $ZnSO_4$ for use as an agricultural supplement. Northwest of the King David-Horn Silver area, the company evaluated a wollastonite deposit on the southern contact of the Cactus stock in Loeber Gulch. Preliminary sampling and testing indicates the wollastonite has low impurities and exhibits good acicularity (wollastonite with a high crystal length to width ratio is desirable).

In 1998, Horn Silver plans to collect 300 to 400 underground samples from the 300, 650, and possibly the 900 levels of the King David mine and a number of additional samples from the Horn Silver mine. The work is expected to begin by early summer. Additional sampling is also planned in the oxidized zinc zone to better confirm the tonnage and grade, and drilling is planned for the wollastonite deposit. The company is hopeful of proving up 1 million st (0.9 million mt) of wollastonite ore. No follow-up work is planned on the gold soil anomalies but a small heap leach operation is planned to process oxidized lead-zinc-silver-gold ore from the Horn Silver-King David area.

Centurion Mines Corporation (now Grand Central Silver Mines) continued to hold properties in the Blue Mountain area southwest of Milford. The properties include the Southern Gold Zone prospect, the Blue Mountain porphyry copper-molybdenum prospect, and the Blawn Wash gold-silver jasperoid prospect. Because of the increased exploration and development work at the O.K. mine, little exploration was done on these properties. At least one hole was drilled on the Blue Mountain prospect which intersected mineralized intrusive rock; assay results have not been released. Exploration plans for 1998 have not been finalized.

West Hills Excavating drilled in three areas in the Star Range and Shauntie Hills areas southwest of Milford for copper and precious metals. The Dirty Dog and Pele prospects were tested for copper in intrusive rocks, and the Hidden Treasure prospect was tested for gold in silicified and altered volcanic rocks. West Hills drilled a single hole on their Dirty Dog prospect south of Shauntie Hills at the south end of the Star range. The drill hole intersected fresh unaltered intrusives with no significant sulfide mineralization and no future work is planned. The company also drilled seven holes averaging 1,000 feet (300 m) deep on their Pele prospect on the northwest side of the range. The holes intersected a weakly propylitized quartz monzonite intrusive with only low metal values. Geophysical work is planned for 1998, possibly followed by additional drilling. Thirteen holes were drilled in late 1997 on the Hidden Treasure prospect north of the Shautie Hills. The holes were 400 to 500 feet (120-150 m) deep. Assays received to date show up to 300 ppb gold; other assay results are pending.

In mid-1997, Neary Resources Corporation through Gemstone Mining, Inc. (GMI) acquired from Kennecott Exploration Company the option to purchase the Ruby Violet gemstone mine and associated claims. The property is located about 25 miles (40 km) southwest of Milford in southern Beaver County. The property is one of the few sources of gem-quality red beryl in the world. From 1993 to 1997, the property was explored and evaluated by Kennecott for "bulk gemstone mining" potential. Kennecott drilled 56 core holes for a total of 12,824 feet (3,909 m), excavated over 2,000 feet (610 m) of underground drifts, and collected over 12,000 st (10,900 mt) of ore for bulk testing and processing. Since acquiring the option, Neary Resources has drilled 13 holes, collected a bulk sample of 2,700 st (2,450 mt) for testing in their pilot plant near Minersville, and retained the services of MVI Marketing Ltd. to evaluate the potential market for the gems. Announced resources (inferred) are 1.72 million st (1.56 million mt) of 13.11 grams/ton (65.55 carats/ton) red beryl. The grade of finished, gem-quality beryl is estimated to be about 4 percent of the overall grade or 2.86 carats/ton. Cut and finished, gem-quality, red beryl sells from $500 to over $5,000/carat depending on size and quality.

During 1998, Neary plans to continue to evaluate, sort, and grade the beryl to determine an average price/carat; prepare a more detailed feasibility study for yearly production rates of 25,000 to 50,000 st/year (23,000-45,000 mt/year); assess and possibly develop the water resources needed for processing; and initiate the mine-permitting process.

West-Central Utah

Clifton Mining Company continued work on their properties in the Clifton district of western Tooele County. In 1997 they built a new road on the

southeast side of Southern Confederate Hill to provide access to the Hidden Mine, Yellow Cougar, and Southern Confederate vein/shear zones; accessed and sampled 1,500 feet (460 m) of drifts, cross cuts, and winzes; sampled 4,500 feet (1,370 m) of surface exposures; and drilled 12 core holes totaling 3,000 feet (910 m). Based on the 1997 work, proven and probable reserves for the "Clifton Shears" have been increased 31 percent to 488,000 st (443,000 mt) at an average silver grade of 8.0 ounces/ton (274 g/mt), 0.04 ounces/ton (1.37 g/mt) gold, and 5.5 percent lead. Reserves added in 1997 include 105,000 st (95,200 mt) at an average grade of 8.47 ounces/ton (290.4 g/mt) silver, 0.024 ounces/ton (0.823 g/mt) gold, and 5.73 percent lead in the Hidden Mine vein/shear, and an additional 8,000 st (7,260 mt) in the Yellow Cougar vein/shear.

The "Clifton Shears" are a series of generally northeast-trending fissure veins and shears in quartz monzonite carrying values in gold, silver, lead, and copper. The veins and shears occur in a 5,000-foot (1,520-m) wide zone extending from the Herat mine in the north to the Monaco mine to the south. At least 40 ore-bearing veins are known within this zone but only 11 have been sufficiently tested to be included in the resource estimate. The veins and shears are from 1 to 10 feet (0.3-3.0-m) wide, up to 6,000 feet (1,830 m) long, and contain pods and lenses of quartz, pyrite, and base-metal sulfides and their oxidation products. A number of bedded replacement deposits are also present in the same area. These deposits are 1- to 3-foot (0.3-1.0-m) thick replacements of interbedded limestone adjacent to the fissure veins and shears. The limestone replacement deposits contain significant silver, gold, lead, and occasional copper values. Average values for these deposits based on surface and underground sampling are approximately 0.04 ounces/ton (1.37 g/mt) gold, 12 ounces/ton (411 g/mt) silver, and 10 percent lead. A recently discovered replacement deposit (Cabin Bedding) assayed 28.1 ounces/ton (963.4 g/mt) silver, 0.013 ounces/ton (0.446 g/mt) gold, and 17.6 percent lead over a 2-foot (0.6 m) intercept. To date no reserve numbers have been assigned to the replacement deposits even though they represent a significant resource.

Clifton Mining Company began milling in late 1997. The mill is currently operating at 250 stpd (230 mtpd) for seven days every two weeks with plans to operate 24 hours/day, 7 days/week by late spring 1998. Initial feed will be from surface cuts and existing workings with subsequent production from several new openings that will intersect multiple veins and shear zones. Construction of a second plant is planned when sufficient reserves are developed which will more than triple the existing milling capacity.

BHP Minerals drilled two, approximately 1,500-foot- (460-m-) deep holes on the "Little Bingham" property in the West Tintic district in 1997 to test concepts

developed during the 1996 program. Results were discouraging and they returned the property to the owner. The target was porphyry copper mineralization beneath alluvium and post-mineralization volcanic cover.

Phelps Dodge did surface mapping and sampling on their Maple Spring property at the south end of the West Tintic Mountains for sediment-hosted gold in association with jasperoids and pebble dikes in Paleozoic rocks. They plan to continue work on the property in 1998. Phelps Dodge also collected surface samples and ran an Induced Polarization survey over the Coyote Springs property west of the Simpson Mountains before returning the property to the owner. The pediment play target was sediment-hosted gold associated with jasperoids in lower Cambrian carbonate rocks.

Orion International Minerals continued to evaluate the Coyote Knolls property in the Desert Mountain district of northern Juab County. The target is a precious-metal-bearing, highly silicified and veined breccia/pebble dike. Orion trenched the length of the exposed structure and collected about 100 surface samples. The samples averaged 0.12 ounces/ton (4.11 g/mt) gold, and 22 ounces/ton (754 g/mt) silver. Orion also drilled seven angle holes totaling 1,800 feet (549 m). The holes intersected 3- to 5-foot- (0.9-1.5-m-) thick zones of silicified breccia at depths of 240 to 260 feet (73-79 m) with grades similar to the surface grades. Plans for 1998 include 1,500 to 2,000 feet (457-610 m) of core drilling, mostly to the west to extend the strike length of the mineralization. Orion also plans to set up a small processing plant on site to test 1,000 to 2,000 st (900-1,800 mt) of stockpiled ore for amenability to gravity concentration.

Very little work was done in the Kings Canyon area of western Millard County. The Kings Canyon property was returned to Crown Resources by Orion International Minerals. The planned 10 hole drilling program was canceled due to low gold prices. Grand Central Silver Mines also holds a number of gold properties in the Kings Canyon area but did little exploration in 1997. Most companies are retaining their properties but doing little work due to current low gold prices and uncertainty about the future of the King Top Wilderness Study Area, which contains many of the better prospects.

Southwestern Utah

In the Goldstrike district of western Washington County, North Mining, Inc. drilled three angle holes to test for deep mineralization along northeast-trending structures in Paleozoic rocks. The holes were drilled in the Padre pit (600 feet [183 m] deep), Main zone pit (600 feet [183 m] deep), and Hamburg pit (900 feet [274 m] deep). All the holes intersected strongly altered and brecciated Paleozoic carbonates, but gold assays were generally low (best assay-0.4 ppm

gold). North Mining terminated the joint venture at the end of 1997 and returned the properties to Bull Valley LLC. Bull Valley feels the property is worthy of additional testing and is seeking joint venture partners.

To the northwest, on the east side of Mineral Mountain, Dakota Mining Company drilled five, 200-foot- (61-m-) deep holes on their Castlerock prospect. The target was sediment-hosted gold below outcropping jasperoids. Results were discouraging and no additional work is planned.

Silver Standard Resources drilled eight holes totaling 5,000 feet (1,524 m) in the northern part of the Silver Reef district. The target was disseminated or roll-front silver in the western downdip continuation of the White Reef sandstone bed at depths of 400 to 700 feet (120-210 m). The holes intersected oxidized silver mineralization associated with copper carbonates and oxides associated with carbonaceous material. The holes intersected one to three silver-bearing zones with individual thicknesses ranging from 2 to 28 feet (0.6 to 9 m). Representative values range from 2 to 8 ounces/ton (69 to 274 g/mt) silver over thicknesses of 3 to 20 feet (0.9-6 m). Several of the better intercepts include 10.8 feet (3.3 m) of 8.7 ounces/ton (298 g/mt) silver in hole B15I, and 28.9 feet (8.8 m) of 3.1 ounces/ton (106.3 g/mt) silver, and 10.5 feet (3.2 m) of 2 ounces/ton (69 g/mt) silver in hole B15F. Additional fence drilling is planned for 1998 to extend the strike length of the mineralized horizons.

Phelps Dodge did surface mapping and sampling in the Stateline district in western Iron County for precious metals. No decision has been made yet on additional work in the district for 1998.

Several companies were active in the Washington-Indian Peak district. Royal Gold drilled seven holes for a total of 4,550 feet (1,387 m) on the Indian Peak property. The target was jasperoid, sediment-hosted gold. Some narrow zones assayed up to 0.05 ounces/ton (1.71 g/mt) gold. Results are currently being evaluated. Farther south, West Hills Excavating drilled eight holes on their Blue Jay gold-copper prospect. The target is copper-gold skarn and gold-bearing jasperoids. Drill results were moderately encouraging with some intercepts assaying up to 0.04 ounces/ton (1.37 g/mt) gold.

South-Central Utah

3-R Minerals continued to evaluate the titanium-zirconium potential of fossil beach placers in the Kaiparowits Plateau region of Garfield and Kane Counties. During 1997, they acquired leases on seven Utah state sections, collected and assayed nearly 100 samples, and conducted commutation and metallurgical studies on samples from the Escalante (Calf-Dave Canyon) deposit. Preliminary

results indicated that: (1) the heavy mineral zones are thicker than initially thought, often as several overlapping stacked lenses; (2) zircon-rich zones are present which were not initially recognized since they are not iron-stained, cemented, strongly magnetic, or radiometric; (3) additional newly recognized favorable horizons are present that contain significant zirconium and titanium values; (4) byproduct niobium, tantalum, and gold are present in some of the black sand deposits; and (5) a premium zircon concentrate and a 62 percent TiO_2 ilmenite concentrate can be produced using a combination of gravity, electrostatic, and magnetic separation techniques.

In late 1997, Southern Mining Corporation BV negotiated an option to acquire 50 percent of 3-R Minerals which it assigned to Southern Mining Corporation, its South African mineral sands mining subsidiary. Southern Mining also agreed to spend up to $10 million on exploration and pre-production costs to develop the deposits and hired TZ Minerals International of Perth, Australia to help in the resource and metallurgical evaluation. Nearly all of the titanium-zirconium placers are within the Grand Staircase-Escalante National Monument and development of any deposits would most likely be confined to those on Utah state sections.

The Henry Mountains mining district is being explored for both lode and placer gold by several companies. For the past several years, Kaibab Industries has been evaluating the hard-rock gold potential in the Bromide Basin on the east side of Mount Ellen, and producing modest amounts of ore from four mines. Production has come from the underground Bromide and Crescent Creek mines, and from the Henrietta and South Basin open-pit mines. About 5,200 st (4,700 mt) of ore have been mined and processed during the past three years, but most was relatively high grade, reportedly averaging 0.2 ounces/ton (6.9 g/mt) gold from the open pit mines and from 0.6 to nearly 2.0 ounces/ton (20.6 to 68.6 g/mt) gold from the underground mines. The ore is present in quartz fissure veins, silicified breccias in Tertiary diorite intrusive rocks, and is associated with pyrite, chalcopyrite, and magnetite. To the east of the lode deposits, MCW Industries of Grand Junction has consolidated the placer properties along and adjacent to Crescent Creek and acquired three state leases. Detrital gold is present in both the stream-channel gravels and in Quaternary fanglomerate and pediment gravels. MCW is planning to build a 150 st/hour (136 mt/hour) recovery plant to process the placer gravels. An estimated 2.5 million st (2.3 million mt) of gold-bearing gravel are present along and adjacent to Crescent Creek averaging $4.00/yard^3 ($5.23/m^3) in gravity-recoverable gold. MCW and Kiabab Industries are planning to jointly build a mill to process the lode ore from Bromide Basin. In addition, several other companies are exploring for both lode and placer gold on the western and southern sides of Mount Ellen.

Southeastern Utah

Little progress was made in 1997 toward developing the Lisbon Valley open-pit, copper mine in San Juan County. In late March 1997, the U.S. Bureau of Land Management approved Summo Minerals Corporation's Plan of Operations and signed a Record of Decision which authorized Summo to begin mine construction and development. This decision was subsequently appealed by a Moab-based environmental group contending that among other issues, that ground water protection had been inadequately addressed. The U.S. Interior Board of Land Appeals reviewed the appeal and dismissed most of the charges but granted a Partial Stay until the ground water protection issue was resolved. Summo recently completed a six-month study which concluded that the natural ground water in the area is Class III (moderately contaminated) and that no measurable changes in ground water quality are expected as a result of mining. Summo is hopeful that the Partial Stay can be resolved by May 1998, and that construction can begin. All arrangements for construction, contract mining, and financing remain in place. Current reserves are 46.5 million st (42.2 million mt) of ore at an average grade of 0.436 percent copper with an overall strip ratio of 2.36:1 in three designated mine areas. Recent feasibility studies indicate the operation is profitable at $0.80 per pound ($1.76/kg) copper.

Figure 1
Utah mineral valuation--gross value estimate, 1995 to 1997.

Figure 2
Utah nonfuel minerals valuation, 1986 to 1996.

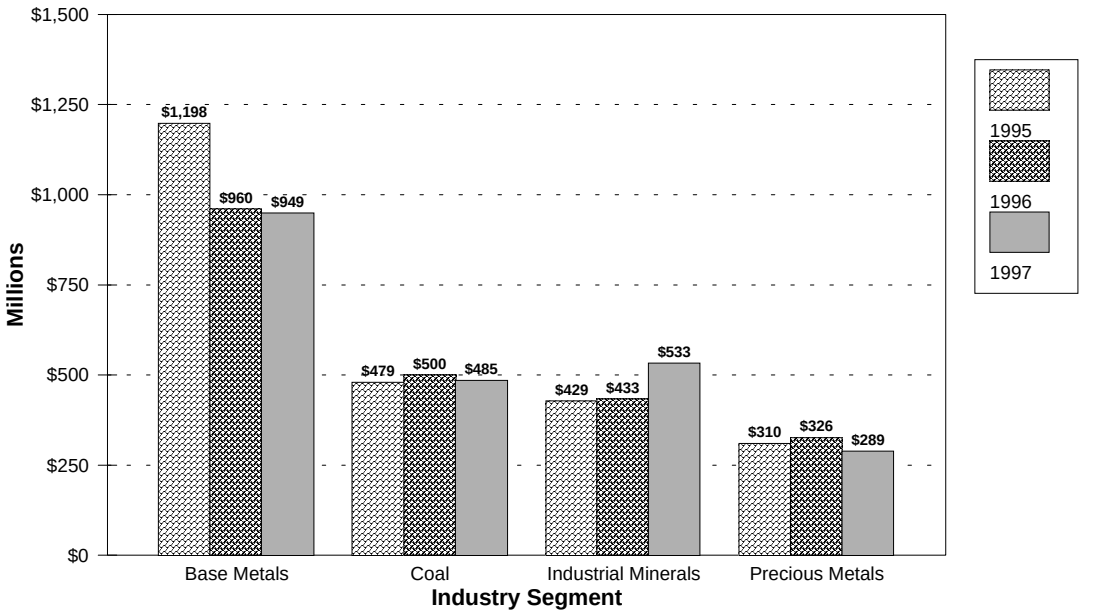
Figure 3
Utah coal production, 1987 to 1997.

Figure 4
Utah coal valuation, 1987 to 1997.

Figure 5
Utah coal sales by destination, 1988 to 1997.

Figure 6
Major base- and precious-metals exploration areas in Utah during 1997.

Figure 1.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$429
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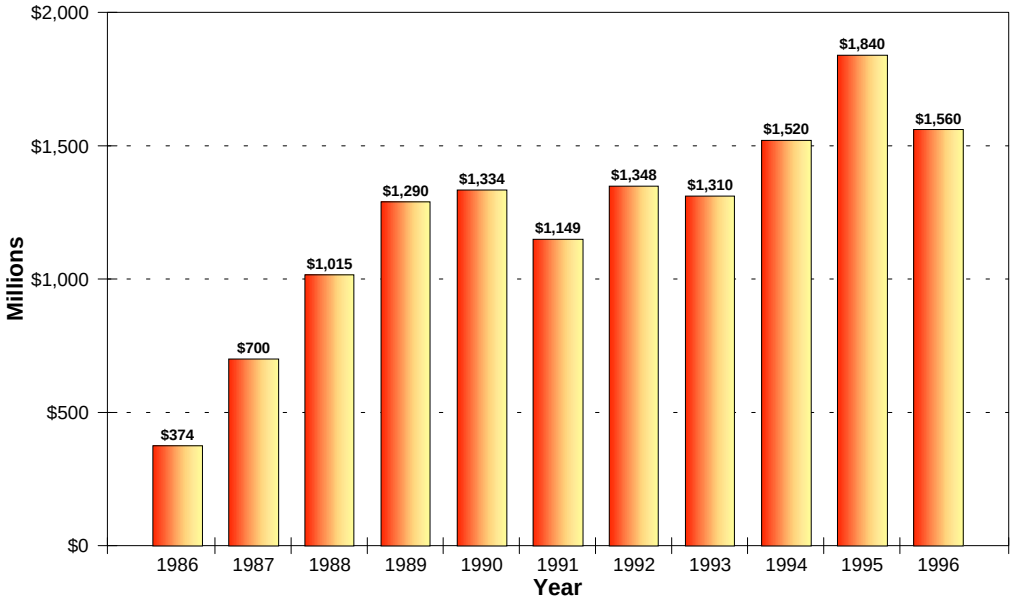
Base Metals
Coal
Industrial Minerals
Precious Metals
Industry Segment
1995
1996
1997

Figure 2.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$1,310
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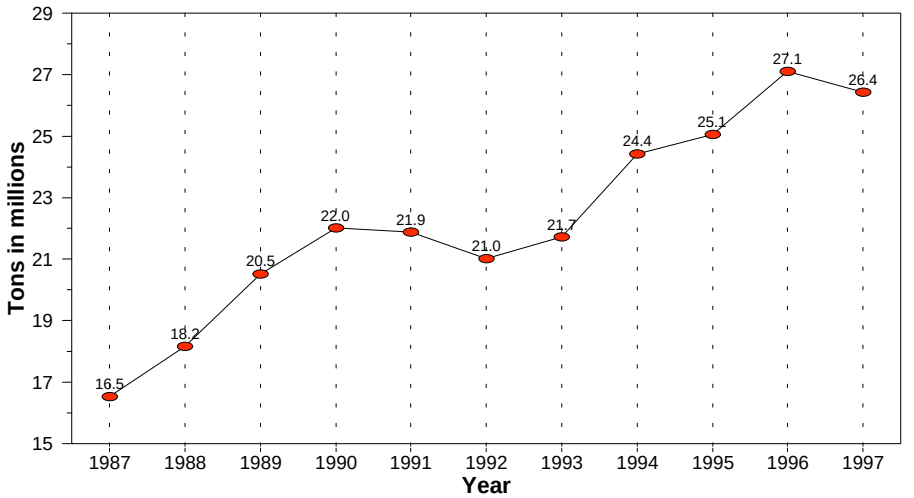
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Year

Figure 3.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21.0
21.7
24.4
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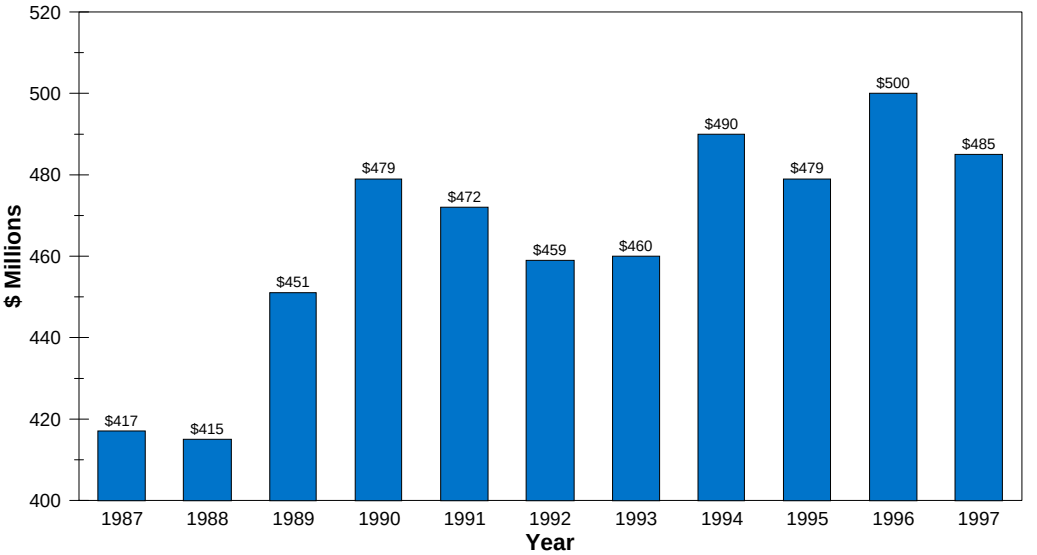
27.1
26.4
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Year

Figure 4.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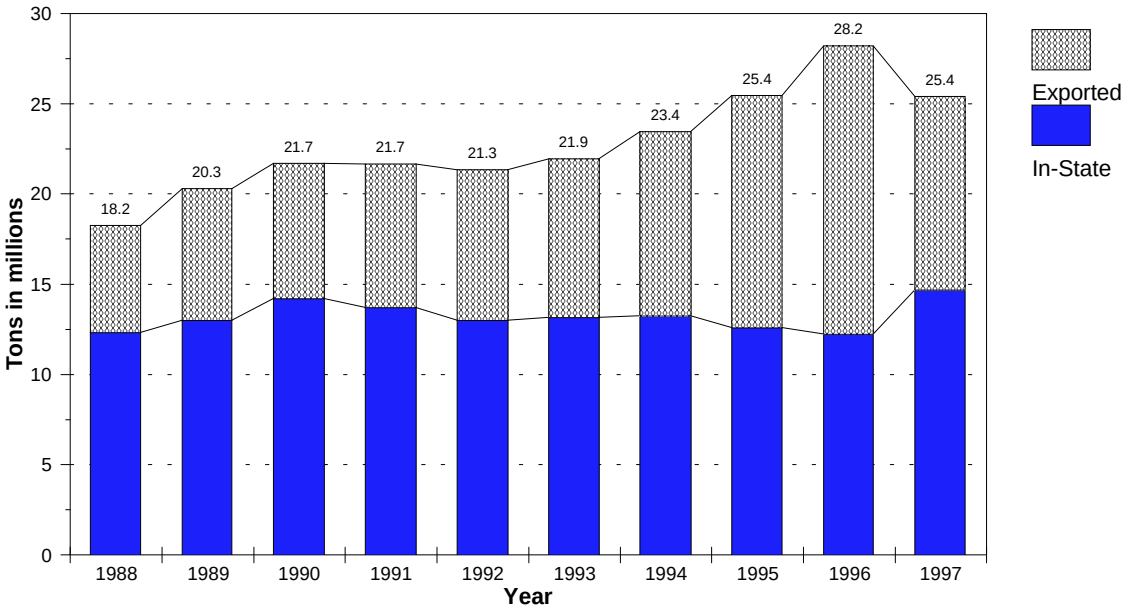
$485
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Year

Figure 5.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Tons in millions
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21.3
21.9
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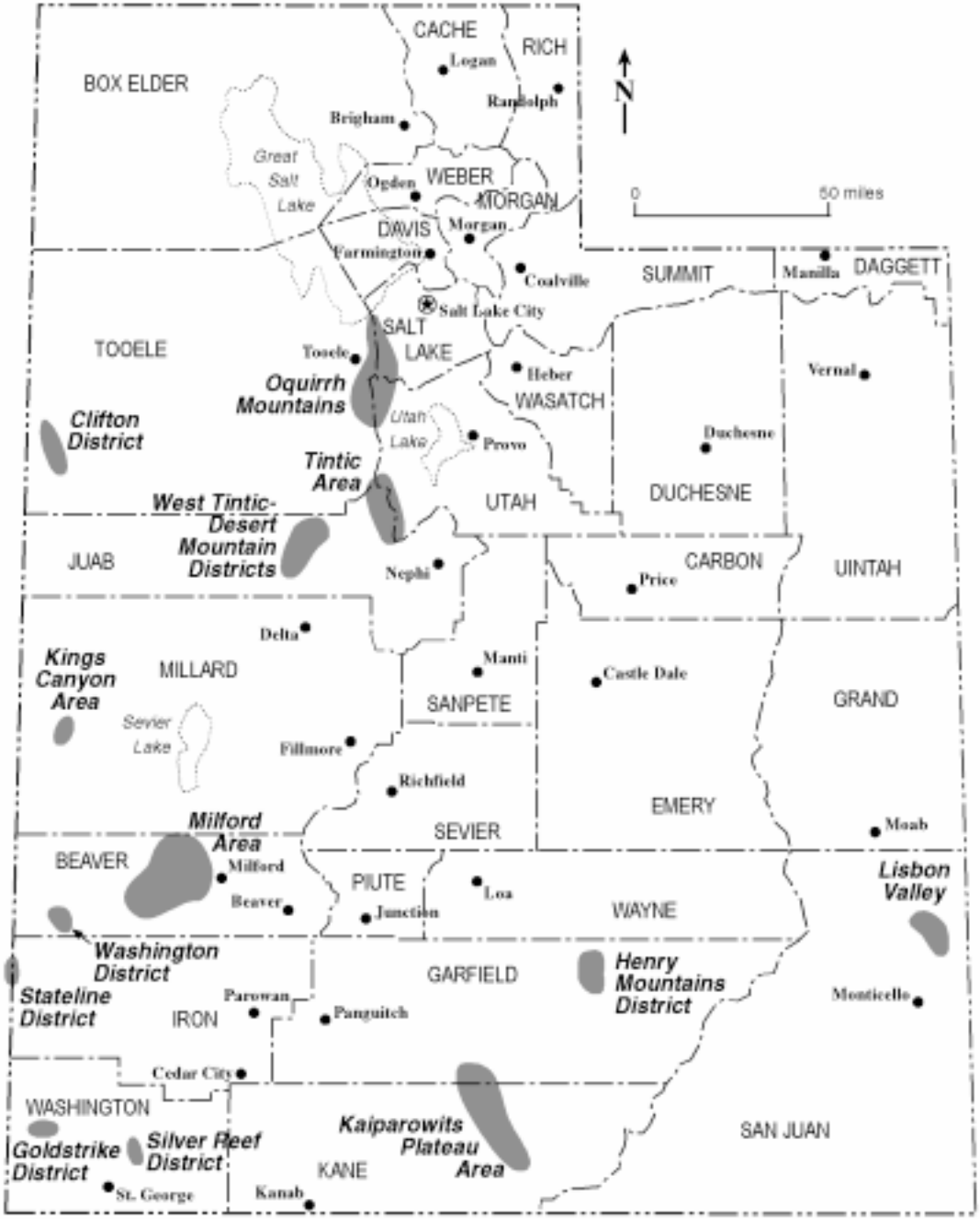
1992
1993
1994
1995
1996
1997
Year
Exported
In-State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Logan
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Ogden
WEBER
MORGAN
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DAVIS
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Farmington
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.