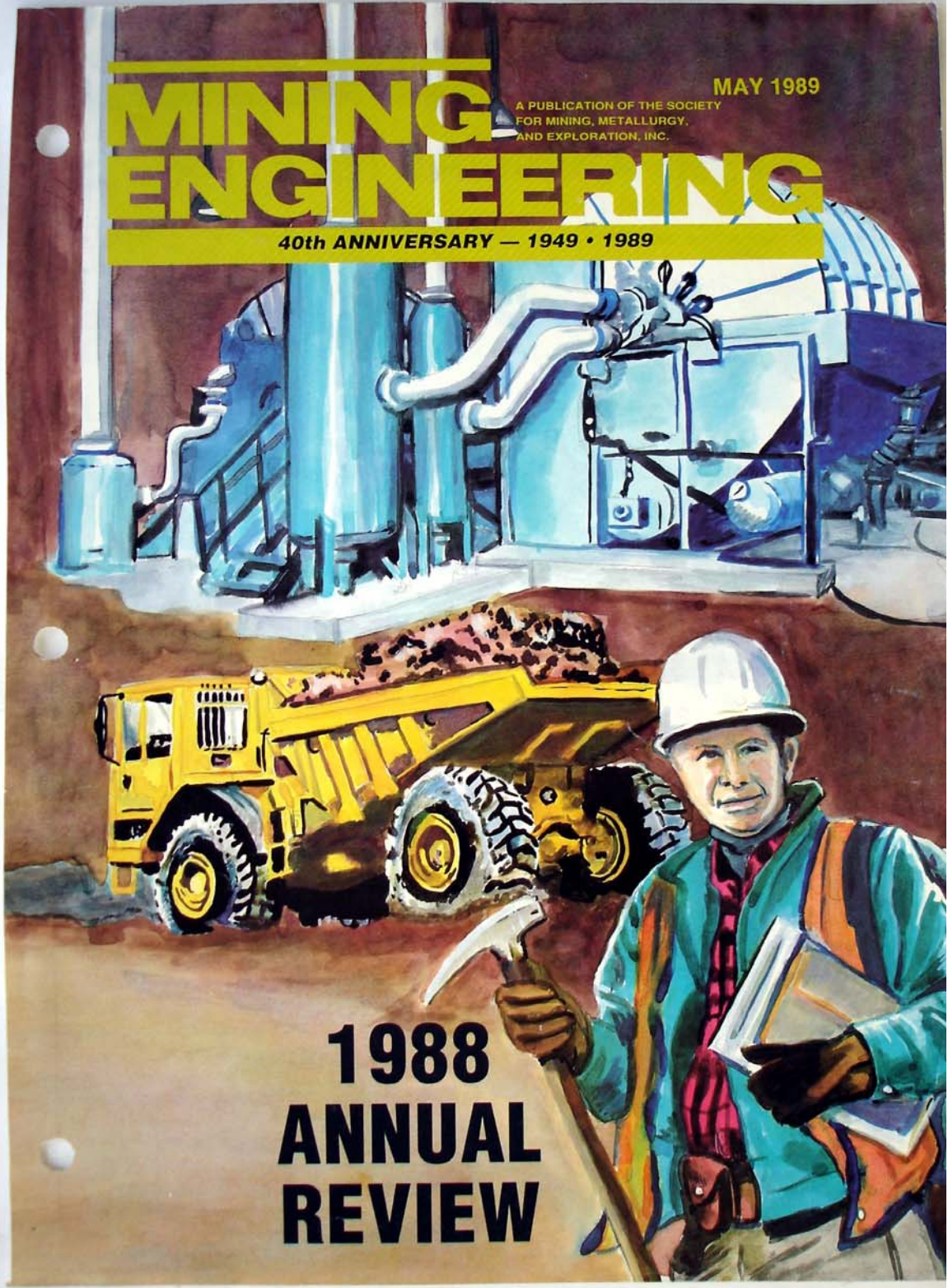


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**1988
ANNUAL
REVIEW**

Exploration in the Colorado Mineral Belt, 1988

Company	Commodity	Property
Hendricks Mining Co	Boulder County Gold, copper, silver	Cross mine
Lord Byron Mining Co Nevada Goldfields Inc. Alvin Mosch Kermit Bohrer Occidental Mineral Development	Clear Creek County Gold, silver, lead Gold, silver, copper Gold, silver Gold, silver Gold, silver, lead, zinc	Coral Decline Empire Project Phoenix mine Wheatland mine Bald Eagle mine
Union Mines Inc.	Conejos County Gold	Platoro Project
Battle Mountain Gold Co.	Costilla County Gold	San Luis Project
Griffin & McCreight	Custer County Gold, silver, lead	Shaun Lode
Dolores Canyon Mines Inc. James Costello	Dolores County Gold, silver Gold, copper	Emma mine Little Silver mine
Elliot Venture Ltd.	Eagle County Zinc, silver, copper, gold, lead	Ground Hog mine
Thurman Warren Keith Marshall	Gilpin County (Central City-Black Hawk) Gold Gold, silver	B&M Claims Cabinsite/ Matchless mine Mascof mine Williams Tunnel Mackey mine Prompt Pay mine
Douglas Mills Kraft Building Contractor Glenn Waltner Waltner/Burdett	Gold, silver Gold, silver Gold, silver Gold, silver	Beaver mine Forest Queen mine Lead Chief mine Old Tom mine
Tincup Mining Co. Forest Queen Mines Inc. Little Darling Mines Inc. John Bert Stitzer	Gunnison County Gold Gold Silver Silver, copper, tungsten	
Russell J. Kuhn	Hinsdale County Gold, silver	Golconda open pit/ underground mine Varden Bell mine
Varden Bell Mining	Silver	
Leadville Mining & Milling	Lake County (Leadville area) Gold, silver	Hopemore Shaft
Myron Cherry Glen Burch	La Plata County Gold, silver Gold, silver	Cunningham Tunnel Hot Potatoes open pit/underground mine Lewis Mountain mine May Day mine Tom Sawyer mine
Randolph Mining Co. Great Guennel Mining Co. MJN Mining Co.	Gold, silver Gold, silver Gold, silver	
Blue Jet Mining Inc.	Moffat County Gold	Blue Jet open pit
Westley Potts Red Arrow Gold Corp.	Montezuma County Gold Gold	Twin Canyon mine Red Arrow mine
Stratman Mining Placer Valley Mining Co. Nirvana Minerals Ltd. Twelve Spokes Ventures	Montrose County Uranium, vanadium Gold, silver Gold Gold	Red Bird mine Mahana open pit Leaping Lizard placer Anna placer
Simms Mining Bachelor Development Co. Fletcher Kirby ZMK Mine Construction Gayno Inc.	Ouray County Gold, silver, lead, zinc Silver, gold Gold, silver Gold, silver Gold, silver, lead, copper	American Nettie mine Bachelor mine Eldorado - Pilot mine Grizzley Bear mine Mountain Top mine
Minco Inc. Gold King Mines Corp	San Juan County Uranium Gold, silver, lead, copper, zinc Gold, silver Gold, silver	Elk Park mine Gold King mine Ridge mine Snowbird mine
Chester Wittwer Terrence Kerwin	San Miguel County Gold, silver	Ophir project
Raphotz Silver Inc.	Summit County Silver, zinc, lead, gold	Silver Wing mine
Moly 1 Corp.	Teller County Gold, silver	Sleepy Jim Tunnel
Young Mining Co.		

companies to spend their exploration and development money in Colorado. Battle Mountain Gold, Gold King Mines, Leadville Mining and Milling, and Nevada Goldfields were the most prominent companies exploring in Colorado in 1988.

The Colorado Geological Survey issued Colorado Metal Mining Activity Map with Directory, Map Series 25. Ninety-seven of the 207 mines and mills in the directory are in standby status. Some await increases in the price of gold and silver; some require development or rehabilitation financing.

Several custom mills await adequate supplies of ore to go onstream or stay in continuous operation. The remaining 110 mines or mills are in various stages of exploration, development, rehabilitation, construction, or production.

Idaho

E.H. Bennett and V.E. Mitchell,
Idaho Geological Survey

Exploration and development for minerals in Idaho continued at a rapid pace in 1988, with 69 projects underway. Canadian juniors continued to explore aggressively in the state and there was an increase in the number of major companies as well. Several new mines are scheduled to be opened in 1989.

Last year's upward trend in exploration activity in the Coeur d'Alene district continued in 1988. Asarco announced it had obtained a 25-year lease on the Silver Summit mine, the site of a seven-year, \$17-million exploration venture by Consolidated Silver (Hecla Mining and Coeur d'Alene Mines). Asarco will spend a minimum of \$100,000 per year and attempt to place the property into production. Consolidated Silver sank the Silver Summit shaft to 1.6 km (5400 ft) and found mineralization but it was not commercial. Asarco now controls all of the ground in the "silver belt" from the Sunshine mine's east-end line to the Galena mine.

Asarco renewed activity on the American Silver drive that was stopped in 1988 due to low silver prices. The Wire Silver vein, the primary target of the program, will be probed from a 1.6-km (5100-ft) long drive from the 1040 m (3400 ft) level of the Coeur mine. The company was 105 m (345 ft) short of the vein when the program was placed on hold.

Callahan Mining continued the \$4

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million, phase two exploration program at its Caladay project. The northwest drift the 1495 m (4900 ft) level was advanced 268 m (880 ft) 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 76-m (250-ft) drill hole near the Boundary vein area below the 1495 m (4900 ft) level. This hole intersected about 41 m (135 ft) of mineralization that averaged 189 g/t (6.7 oz per st) of silver and 10% lead. The last 15 m (50 ft) of the hole averaged 273.7 g/t (9.7 oz per st) silver. Another hole intersected lower grade mineralization. Encouraged by these results, the program was accelerated at year's end by adding a second shift. This should enable the exploration phase to be completed in three months. Funding for the program is split between Calahan, 82.3%, Hecla 12%, and Asarco 5.7%.

Hecla reopened the 518 m (1700 ft) long Snowstorm No. 3 tunnel at the Snowstorm 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, MT 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.

Newmont continued an exploratory drilling program at the Golden Chest mine near Murray. The Golden Chest is owned by Golden Chest, Tap Resources, and Viking Resources. Other claims held by Viking and Cominco are included in the program. Newmont is looking for a low-grade, bulk minable deposit.

Companies exploring in other parts of the state continued to stress precious metals. The following list of projects starts in the northern part of Idaho and moves south. Locations are shown on the accompanying map.

Cominco put down another hole near Blackdome Peak south of the St. Joe River and drilled a hole near No-seum 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.

Development of underground work-

ings in the Gold Dust claims and the Pastime mine continued. These properties are located in the Hoodoo mining district.

Pegasus gold drilled 2.7 km (9000 ft) 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 continued planning a heap leach gold mine in Buffalo Gulch, about 10 km (6 miles) northwest of Elk City.



Location map of Idaho exploration projects.

Preliminary leach testing was conducted last year and the mine should go into production in 1990. The deposit has reserves of 4.5 Mt (5 million st) of 0.84 g/t (0.03 oz per st) gold. About 744 kt (820,000 stpy) of ore will be mined, yielding 560 kg to 622 kg/a (18,000 to 20,000 oz per year) for six years. Idaho Gold also negotiated an option to acquire 100% interest in the Erickson Reef property located immediately north of Buffalo Gulch. The property contains 2.2 Mt (2.5 million st) of 1.7 g/t (0.06 oz per st) gold with a stripping ratio of 2:1.

Thunder Mountain Gold obtained state leases on 10 km² (2500) acres that contain black sand placer deposits. The company owns claims on an additional 1.5 km² (380 acres). The black sands are being evaluated for rare earths that are used to make superconducting materials and microelectronic components.

Canyon Resources entered a \$1.8-million venture with Golden Shamrock Mines to continue exploration and development of the Robinson Dyke mine.

The company plans to place the mine into production next year. The property contains 600 kt (660,000 st) of 1.18 g (0.042 oz per st) gold in proven and probable reserves. Production is planned at 311 kg/a (10,000 oz per year).

Silver Crystal drove 35 m (117 ft) of new drift in the Umatilla mine. The mine is being explored for precious metals including gold and platinum group elements. The company has built a pilot wet-chemical extraction plant for platinum group metals at the mine site.

Blackbird Metals plans to buy the Blackbird mine and build a cobalt refinery in the Salmon area. The company will spend \$85 million including \$47 million for the new refinery and \$31 million to buy and reopen the mine. Production is projected at 2.2 kt/a (2500 stpy) of cobalt.

Meridian Gold, Canyon Resources, and Minex announced a new gold discovery, the Beartrack deposit north of Leesburg. Beartrack is the state's largest gold discovery and production could reach 90.2 t (2.9 million oz) mined from placer and lode deposits in the Boise Basin. At year-end, the joint venture announced 62.2 t (2 million oz) as a geologic resource. Reserves are estimated at 36 Mt (40 million st) averaging 1.55 g/t (0.055 oz per st) gold. More than 15 km (50,000 ft) were drilled last year in more than 100 holes. Mineralization extends at 152 m (500 ft) deep, the companies reported. The deposit is quartz stockwork with mineralization hosted by a roof pendant (Yellowjacket Formation) and Precambrian Granitoid.

BP Minerals and American Gold Resources have drilled 14, 91-m to 122-m (300- to 400-ft) deep holes near the Haidee mine over the past two years. The companies continued to acquire land and stake claims adjacent to the Beartrack project. The drilling and regional exploration will continue this year.

Corona Gold drilled claims in the Leesburg area north and east of the Beartrack deposit. The property 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. This area was explored in 1987 by McConnell-Peel Resources.

American Diversified Minerals joint ventured with Leesburg Land and Mining to expand operations at the Leesburg claims. GEXA explored claims near Blackbird Mountain. A drilling program is set for 1989.

FMC did a little work on its Ditch Creek property north of Salmon and was looking for a farm-out agreement that fell through at the end of 1988. The company will hold the claims and continue development next year. FMC also drilled 15 holes on Sage Creek near the Ulysses mine. Noranda leased the Ulysses mine property from Echo Bay, which inherited it from Tenneco Minerals. Echo Bay drilled it in 1988 and Noranda plans more drilling this year.

West Fork Gold Mining drilled on the West Fork of Indian Creek. Sovereign Exploration drilled in Tower Creek (Gold Star Gulch). 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.

Sunbeam Mining continued to drill near its Sunbeam mine as well as on Red Mountain and near Sheep Mountain. Mineralization was found in 14 of 20 holes on Grouse Creek. The company had planned to begin operations at the Sunbeam mine in 1989. CoCa Mines acquired Geodome Resources, Sunbeam's parent. CoCa did not reveal its plans for the Sunbeam mine.

Shama Minerals, Chemical, and Oil increased its claim block to nearly 5000 claims in the Challis area. The company conducted a diamond drilling program in the Baker Creek area.

Gold Post Resources USA was evaluating results from a 14-hole, 1.5 km (5000 ft) drilling program in the Gold Hill district. The mine is on the largest gold lode in the Boise Basin district. The company is considering a joint venture partner on the project.

Cactus West conducted a preliminary sampling program at the Missouri gold property. Three vein systems are being examined and a drill program is planned for next year.

Frontino 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 continued evaluating the Atlanta Hill property in central Idaho. The company spent \$3 million last year. In 1988, 14 km (46,000 ft) of reverse circulation drilling was done in the East Pit area, increasing reserves to 8.3 Mt (9.2 million st) of 2 g/t (0.072 oz per st) gold (40% leachable) for a reserve of 20.5 t (661,000 oz) of gold.

The West Pit area contains 1.2 Mt (1.3 million st) of 1.4 g/t (0.051 oz per st) gold and 2.45 g/t (0.087 oz per st) silver (about 75% sulfide ore). Open pit cyanide heap leach and conventional milling operations are being considered.

GEXA Gold continued drilling in Hardscrabble Gulch in the Rocky Bar district, drilling 25 new holes. Last year the company drilled 26 holes, totaling 2.3 km (7450 ft). About 249 kt (275,000 st) of 1 g/t (0.037 oz per st) gold have been outlined in Hardscrabble Gulch and 284 kt (313,000 st) of 1.3 g/t (0.046 oz per st) gold in Wide West Gulch, for a total reserve of about 15.5 t (500,000 oz) of gold.

Nerco Minerals continued a feasibility study at Florida Mountain. If mining begins, ore would be hauled to the company's cyanide plant and heap leach facility at the Delamar mine west of Florida Mountain.

War Eagle Mining has more than 145 claims near Silver City centered on War Eagle Mountain. The company leased a 259 hm² (640-acre) tract from Nerco. War Eagle drilled 39 holes. Several in section 16 near War Eagle Mountain showed encouraging intercepts. These included 23 m (75 ft) of 3.2 g/t (0.114 oz per st) gold in one hole and 84 m (275 ft) of 4.5 g/t (0.161 oz per st) gold and 183 g/t (6.5 oz per st) silver in an offset hole. Another hole, 914 m (3000 ft) north of the other, contained 17.3 g/t (0.616 oz per st) of gold and 12.7 g/t (0.45 oz per st) of silver for 21 to 23 m (70 to 75 ft).

Golconda Resources said it plans to drill on the Morning Glory property about 3 km (2 miles) from War Eagle Mining's claims. The company plans 10 holes that will go to 91 m (300 ft) to test a mineralized area called the Main Zone. Selected samples for the property contain 7 to 53.6 g/t (0.25 to 1.9 oz per st) gold.

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

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

Chevron drilled five holes at the Haystack Peak gold project north of Weiser and four holes at a new project at Indian Head, 8 km (5 miles) from Haystack Peak. Both properties are low-grade, mercury-gold occurrences similar to the

Idaho Almaden mercury mine. Western Gold Exploration drilled seven holes in a skarn occurrence in Copper Basin. The project will continue next year. Yanke Machine drilled six holes at the Golden Eagle mine in Elmore County. The company acquired the property in 1987.

Western Gold Exploration picked up Meridian Gold's claims near Scout Mountain and Mink Creek. Meridian drilled five holes in 1986 and another 16 to 18 in 1988. 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 to 14 holes.

Freeport McMoRan Gold drilled 19 holes on Caribou Mountain near Grays Lake in southeastern Idaho. 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 in Oneida County. The company is looking for precious and base metals 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. These are the same as graptolites in the Phi Kappa Formation to the north.

Chevron drilled nine holes northwest of Craters of the Moon and is evaluating the results.

Rothchild's Corp. continued 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 near Ketchum.

Freeport McMoRan Gold drilled six holes at the Grasslands site near Lidy Hot Springs. Results were disappointing and the project was dropped.

MVC Resources drilled three holes, totaling 457 m (1500 ft), in the Hunter Creek district in Elmore County. Work centered on the old Jingo, Hornet, and President mines. Sawtooth Resources (an MVC subsidiary) picked up property in the Queens River and Black Warrior districts near Atlanta.

A number of companies explored for industrial minerals in 1988. Greco evaluated its diatomite claims near Deep Creek in Owyhee County. A drilling program is scheduled soon for the high-grade deposit. American Diatomite continued evaluating the diatomite deposit located north of Gooding.

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Development work is planned. Teague Mineral Products evaluated zeolite deposits near Aimcor's pits west of Oreana. These deposits are very pure and are believed to be the highest grade deposits of clinoptilolite in the US.

Illinois

J.W. Baxter, H.H. Damberger, and R.E. Hughes, *Illinois Geological Survey*

Coal exploration continued at a very low level in 1988. Only 249 plugging affidavits for coal tests were filed with the Department of Mines and Minerals and Illinois State Geological Survey. About 54 of them probably were for exploration wells. This compares to 689 and 100, respectively, in 1987.

East central Illinois is experiencing somewhat of a revival in coal interest. Peabody Coal Co. is constructing its new Universal mine in Edgar County. The main target apparently are relatively low sulfur Danville coal reserves in the area. This type of coal is already mined by Peabody in neighboring Indiana.

Forty-two development wells were drilled in 1988. Consolidation Coal Co. drilled 17 exploration wells in Clark County, immediately south of Edgar County, probably in search of additional relatively low sulfur coal reserves in the Danville coal. Amco-Illinois started shipping coal from its newly constructed Embarras No. 1 underground mine. This mine taps a reserve of relatively low sulfur Herrin coal.

Assessment of the mineral potential of the Paducah 1° x 2° map sheet (Paducah CUSMAP; IL, MO, KY, IN; 1:250,000), begun late in 1986, continued during the year. As part of this effort, the Illinois State Geological Survey and the US Geological Survey cooperated in sampling and obtaining semiquantitative spectrographic analysis of insoluble residues from major carbonate units and from basal Paleozoic (Mt. Simon) sandstone within the Illinois Basin. Results of these samples will be used to help trace the movement of deep basinal, metal-bearing brines and to assess the possibilities for deep, Mississippi Valley type (MVT), metallic mineralization.

Several factors have sparked renewed activity in the Illinois-Kentucky

fluorspar district. Some of these factors include growing concerns about levels of toxic trace elements, particularly arsenic, in some imported fluorspar products; encouraging reports on the development of new, environmentally safe fluoro-fluorocarbon compounds to replace chloro-fluorocarbons in aerosol applications; and improved zinc prices.

Ozark-Mahoning acquired certain holdings of Inverness Mining Co., including the former Minerva No. 1 mine in the inactive Cave-in-Rock district located south of the Rock Creek Graben in Hardin County. Pumping to dewater the mine and extensive interconnecting underground workings continues. Mining is scheduled to resume sometime in 1989.

Meanwhile, Ozark Mahoning continues to operate two underground mines in the Harris Creek district, north of the Rock Creek Graben. Three drilling rigs were in use, mainly for surface drilling in support of mine development.

Illinois Minerals Co. continued an annual summer exploration program using air drilling techniques designed to assess tripoli holdings and direct open-pit mining operations, mostly in Alexander County.

A few clay companies drilled and evaluated kaolinitic clays associated with the McNairy Sandstone (Cretaceous) in extreme southern Illinois. There was related general interest in kaolinitic clays to serve a need within the greater Chicago market area. A few companies looked for common clays that would yield high quality, red-firing bricks at specific market locations.

At least one aggregate producer is actively involved in geological and geophysical exploration for potential sources of sand and gravel or quarriable limestone. Interest continued in sources of high calcium limestone, particularly for use in SO₂ scrubbers used with coal-fired boilers.

Kentucky

G.R. Dever, Jr.,
Kentucky Geological Survey

Construction stone and industrial grade limestone and dolomite were exploration targets in 1988. No exploratory drilling for metals or mineral deposits was reported in Kentucky's three mineral districts.

Crushed stone production reached record levels in of 39.7 Mt (43.8 million st) 1988 due to increased construction activity. It was valued at nearly \$175 million. The use of carbonate rocks and lime for SO₂ emission control is providing an increasingly important market for these commodities. Both flue gas desulfurization and fluidized bed combustion systems are operating in the state.

In 1988, two of the three coal-fired power plants that use limestone in wet scrubbing systems awarded contracts for the purchase of stone. The Kentucky Stone Co. received a five-year contract to supply limestone for two scrubbers at the Tennessee Valley Authority (TVA) Paradise plant in Muhlenberg County.

Kosmos Cement Co. was awarded a 10-year contract from the Louisville Gas & Electric Co. (LG&E). Its Kosmosdale cement plant in Jefferson County produces ground limestone slurry that is pumped by pipeline to holding tanks for four scrubbers at the nearby LG&E Mill Creek station. The three power plants include the Big Rivers Electric Corp. Wilson plant in Ohio County. They require a total of about 725 kt/a (800,000 stpy) of limestone.

Thiosorbic lime, produced in Mason County by Dravo Lime Co., and byproduct carbide lime currently are used in the wet scrubbing systems at four coal-fired power plants. Total lime consumption is estimated to be 362 kt/a (400,000 stpy).

In October 1988, TVA started up a 160-MW (215,000 hp) (electric) atmospheric fluidized bed combustion (AFBC) demonstration plant in McCracken County. The plant will demonstrate the performance of a utility scale AFBC unit. It was built beside the No. 10 unit of TVA's Shawnee power plant and uses its turbine and generator. The Kentucky Stone Co. was awarded a one-year contract, with a two-year renewal option, to supply 113.4 kt (125,000 st) of limestone for use as the SO₂ sorbent.

Minnesota

R.W. Ruhanen, Jr., *Minnesota Department of Natural Resources*

Mineral exploration, as reflected by drilling activity, increased in Minnesota during 1988. Gold and platinum group elements remain the most sought after