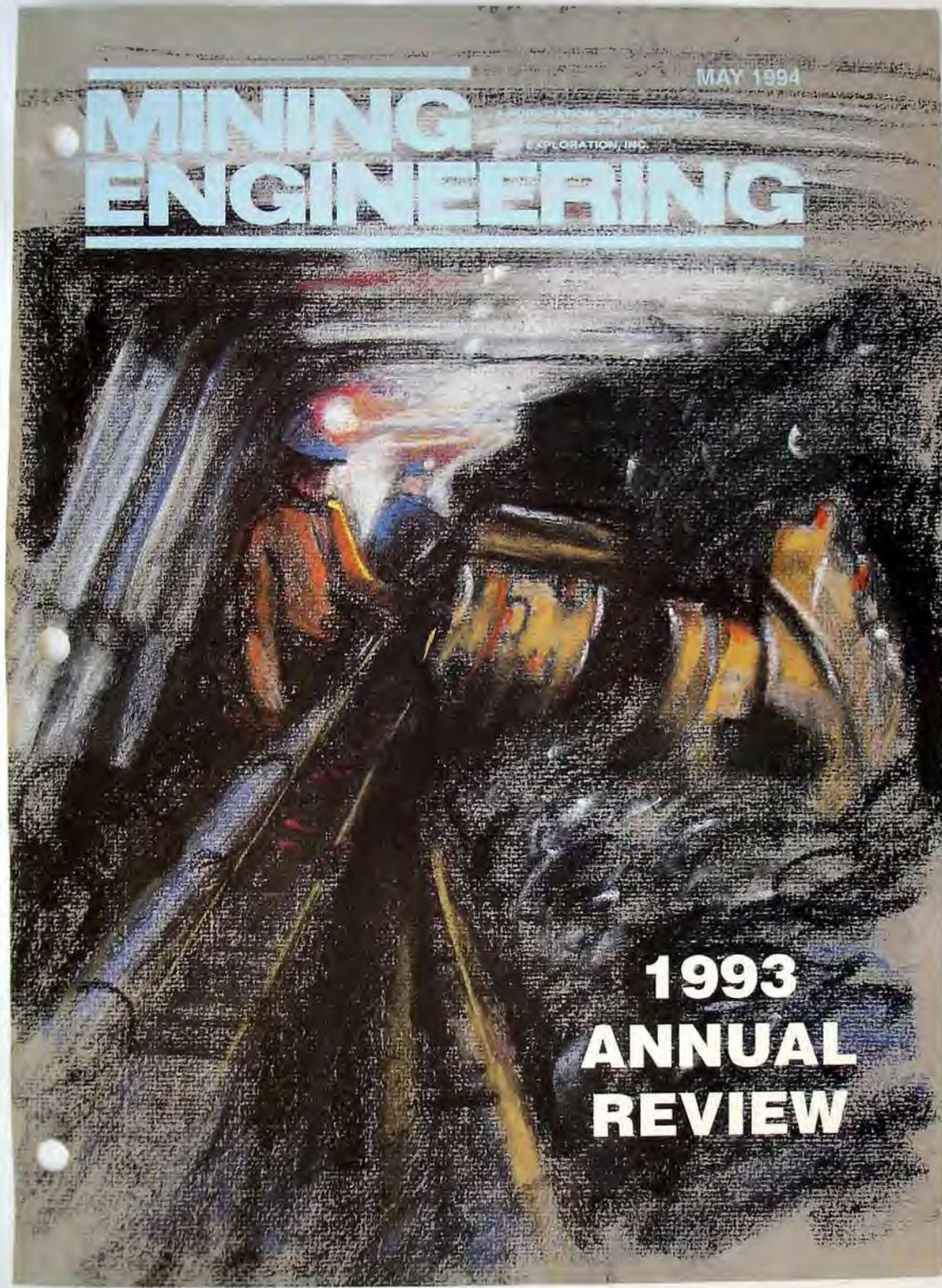


MAY 1994

# MINING ENGINEERING

EXPLORATION, INC.

**1993  
ANNUAL  
REVIEW**



## STATE ACTIVITIES 1993

should be in production by early 1995. Gold production at the Cresson Mine is scheduled to be between 4.6 to 5.6 t/a (150,000 to 180,000 oz/year).

In 1993, Pikes Peak Mining Co. completed more than 59,400 m (195,000 ft) of rotary and core drilling in the Cripple Creek district, mostly on the Cresson deposit. Exploration plans for 1994 include 13,700 m (45,000 ft) of rotary and core drilling on exploration target areas.

### Base metals

The Black Cloud Mine near Leadville is the state's sole significant base metal producer. The mine has a capacity of 816 t/d (900 stpd) and operates from two underground shafts. Staffing at the mine will remain at 135 to 150 employees as long as metal prices remain at current levels.

The ore body is a complex massive sulfide replacement deposit in the Mississippian Leadville Limestone. The ore grade is 7% to 9% lead, 3% to 5% zinc, 70 g/t (2 oz/st) silver and 2.8 g/t (0.08 oz/st) gold.

### Construction materials, industrial minerals

The sand, gravel and aggregate industries enjoyed another good production year. In 1993, about 43 Mt (47 million st) of sand, gravel and aggregate were produced in the state, valued at about \$190 million. That is up about 15% from the 37 Mt (41 million st) of production in 1992. The increase is due to the substantial requirements of the new Denver International Airport, new home and commercial construction, and highway maintenance projects.

Production in 1994 is projected to remain at these same high levels. However, some slowdown is expected for 1995.

The Colorado Yule Marble Co. is mining white marble from the historic Yule Marble Quarry near Marble. In 1993, the company produced 1415 m<sup>3</sup> (50,000 cu ft) of salable marble.

About two-thirds of the production was sent overseas, primarily to Italy and Japan, where it is fabricated into consumer products. In 1994, a new chain saw and other development work will allow a production increase to 2265 m<sup>3</sup> (80,000 cu ft).

Gypsum production came from the Eagle Mine near the town of Gypsum in Eagle County. Production there was

305 kt (337,000 st), up 20% from 254 kt (280,000 st) produced in 1992. About 60% of the wallboard produced at the plant goes to the Colorado construction industry. In 1994, production is projected to be 360 kt (400,000 st).

The White River Nahcolite Minerals Ltd. Liability Co. substantially increased nahcolite, NaHCO<sub>3</sub>, production at its solution mine in Rio Blanco County. The company spent \$4 million on plant improvements to enter the food grade bicarbonate market.

### Exploration

In 1993, American Copper and Nickel Co. conducted a stream sediment sampling reconnaissance program in various parts of the state for Proterozoic-hosted, massive sulfide, base metal deposits.

Challenger Gold continued an exploration program on its Baca Land Grant property along the foothills of the Sangre de Cristo Mountains in Saguache County.

Mapping and sampling as well as 1830 m (6000 ft) of reverse-circulation drill holes were completed on the prospect. The geology and alteration found in the drilling program is similar to that found at the San Luis Gold Mine 95 km (60 miles) to the south.

Hendricks Minerals of Canada Ltd., a new public company, consolidated several properties in the Caribou district, Boulder County. The company completed 167 m (550 ft) of new haulage drift in the Cross Mine and have drilled several long holes from underground stations. In September, Hendricks Minerals conducted an aeromagnetic and scintillometer survey over the district. Several 305 to 915 m (1000 to 3000 ft) core holes are planned for 1994 on targets developed from the geophysical survey.

St. Mary Minerals Inc. conducted a drilling program on a gold placer prospect in the Tarryall district of Park County. The gold is thought to have been derived from a precious metal skarn system. St. Mary also completed mapping and sampling at a sandstone-hosted copper deposit in the Wingate Sandstone at its recently acquired Cashin Mine property in Montrose County. A drilling program is planned for the summer of 1994.

The Powderhorn district in Gunnison County is estimated to contain about 450 Mt (500 million st) of titanium ore.

Most of the titanium resource is in perovskite, a mineral that presents unique processing problems. Teck Resources has been evaluating the Powderhorn titanium resource since 1990. In 1993, Teck continued its economic evaluations.

Colorado Diamond Co., a subsidiary of Redaurn Red Lakes Mines Ltd. of Toronto, announced encouraging results from a bulk sampling program on its Kelsey Lake kimberlite properties in the State Line district of Larimer County. About 1.8 kt (2000 st) of bulk samples taken over the past two years have yielded more than 600 diamonds of gem and industrial quality. The recovered diamonds weigh more than 60 carats and range in weight from 0.1 to 6.2 carats. The 6.2 carat gem quality diamond is the largest diamond yet recovered from the State Line district. Continued bulk sampling is planned for 1994.

Churchill Resources of Vancouver acquired three kimberlite prospects within the State Line district: the George Creek, Sand Creek and Pearl Creek prospects. About 89,000 diamonds weighing 1817 carats were recovered from the George Creek prospect in the mid-1980s. Trenching and bulk sampling are planned for 1994.

Royalstar Resources Ltd. reached an agreement with Dia-Met Minerals to evaluate the diamond potential of the Sloan kimberlites in the State Line district. Current operations include a 45-t (50-st) bulk surface sample and a 2.7-kt (3000-st) underground bulk sample from a newly-driven test adit. ♦

## Idaho

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Idaho Geological Survey

Though environmental issues overshadowed actual mining and exploration developments in Idaho in 1993, there were several projects in the state. Lower commodity prices, especially in the first half of the year, plus legislative uncertainty and foreign opportunities, fueled a decline in the number of exploration projects (Fig. 1). The amount of reconnaissance work decreased as well, except for work in the Idaho copper-cobalt belt near Salmon.

Hecla Mining began building its Grouse Creek Mine in Custer County. The open pit mine has reserves suffi-

cient for an eight-year mine life with production at 3.1 t (100,000 oz) of gold and 49.7 t (1.6 million oz) of silver annually.

Two of Idaho's newest mines, Peas Black Pine Gold and Chemstar Lime, maintained full production during the year.

Two operations were sold. In mid-year, Nerco Minerals was sold to Kennecott, which then spun off the mining interests to Kinross.

Idaho's gold-silver mine in Owyhee County is now owned by Kinross DeLamar Mining. The company had a major drilling program at the mine, which produced about 1 Mt (1.2 million st) of ore.

#### **Coeur d'Alene district and northern Idaho**

Exploration by major companies in northern Idaho was minimal. However, two silver producers, the Sunshine Mine and the Lucky Friday Mine, continued to operate in the Coeur d'Alene district.

Sunshine Mining announced in September that geologists at the Sunshine Mine had discovered a new high-grade vein, the 413 vein, in the West Chance area off the 4200 level.

A nearby discovery, the C-fault area, a new showing called the Silverline, north of the Jewell shaft, were also being evaluated.

Placer Mining continued to employ a few men at the Bunker Hill Mine. Rehabilitation efforts focused on the main Kellogg tunnel level. The only mining was for pyromorphite crystals, which are sold to mineral collectors.

Arbor Resources and Wealth Resources, two Canadian junior companies, were surprised by deep drilling intercepts of banded sulfides at the Galena Giant project near the old Jack Waite Mine north of the Coeur d'Alene district. Their property, drilled in 1992 by Kennecott, extends over the state line into Montana.

#### **Salmon area**

The Salmon area experienced a mini-boom of exploration activity. Much of it was directed at the Proterozoic-age copper-cobalt-gold belt, hosted in quartzites and siltites of the Yellowjacket Formation. Several major companies were reportedly doing reconnaissance exploration along the belt in Lemhi County.

Meridian Minerals, a subsidiary of FMC Gold, continued to keep its fully permitted Beartrack heap leach gold project on hold. The deposit contains 25

Mt (27.6 million st) of ore averaging 1.2 g/t (0.035 oz/st) gold.

American Gold Resources (AGR), a wholly-owned subsidiary of International Gold Resources Corp., drilled 17 reverse-circulation delineation holes on its Arnett Creek property. Baseline water quality studies and archaeological and cultural studies were also performed. The company was cited by the US Forest Service for its excellent reclamation work. In the fall, AGR drilled a 35-hole program at the Humbug or Ditch Creek property near North Fork. Several other companies have explored at Ditch Creek in the last few years.

Phelps Dodge drilled five reverse-circulation holes on the Kenney Creek property southeast of Salmon.

Newmont Exploration drilled five deep core holes at its Musgrove project. The inclined holes reportedly intersected ore-grade gold mineralization at depth. Newmont was planning an aggressive program in 1994.

Formation Capital explored the Idaho copper-cobalt belt. In 1993, the company acquired the 404-hm<sup>2</sup> (1000-acre) Blackpine Mine property 27 km (17 miles) southwest of Salmon in Lemhi County. The stratiform copper-cobalt deposit is along the same horizons that host Noranda's Blackbird Mine.

Formation's surface work, including geophysics, soil geochemistry and trenching, extended mineralization at the Blackpine to more than 5180 m (17,000 ft) of strike. An April through November drilling program completed 4570 m (15,000 ft) of core in 45 holes along 1830 m (6000 ft) of strike length. Higher grade intercepts were common, including BP-7 with 2.1 m (7 ft) of 7.26% copper and 0.2 g/t (0.006 oz/st) gold. Cobalt-rich horizons locally carry 0.25% cobalt.

Encouraged by the results at Blackpine, Formation Capital picked up several other properties in the copper-cobalt belt. These included Badger Basin southeast of Blackpine, the Sweet Repose Adit north of the Blackbird Mine and Salmon Canyon Copper located at the northwest end of the belt. Formation plans to expand its exploration and drilling program in 1994.

#### **West central Idaho**

USMX signed a mid-year agreement to explore the newly consolidated holdings of Thunder Mountain Gold and Dewey Mining in Valley County. In 1992, Kennecott drilled more than 1070 m (3500 ft), mostly at the Dewey Mine. Previous reserves there were 4.7 Mt (5.2

million st), grading 15.4 g/t (0.45 oz/st) gold.

Starting in July, USMX drilled 76 reverse-circulation holes totaling 5030 m (16,500 ft). Results were encouraging and USMX was considering gravity methods to process the ore. The Thunder Mountain mine, closed by Coeur d'Alene Mines in 1990, is located nearby.

Strata Mining and Exploration was exploring the Wallawalla, Alberta, Golden Anchor and other mines in the remote Marshall Mountain mining district in Idaho County. The company was installing a mill and doing underground drifting.

#### **East central Idaho**

Hecla Mining's Grouse Creek Mine in Custer County was given the green light, following a successful stock offering to raise capital. The project is located on Jordan Creek, a tributary of the Yankee Fork, near the old Sunbeam Mine.

Current reserves are 25.8 t (831,000 oz) of gold and 544.3 t (17.5 million oz) of silver located in two deposits, the shallow Sunbeam pit and the deeper Grouse Creek zone. The 5.4 kt/d (6000-stpd) mill will include closed-circuit cyanide and gravity concentration.

Hecla sold a 20% interest in the project for \$6.8 million to Great Lakes Minerals, which will also pay 20% of the construction costs. The mine is scheduled to open in late 1994.

An extensive winter drilling program resulted in the discovery of a deep high-grade zone, the Grouse South, which will be evaluated by an underground decline. Hecla also did some exploration drilling on Estes Mountain across the valley from the Grouse Creek project.

#### **Boise Basin and southeast Idaho**

Cactus West drilled nine holes at its property between Alder Creek Summit and the Gold Hill Mine. Results were disappointing but some additional surface work was done later in the year.

Atlas Precious Metals dropped its claims on the Third Fork of Rock Creek south of Twin Falls. Local opposition to the project was vocal. The company also closed its Boise exploration office and is concentrating domestic exploration efforts at its Gold Bar Mine in Nevada. The Atlas office was responsible for discoveries at Grassy Mountain, OR and the Musgrove property near Salmon, ID.

Pegasus Gold took over the Kilgore project in Clark County from Placer Dome, which explored the epithermal

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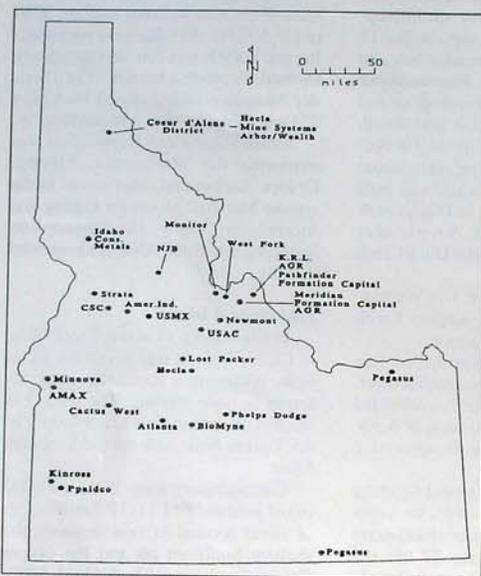


Fig. 1 — Exploration projects in Idaho.

target for several years. Pegasus drilled 20 reverse-circulation holes.

Pegasus Gold also undertook a large exploration effort at the Black Pine gold mine in Cassia County. The mine poured about 1.8 t (60,000 oz) of gold taken from 2.7 Mt (3 million st) of ore. Exploration efforts at Black Pine included regional stream sediment geochemistry and 24,385 m (80,000 ft) of reverse-circulation drilling.

### Southwest Idaho

Amex Gold continued to hold an option on the Idaho Almaden Mine northeast of Weiser. The former mercury producer hosts a sizable gold resource.

Minnova completed an early season drilling program at the Blue Dog property in Washington County. Results of the 13 holes drilled on geophysical targets were disappointing and the property was returned to Gold Canyon Resources.

Kinross DeLamar Mining continued full operation at the DeLamar Mine west of Silver City. About 4575 m (15,000 ft) of development drilling was completed in the Glensilver and South Wahl pits. The company also reviewed reserve figures on the proposed Stone Cabin Mine, located on Florida Mountain, 8 km (5 miles) east of DeLamar.

### Industrial minerals

Idaho's only diamond prospect is located west and north of McCall. Golconda Gold, a Canadian company, drilled about 20 shallow test holes for diamonds in the Bear Basin and Ecks Flats areas, 6.5 km (4 miles) north of McCall on land owned by Boise Cascade. In 1993, Golconda reported the discovery of indicator minerals for kimberlite and lamproitic pipes in bulk samples from trenches. Idaho's only rumored diamond find was three diamonds found in the Rocky Flat placer west of McCall in the 1920s.

More common industrial minerals had a tough year due to a sharp drop in prices for phosphate fertilizer during the first part of 1993. Idaho's phosphate mines continued full production except for NuWest's Conda Partnership Mountain Fuels Mine, which is exhausted. NuWest signed a seven-year agreement with Rhone-Poulenc. It calls for Rhone-Poulenc to supply NuWest's fertilizer plant at Conda by increasing production at Rhone-Poulenc's Rasmussen Ridge Mine from 544 kt to 1.8 Mt/a (600,000 to 2 million stpy).

Demand for construction-related materials continued strong as the state's economy fueled a construction boom. The value of industrial minerals outpaced metals. ♦

## Illinois

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Illinois State Geological Survey

Industrial minerals production and value in Illinois remained relatively high in 1993, but showed a slight decrease from 1992. Exploration continued to be at a low level, with most activity restricted to developing new reserves adjacent to existing operations. Construc-

tion aggregates, including crushed stone (limestone and dolomite), sand and gravel, accounted for 64% of the total nonfuel mineral value of \$732 million.

Construction aggregate companies in Illinois had a good but spotty production year, with an overall gain of 5%. They produced about 100 Mt (110 million st). A few operations along the Mississippi River were flooded. Most were not, however, and they experienced increased demand for material to aid in flood control and to repair flood damage to the area's infrastructure. However, producers that ship material by barge were adversely affected because the Mississippi was closed to barge traffic for up to six weeks.

Aggregate exploration activity was relatively low. Several producers in the greater Chicago area were looking for reserves that could be mined underground rather than moving ever greater distances from the city. Also, aggregate producers in south central Illinois increased their exploration activities because reserves in relatively small deposits of Pennsylvanian-age limestone are being depleted. Sand and gravel reserves are also difficult to replace in part of the state.

Commercial deposits of high-calcium limestone continue to be an exploration target to supply the chemical, glass and agricultural industries. Union Pacific Minerals completed exploration work on its high-calcium limestone prospect in Alexander County.

Exploration drilling continued for fluorite, lead-zinc and rare earths, but at an even lower rate than in previous years. The primary target in Hardin County is fluorite, while lead-zinc and rare earths are secondary.

Lead-zinc mineralization is the primary target in Carroll County, where galena and sphalerite were mined for more than 100 years in the northwest Illinois lead-zinc mining district. Illinois has not had an active metal mine since 1973. Small amounts of lead, zinc, copper and silver were recovered in 1993 as byproducts of fluorite production.

Ozark-Mahoning, the leading US producer of fluorite, continued operating its three mines and one mill in Hardin County. However, one of its mines is nearly depleted and may be closed soon. As in 1992, only two rigs were needed for exploration drilling. Most of that