

MAY 1995

MINING ENGINEERING

A PUBLICATION OF THE SOCIETY
FOR MINING, METALLURGY,
AND EXPLOATION, INC.

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1994
Annual
Review

Mining Overview: Exploration & Development

Tertiary-Age quartz monzonite intrusive and surrounding Precambrian rocks. Also completed during 1994 were a 1525-m (5000-ft) sample, surface soil geochemical sampling program and an aerial polarization survey. Preliminary reserve calculations indicate 1 Mt (1.1 million st) at a grade of 2.7 g/t (0.08 oz/st), including a high-grade zone of 351 kt (387,000 st) at a grade of 7.2 g/t (0.21 oz/st) of gold.

Royal Gold entered into an agreement with Union Pacific Minerals to explore for precious metal deposits on Union Pacific Minerals' land in Colorado and Wyoming. Royal Gold was to have selected 202 km² (50,000 acres) by Aug. 15, 1994. The agreement calls for an initial term of 15 months and a minimum expenditure of \$400,000.

Summo, a partnership between Denver-based St. Mary Minerals, MLP Associates and other investors, completed several exploration drillholes on the Cashin sandstone-hosted copper deposit in Montrose County. A preliminary ore reserve calculation indicates that there are 10 Mt (11 million st) grading 0.6% copper. Metallurgical tests confirm that the ore is amenable to solvent extraction/electrowinning. More drilling is planned for 1995.

The Powderhorn district in Gunnison County is estimated to contain about 453 Mt (500 million st) of titanium ore. Most of this resource is in perovskite, a mineral that presents unique processing problems. Teck Resources has been conducting an evaluation program on the Powderhorn titanium resource since 1990. In 1994, Teck completed the purchase of a 100% interest in the property.

Colorado Diamond Co. announced encouraging results from a 9-kt (10,000-st) bulk sampling program from its Kelsey Lake kimberlite prospect in the State Line district of Larimer County. More than 60% of the diamonds recovered are of gem quality, including a 14.2-carat white diamond, the largest ever discovered in the State Line district and the eighth largest found in North America.

In 1995, Colorado Diamond plans to build a 249-kt/a (275,000-stpy) processing plant for a trial mining program. The diamonds will be sold to test their market value. There are eight kimberlite pipes on the Kelsey Lake prospect. Pipe No. 2 covers 3.8 hm² (9.5 acres) and will supply the ore for the 1995 trial mining program.

Royalstar Resources completed a 3-kt (3300-st) bulk-sampling program at

its Sloan 2 pipe test adit on the Sloan kimberlite prospect in the State Line district. A total of 8842 diamonds totaling 327 carats were recovered from 2.7 kt (3000 st) of processed ore. The grades range from 16 to 23 carats per hundred tons. The largest recovered stone is a 5.5-carat, good-clarity diamond. Plans for 1995 include an additional 215 m (700 ft) of drifting and crosscutting below high-grade zones indicated by surface sampling. Testing in the 1980s yielded more than 21,000 diamonds from the Sloan kimberlites.

Phelps Dodge is looking at mineral opportunities in Colorado. BHP is conducting a base-metals exploration program in undisclosed areas. ♦

Idaho

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While Idaho mining had its ups and downs in 1994, there were several highlights. Hecla Mining opened its Grouse Creek precious metal mine in Custer County. FMC received approval to build its Beartrack gold mine in Lemhi County. And metal prices, particularly molybdenum and silver improved, which boosted earnings and hopes.

The number of exploration projects was about equal to that of 1993. Several advanced projects were under way (Fig. 1).

Hecla Mining reached the 3.1-kt (100-million oz) of silver production mark at the Lucky Friday mine in the Coeur d'Alene district.

A streamlined Thompson Creek molybdenum mine reopened in March under a new owner, Steven Mooney. He bought the Custer County mine from Cyprus Amax in 1993. With half the previous workforce, Thompson Creek was still processing more than 27 kt/d (30,000 stpd)

through the mill and relishing the highest moly prices in years.

Full operations continued at Pegasus Gold's Black Pine mine in Cassia County, the Kinross DeLamar mine in Owyhee County, US Antimony's Yellowjacket mine in Lemhi County and the small Rescue mine in Warren.

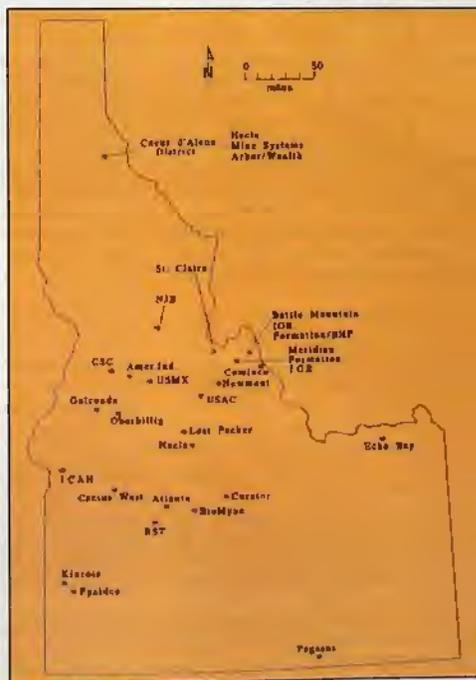
Coeur d'Alene district and northern Idaho

Exploration was minimal in northern Idaho outside of the Silver Valley. Sunshine Mining and Refining offered miners their first pay raise in six years. This was due to improved company finances and silver prices. Exploration at the Sunshine mine evaluated the West Chance vein by a new drift on the 3100 level. This vein was discovered 1993.

The New Bunker Hill Mining Co. mined pyromorphite crystals for sale to collectors. The company also added a small mill that was processing 47 t/d (40 stpd) of lead-silver concentrates by the end of 1994.

Hecla Mining lost and appealed a court case over a canceled lease with now-defunct Star-Phoenix Mining. A hoist accident in August closed the company's Lucky Friday Silver Shaft for a couple of months.

Hecla Mining also announced plans



STATE ACTIVITIES 1994

for a \$4.7-million exploration effort on the Gold Hunter ore body, discovered in 1991. New miners were hired to drive 1830 m (6000 ft) of drift from the 4900 level of the Lucky Friday. A 6705-m (22,000-ft) underground-drilling program is planned.

Outside of the Silver Valley, a joint venture of Arbor Resources and Wealth Resources drilled a 1830-m (3010-ft) deep core hole near the Idaho-Montana line at the Galena Giant property.

Salmon area

The Salmon area was the place for exploration in 1994. Reconnaissance activity continued in the Precambrian stratiform copper-cobalt-gold terrane. Several drilling projects explored Cretaceous and Tertiary copper and gold mineralization along the Trans-Challis fault system in Lemhi County.

FMC Gold (Meridian Gold) started construction at the Beartrack mine near Leesburg. The property was placed on hold in 1992 awaiting favorable gold prices. A reserve of 22.2 t (715,000 oz) of recoverable gold was outlined in 27 Mt (30 million st) of ore in two ore bodies, the North and the South, along the Panther Creek fault.

The open-pit, heap-leach Beartrack operation is expected to be fully open in May 1995. It will have 150 permanent employees, a seven-year mine life and a capital investment of more than \$75 million. By late fall 1994, mining had commenced on the South ore body. The leach pad had been lined and construction had begun on shop and plant buildings. As part of its permit, Beartrack built an award-winning wetlands out of old dredge piles on Napias Creek below the mine.

A few miles away, Formation Capital continued to expand the size of the Blackpine copper-cobalt-gold project. The company is interested in an open-pit mine using solvent extraction/electrowinning to recover copper and cobalt, plus gold, from mineralized horizons in the Proterozoic-age Yellowjacket formation.

Formation Capital acquired the Blackpine property in 1993. It has an underground reserve of 526 kt (580,000 st) in the Swift Zone grading 3.5% copper with cobalt and gold. The company drilled 183 holes, including more than 100 reverse-circulation plus core and metallurgical holes, along the 5-km (3-

miles) of mineralized strike length.

Reserves, grading about 1% copper and 0.004% cobalt, were calculated for the Swift West and Jacobs zones. Core hole 17 in the Regina zone intersected a 2.8-m (9.2-ft) intercept that averaged 1.25% cobalt and 0.03% copper with 14 g/t (0.41 oz/st) of gold. Substantial oxide mineralization exists above the sulfide ores. World prices of cobalt were \$25/lb at the end of 1994. Formation was looking at an extensive program in 1995.

At the Musgrove project, Newmont Exploration kept a team of geologists busy all season with mapping, sampling, geophysics and drilling. About 10 core holes were drilled into Yellowjacket rocks near Tertiary volcanics. The company was tight-lipped on results but did plan to return in 1995. Atlas Precious Metals made the initial Musgrove discovery in 1991.

Cominco American continued its long-term look for stratiform base metal mineralization in the Precambrian rocks. Five core holes were drilled near Freeman Peak in the Beaverheads and two holes were completed at Bohannon Creek. Both had mixed results.

Late in the year, BHP Minerals signed a joint-venture agreement with Formation Capital to explore the Napoleon Ridge-Bobcat property. BHP drilled three core holes, totaling 550 m (1800 ft), to explore this porphyry copper target. It was initially drilled by Cominco in 1980.

American Gold Resources, a subsidiary of International Gold Resources, was drilling an additional 20 reverse-circulation holes at its Humbug (Ditch Creek) property near North Fork. The company had planned to sell the Humbug and the Arnett Creek gold properties but decided to conduct further evaluation at the Humbug.

At the end of 1994, Battle Mountain Gold announced that it had signed a joint venture with Formation Capital on the Morning Glory-King Solomon property located about 5 km (3 miles) from Beartrack. Battle Mountain planned to conduct mapping and sampling in 1995. The property was explored from 1989-1992 by Formation's joint ventures with Hecla, Corona and Teck.

West-central Idaho

USMX drilled 99 core and reverse-

circulation holes at its patented Dewey mine property in the Thunder Mountain district of Valley County. The 853-m (28,000 ft) of drilling was in addition to ground-water monitoring, soil tests and engineering studies at the deposit. In 1993, the Dewey property had a reserve of about 4.2 Mt (4.7 million st) grading 1.7 g/t (0.05 oz/st) of gold. One drill hole returned an 24-m (80-ft) intercept grading 34 g/t (0.983 oz/st) of gold. Exploration drilling also explored three nearby targets. USMX planned to return in 1995.

Harlow Oberbillig drilled six holes into the Golden Gate deposit near Antimony Ridge, south of Yellow Pine. Amselco worked on the property in the late 1980s.

East-central and south-central Idaho

Hecla Mining began mining at the Grouse Creek project in Custer County. The property, 80%-owned by Hecla and 20% by Great Lakes Minerals, hosts a minable reserve of 13.6 Mt (15.1 million st) grading 1.9 g/t (0.055 oz/st) of gold and 38 g/t (1.1 oz/st) of silver.

The Grouse Creek mine includes two pits, the Sunbeam and Grouse Creek, and a high-grade underground reserve below the Grouse Creek pit. Mining started at midyear in the Sunbeam pit and A3 and B3 underground zones. The 5.4-kt/d (6000-stpd) mill uses gravity separation, vat leach, carbon-in-pulp circuits and Merrill-Crowe process to recover the gold. Mill startup was on Oct. 25 and the first gold was poured before the end of the year. Capital investment for the project was \$85 million. The mine was designed for an eight-year life.

Concurrent with construction at Grouse Creek was an ambitious exploration and development program that included 19,800 m (65,000 ft) of drilling in 63 reverse-circulation and core holes. Some spectacular intersections were cut from the underground high-grade zones. Hole 38 returned 4.5 m (15 ft) grading 1654 g/t (48.244 oz/st) of gold and 1114 g/t (39.48 oz/st) of silver in the epithermal ore. Underground mining at Grouse Creek will last about a year at a rate of 362 t/d (400 stpd).

Biomyne continued gold exploration near the headwaters of the West Fork of Warm Springs Creek, where the company has been working since 1988.

Biomine drilled 16 reverse-circulation holes along a temporary road. The company also put down a few holes at Moran Creek, southeast of Ketchum. At midyear, Biomyne changed its name to Aurtex Inc. and leased its Vienna district properties near Galena Summit.

CSC Mining continued development drifting and fine-tuned the mill at the Rescue gold mine near Warren. Two truckloads of concentrates were shipped to a smelter in East Helena, MT.

In late 1993, Atlanta Gold formed a joint venture with Ramrod Gold USA to conduct work on the Atlanta property in Elmore County. The 900 level on the old Talache mine was reopened and 762 m (2500 ft) of new and rehabilitated drift was completed. A 3660-m (12,000-ft) underground drilling program began in November to test the downward extension of the Atlanta Lode. Ramrod also drilled (reverse-circulation) 4270 m (14,000 ft) of surface to expand the open-pit resource along the shear.

Boise Basin and southern Idaho

In the Boise Basin, Cactus West returned to drill four core holes totaling 915 m (3000 ft) in the Alder Creek Summit area.

In southeastern Idaho, Echo Bay Mines leased the Kilgore project from Glacier Dome USA. Echo Bay drilled 17 reverse-circulation and two core holes into the main resource area of this precious-metal, hot-spring deposit in Clark County.

In southwestern Idaho, Ican Minerals did additional work on its Idaho-Almaden mine in Washington County east of Weiser. Amax had done extensive drilling and feasibility studies on the historic mercury producer but dropped the property following its merger with Cyprus Minerals. Ican drilled 44 core and reverse-circulation holes on the main ore body and two new targets, Stinking Water Basin and Cove. Ican also generated new structural and genetic interpretations for the hot-spring gold mineralization. The company plans additional work in 1995.

Fairview Resources and its subsidiary, Minex (both owned by Pacific Power and Industry) continued work to reopen the Sinker tunnel and other sites on War Eagle Mountain in the Owyhee Mountains.

Exploration at the Kinross DeLamar mine in Owyhee County added tons to the mine reserve. The company completed the final environmental impact statement for its Stone Cabin

mine project, located about 8 km (5 miles) east of the DeLamar mine. Reserves are estimated at 5.9 Mt (6.5 million st) grading 2.09 g/t (0.059 oz/st) of gold and 28.62 g/t (0.83 oz/st) of silver. Trucks will transport the ore to the existing DeLamar mill.

Industrial minerals

Golconda Resources continued with a second season of exploration drilling for diamond-bearing rocks in the McCall area. Idaho's phosphate industry had an uneventful year with full operations at the four plants and four large mines in southeastern Idaho. Monsanto received awards for its innovative environmental reclamation programs.

Chemstar Lime changed its name to Chemical Lime. The company produces 544 t/d (600 stpd) of lime at its quarry and plant near Bancroft.

Three Rivers Stone expanded production at its quartzite quarry near Clayton. The expansion was due to increased demand for dimension stone and landscaping rock. Unimin bought Aimcor's Idaho operations.

Other industrial minerals produced in Idaho in 1994 included sand and gravel, industrial and gem garnets, cement, limestone, silica sand, scoria, clay and pumice. ♦

Illinois

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Mineral exploration in Illinois during 1994 was low in general and, in some cases, nonexistent. Construction aggregates production increased significantly, whereas production of most other industrial minerals remained relatively steady. Coal production posted a strong recovery compared with 1993.

Coal

In recent years, Illinois coal production averaged about 54 Mt/a (60 million stpy). However, in 1993 it dropped to 38 Mt (42 million st) due to a coal-miners' strike. The strike and the uncertainty faced by Illinois Basin coal miners due to the Clean Air Act Amendments of 1990 put a damper on coal exploration. Despite that, 1994 production recovered to 46 Mt (51 million st).

Drilling in 1994 was confined to mine development needs. Plugging

affidavits filed with the Illinois Department of Mines and Minerals in 1992, 1993 and 1994 numbered 537, 530 and 349, respectively, for development drilling and 81, 13 and zero for exploration drilling.

Planning and development at one mine accounted for nearly two-thirds of the 1994 drilling activity. Closely spaced testing was conducted to delineate lenses of unstable roof shale at that mine.

One-fifth of the drilling was performed for development purposes at a small strip mine in southern Illinois.

The rest of the development holes drilled during 1994 were linked to the planning needs of several large underground mines.

Industrial minerals

Industrial-mineral production increased significantly during 1994. Total production value increased nearly 5% from 1993. Crushed stone, construction sand and gravel, cement, industrial sand and lime were the state's five leading mineral commodities. In 1994, 92 Mt (101.5 million st) of crushed stone and construction sand and gravel were produced. Due to the downward revisions of 1992 and 1993 aggregate production figures, 1994 may be the first year since 1979 that production exceeded 91 Mt (100 million st).

Industrial minerals exploration remained low throughout 1994. Most of the activity was restricted to developing new reserves adjacent to existing operations.

Also in 1994, aggregate exploration activity was low and spotty. Producers in metropolitan Chicago continue to search for new stone reserves that can be mined underground rather than moving operations farther from their markets. Expansion adjacent to existing operations is another way for companies to increase reserves.

The public's "not in my backyard" attitude and other pressures against mining are making it increasingly difficult to obtain the required permits to open a new extraction site. In one crushed-stone-producing area, it took a company four to five years to obtain permits for a new quarry. In a different producing area, another company was unable to open a quarry because a court upheld the county board's decision not to change the zoning from prime agricultural land to allow stone quarrying.

Large operations are buying smaller ones as another way to increase or replace