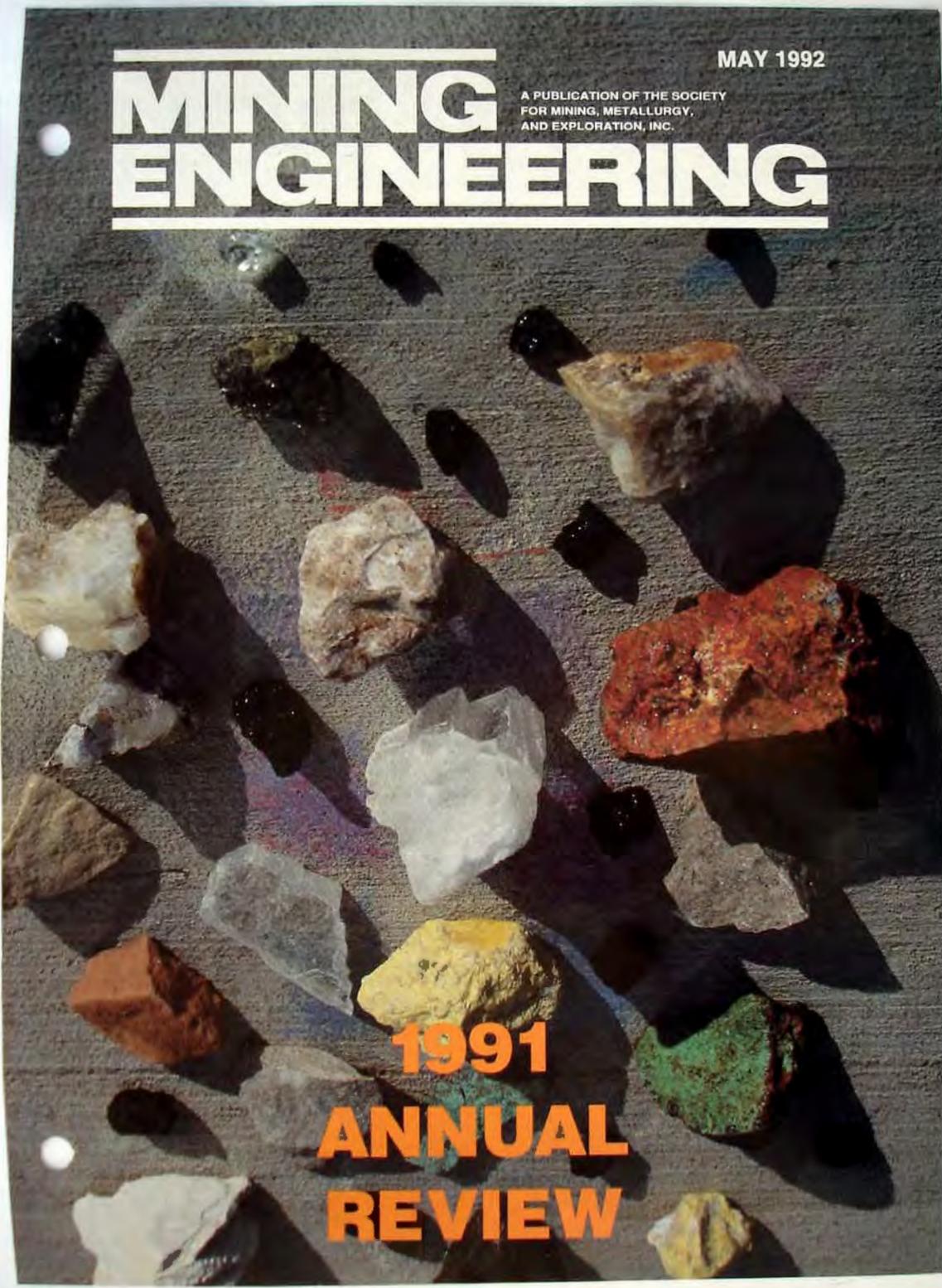


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**1991
ANNUAL
REVIEW**

Climax underground mine in Lake County. The underground mine was closed late in the year. The company anticipates that open-pit mining will begin again at Climax in the fourth quarter of 1992.

The Henderson Mine in Clear Creek County is also owned by Amax. It produced about 15.9 kt (17,500 st) of molybdenum. A production milestone of 91 Mt (100 million st) was reached during the year. The mine started production in July 1976. A complete mill and mine modernization was completed and a new production level was added at Henderson.

Amx expects molybdenum production to decline slightly due to the continuing recession in Europe and the loss of markets in the former Soviet Union.

Asarco and Resurrection Mining Co. continue to produce 770 to 815 t/h (850 to 900 stph) of ore from the 507-m (1665-ft) deep Black Cloud Mine near Leadville. Ore grade is 2.4 g/t (0.069 oz per st) gold, 52.4 g/t (1.53 oz/st) silver, 3.64% lead and 7.87% zinc.

A BHP Utah-Caprock Corp. joint venture completed five drill holes on the Caprock property in North Park, Jackson County. Before the 1991 drilling, there was an indicated reserve of 719 kt (783,000 st) of 7% zinc plus lead, copper and silver credits.

Industrial minerals, construction materials

An application for a state mineral lease was received in the Virginia Dale diamondiferous kimberlite district near the Colorado-Wyoming state line.

Teck Resources will start a new phase of exploration drilling in the spring of 1992 for titanium at the Powderhorn Carbonatite Complex in Gunnison County. Bulk samples will be obtained for metallurgical test purposes.

Clay production in 1991 suffered a slight decline from previous years with a production of 241.6 kt (266,330 st) at a value of \$1.8 million.

The 1991 estimated production of sand, gravel and crushed stone was 31 Mt (34 million st) with a total value of \$124 million. Cement production in 1991 increased modestly from 1990. Demand for construction materials will increase, possibly up to 25%, over the next two years due to new home construction around Denver and the peak construction period at the new Denver International Airport.

In 1991, the world famous Yule Marble Quarry near Marble in Gunnison County, produced more than 1700

m³ (60,000 cu ft) of marble. Production is projected to increase by 50% in 1992.

Energy minerals

Uranium and vanadium production in Colorado was almost nil and solely related to mine development activities. A uranium price of less than \$17.63/kg (\$8/lb) and exports from Canada and Russia have strangled this part of the Colorado industry.

Unocal closed its oil shale production facility near Parachute. The plant, completed in 1983, cost \$650 million.

Coal production in Colorado continued its steady gains from a low in 1987. In 1990, 21 coal mines produced 17.3 Mt (19.1 million st) with an estimated value of \$410 million. Production in Colorado in 1991 through June was 8.5 Mt (9.4 million st) compared to 8.8 Mt (9.7 million st) for the comparable period in 1990. ♦

Idaho

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Idaho Geological Survey

Exploration activity in Idaho during 1991 was down about 50% from 1990 (Fig. 1). The principal target of the 42 advanced projects was gold, though a few projects for base metals were underway. Of the six development projects noted last year, Pegasus Gold Co.'s Black Pine Mine and US Antimony's Yellowjacket deposit were in production by the end of 1991. Meridian Gold's Beartrack project at Leesburg, Idaho Gold Corp.'s Buffalo Gulch Mine near Elk City, Hecla's Grouse Creek project in Custer County and Nerco Minerals' Stone Cabin Mine in Owyhee County were delayed. This was due in part to low gold prices and wetland permitting problems.

A new gold discovery near Shale Mountain in the Kelly-Cayuse Roadless area was announced by a federal-state team that mapped and sampled the breccia-hosted occurrence.

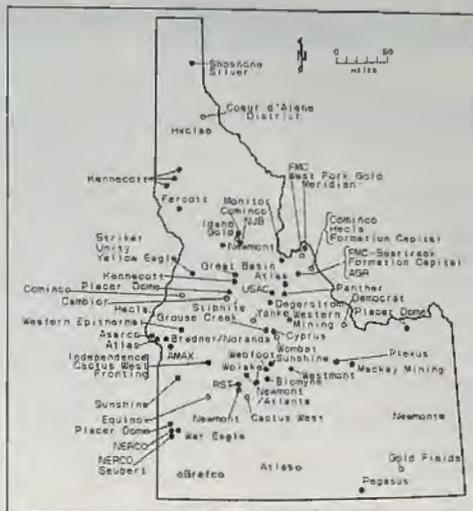


Fig. 1 — Exploration map of Idaho.

Coeur d'Alene district and north Idaho

The Silver Valley suffered in 1991 as the Bunker Hill and Star Mines shut down due to bankruptcies. Low silver prices forced closure of the Coeur Mine and layoffs at the Sunshine Mine. Exploration was minimal, as the three remaining operating mines — Galena, Lucky Friday and Sunshine — cut expenses. The three mines still lost money due to low metal prices.

Elsewhere in north Idaho, a crew at Shoshone Silver blasted out 61 m (200 ft) of exploration drift at the Keep Cool Mine.

In the Ruby Mining district, Kennecott Exploration drilled seven core holes at the King David Mine looking for Coeur d'Alene type veins. Kennecott also explored two copper skarn occurrences in Latah County at the Lad project north of Bovil and the LBC prospect on Little Bear Creek near Troy.

Cominco conducted a 16-hole reverse-circulation drilling project in the Big Creek area near Dixie.

Newmont Gold Co. drilled for the second year at Leggett Creek near Golden. The company put down 25 reverse-circulation and core holes.

NJB Mines, Inc. built a 22-t/d (25-stpd) gravity mill for a small open-pit gold mine near the Red River ranger station.

State and Bureau of Land Management (BLM) permits were received for Idaho Gold's Buffalo Gulch heap leach gold project. It contains 4.3 Mt (4.8

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million st) of 0.8 g/t (0.023 oz/st) gold. The project has been put on hold due to the protracted 404 wetlands permitting process and low metal prices.

Salmon area

A flurry of exploration activity in the Salmon area last year was sparked by the Beartrack discovery two years ago. The action cooled down considerably in 1991. Teck Resources, Corona and Gold Fields dropped or reduced their joint venture interests.

A delayed 404 wetlands permit held up operations at the Beartrack gold mine under development by Meridian Gold, a subsidiary of FMC Gold. The permit was received at year's end, but the delay and weak gold prices have put the project on hold.

Formation Capital regained full control of its Morning Glory, King Solomon, Bobcat/Redrock, Moose Creek and other properties in the Leesburg/Salmon area. Formation performed additional surface mapping, geophysical surveys and soil sampling, particularly on the Bobcat/Redrock land package.

FMC returned the 68.8-km² (17,000-acre) Arnett Creek property to American Gold Resources (AGR). An independent resource estimation calculated a "potentially minable reserve" at Arnett Creek of 10.6 Mt oxide (11.7 million oxide st) of 1 g/t (0.028 oz/st) gold.

FMC drilled 10 reverse circulation holes into a thrust fault in the Blacktail Creek area east of North Fork.

Noranda Exploration had a geochemistry and geophysics program at the Harmony Mine south of Salmon. The company also had a project at McConnell Creek near Shoup.

Cominco leased the Iron Creek copper-cobalt property south of Salmon from Centurion Gold Ltd.

Southwest of Salmon, Panther Gold worked on the Rabbitsfoot property. The company drilled 305 m (1000 ft) in three reverse circulation holes. Results were being evaluated at year's end.

NA Degerstrom drilled six holes at the Ramshorn Ranch on Silver Creek near Meyers Cove. Atlas Corp. started a 12-hole drilling program in December on Musgrove Creek.

West-central Idaho

Placer Dome completed the third year of a project at Red Mountain, north of Yellow Pine in Valley County. Eight

reverse circulation holes totaling about 957 m (3200 ft) were drilled into a gold-bearing silicified zone. Cambior USA, Inc., established a land position on Antimony Ridge south of Yellow Pine.

Kennecott was rumored to have had considerable success with its drilling program at the Moscow Mine near Moore Creek in central Idaho. Kennecott drilled 13 core holes totaling 1865 m (6119 ft) and performed detailed geologic mapping around the mine.

Independence Mining pulled out of its Big Creek joint venture with Nereo Minerals at the McCrae tungsten mine in Valley County. Nereo formed a new partnership with Great Basin Exploration, which recovered 2743 m (9000 ft) of core from 15 holes.

Unity Gold Mines, Inc. cleaned out and retimbered 670 m (2200 ft) of a 1.6-km long (1-mile) crosscut at the old Unity Mine near Warren in Valley County. Also in Warren, Jim Striker started a new tunnel under the Rescue Mine, last operated in 1942.

East-central Idaho

US Antimony opened the new Yellowjacket Mine in Lemhi County after a mill shakedown in May. The mine has known reserves of 1.28 t (41,279 oz) of gold in brecciated and oxidized Precambrian Yellowjacket Formation.

Hecla Mining took over as operator of the Grouse Creek project at Jordan Creek on the Yankee Fork. This occurred when Hecla merged with CoCa Mines last summer. Hecla drilled more than 15240 m (50,000 ft) on the two ore bodies — the volcanic-hosted Sunbeam deposit and the sediment-hosted Grouse Creek ore body. The proposed mine is expected to yield 2.18 t/a (70,000 oz/year) of gold and 46.6 t/a (1.5 million oz/year) of silver. Reserves at the end of 1990 were 3 Mt (3.3 million st) of 2.5 g/t (0.075 oz/st) gold at Sunbeam and 5.8 Mt (6.4 million st) of 1/7 g/t (0.049 oz/st) gold and 70 g/t (2 oz/st) silver at Grouse Creek.

Sunshine Mining Co. finished a 10-hole drilling program on a gold skarn at Washington Basin in the Sawtooth National Recreation Area. Umont Mining Inc. and Western Mining Co. USA (an Australian firm) signed an agreement covering the Bayhorse lead-silver district.

Cyprus Minerals did some gold exploration in a magnetite skarn on claims adjoining its Thompson Creek

molybdenum mine in Custer County. The company drilled 29 shallow, reverse-circulation holes with a Caterpillar all-terrain drill rig to minimize environmental impact.

South-central Idaho

BioMyne, Inc., a Princeton University-based company, continued a gold exploration program near the West Fork of Warm Springs Creek, west of Ketchum. The company drilled 10 helicopter-assisted reverse circulation holes.

Westmont Mining was back for another year at the DSA property at the head of the North Fork of the Big Lost River. The company drilled 317 m (1040 ft) of core in two holes at this stratabound, base metal deposit.

Plexus Resources put down 20 angle, reverse circulation holes totaling 1839 m (6030 ft) on two properties at Navarre Creek west of Mackay.

Newmont dropped its option on the Atlanta gold project after drilling 12 holes and returned the property to Atlanta Gold Corp. Newmont was interested in high-grade gold veins located below known, low-grade deposits on the top of Atlanta Hill. Atlanta Gold raised money with a private placement and started its own \$375,000 drilling program late in the fall to evaluate the full length of the Atlanta shear zone.

Newmont also completed its third year of exploration in the Rocky Bar district on claims leased from GEXA Gold. Eleven reverse circulation holes, totaling some 3657 m (12,000 ft), were drilled, including a deep hole at the Ophir Mine. Although gold mineralization was found, reserves were insufficient and Newmont dropped the property.

Cactus West had success with a soil sampling program on its claims in the eastern portion of the Rocky Bar District.

Boise Basin

In 1991, there was more reclamation activity in the Boise Basin than exploration activity. Boise Basin is the largest gold producing area in Idaho with some 93.3 t (3 million oz) to its credit.

Cominco did exploration and rehabilitation work on the Elk Horn project, north of Idaho City. Cactus West did soil and rock chip sampling on its Century project near Placerville. A 10 hole RC program was scheduled for December.

Equinox Resources explored at the Boise Queen Mine in Ada County, east of Boise. An encouraging soil sampling program over the Boise Queen, West, and Celtic shear zones was followed by five RC holes with discouraging results.

Southeast Idaho

Pegasus Gold Inc. started production in December at the Black Pine heap leach, open-pit gold mine in Cassia County. The 4.25-km² (10,500-acre) property was purchased from Noranda Exploration in 1990 for \$6.4 million. The mine has reserves of 14.3 Mt (15.8 million st) of 1 g/t (0.028 oz/st) gold. Pegasus and Noranda completed more than 7000 m (20,000 ft) of exploration drilling.

Newmont Exploration continued an exploration program started in 1990 on Caribou Mountain in Bonneville County. The company drilled six reverse circulation holes totaling 915 m (3000 ft) from the old House Basin road. The target was disseminated gold in the Ephraim Formation adjacent to a syenite intrusion.

Placer Dome drilled 10 holes totaling 1830 m (6 ft) at the Kilgore prospect north of Ashton in eastern Idaho. Kennecott Exploration drilled the hot spring system a few years ago.

Southwest Idaho

Nerco Mineral's proposed Stone Cabin Mine, located on Florida Mountain in Owyhee County, is about 8 km (5 miles) east of the DeLamar Mine. It contains 11.8 to 12.7 Mt (13 to 14 million st) of gold-silver ore. The ore will be processed in the DeLamar Mill or on a new heap leach pad. The 404 wetlands permitting process delayed development during 1991.

Nerco Exploration was active on its Twin Peaks drilling project located a few miles north of the DeLamar Mine. Placer Dome drilled five-to-seven reverse circulation holes nearby at the Black Sheep prospect in Slaughterhouse Gulch.

War Eagle Mining leased its property on the southeast side of War Eagle Mountain above Silver City to Great Basin Exploration of Henderson, NV. Great Basin drilled two core holes.

Early in 1991, Noranda signed an agreement with Gold Canyon Resources to explore the Blue Dog hot springs gold property north of Weiser. Noranda drilled 1220 m (4000 ft) in 20 reverse circulation holes. Results were disappointing and Noranda dropped the property.

A joint venture between Silver Standard Resources, Carlin Resources and Bradner Resources drilled the Chandler property adjacent to the Blue Dog project. The joint venture drilled 910 m (2985 ft) in 12 holes, all of which intersected anomalous gold in altered rocks.

Amax Exploration leased the Idaho-Almaden property owned by ICAN Minerals. The old mercury mine, east of Weiser, contains reserves of 27 Mt (30 million st) of 1.1 g/t (0.03 oz/st) gold. Amax did surface work and drilled three core holes.

Atlas Corp. drilled four reverse circulation holes on claims leased from Manville at Thirsty Mountain north of Weiser. Western Epithermal and the J.L. Carroll Mineral Exploration Office drilled seven holes near the old Consolidated Mercury prospect near the mouth of Crane Creek northeast of Weiser.

Asarco put down 10 drill holes totaling 762 m (2500 ft) at the Olfer Project near Olds Ferry in Washington County. The target was an epithermal hot spring similar to the Kirby deposit located across the Snake River in Oregon.

Sunshine Mining reopened and sampled old adits and trenches at the Cartwright Creek prospect in Boise County. Sunshine has drilled 17 holes there in the past couple of years. Due to the company's financial difficulties, this interesting gold vein-hot spring system is available for joint venture. ♦

Illinois

W.T. Frankie, J.M. Masters, R.E. Hughes,
Illinois State Geological Survey

Mineral resource activity in Illinois during 1991 included exploration, acquisitions and expansions in the private sector along with accelerated research, mapping and mineral assessment programs by state and federal agencies.

Coal exploration

Coal exploration and development activity remained steady in 1991. Thirteen companies from 18 different counties filed 680 Test Hole Record and Plugging Affidavits with the Illinois Department of Mines and Minerals (IDMM). During 1988, 1989 and 1990, the coal industry filed 637, 889, and 674 Test Hole Records, respectively.

About 103 of the 680 holes drilled were far enough away from active mines to be classified as exploration holes. This was a significant decrease from the 222 exploration holes drilled in 1990.

The 1991 exploration holes were drilled in Clark, Hamilton, Perry, Randolph, White and Vermilion Counties. The remaining 577 holes were classified as developmental and are located near active mines in southern Illinois. The four leading counties were Saline, St. Clair, Perry and Williamson. They accounted for 451 of the drill holes.

Significant developments in the Illinois coal industry in 1991 included the reopening of Freeman United Coal's Crown III Mine in Macoupin County. Also, Zeigler Coal closed its Old Ben No. 21 Mine in Franklin County. Other significant events included the opening of the Conant Mine by Cutler Mining in Perry County, owned by Arch of Illinois, and the No. 2 Mine by Southern Illinois Mining in Williamson County.

Exploration for potential new mining sites was conducted by Consolidation Coal in Clark and Randolph Counties, Kerr McGee Coal in Hamilton County, Amax Coal in Perry County, Mapco/White County Coal in White County and Vermilion Energy in Vermilion County.

Coal production

Illinois mines produced 54 Mt (60 million st) of coal in 1991, a slight decrease from the 55.9 Mt (61.7 million st) produced in 1990. The four leading coal producing counties were Perry 9.1 Mt (10.1 million st), Saline 7.1 Mt (7.9 million st), Randolph 5.7 Mt (6.3 million st) and Franklin 5.6 Mt (6.2 million st).

Other minerals

During 1991, the Illinois State Geological Survey received 69 Test Hole Record and Plugging Affidavits from the IDMM for mineral exploration or structure tests. Sixty-five of these holes were for exploration of fluorspar and other minerals by Ozark-Mahoning in Hardin County. Four of the holes were mineral tests drilled by Noranda Exploration in Carroll County.

Private exploration for nonfuel minerals, and development of known resources continued at about the same level as experienced in 1990. In 1991, the acquisition of new reserves in Illinois, particularly aggregate and industrial sand producers, was basically restricted to properties adjacent to existing operations and continued purchase of small companies by larger ones.

High calcium limestone, suitable for use in desulfurization processes and other chemical application and high-purity, high-brightness carbonates for