IDAHO MINING AND EXPLORATION, 1988

Earl H. Bennett

Staff Report 26-02
August 2026

Idaho Geological Survey
Morrill Hall, Third Floor
University of Idaho
Moscow, Idaho 83844-3014

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THE COEUR D'ALENE DISTRICT

Asarco

Asarco continued full operations from the Galena and Coeur mines. Both mines had a slight reduction in grade over previous years.

Bunker Hill Mining Company (U.S.) Inc.

In June, Syringa Minerals (formerly Bunker Ltd. Partnership) announced that a new mining company would take over operation of the Bunker Hill and Crescent mines. The Canadian company is called the Bunker Hill Mining Company (U.S.) Inc. Three million shares were sold in the new company raising $7.7 million Canadian. The new firm announced that the Bunker Hill mine would be reopened and the first ore was brought out of the Kellogg Tunnel in September. The company currently employs over 100 men at the mine and mill. Operations are centered on the Quill ore body that contains 10 percent zinc, 5 percent lead, and 2 ounces of silver per ton. Production is at 750 tpd but is scheduled to go to 1,500 tpd next year. Ore from the mine is concentrated in the Bunker Hill mill. Lead/silver concentrates are shipped to the Asarco smelter at East Helena, Montana, and zinc concentrates are shipped to two Japanese smelters. Fausett International has leased part of the mine and began active mining late in the year.

The principals in the Bunker Limited Partnership received shares in the new company. In May, the new company paid Shoshone County $570,000 in back taxes; welcome income for a tax base eroded as a result of mine closures. The County commissioners are also trying to obtain funding to buy Bunker's industrial water-treatment plant.

Bunker Hill retirees received checks totaling some $3 million for health and medical expenses as a result of a lawsuit settled last year between the former employees and Gulf Resources and Chemical Corporation, the owner of the giant complex before it closed in 1982.

The new company will be a big help with the town of Kellogg's plans to build a gondola as a tourist attraction. Bunker will pay about one-fifth of the $100,000-per-year, 20-year tax levy approved by voters in September to fund the gondola project. A government grant was announced early this year for $6 million contingent on the town raising another $6 million. Van Roll Transport System, the manufacturer of the tram system, will finance the $6 million now that the tax levy has passed.

Fred Bradley (1863-1933), the early-day kingpin of Bunker Hill and later a giant in North American Mining was elected by the American Mining Congress to the National Mining Hall of Fame.

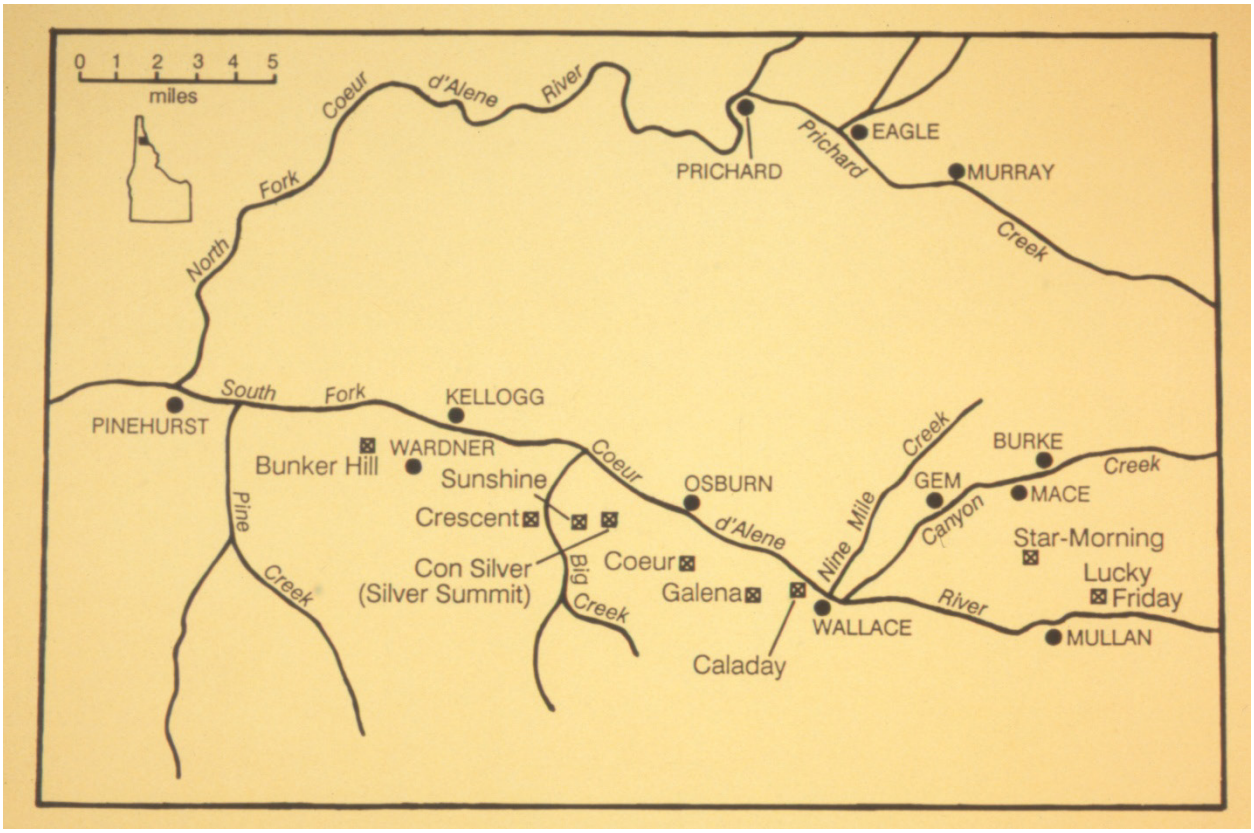

Figure 1. Coeur d'Alene mining district.

Callahan Mining Company

Callahan suffered a $1.9 million loss for the first three quarters of 1988. Grades at the Galena mine, the company's main source of income, slipped by nine percent from 16.71 ounces last year to 15.17 ounces. In addition, the company experienced problems with the Ropes Gold mine in Michigan.

Coeur D' Alene Mines Corporation

Eight years ago, Coeur d'Alene Mines Corporation (Cda) was a small mining company with 22 employees and $14 million in assets. Now, Cda Mines has 400 employees and $163 million in assets, a remarkable growth record. The success story continued in 1988 with record earnings for the first three quarters which will surpass last year, also a record year for the company. Gold production at the company's mines increased this year by 36 percent (to 54,384 ounces) and silver production increased 23 percent. The company was listed on the American Stock Exchange in April, a step up from NASDEQ.

Early in the year, the company took over all mining operations at the Rochester mine in Nevada from the mining contractor, Morrison Knudsen. Rochester is the largest heap-leach silver mine in the world and ranked second in silver production in the United States last year yielding 4.01 million ounces.

In addition to Rochester, the company operates the Sunnyside mine in the Thunder Mountain district in central Idaho and owns the Coeur mine in the Coeur d'Alene district. The company wants to start a new mine not far from the Sunnyside at Lightening Peak. Cda Mines is also in a joint venture with Echo Bay to develop the Kensington gold mine in Alaska. A new discovery was announced at Kensington by Echo Bay late in the year.

In mid-year the company merged with Royal Apex Silver and spun Galli Exploration off as a separate company called GEXA Gold.

The company started a new Employee Incentive Plan. Success extended to even the small things; CDA's annual report received an award from the National Association of Investors Corporation (NAIC).

Hecla Mining Company

Hecla continued with full operations at the Lucky Friday mine near Mullan that was reopened last year. The Lucky Friday Underhand Longwall (LFUL) mining method is now being used and has improved productivity by 28 percent. The mechanized method will require about 115 fewer miners than the standard cut and fill method used previously. LFUL should help alleviate rock bursts below the 5100 level. Mining costs with the new system are about $5.00 per ounce of silver. Currently, two 500-foot-long LFUL stopes are in production with two more scheduled to be started next year.

A rockburst measuring 4.0-4.2 on the Richter scale rocked Mullan and the Lucky Friday mine in October. The burst occurred on the 5100 level of the mine following blasting. Fortunately, no one was injured as this was the most severe rock burst in the district's history.

Hecla reached an agreement with Pioneer Metals to process oxidized gold ore from the Yellowpine mine in Valley County at Pioneers heap-leach cyanide operation at Stibnite. Pioneer will produce about 25,000 ounces of gold annually for Hecla over the next four years. Stibnite is a seasonal operation as the mine is at an elevation of 6,500 feet. Hecla is also investigating the possibility of building a mill to process refractory sulfide ores at Yellowpine that are a much larger gold resource than the leachable ore. An agreement was signed with Artech Recovery Systems Inc. for evaluating a low-temperature chemical technique called the Cashman process to process the arsenical ore.

Hecla has expanded outside of the Coeur d'Alene district in the past few years and has added both gold properties and industrial rock and mineral producers.

<u>The company owns or shares in the following active mining operations:</u>

- Lucky Friday mine, Idaho (100% owned), silver and lead
- Galena mine, Idaho (12.5% interest), silver
- Coeur mine, Idaho (5% interest), silver
- Yellowpine mine, Idaho (100% owned), gold

- Republic Unit, Washington (100% owned), gold
- Escalante mine, Utah (100% owned), silver, will close at the end of this year
- Greens Creek, Alaska (28% interest), silver and base metals

The following major exploration projects:

- Mooseland, Nova Scotia (gold)
- Sulphurets, British Columbia (precious metals)
- Thor Lake, Nova Scotia (beryllium and rare earths)
- Agnico Eagle joint exploration venture in Canada

The following industrial rock and mineral companies:

- Colorado Aggregate, a producer of scoria for gas barbecues and decorative rock, increased sales 26% this year.
- Kentucky-Tennessee Clay Company—Hecla added to its Kentucky-Tennessee Clay division by purchasing Cyprus Mineral's kaolin mines and plants at Sandersville and Deepstep, Georgia, and Aiken, S. Carolina as well as a ball clay plant and mines near Gleason, Tennessee.

A scientific experiment to study neutrinos was conducted 4,000 feet below the surface at the Silver Summit mine by physicists from the University of New Mexico, University of California at Berkeley, and the Idaho National Engineering Laboratory. The experiment was conducted underground to shield the project from cosmic radiation. Hecla is a major shareholder in the mine that was recently explored by the Consolidated Silver Corporation.

Sunshine Mining Company

Miners went back to work at the Sunshine mine in February after a 19-month closure due to low silver prices. The miners, represented by the United Steelworkers Union, worked while a new contract was negotiated. Talks broke down in May, and the miners walked out for a 9-day strike. A three-year contract was signed later in the month, and everybody went back to work (about 288 employees). The contract is unique in that wages are tied to the price of silver and are adjusted up and down reflecting market trends. In August, wages were raised $.25 per hour when silver went to $7.99 per ounce. In October, and again in November, wages were reduced by $.25 per hour as silver prices declined sharply. The mine should produce 2.5 million ounces of silver this year and 5.1 million in 1989.

A fire on the 3100 level of the mine closed the operation in March. Sixty-seven men, alerted by a stench warning system, were evacuated without incident. The fire was put out by mine rescue teams from the district and operations resumed in a few days.

The silver refinery on Big Creek operated at two-thirds capacity in June. The plant has a capacity of 8-million ounces of silver per year. A major contract for the high purity silver produced by the refinery was signed with a chemical company.

Sunshine Metals operated the mint at Coeur d'Alene. The company plans to market silver bars, jewelry, and coins on cable television.

Sunshine sold the Sunshine Energy Company, Republic Natural Gas, and Prairie Gas and Transportation to a group of the unit's managers and other investors. In October, the company offered to buy all outstanding interest in 44 oil and gas limited partnerships and joint ventures owned by Woods Petroleum Company, a wholly owned subsidiary. The cost was estimated at $25 million.

In July, the company was restructured into three units, Sunshine Precious Metals Inc., Sunshine Oil and Gas Inc., and Sunshine Management Inc. In April the company offered $65 million in convertible debentures due April 15, 2008. Proceeds were used for working capital and to redeem senior increasing rate notes due June 1, 1990. A wholly owned subsidiary, Sun Mountain Mining Ltd., purchased 500,000 shares of newly issued stock in the Bunker Hill Mining Company (U.S.) Inc.

At year's end Sunshine announced that it planned to acquire Rexene Corporation, a plastics and petrochemical business, for $865 million in cash and securities or about $28 per share. Sunshine wishes to diversify from the mining and oil and gas businesses that have been its mainstay. No major changes are planned in Rexene operations according to Sunshine spokesmen. The company makes thermoplastic resins and petrochemical products from liquids derived from natural gas. Rexene is a larger company than Sunshine and some analysts compared the acquisition to a minnow swallowing a whale.

Sunshine lost $37.1 million in the first nine months of the year. Company spokesman said the company will not be profitable for at least a year. The loss for this year follows losses of $103.2 million in 1986 and $51.8 million in 1987.

OTHER OPERATING MINES AND METAL PLANTS IN IDAHO

The year started with gloom and doom at Cyprus Mineral's Thompson Creek molybdenum mine. The number of employees had fallen from a high of 500 in 1983 to about 136 in January. Equipment was shipped from the site to the company's Sierrita mine in Arizona and rumors were rampant that the huge mine might shut down. A dramatic turnaround occurred in mid-year. The company employed 380 employees by year's end and was working three shifts, seven days a week. The mill, designed to process 25,000 tpd was operating at full capacity. Production for the year increased from an estimate in January of 3.5 million pounds of MoS_2 to 10 million pounds at year's end. This is still only half the capacity of the plant. The turnaround was due to increases in the price of MoS_2 related to recovery of the U.S. steel industry and to aggressive marketing by Cyprus. The company successfully identified markets that needed its product, in effect, giving MoS_2 a value-added dimension. During the year, five 120-ton and six 170-ton trucks and two 2100-series shovels were returned to the site from Sierrita. The main fleet now has 16 of the huge 170-ton haul trucks. The company ended the year by announcing a $1 million mill expansion to produce more high-grade molybdenum product.

Cyprus Minerals has been very successful since being spun off as separate company from Standard Oil of Indiana in 1985. Cyprus reorganized into four new operating companies this year; Cyprus Copper Company, Cyprus Gold Company, Cyprus Specialty Metals Company and the Cyprus

Development Group. In addition to Thompson Creek, Cyprus Copper operates the Sierrita, Bagdad, and Casa Grande (formerly the Lakeshore mine) copper mines in Arizona and the Pinos Altos underground copper mine in New Mexico. This year the company purchased Inspiration's copper smelter and mines near Miami in Arizona, the Twin Buttes copper mine located near Sierrita, and the Tonapah copper/moly mine in Nevada. Cyprus Specialty Metals has a beryllium mine in Texas (owned with Cabot Minerals), acquired Foote Mineral (a lithium producer with mines in Chile and Nevada), and operates several talc mines in Montana and newly purchased talc mines in Vermont and Spain.

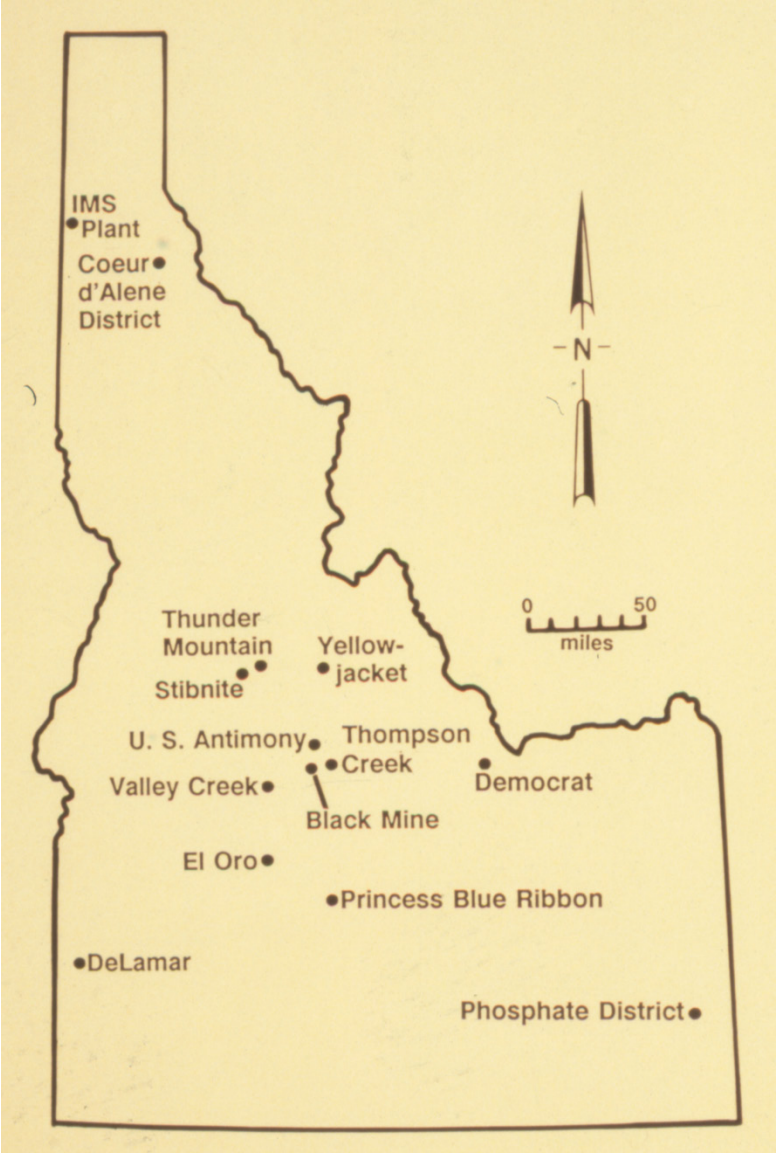

Figure 2. Producing mines and plants.

Nerco Minerals continued with a feasibility study on Florida Mountain located due east of the Delamar mine in Owyhee County. The company operated its vat leach plant at the Delamar mine and new heap-leach plant, located just west of the vat leach mill all year. The new plant is

processing waste rock and should recover 1.4 million ounces of silver and 65,000 ounces of gold over its seven-year lifespan.

U.S. Antimony Corporation continued operations at its 350 tpd flotation mill and vat-leach plant at Preachers Cove on the Yankee Fork of the Salmon River. The company milled about 6,000 tons of gold ore averaging .14 ounces of gold per ton from the Yellowjacket mine that is under development. Plans call for building a mill at the mine site to avoid the 110-mile trek to Preachers Cove. An area 1,500 feet long by 60 feet wide is mineralized at Yellowjacket. The company continued to process ore from the Golden Maple mine near Stanley and from the Custer Slide and mines on Estes Mountain near the Preachers Cove mill site.

Pioneer Metals reached an agreement with Hecla Mining Company to process ore at the rate of 400,000 tons per year from Hecla's Yellowpine mine (also referred to as the Homestake orebody) located at Stibnite near Pioneer's heap leach operation. Pioneer processed 36,000 ounces of gold and 22,400 ounces of silver last year from its West End open-pit mine that was near exhaustion. The company obtained ore from a new pit located above the West End mine and has developed about three-million tons of reserves in several small deposits that ensure about four more years of operation in addition to processing ore for Hecla. The first gold from the Hecla joint venture was poured in June. Hecla estimates that the mine will produce about 25,000 ounces of gold per year. Reserves at Yellowpine are 1.6 million ounces averaging .077 gold in oxidized ore. Argee Corporation is the mining contractor for Pioneer and Hecla. The cost of starting the new Hecla operation was $700,000. The project employs about 100 people.

In addition to the oxidized ore, Hecla has 15-20 million tons of sulfide ore averaging .1 ounce of gold per ton at the Yellowpine mine. The company is evaluating development of this orebody which is not amenable to heap leaching.

Coeur d'Alene Mines Corporation continued the seasonal operation at the Thunder Mountain gold mine in central Idaho. Production for the year was estimated at 25,000 ounces of gold and 30,000 ounces of silver from the cyanide heap-leach, open-pit gold operation. The company began permitting procedures for a new open-pit mine near Lightning Peak near the current operation at the old Sunnyside mine. About 1 million tons of ore will be mined from the new pit that contains reserves of 70,000 ounces of gold. The Lightening Peak orebody will extend the life of the operation by two to three years. At 8,500 feet, the Thunder Mountain mine is Idaho's highest heap-leach mine and only operates about 8 months of the year due to severe winter conditions. Thunder Mountain Gold Inc. owns the mine and Cda Mines operates the property under a lease agreement.

Precious Metals Technology placed the Princess Blue Ribbon mine in Camas County in production. A 100-tpd flotation plant and a vat-leach cyanide mill are operating at the site. Gold occurs in pyrite and as fine free gold in veins in an oxidized zone that is exposed in the open-pit mine.

International Mill Service began construction of a $15 million plant located near Hauser Lake in Kootenai County for recycling aluminum cans. The facility, housed on 33 acres, contains a 42,000 square foot building (beverage-can remelting), a 36,000 square foot building (dross recovery plant), and a 3,400 square foot administration building. The facility should be completed by March 1989. IMS has a contract to provide molten aluminum to Kaiser Aluminum and Chemical Corporation. The new facility will employ 67 people and have an annual payroll of $1.25 million. The company initially had trouble finding a disposal site for dross, a waste product, but will haul the material to a landfill in Wendover, Utah.

PHOSPHATE

The U.S. Bureau of Mines noted that there was a 15 percent increase in phosphate rock production in the 1988 crop year (July 1987-June 1988) from 37.6 million metric tons in 1987 to 43.3 million tons this year. Marketable rock sold increased by 10.8 percent to 45.8 million metric tons although the cost of rock decreased from $21.11 per ton to $18.75 per ton. Production in the U.S. comes from Florida, North Carolina, Tennessee, Montana, Utah, and Idaho. Production from Florida and North Carolina decreased 19 percent from last year. The United States exported 8.0 million tons of rock, about 4 percent less than last year. Imports to the U.S. were primarily from Togo, Morocco, and the Netherlands' Antilles.

The phosphate industry in Idaho had a very good year as market conditions continued to improve for agricultural products and the sales of elemental phosphorus remained strong. The drought in Idaho did cause fears of possible power outages for the elemental phosphorus producers and there were a few short curtailments.

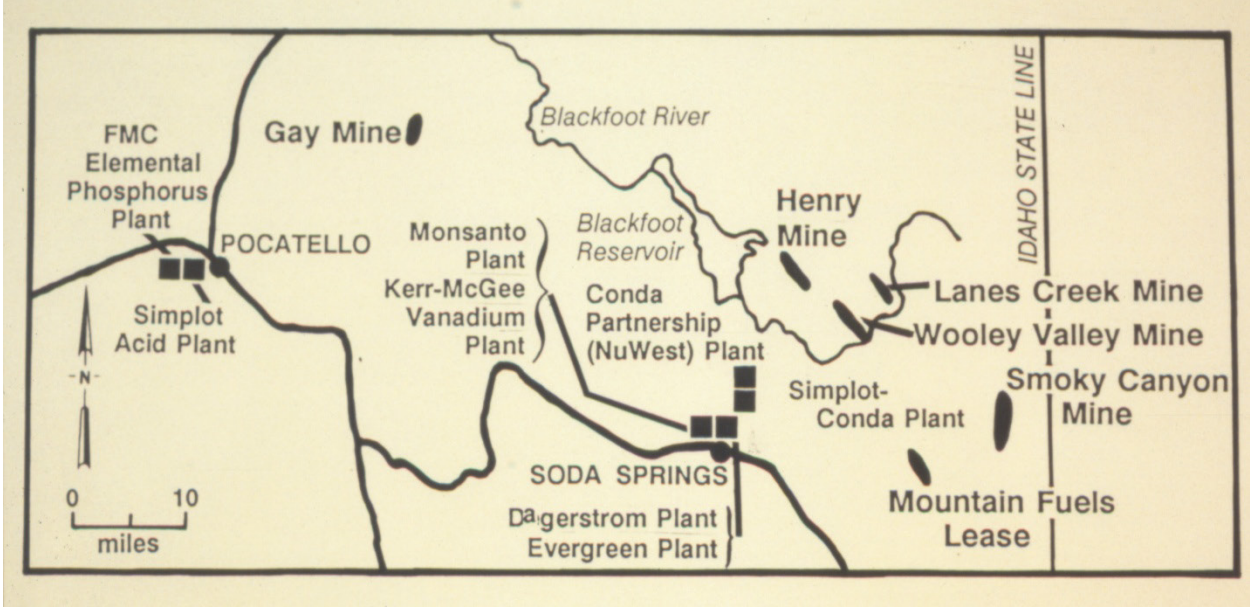

Figure 3. Phosphate district.

Idaho companies produce about 10 percent of the country's phosphate. The State's fertilizer manufacturers were successful in filling value-added markets (NuWest) and in increasing production (J.R. Simplot). Highlights for the elemental phosphate firms in 1988 included FMC opening a new mine and Monsanto maintaining maximum production. Kerr McGee will expand its vanadium extraction plant, and Degerstrom Inc. is constructing a new plant to extract gallium and silver from treater dust.

FMC announced plans to open a new mine on 664 acres of federal and state leases in Dry Valley to replace dwindling reserves at the Gay mine. The new mine is about 25 miles northeast of Soda Springs. The company may tie into a 58-mile-long slurry pipeline that will be built by J.R. Simplot to transport slurried phosphate ore from Conda to Pocatello. The pipeline will replace conventional rail transportation. The South 40, a new tract at the Gay that was explored last year, proved

disappointing and prompted the need for additional reserves for FMC's elemental phosphorus operation near Pocatello. This is the largest elemental phosphorus plant in the world, employing about 600 people.

About 2 million tons of phosphate ore are mined yearly from the 7,000-acre Gay mine by J.R. Simplot, mining contractor. About 80 percent of the ore goes to FMC's plant and the remainder to Simplot's fertilizer plant, both in Pocatello. The mine is on the Fort Hall reservation of the Shoshone-Bannock tribe and employs about 165 people. Ore reserves at the Gay will be exhausted by 1992. The closure of the mine will have a negative impact on the tribe as an estimated one-third of the tribe's economy ($2.1 million) comes from the mining operation. About 65 percent of the mine workers (105 employees) are tribal members. The shutdown will also adversely affect the tax revenues of Bannock County ($150,000 loss) and Bingham County ($180,000 loss). The new mine in Dry Valley will increase revenues for Caribou County that already receives half of its total taxes from phosphate operations.

FMC announced that a multi-million-dollar stacker/reclaimer will be built at the Pocatello plant. The new equipment is made in Denmark and will replace about 10 bulldozers that currently are used to handle feed-stockpiles. The stacker will break up frozen ore and reduce dust problems from the ore stockpile. Construction of the new automated facility, the first of its kind in the U.S., should be completed by mid-89.

The secondary condenser at FMC's Pocatello plant was overhauled this summer at a cost of some $1 million to improve emission control. The original condenser was installed in 1970 at a cost of $2.6 million. This is the final phase of a $13 million, three-year program, to decrease pollution at the plant. The plant uses 1.7 million tons of ore, 60,000 tons of silica and 75,000 tons of coke to produce 270 million pounds of elemental phosphorus annually.

The drought impacted FMC's major electrical power source furnished by Idaho Power. The four electric furnaces at the Pocatello Plant use 240 megawatts of power or 15 percent of Idaho Power's generating capacity. The drought forced Idaho Power to rely more on its coal-fired generating plants. This translated into higher power costs for FMC and intermittent power shortages that plagued operations throughout the summer.

NuWest Industries reached full production at its fertilizer plant at Conda only one year after taking control from the bankrupt Beker Corporation. The company paid about $50 million for the plant and has invested $1.7 million in restarting the facility. The success was achieved by increasing the capacity of the super-acid plant by 25-30 percent (from 9,000 to 12,500 tons a month) at a cost of some $600,000. According to company spokesmen, super acid is the most value-added chemical produced at the plant and the fastest growing fertilizer product in the country.

The fertilizer plant has a capacity for processing 700,000 tons of phosphate ore per year and employs 200 people. NuWest plans on building a $30-35 million cogeneration plant at the Conda site. The plant's success is just short of phenomenal, and NuWest has been so successful that bonds issued by the old Beker Industries Corporation increased 850 percent this year even though Beker is still in Chapter 11. The bonds can be converted into NuWest stock if Beker's reorganization plan is approved.

In June, NuWest announced the purchase of Beker's phosphate mine and 4,500 acres in Florida for $4.75 million. This followed the purchase for $33 million of Mississippi Chemical's fertilizer plant

with access to a deep-water port at Pascagoula, Mississippi in April. These acquisitions make Nu-West the fourth or fifth largest fertilizer producer in the world only nine months after incorporation.

NuWest obtains ore from leases in Dry Valley. Washington Construction is the mining contractor employing some 200 people at the mine site. About 1.5 million tons of ore are mined each year.

Western Cooperative Fertilizer of Calgary Canada is a partner with NuWest (Conda Partnership) in the mining operation and operates three calcining plants adjacent to the NuWest plant. Western is supplying NuWest with calcined rock but is not shipping any rock to its fertilizer plant in Calgary, Canada, that has been closed since 1987. Western Cooperative plans to start up another calciner soon and may resume shipments to its plant in Canada. Sherritt Gordon obtained an option to buy Western's fertilizer plant in Canada in March.

Alumet hauled about 170,000 tons of ore for NuWest this year from its Lane's Creek and Diamond Creek mines. The company is hoping for a longer-term contract for as much as 500,000 tons over the next five years. Complaints were filed with the county over Alumet hauling ore with heavy trucks along the Narrows Road that parallels the Blackfoot River. The road may have to be upgraded if large amounts of ore are trucked in the future.

J.R. Simplot will spend $30 million on a 58-mile long, 9-inch-diameter pipeline to transport slurried phosphate ore from Conda to the fertilizer plant at Pocatello. The pipeline will connect with the 27-mile line from the company's Smoky Canyon mine near Afton, Wyoming, to Conda and should be completed in 1991. The pipeline will cut down further on air pollution at the plant by eliminating the need for dry ore storage and resultant dust problems. The pipeline will allow for a 20 percent expansion (60,000 tons of P_2O_5) of the Pocatello facility to 400,000 tons of P_2O_5 per year. A $50 million plant modernization and improvement program was completed last year at Pocatello. The plant employs about 550 people.

Monsanto continued full production from the Henry mine and operation of its elemental phosphorus plant at Soda Springs. Monsanto was not as exposed to power shortages as FMC as its power comes mostly from Utah Power and Light's coal fired plants. The company uses 1.1 billion kilowatts a year for its electric furnaces. Monsanto produces about 220 million pounds of elemental phosphorus annually and mines about 1 million tons of ore. The mining contractor is Dravo Corporation. About 400 are employed at the plant and 100 in the mining operation.

Kerr McGee continued full production at its vanadium processing plant in Soda Springs. The plant extracts vanadium from ferrophosphorus slag, a waste product from Monsanto's elemental phosphorus plant located across the road from Kerr-McGee. A fear of shortages drove vanadium prices substantially higher during the year (130 percent over its low price in the past three years). The largest vanadium supplier in the world is South Africa (Highveld Steel and Vanadium Corporation), and recently there has been concern over the reliability of supplies from the racially troubled country. Kerr McGee is the largest domestic producer of vanadium. The price increase prompted Kerr McGee to announce a 30 percent plant expansion next year. Capacity will increase to 4.3 million pounds of vanadium pentoxide (up a million pounds from current production). About 10 more employees will join the current workforce of 50 people. Vanadium, listed as a strategic metal by the U.S. Bureau of Mines, is a steel additive and a component in various catalysts.

Degerstrom Inc. broke ground for a new $2.25 million plant located just north of Soda Springs. The facility will extract gallium and silver from treater dust that is a waste product of Monsanto's elemental phosphorus plant. The Degerstrom process will react the dust with sulfuric acid to

produce phosphoric acid and then use organic compounds to extract gallium. Silver will also be recovered. Gallium is in demand by the electronics industry. Gallium arsenide computer chips are faster and operate at higher temperatures than the widely used silicon chips. The plant will produce about 4,000 kilograms of gallium and 180,000 ounces of silver per year and will employ about 18 people.

Stauffer Chemical (a division of Rhone-Poulenc) shipped about 400,000 tons of phosphate ore from the Wooly Valley mine (located northeast of Soda Springs) to its elemental phosphorus plant at Silver Bow, Montana. Fifty-four men are employed in the mining operation.

Evergreen Resources Inc. continued to produce a variety of fertilizer products at its plant in Soda Springs. The company extracts phosphate from a waste product of Kerr-McGee's vanadium plant.

Vaughn Smith Construction built a small plant in Soda Springs to crush slag from Monsanto's operation for construction purposes.

A group of concerned citizens and businessmen called the Clark Fork Coalition was successful in getting the city council of Missoula, Montana, to approve a ban on phosphate detergents. The detergents are blamed for water quality degradation in lakes and rivers. Similar bans are being considered by Sandpoint, Idaho, and other towns. Unions representing phosphate workers in southeast Idaho are opposed to the bans and have vowed to fight them.

INDUSTRIAL ROCKS AND MINERALS

Emerald Creek Garnet remodeled its mill at Fernwood, installing a new dryer and screening system. The company is the country's largest producer of garnet, shipping 26,000 tons of finished garnet product in 1988. Garnet is dredged from Emerald and Garnet Creeks with five washing plants and draglines. The material is separated in a new jig plant and then sized and packaged. Garnet is used as an abrasive, a filtering medium, and as a cutting material in water-garnet high pressure cutting tools.

The Nez Perce tribe finished another year's contract providing limestone for Potlatch Wood Products' paper mill in Lewiston. The company is also looking at the agricultural lime market. Eight people are employed in the mining operation.

Ted Orchard, former plant manager of the Marble Shop, bought the travertine facing stone operation in Idaho Falls from the parent company in Tennessee. The company is now called Idaho Travertine. The business employs about 25 people who cut and slab travertine and other types of decorative facing stone. Work continued on a contract for facing stone on a 28-story building in Atlanta, Georgia that was started last year. Travertine is not fashionable this year as a facing stone, so the company is using other types including a dolomitic limestone shipped from Minnesota and granite. No new travertine was mined at the company's quarries east of Idaho Falls, but several new quarries will be opened next year to obtain different types of travertine. Clayburn Industries shipped about 1,700 tons of calcined clay from the old Simplot operation near Bovill to its refractory brick plant at Abbotsford, B.C. The company is also using about 12,000 tons of sand stockpiled at Bovill in a new mortar product.

A.P. Greene had a good year for its first year as a separate company after being spun off last year by U.S. Gypsum. In 1988, the company rebuilt two kilns and mined about 5,000 tons of clay for

its refractory brick plant at Troy. The bricks are used by the wood products and mining industries. An upturn in the steel and aluminum industries has been positive for A.P. Greene with most plants operating at capacity all year.

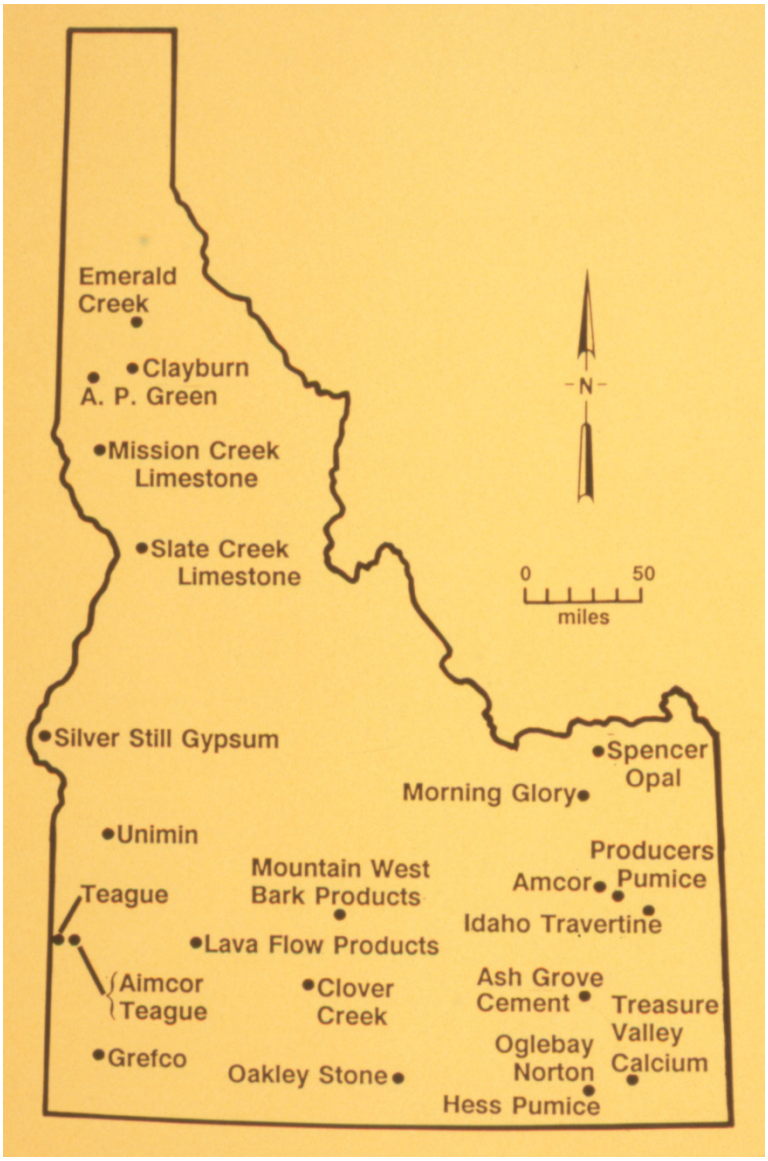

Figure 4. Industrial rocks and minerals.

Grefco evaluated their diatomite claims near Deep Creek in Owyhee County. A drilling program is scheduled for next year on the high-grade deposit.

American Diatomite continued evaluating the diatomite deposit located north of Gooding. Development work is planned for next year.

Teague Mineral Products mined most of the zeolites it sells from deposits located just north of Sheaville, Idaho (north of Jordan Valley, Oregon). The material is shipped to the company's plant at Adrian, Oregon. The zeolite is used as a feed supplement and as a carrier for fungicides. Teague,

in cooperation with the U.S. Bureau of Mines, is investigating the use of zeolites for cleaning up radioactive debris and heavy metals at the Bunker Hill Superfund site. New zeolite deposits located near Aimcor's pits west of Oreana, Idaho, are being evaluated. These deposits are very pure and are believed to be the highest-grade deposits of clinoptilolite in the U.S.

Silver Still Mining operated a gypsum mine near Iron Mountain. The company has a crushing plant at Weiser and a contract with Simplot Soil Builders.

Mountain Bark Products, located near Mountain Home, continued to sell basaltic scoria for landscaping and other uses including aquarium rock, gas barbecue rock, roofing products, potting mixes, and roadbed material for model railroads.

Ash Grove Cement West's plant at Inkom in Bannock County is the only cement producer in the state. The company reached a milestone in safety in 1989, exceeding 2,000 days without lost time due to an employee work-related injury. It is another record in a long list for the company that has been accident free for 15 of the past 30 years, and has won among other awards, the Portneuf Cement Association safety award five times since 1963.

Oglebay Norton doubled perlite production over 1987, when the company purchased the old Oneida perlite operation located at Malad. The load-out mill at the mine site was upgraded and quality control improved substantially. Most of the 25,000 tons of perlite shipped this year was crude perlite but about 5 percent was expanded perlite processed at the Malad plant. A new office facility was constructed near the mill in town.

Hess Pumice continued full production from the new $1.1 million dollar plant at Malad. The facility produces ground pumice ranging from No.4 to -325 mesh. Flour mill screens sieve the finer material, and process controllers are widely used throughout the automated plant. The company mines pumice from a very pure source at the Wrights Creek mine located 22 miles northwest of Malad. The mine has a minimum reserve of 10 million tons. Hess ships sized pumice that is used as a grinding compound (printed circuit boards and television tubes), as an abrasive in hand soaps and polishing compounds, and has a unique role in making stone washed denim. Hess can custom blend any size combination needed for a particular application and produces a very pure, high-quality product. Bulk pumice is also sold as light-weight aggregate that is used in making specialty concrete blocks.

An Idaho entrepreneur, Bill Miller, of Hayden Lake, started a new business last year called Kat-Pak Inc. The product, a disposable container of cat litter, uses diatomaceous earth and Sta-Dri, a super-absorbent polymer used in disposable diapers. The polymer makes four pounds of litter as absorbent as 15 pounds of regular litter. The company employs 15 people in Smelterville and markets the product throughout the west coast.

EXPLORATION

Coeur d'Alene District

Asarco Inc. announced late in the year that they had obtained a 25-year lease on the Silver Summit mine, the site of a seven-year, $17 million exploration venture by the Consolidated Silver Corporation (Hecla and Coeur d'Alene Mines Corp.). The company will spend a minimum of

$100,000 per year and make every effort to place the property in production. Consolidated Silver Corporation sank the Silver Summit shaft to a depth of 5,400 feet and found mineralization, but it was not commercial. If the mine is brought into production net profits will be split 65 percent Asarco and 35 percent Con. Silver Corp.

Asarco renewed activity on the American Silver drive that was stopped in May 1986 due to low silver prices. The Wire Silver vein, the primary target of the program, will be probed from a 5,100-foot-long drive from the 3400 level of the Coeur mine. The company was 345 feet short of vein when the program was placed on hold.

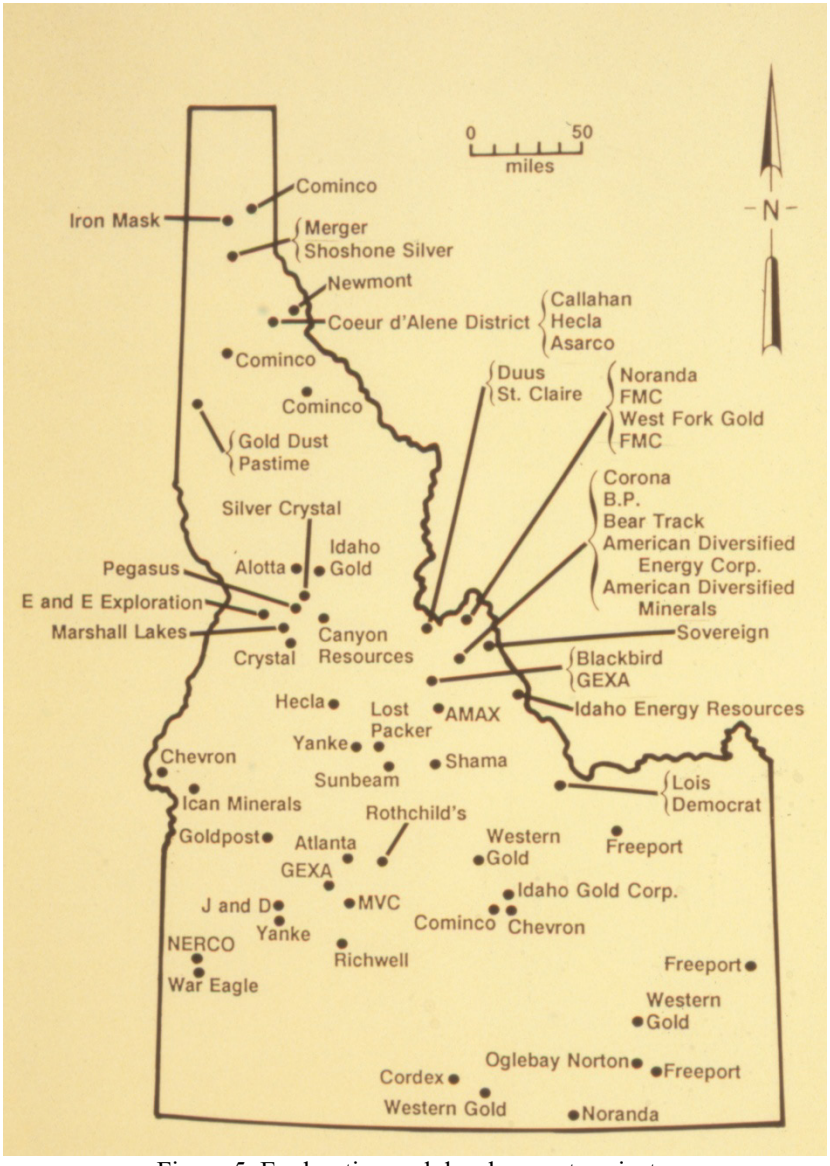

Figure 5. Exploration and development projects.

Callahan Mining Corporation continued with the $4 million, phase-two exploration program at the Caladay project. The northwest drift on the 4900 level was advanced 830 feet and crossed into the adjacent Galena ground in May. A number of mineralized stringers were found near the Galena-

Caladay boundary and mineralization was found in a 250+ foot-deep drill hole near the Boundary vein area below the 4900 level. This hole intersected about 135 feet of mineralization averaging 6.7 ounces of silver per ton and 10 percent lead. The last 50 feet of the hole averaged 9.7 ounces of silver per ton. Another hole intersected lower grade mineralization. Encouraged by these results, the program was accelerated at year's end by adding a second shift which should enable the exploration phase to be completed in 3 months. Funding for the program is split between Callahan (82.3 percent), Hecla (12 percent), and Asarco (5.7 percent).

Hecla reopened the 1,700-foot-long Snowstorm No.3 tunnel at the Snowstorm mine located east of Mullan near the Lucky Friday mine. The adit will be used for an exploratory drilling program. The company is looking for low-grade silver-copper mineralization similar to that mined at Troy, Montana, and in mines being developed at Noxon and Rock Creek near the Troy mine. This type of ore was mined from the Snowstorm years ago. The $1.5 million Silver Mountain project probed beneath the old Snowstorm workings in the 1950s. Hecla, Bunker Hill Company (U.S.) Ltd, and Silver Mountain Lead Mines are the owners of the property.

Newmont continued with an exploration/drilling program at the Golden Chest mine near Murray. The Golden Chest is owned by Golden Chest Inc., TAP Resources Ltd., and Viking Resources Ltd. Other claims held by Viking and by Cominco (Dolly claim block) are included in the program. Newmont is looking for a low-grade, bulk-minable deposit.

Other Exploration Projects

Cominco put down another hole near Blackdome Peak south of the St. Joe and drilled a hole near No-see-um Peak. Some trenching was also done near St. Maries. The company also conducted a drilling program near Lightning Creek southeast of Bonners Ferry.

Shoshone Silver did some trenching at the Idaho-Lakeview mine in the Pend Oreille district. The company is waiting for better silver prices to continue mining activities.

Merger Mines did assessment work only at the Cedar Mt. mine located near the Idaho Lakeview and the Cyanide Gulch property near Gibbonsville. The company is waiting for improved silver prices.

John Hayden continued to develop underground workings at the Gold Dust Claims in the Hoodoo Mining district east of Potlatch. Sam Gill operates another small mine, the Pastime, in the same area.

Pegasus Gold Inc. drilled 9,000 feet in the Buffalo-Hump area concentrating on the Big Buffalo, Concorde, and Jumbo mines. A bulk sampling program was carried out at the Big Buffalo. This is the second year of this program; more drilling was done last year. The company is currently evaluating results.

Idaho Gold Corporation continued planning for a heap-leach gold mine in Buffalo Gulch, located six miles northwest of Elk City. Preliminary leach testing was conducted last year, and the mine should go into production in 1990. The company is owned by Amir Mines Ltd. (62%), Glamis Gold Ltd. (15%), and Normine Resources Ltd. (22%). At year's end, Amir Mines Ltd., Bema International Resources Inc., and Normine Resources Ltd. were consolidated and are now called Bema Gold Corporation. The mine will employ 35-40 people. The deposit has reserves of 5 million tons of .03 ounces of gold per ton. About 820,000 tons of ore per year will be mined,

yielding 18-20,000 ounces of gold annually over the six-year life of the mine. Construction costs are estimated at $3.5 million. Mining will be seasonal although a year-round operation is possible.

Idaho Gold also negotiated an option to acquire a 100 percent interest in the Erickson Reef property located immediately north of Buffalo Gulch. The property contains 2.5 million tons of .06 gold with a stripping ratio of 2:1.

Thunder Mountain Gold Inc. obtained state leases on 2,500 acres that contain black sand placer deposits in Valley County, Idaho. The company owns claims on an additional 380 acres. The black sands are being evaluated for rare earths that are important in the development of superconducting materials and microelectronic components.

Canyon Resources entered a $1.8 million venture with Golden Shamrock Mines Ltd. to continue exploration and development at the Robinson Dyke mine near Dixie in Idaho County. The company plans on placing the mine in production in 1989. The property contains 660,000 tons of .042 gold in proven and probable reserves. Production is planned at 10,000 ounces of gold per year. A drilling program this year improved reserves.

Silver Crystal drove 117 feet of new drift in the Umatilla mine near Orogrande. The mine is being explored for precious metals including gold and platinum group metals. The company has built a pilot wet-chemical extraction plant for platinum group metals at the mine site.

B.P. Minerals (formerly Amselco) dropped their extensive holdings at the Golden Gate tungsten mine south of Yellowpine. The company has had an extensive drilling program at the site over the past two years.

In July, a New York based partnership, Blackbird Metals, announced plans for purchasing the Blackbird mine (located about 20 miles west of Salmon) and building a new cobalt refinery in the Salmon area. Chalmers Dale, spokesman for the group, said the company would invest $85 million in the venture including $47 million for the new refinery, $31 million for purchasing and opening the mine, and $7 million to settle a 5-year-old lawsuit between the state and former owners of the mine concerning pollution of Blackbird Creek by acid mine water. Production from the venture is estimated at 2,500 tons of cobalt per year. The new refinery would employ about 250 people. In November, the company asked the state of Idaho to cancel the $7-million agreement although plans for developing the mine are still alive.

The Blackbird mine, the nation's most readily available source of the strategic metal cobalt, is owned by Noranda Mining Corp. and Hanna Mining Company. Noranda spent $30 million in developing the property but wrote the venture off in 1982 after the price of cobalt plunged from $20 to $7.00 per pound. In addition to cobalt, the deposit contains copper and some gold.

Meridian Minerals Company (subsidiary of Burlington Resources Inc.), Canyon Resources Corporation, and Minex announced a new gold discovery north of Leesburg called the Beartrack Joint Venture. This is the largest gold discovery in the state's history and production may exceed the 2.9 million ounces mined from placer and lode deposits in Boise Basin, the largest gold district in Idaho. At year's end, the company announced 2 million ounces of gold as a geologic reserve with the property still open for further development. Meridian has a 60 percent interest and Canyon Resources and Minex 40 percent. Production from the mine could be 120,000 ounces of gold per year over a 20-year mine life. Reserves are about 40 million tons averaging .055 gold. Over 50,000 feet were drilled this year in over 100 holes. Mineralization extends at least 500 feet deep. The

deposit is a quartz stock work with mineralization hosted by a roof pendant (Yellowjacket Formation) and Precambrian granitoid.

B.P. Minerals and American Gold Resources have drilled 14, 300-400-foot-deep holes near the Haidee mine on Arnett Creek over the past two years. The companies continued to acquire land and stake claims adjacent to Meridian's Beartrack project. The drilling and regional exploration program will continue next season.

Corona Gold drilled claims in the Leesburg area just north and east of Meridian's Beartrack holdings. The property is located on Napoleon Hill and is the site of the Bobcat Gulch stockwork molybdenum deposit explored by Cominco in the late 1970s. Corona plans more work next season.

Homestake Mining drilled two holes on claims on Porphyry Ridge explored last year by McConnell-Peel Resources Ltd.

AMAX Exploration drilled eight holes near the Rabbitfoot mine. The nearby Singheiser mine was explored several years ago by Tenneco. Amax will continue this program next year and is doing general reconnaissance in the trans-Challis fault system.

American Diversified Minerals (a subsidiary of Trans Global Industries) joint ventured with Leesburg Land and Mining Company of Lakewood Colorado to expand operations at the Leesburg claims. Production is estimated at 1,500 tons of .98 ounce gold per day. The company also signed an agreement to operate the Stormy Peak mine near Salmon and is reportedly building a small refinery in Salmon.

GEXA Inc. explored claims near Blackbird Mountain located south of Musgrove Creek. A drilling program is scheduled for next year.

FMC did little work on its Ditch Creek property north of Salmon and was looking at a farm-out agreement that fell through at year's end. The company will continue to hold the claims and will continue development next year.

FMC drilled 15 holes on Sage Creek that is across from the Ulysses mine above Shoup. Results are being evaluated.

Noranda leased the Ulysses mine property from Echo Bay who inherited it from Tenneco Minerals. Echo Bay drilled it last year and Noranda drilled this year. Noranda has decided to drop this project.

The West Fork Gold Mining Company was back on the West Fork of Indian Creek and did more drilling.

Sovereign Exploration drilled in Tower Creek (Gold Star Gulch).

Charles Duus went underground at the Monitor mine in Upper Owl Creek. Another company is at the St. Claire Mine in Owl Creek close to Mr. Duus.

Idaho Energy Resources did some underground work on the Montana side of the Lemhi pass thorium district and opened adits at the Wonder Lode and Caga mines in Idaho.

In March, the Environmental Protection Agency approved a pollution-discharge-system permit, the last remaining hurdle to starting up the Sunbeam mine on Jordan Creek in Custer County owned by Sunbeam Mining Company (a subsidiary of Geodome Resources Ltd.). The National Wildlife Federation immediately appealed the decision in September arguing that the EPA did not have authority under the Clean Water Act to grant the permit. The group believes that jurisdiction for

the permit lies with the Army Corps of Engineers. The appeal has again slowed development at the mine site.

Design work for the project is nearly complete. Sunbeam raised about $20 million during the year to finance construction of the closed vat-leach mill and mine. Three of six sediment ponds were excavated. The mine will operate 10 months of the year to avoid problems with spring runoff, that caused problems at the site several years ago for a heap-leach project operated by another company.

Sunbeam continued to explore nearby areas and drilled on Red Mountain and near Sheep Mountain. A drilling program on Grouse Creek was encouraging. Mineralization was found in 14 of 20 holes.

In November, CoCa Mines Inc. acquired Geodome Resources Ltd., for stock warrants and shares valued at $13 million. Coca's plans for the Sunbeam mine venture were not known at year's end.

Shama Minerals Chemical and Oil Inc. increased its claim block to nearly 5,000 claims in the Challis area. The company conducted a diamond drilling program in the Baker Creek area.

Gold Post Resources USA Inc. was evaluating results from a 14-hole, 5,000-foot drilling program at the Gold Hill mine near Idaho City. The mine is the largest gold lode mine in the Boise Basin district. The company would consider a joint venture partner on the project.

Cactus West Exploration conducted a preliminary sampling program at the Missouri gold property near Placerville. Three vein systems are being examined, with a drill program planned for next year.

Frontino Corporation completed roads and drill pads at the Mineral Hill and Ophir mines near Idaho City. A drilling program is scheduled for next year.

Atlanta Gold Corporation continued evaluating the Atlanta Hill property in central Idaho. The company invested about $3 million in Atlanta Hill last year. In 1988, 46,000 feet of reverse circulation drilling was done in the East Pit area increasing reserves to 9.18 million tons of .072 gold (40 percent leachable) for a reserve of 661,000 ounces. The West pit area contains 1.3 million tons of .051 gold and .087 silver (about 75 percent sulfide ore). Some deep drilling was done early in the year in the East pit area. Both open-pit cyanide-heap-leach and conventional milling operations are being considered. The stripping ratio for open-pit mining is 3.98:1. The company is encouraged by deep drilling results.

GEXA Gold Corporation continued a drilling program started last year in Hardscrabble Gulch in the Rocky Bar district, drilling about 25 new holes. Last year the company drilled 26 holes totaling 7,450 feet. About 275,000 tons of .037 gold have been outlined in Hardscrabble Gulch and 313,000 tons of .046 gold in Wide West Gulch, just south of Rocky Bar for a total reserve of about 25,000 ounces of gold.

J and D Minerals continued with underground development at the Competence mine in the Neal district in Elmore County. A number of improvements were made to the company's mill.

War Eagle Mining has over 145 claims near Silver City centered on War Eagle Mountain. This year the company leased a 640-acre tract from Nerco Minerals near Florida Mountain. War Eagle drilled 39 holes this year. Several holes in section 16 near War Eagle Mountain showed encouraging intercepts. These included 75 feet of .114 gold in hole 16-2 and 275 feet of .161 gold and 6.5 ounce silver in an offset hole, 16-2A. Another hole (CCB-1), 3,000 feet north of 16-2, contained .616 ounces of gold and .45 ounces of silver from 70 to 75 feet. Mineralization occurs

in both latite and underlying sediments that both overlie granite that is also mineralized. Announcement of the find started a buying frenzy for the company's stock on the Vancouver B.C. stock exchange. The price rose from $1.60 per share on October 26 to $8 per share on November 11 when trading was suspended. The price fell to $3.75 per share when trading resumed on November 15. The company raised $1.2 million with a private placement of 300,000 shares of stock to the Ivanhoe Capital Corporation.

Golconda Resources announced it would start a drilling program on the Morning Glory property located about two miles from War Eagle Mining Company's claims. The company plans 10 holes that will go to a maximum depth of 300 feet to test a mineralized area called the Main Zone. Selected samples from the property contain .25 to 1.90 ounces of gold per ton.

Richwell Resources tested its new mill near Fairfield. The company plans to run the mill at 20 tons per day but could expand capacity to 65 tpd. Ore will be mined from the company's Blackstone mine in the Volcano district.

Atlas Minerals, a subsidiary of Atlas Corporation, opened an exploration office in Boise. The company is developing a new discovery at Grassy Mountain located in Malheur County, Oregon. Atlas will use the office for exploration efforts in Oregon, Idaho, and other Pacific Northwest states.

Ican Minerals Ltd. drilled more holes at the Idaho Almaden mine north of Weiser. The company signed an option agreement with Granges Exploration last year to develop the property.

Chevron drilled 5 holes at the Haystack Peak gold project located north of Weiser and four holes at a new project at Indian Head, five miles from Haystack Peak. Both properties are low-grade mercury-gold occurrences similar to the Idaho Almaden mercury mine. The company was evaluating results at year's end.

Silver King Mines did nothing at the Iron Dyke mine or at the mill in Cuprum. The company claims they have to have a price of more than one dollar a pound for copper to make the mine profitable.

Western Gold Exploration, a company associated with Inspiration Gold, drilled 7 holes in a skarn occurrence in Copper Basin. The project will continue next year.

The Lost Packer reportedly shipped 200 tons of high-grade ore in the fall.

Yanke Machine did some development work at the Greyhound mine. The mill was rehabilitated and several test runs made totaling about 800 tons.

Yanke Machine drilled six holes at the Golden Eagle mine near the Neal District in Elmore County. The company acquired the gold property last year.

Freeport Gold continued drilling at Malad Summit this year. The property was acquired last year.

Western Gold Exploration picked up Meridian's claims near Scout Mountain and Mink Creek. Meridian drilled 5 holes near Scout Mountain in 1986 and another 16-18 holes last year. The drilling program reportedly discovered low-grade gold values. Western Gold also acquired Meridian's Middle Mountain claims located south of Oakley and drilled 13-14 holes this year.

Noranda Inc. continued progress at the Tallman mine in the Black Pine district in Cassia County. The cyanide heap-leach facility could process one million tons of ore per year. Mine reserves are 5.3 million tons of .038 gold in the main pit area and in the A and B zones. The mine is located on a 340-acre tract. The operation will employ 200 workers during construction and 90-100

employees when mining starts. Most of the mine will be in Cassia County but the northern leach pad will be Oneida County. In the 1950s, about 15,000 ounces of gold were extracted from 100,000 tons of ore in a vat-leach mill at the old Tallman mine. The company has obtained permits from the state and hopes to start mining this spring. The mine is a sediment-hosted, bulk minable, low-grade deposit similar to Carlin-type mineralization.

Freeport McMoran Gold Company conducted a drilling program (19 holes) on Caribou Mountain near Grays Lake in southeast Idaho. The company built 3,000 feet of road to the drill site. Freeport will continue this program next season. The Caribou district has a history of base and precious metal production.

Oglebay Norton continued a drilling program near its perlite mine near Malad in Oneida County. The company is looking for precious and base metal mineralization on its extensive holdings in the area.

Cominco drilled three holes near Fish Creek Reservoir in Long Canyon. The company found graptolites at the site that are tentatively identified as Ordovician in age, the same as graptolites in the Phi Kappa Formation to the north.

Chevron drilled 9 rotary holes northwest of Craters of the Moon. The company is evaluating results.

Idaho Gold Corporation approved plans to develop a heap-leach plant at the Champagne mine in the Lava Creek district about 15 miles west of Arco. This year, 30,000 tons were tested for heap leach and four 325-ounce gold bars were recovered. The company controls 8,200 acres in this area. Initial investment will be $3 million to extract 15,000 ounces of gold and 240,000 ounces of silver a year from 700,000 tons of ore over the next 4 to 5 years. Reserves are estimated at five to six million tons of .04-.05 ounces of gold per ton. There is potential for developing additional reserves. The property was explored two years ago by Goldfield Mining Company but was too small for the large firm. Idaho Gold is a partnership of Bema Gold Corporation and Glamis Gold Corporation. The company has pledged to clean up a mess left by past mining operations at the site as part of its reclamation plan.

Rothschild Corporation continued with exploration in the Vienna district. The company completed a raise and stockpiled ore at the Webfoot mine. A few test batches of ore were run through the company's mill on Warm Springs Ave. just west of Ketchum.

Freeport drilled six holes at the Grasslands site near Lidy Hot Springs early in the year. Results were disappointing and the project has been dropped.

MVC Resources (Canadian, Vancouver, B.C.) drilled three holes totaling 1,500 feet in the Hunter Creek district near Lime Creek in Elmore County. Work centered on the old Jingo, Hornet, and President mines. Sawtooth Resources (a subsidiary of MVC) picked up property in the Queens River and Black Warrior districts near Atlanta.

Clinton Snook shipped some ore to the East Helena smelter from the Spring Mt. Canyon district in the Lemhi Range. He opened up several adits and has an extensive claim block in this area.

Sandy Sims shipped several loads of ore to East Helena from the Democrat mine located in the Spring Mt. district.