Developments in Minerals, Mining, and Energy in Idaho for 1981

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Developments in Minerals, Mining, and Energy in Idaho for 1981[1]

by

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INTRODUCTION

This report on Idaho's mineral industry and energy resources for 1981 is a cooperative effort among several state and federal agencies and an industrial organization. The Idaho Bureau of Mines and Geology acknowledges the contributions of the Idaho Bureau of Minerals, the Idaho Oil and Gas Conservation Commission, the U. S. Bureau of Mines, and the Idaho Mining Association. Previous reports from 1977 through 1980 on annual developments in mining and minerals in Idaho are available from the Idaho Bureau of Mines and Geology.

MINERAL ECONOMICS

The 1981 report on mineral economics in Idaho is one of sharp contrasts with the year before. Record high prices for precious and strategic metals and assorted major mining investments highlighted our 1980 report. In 1981 the value of all metals produced in the state tumbled drastically, and most companies reported lower profits or losses, reflecting the deepening economic recession throughout the land.

Nationally, the mining industry during 1981 was affected by a large number of takeovers and mergers of natural resource-based companies. Heading the list of these transactions (Table 1) was the largest corporate merger in U. S. history, the $7.5 billion takeover of Conoco Oil by the Dupont Company. Most transactions involved diversification by petroleum companies into other mining industries and investments by foreign companies in U. S. natural resource-based firms. The takeovers that directly affect Idaho companies in the Coeur d'Alene district include the merger between the Hecla Mining Company and Day Mines, Inc., and the merger of four companies: Sunshine, Silver Dollar, Silver Syndicate, and Sunshine Consolidated. In Owyhee County, the mining operations of Earth Resources, Inc., including the Delamar mine, were purchased by Mapco.

Silver, so important to Idaho's economy, started 1981 around $16 an ounce and finished at under $8, averaging $10.50 an ounce for the year. Nevertheless, this was the third best year ever, following the record prices in 1979 and 1980. The price decline was attributed to the worsening recession and the high interest rates.

The silver market was not strengthened by an announcement from the General Services Administration that 1.25 million ounces of silver would be auctioned weekly from the nation's strategic stockpile of 139.5 million ounces. The auctions started in October and were to continue until the stockpile was exhausted. From the beginning the sales were not successful, and in most weeks GSA refused all bids. Out of 46.5 million ounces offered only about 2 million were sold. Three foreign silver producers, Peru, Mexico, and Canada, asked the United States not to sell the stockpile because of the adverse affects such sales would have on an already falling market. A ban on future sales was achieved by the passage of the Defense Appropriations Bill that included an amendment halting all silver sales. The amendment was successful due to the efforts of Senators James McClure and Steven Symms of Idaho and Senator Henry Jackson of Washington.

The U. S. Bureau of Mines' estimated nonfuels mineral production for Idaho is shown in Table 2. The sharp decline in the price of silver is evident by comparing the state's production of 13,695,000 ounces valued at $282,663,000 in 1980 with the estimated 1981 production of 16,265,000 ounces valued at $178,915,000. Production increased by over 2.5 million ounces but value fell by $103,748,000. This drastic decrease in silver accounted for most of the decline in the total value of all Idaho's mineral production from $522 million in 1980 to an estimated $420 million in 1981 (Figure 1).

Most other metals important to Idaho's economy registered lower prices during the year. Gold slipped from $585 an ounce in January to under $400 in December. Lead increased in price at midyear to over 40 cents a pound but dropped to the 30 cent range by year's end. Zinc reached a high of 48 cents a pound in the fall but fell to 42 cents in December. Although of minor economic importance to Idaho's mining industry, copper slid from 88 cents a pound to near 80 cents. Major copper producers decreased or curtailed mining operations as the price remained below their production costs.

Cobalt provides another example of the rapid fall in prices of strategic and

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[1]This report is based in part on a paper presented in December 1981, at the Regional Developments Session, Northwest Mining Association's Annual Convention, Spokane, Washington.

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critical metals during the year. The producer price of $25 a pound in January was near $17 at year's end, with spot prices under $10 per pound. The United States purchased 5.2 million pounds for the strategic stockpile from Zaire, the world's largest cobalt producer, at a price of $15 a pound. The price decrease changed Noranda's plan for reopening the Blackbird mine in Idaho. Noranda began looking for a joint-venture partner to share costs. Molybdenum also had a major price reduction from over $9 a pound in 1980 to under $8 in 1981, with spot prices around $4.50 a pound. The spot price had been nearly $20 a pound in 1980. In both the United States and Canada, production was decreased and several major new operations were curtailed.

By year's end there were over 71,000 mining claims in Idaho registered with the U. S. Bureau of Land Management. Over 5,000 new claims were filed during 1981. The Department of Water Resources issued over 700 stream alteration permits for recreational dredge and placer operations, an indication of the popularity of this pasttime as Idaho's weekend prospectors search for the yellow metal.

Table 1. Selected Takeovers, Mergers, and Major Investments in Natural Resource Companies during 1981.

BIDDER	PRICE	ACQUIRED COMPANY
DuPont Company[1]	Takeover $7.5 billion	Conoco Oil
Fluor Company	Takeover $2.7 billion	St. Joe Minerals
Societe Nationale Elf Aquitaine (French) split with Canada Development Corporation (Canadian)	Takeover $2.7 billion	Texasgulf, Inc.
Consolidated Gold Fields (British) (25-49% of stock)	Major investment (pending)	Newmont Mining
Brascan (Canadian) (70% interest in Brascade that now has a 42% interest in Noranda)	Takeover $921 million (est.)	Noranda Mines, Ltd. (42% voting interest)
Standard Oil Company of Ohio[2]	Takeover $1.8 billion	Kennecott Company
U. S. Steel	Takeover $6.4 billion (pending)	Marathon Oil
Hanson Trust (British) (5% of stock)[3] HCI Holdings, Ltd., and Belzberg Interests (Canadian) (6% of stock)	Major investment	Gulf Resources and Chemical Corporation
Occidental Petroleum	Takeover $760 million (pending)	Zapata
Tenneco	Takeover	Huston Int. Minerals Corp. (formerly Huston Oil and Gas Company)
Kuwait Petroleum Corporation (Kuwait)	Takeover $2.5 billion	Santa Fe International Corporation
Dome Petroleum[4]	Purchase $1.7 billion	Hudson's Bay Oil and Gas Company
Asarco[5]	Purchase $342 million	21% of its own shares held by Bendix Corporation
Private Investors[6]	Purchase $50-60 million (est.)	New Jersey Zinc Company
Mapco Minerals Corporation	Takeover $345 million	Earth Resources (Delamar mine)
Hecla Mining Company[7]	Takeover $100 million	Day Mines, Inc.
Sunshine Mining Company[8]	Takeover $55 million	Silver Dollar, Silver Syndicate, Sunshine Consolidated

[1]Largest corporate takeover in U. S. history. DuPont was the successful bidder, but Seagram received 20% of DuPont as a consolation prize.

[2]British Petroleum owns 53% of Sohio and 6.8% of Amax. BP agreed to sell the Amax stock. Kennecott is the seventh of eleven U. S. copper companies to be taken over since 1963, six of those by oil companies.

[3]The Placid Oil Company (Hunt family) controls 11% of Gulf Resources and Chemical Corporation.

[4]Dome purchased 53% of Hudson's Bay Oil from Conoco. Dome is seeking to purchase the rest of Hudson's Bay Oil. Hudson's Bay Oil holds 98% of Cyprus Anvil, purchased from Amoco Minerals Company for $332 million. Amoco acquired Cyprus Mines (U. S. parent of Cyprus Anvil) in 1980.

[5]Asarco purchased 21% of its own shares held by Bendix Corporation. Asarco's Australian affiliate, M.I.M. Holdings, Ltd., owns 16% of Asarco and Asarco owns 44% of M.I.M.

[6]Purchased from Gulf and Western Industries, Inc. The executive vice president purchased the company and changed the name to The New Jersey Company.

[7]Rosario Resources (Amax) owned 21.06% of Hecla's stock and will own 12.4% of the combined company's stock. Sunshine Mining Company owned 5.30% of Hecla's stock and will own 3.24% of the combined company's stock.

[8]Mediterranean Investors Group S.A. owned 22.4% of Sunshine stock and will own 16.7% of the combined company's stock.

MINERAL OPERATIONS

METALLIC MINERALS

Coeur d'Alene Mining District

In 1980 most mining companies in the Coeur d'Alene mining district had a banner year. That year the district produced 12,605,000 ounces of silver, 46,979 tons of lead, 34,963 tons of zinc, 2,930 ounces of gold, and 3,186 tons of copper valued at $334,310,000. In 1980 over $76 million was committed in new capital ventures in the district. Since 1884, the Coeur d'Alene district has produced metals valued at $3,845,732,000. The production figures for many of the district's companies for 1980, as filed with the Shoshone County assessor's office, are shown in Table 3. Because the county assessor's figures for 1981 will not be available until late in 1982, these figures will be included in next year's report.

Drastically lower silver prices during 1981 slowed development of the district's mines and in part sounded the death knell for the Bunker Hill Company which closed at year's end. The Coeur d'Alene mining district followed the national trend in corporate takeovers. Sunshine Mining Company consolidated its position in the "Silver Belt" by taking over four smaller companies. Hecla Mining Company merged with Day Mines, Inc., to solidify its position and make Hecla the largest producer of domestic silver.

The Bunker Hill Company (a wholly-owned subsidiary of Gulf Resources & Chemical Corporation). The year started well for the Bunker Hill Company on the heels of a record 10.2 million ounces of refined silver produced in 1980. Refined lead production in 1980 reached 129,000 tons, the highest since 1973. The company produced roughly 25 percent of the nation's refined silver and 21 percent of its refined zinc and lead. The Bunker Hill mine continued to produce the most ore in the district. The annual report for 1980 noted many industrial achievements, including a new constant-volume air control system at the lead blast furnace in the smelter. Bunker Hill-owned mines, including the Bunker Hill, the Crescent, and 70 percent of the Star, produced a total of 2.2 million ounces of silver in 1980 and 2.3 million ounces in 1979, and approximately 26,000 tons of zinc and 23,000 tons of lead in concentrates in both years. Figures filed with the Shoshone County assessor's office (Table 3) show that the mines made a profit of over $16 million in 1980.

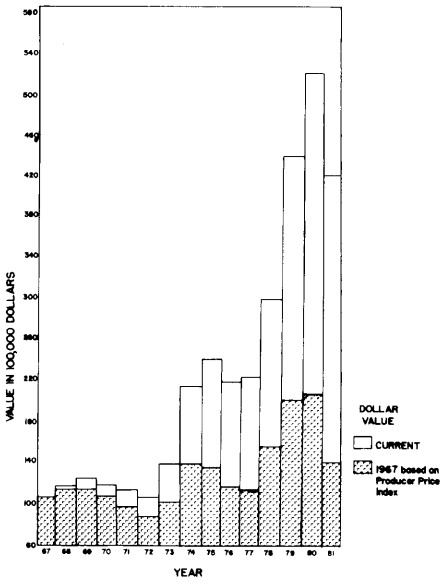

Figure 1. Value of mineral production in Idaho, 1967-1981.

Early in 1981 a temporary shortage of zinc concentrates forced the layoff of 66 zinc plant employees in February and 80 more workers in March. Sixty employees at the lead smelter and 266 workers at the zinc plant were laid off for a month in May because of temporary changes in operating requirements.

Table 2. Nonfuel Mineral Production in Idaho[1].

Mineral	1980 Quantity	1980 Value (thousands)	1981[P] Quantity	1981[P] Value (thousands)
Antimony ore and concentrate, antimony content .... short tons....	83	W	450	W
Clays ..... thousand short tons....	27	$301	21	$265
Copper (recoverable content of ores, etc.)..... metric tons....	3,103	7,006	4,000	6,700
Gem stones.....	NA	60	NA	60
Gold (recoverable content of ores, etc.) ..... troy ounces....	W	W	31,500	14,700
Lead (recoverable content of ores, etc.) ..... metric tons....	38,607	36,139	36,600	32,000
Phosphate rock ..... thousand metric tons....	4,991	100,873	5,000	105,000
Sand and gravel ..... thousand short tons....	[2] 5,299	[2] 14,203	5,000	13,400
Silver (recoverable content of ores, etc.) ... thousand troy ounces....	13,695	282,663	16,265	178,915
Stone[3]..... thousand short tons....	2,007	7,240	1,940	7,804
Zinc (recoverable content of ores, etc.) ..... metric tons....	27,722	22,876	31,000	30,500
Combined value of cement, garnet (abrasives), gypsum, lime, perlite, pumice, sand and gravel (industrial, 1980), stone (dimension), tungsten, vanadium, and values indicated by symbol W	XX	50,734	XX	30,396
Total	XX	522,095	XX	419,740

[P]Preliminary. [NA]Not available. [W]Withheld to avoid disclosing company proprietary data; value included in "Combined value" figure. [XX]Not applicable.

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2]Excludes industrial sand; value included in "Combined value" figure.

[3]Excludes dimension stone; value included in "Combined value" figure.

Severe reversals in the company's fortunes were obvious when Bunker Hill reported a $7.7 million loss for the first six months of 1981 and estimated a loss for the year of as much as $20 million. Lower prices for lead and zinc, problems in obtaining concentrates, and much lower prices for silver were responsible for the anticipated shortfall. A proposed wage rollback agreement between the company and union workers to help alleviate the fiscal crisis failed on August 20, 1981.

Gulf Resources & Chemical Corporation announced on "Black Tuesday" (August 25, 1981) the beginning of an orderly shutdown of all Bunker Hill operations. The closure would affect the smelter, zinc plant, and fertilizer plant by the end of 1981 and the mine and milling complex at some future date. The shutdown directly affected 2,100 Bunker Hill employees and meant the loss of a $50 million payroll. The company was the largest single employer in northern Idaho. The closure was a devastating blow to the local community as well as to the state's economy. Hardest hit was Kellogg (population 3,400), which depends entirely on the mining and smelting complex for its livelihood.

Reasons that may have contributed to the closure include:

(1) Declining silver prices from a $50-per-ounce high in 1980 to $10 per ounce during much of 1981. Silver produced from the Crescent mine was responsible for about one-third of Bunker Hill's 1980 profits.

(2) Depressed prices for lead and zinc, in part related to a production slowdown in the nation's auto industry, the largest user of zinc (for galvanizing and die-casting) and lead (auto storage batteries).

(3) Problems in obtaining foreign concentrates for the smelter and zinc plants. Bunker Hill imports roughly 70 percent of its lead and zinc concentrates from outside the district and must compete with other smelters worldwide for these concentrates.

(4) Cost of antipollution equipment that exceeded $25 million from 1968 to 1978, including $14 million for the tall stacks and flues completed in 1977 at the smelter and zinc plants.

Table 3. Net Production and Earnings in 1980 in the Coeur d'Alene Mining District [Compiled from sworn statements on file with the Shoshone County Assessor].

	Tons Extracted	Gross Value	Cost of Extraction	Freight and Treatment	Betterments and Repairs	Net Profit (Net Loss)
Big Creek Apex (Snowstorm and Apex area of Evolution mining district)	—	$ 403,852	$ 176,747	$ —	$ —	$ 227,105
Bunker Hill Company (Bunker Hill and Crescent)	570,129	50,399,368	29,498,662	6,762,311	1,637,259	12,501,135
Bunker Hill Company (Star unit—70% share)	197,299	23,703,438	13,154,303	6,821,529	8,514	3,719,092
Callahan Mining (Galena mine)	192,210	72,564,958	11,850,827	812,464	381,835	59,519,832
Coeur d'Alene Mines (Coeur mine)	164,966	52,336,950	6,831,363	730,942	264,153	44,504,492
Day Mines, Inc. (Hunter portion of Lucky Friday)	5,227	2,743,414	713,954	—	—	2,029,460
Hecla Mining Company (Lucky Friday)	184,410	68,420,982	13,893,905	3,916,437	11,419,625	39,191,015
(Sunshine unit—30% share)	42,968	5,484,870	3,438,593[a]	104,610	—	1,941,667
(Star unit—30% share)	84,557	12,846,987	5,517,345[a]	5,353,102	2,894	1,973,646
Hecla-lessees (Consolidated Silver venture)	1,998	—	2,000,821	—	—	(2,000,821)
Silver Dollar Mining Company (Sunshine unit area)	—	1,943,883	1,818,532	—	—	125,352
Silver Syndicate (Rambo and Snowstorm area—Sunshine mine)	—	5,435,212	3,269,139	—	—	2,166,073
Sunshine Mining Company (total production)	50,961					
(Sunshine's share)	28,549	7,293,274	7,819,466[a]	159,415	5,260,714	(5,946,320)
TOTALS	1,494,725	$303,577,184	$99,989,657	$24,660,810	$18,974,994	$167,898,840

[a]Includes royalties paid.

(5) Uncertainties regarding the ability of the company to meet future Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements and regulations.

(6) Declining lead and zinc ore grades in the Bunker Hill mine.

(7) Plans by the General Services Administration to sell 1.25 million ounces of silver each week for a year, starting in October 1981. This was construed by the industry as having a negative effect on the price of the precious metal. The governor of Idaho and Idaho's congressional delegation vigorously opposed the sale.

(8) High labor costs.

(9) Problems with aging facilities that must compete with modern metal refineries overseas.

(10) High transport costs associated with a smelter located inland having to compete with domestic smelters closer to major sea ports.

On August 27, 1981, the governor of Idaho announced the formation of the Silver Valley Economic Recovery Task Force. The purpose of this group was to find a buyer, a "White Knight," for the Bunker Hill complex. Gulf Resources had been trying to find a buyer for the past two years. In September, members of the United Steelworkers of America approved a wage rollback and an employees' stock ownership plan (ESOP). Approximately $50,000 was raised to examine the feasibility of the ESOP, and the study showed that the union could raise $23 million to apply toward purchasing the company by accepting a 15-percent wage rollback. Other local interests (reportedly Hecla Mining Company) would put up the funding to gain control of 54 percent of Bunker Hill. Gulf Resources would retain a 46 percent interest. This plan was rejected by the Bunker Hill Company as inoperable in November.

The task force was able to obtain a 5-year postponement of OSHA regulations concerning blood lead levels in workers. EPA also cooperated with the task force and spelled out antipollution requirements that would have to be met by Bunker Hill or a potential buyer over a 5-year period.

The search for a White Knight to buy the company was unsuccessful. Companies that expressed an interest in the purchase included Noranda Mines, Ltd., Hecla Mining Company, and a Florida financial coalition. On November 10 the task force ceased looking for a buyer and turned its effort toward looking at services that could be provided to ease the effects of the closure on employees and others in the area.

The closure and lay-off schedule for the Bunker Hill Company was as follows: By the end of September 1981, 238 of Bunker Hill's 2,100 employees had been laid off. The company also placed the Crescent mine on standby. The last shipment of concentrates was received on October 29, 1981. The phosphoric acid and fertilizer plant closed in mid-November. Companies interested in bidding on the demolition of the surface plants toured the area. Another 100 workers were laid off early in November. The last concentrates were processed and more lay-offs were issued by the end of November. The mine was placed on standby in December and another 325 employees were laid off. Gulf Resources estimated that the 1981 loss to the company from closing the Bunker Hill complex will be $83.3 million.

The celebrated underground greenhouse will still operate until mid-1982 when the current crop of 180,000 seedlings is to be harvested. The greenhouse was part of Bunker Hill's revegetation program in the Silver Valley and had received national interest.

A collapse in the 4,500-foot Hooper tunnel caused the Cresent mine to close down for a short time in June. The Crescent mine, crown jewel of the Bunker Hill Company, was placed on standby in September after the mine closure announcement. Production prior to the closure was 408,000 ounces of silver and 63 tons of copper from 25,000 tons of ore.

The company's problems had been compounded by the $20 million lawsuit filed in 1977 by the parents of nine children of Kellogg, who claimed that the children suffered irreversible mental and physical damage from lead fumes released in earlier years by the Kellogg smelter. Testimony describing the children's mental state was presented during the trial held in September in Boise. Former Bunker Hill workers testified that the company knowingly discharged lead contaminants into the atmosphere in 1973 and 1974 following a fire that destroyed part of the baghouse used to filter out contaminants. The company denied these charges. The case was settled out of court for $1.6 million. The children will start receiving payments when they reach 18 years of age.

A second legal suit was filed against the company in mid-November on behalf of 238 children (38 named and 200 or more John or Jane Does) by the plaintiffs' attorneys in the previous case. The suit also seeks compensation for alleged physical and mental damage due to emissions from the Bunker Hill plant.

On December 12, 1981, a purchase option for the Bunker Hill mining and refining complex was obtained from Gulf Resources by three north Idaho businessmen: Duane Hagadone, Harry F. Magnuson, and J. William Pfeiffer. The option, good until December 31, 1981, was for a purchase price of $65 million; $50 million in cash and notes and $15 million in future production. In January the investors were joined by three more partners: the J. R. Simplot Company, Sunshine Mining Company, and Coeur d'Alene Mines Corporation. An extension of the option until January 22, 1982, was obtained.

Hopes were high that the eleventh hour effort by the investors' group would be successful and keep the mining and smelting complex alive. The group worked tirelessly to put together the necessary financing plan. The investors announced a proposal that called for substantial reductions in manpower and a 20 to 25 percent wage rollback, as well as favorable electric, natural gas, and railway rates, for their plan to work.

A tentative contract was presented to the local leaders of the United Steelworkers of America, Local 7854, in January. The union leaders immediately responded that the contract was unsatisfactory because of clauses that they believed threatened seniority, pension plans, and other benefits. The wage rollback was not a problem to the labor leaders.

The investors countered that the proposal was nonnegotiable because of time limitations on the option and in obtain-

ing the necessary funding. On January 17, the union membership in Kellogg voted to accept the investors' proposal. The union's international leadership, however, refused to accept this outcome and rejected the contract. Countering this action, the local membership elected new officers, who immediately accepted the investors' offer, but the legality of this was in doubt. As a last resort, some workers started a new union, the Silver Valley People's Union, and attempted to decertify the Steelworkers Union. Many workers felt that they had been sold out by the national leadership who were allegedly more interested in contract benefits than in the members' jobs.

On January 20, 1982, the investors announced that they had cancelled their option with Gulf Resources and were no longer interested in purchasing the Bunker Hill complex. Discussions continued, however, and federal mediators, including Idaho's congressional delegation, tried to organize a meeting between all parties, but to no avail.

Back in August the company placed on sale a series of five silver medallions commemorating significant events in the history of the Bunker Hill Company. Sale of these medallions was reportedly brisk, undoubtedly because many people wished to have a memento of one of the world's largest lead and zinc mining, smelting, and refining operations. The company also marketed three new zinc foundry alloys in midyear. The zinc-aluminum alloys combine high strength, light weight, and good machineability.

Bunker Hill received eight awards in 1981 from the Spokane Advertising Federation. Over the years, the company has sponsored several television programs, including High School Bowl. The company received national publicity for its public service film "Angel Dust," a documentary on the growing use of a dangerous street drug, PCP.

Sunshine Mining Company. The Sunshine mine returned to its historic role as the nation's top producer of primary silver, enjoying the highest production of any of its last three operating years. The company finished the year with a $1,174,000 loss, owing to the downturn in the price of silver, Sunshine's principal product. Production from the Sunshine mine in 1981 was 4,050,627 ounces of silver from 197,154 tons of ore. An additional 94,105 ounces of silver were recovered from low-grade, above-ground stockpiles.

Despite losses, Sunshine proceeded on schedule with some $30 million in capital projects, three of which—the Sixteen-to-One mine at Silver Peak, Nevada, the No. 12 Shaft sinking underway at the Sunshine mine, and the first phase of the company's new silver refinery—were completed early in 1982.

A major corporate change for the company, and indeed for the Coeur d'Alene district, occurred when Sunshine merged with four companies that controlled mining properties mined by Sunshine under separate agreements. The four companies are Silver Dollar Mining Company, Sunshine Consolidated, Inc., Big Creek Apex Mining Company, and Silver Syndicate, Inc. The path leading to the merger involved numerous lawsuits and counterclaims by all parties, but these were settled by midyear. The final merger involved a reported $50 million stock swap.

Under the terms of the agreement, each share of Silver Dollar was converted into 1.15 shares of Sunshine, each Sun Con share into .55 Sunshine shares, each Big Creek share into .715 Sunshine shares, and each Syndicate share into .75 Sunshine shares. Sunshine issued 5.6 million new shares valued in December at about $50.2 million to cover the merger. In addition, favorable employment and retirement agreements were granted to officers of the four companies. As a result of the merger all litigation between the companies was dropped.

Acquisition of the four companies increased Sunshine's share of total silver production at the Sunshine mine from 56 percent to 76 percent. The Sunshine-owned interest in the Unit Area of the mine rose from 57.14 to 66.75 percent when combined with Silver Dollar's 9.61 percent. The Unit Area accounts for about 80 percent of the mine's total production. Sunshine doubled—from 50 to 100 percent—its interest in adjoining properties formerly covered under agreements with Syndicate, Sun-Con, and Big Creek Apex. These include properties along the Syndicate fault containing the Syndicate vein; the Rambo area; the 625, "H" and "J" veins; and the Snowstorm, Big Creek Apex, and Sun-Con areas. A summary of the ownership of the Sunshine mine area prior to the merger is shown in Table 4. The only remaining outside interests in the Sunshine mine are Hecla Mining Company with 33.25 percent of the Unit Area; Metropolitan Mines Corporation, with 50 percent of the proceeds from the Metropolitan area and 16 percent from the Yankee Girl area; and Silver Surprize, Inc., with 50 percent of the "S" area.

The acquisitions greatly economize Sunshine's accounting procedures, facilitate planning for future development, and bring to an end decades of costly litigation and dissension among the parties.

Work continued on the No. 12 shaft that will provide access from the 3,700-foot level to deeper portions of the west-central part of the mine and will allow increased total production in 1983. Some production will be hoisted up the shaft in 1982. The shaft passed the 5,000-foot mark at year's end with an initial target depth of 5,250 feet. Continued development from the No. 12 shaft will take place on the 4,800- and 5,000-foot levels and will interconnect with the No. 10 shaft through a lateral cross-cut, the Copper Vein drift, on the 5,000-foot level. The drift was advanced 778 feet in 1981 and was 1,842 feet from its objective at year's end.

The building to house the new silver refinery was completed and some of the equipment purchased. The rapid decline in silver prices during the year delayed the completion of the $15 million facility, which when finished will make Sunshine a totally integrated silver producer. The dore processing equipment for ore from the company's Sixteen-to-One mine in Nevada was installed late in the year.

Sunshine's most ambitious capital project—development of a new silver mine and construction of a 500 ton-per-day, cyanide-leaching mill at Silver Peak, Nevada—was 90 percent complete by the end of 1981. Reserves total nearly 10 million ounces, at an average grade of 7.77 ounces of silver per ton.

In February 1981 it was announced that Sunshine had purchased 5.3 percent of Hecla Mining Company's stock. Sunshine increased its holdings to 6 percent as a result of the Hecla-Day merger, giving the company 3.6 percent of the

shares of the combined company. Sunshine also maintains a 23.9 percent interest in a Consolidated Silver venture operated by Hecla.

A diamond-drilling program was begun as part of an exploration agreement with Allied Silver-Lead Company to explore and develop 400 acres of Allied holdings located under the city of Mullan near the Lucky Friday mine. Many landowners in Mullan have shares in the venture because they own the mineral rights below their property. Allied leased the mineral rights under 200 acres of city-owned property. A diamond-drill hole planned to go to 4,000 feet was at 3,700 by October. Several siderite veins with low silver values were intersected by the hole. U. S. Borax Company and Bueno Coeur d'Alene had priviously drilled this area in separate ventures, but neither program drilled deep enough to intersect hoped for extensions of the Lucky Friday vein system. Sunshine is committed to spend $1.2 million by 1985 on the Allied property.

In May, the company entered a joint venture with Metal Arts Company, Inc., to establish a program for the production and sale of silver medallions. This is part of Sunshine's strategy to make these medallions (similar to the successful "Sunshine 80" 1-ounce silver piece) the standard-bearer of the silver industry. The 1-ounce medallion and 10-ounce bar went on sale late in the year, and trading was reported brisk.

Sunshine continued with its efforts to divest itself of J. H. Rayner, Ltd., a London-based commodities firm purchased by the company in 1979. There are numerous outstanding claims against this company. The Securities and Exchange Commission conducted a private investigation into the Rayner-Sunshine transaction.

The Coeur d'Alene district was visited by Sir Edmund Hillary who made an underground tour of the Sunshine mine. Hillary, the first man to climb Mt. Everest, was in the company of several mountaineers who were to embark on another attempt to climb the famous mountain.

Silver Surprize, Inc. resumed its suit against Sunshine initiated in 1965 over ore mined by Sunshine from Silver Surprize ground. A proposed merger in 1979 between the companies was not successful, and Silver Surprize decided to complete litigation late in 1981.

Asarco, Inc. The Galena mine, operated by Asarco on a 30-year lease renewed with the Callahan Mining Company in 1976, was the number two silver producer in the district in 1981. Production in 1981 was 3,501,650 ounces of silver and 1,262 tons of copper from 196,500 tons of ore. This is an increase from the 192,212 tons of ore, netting 3,384,560 ounces of silver and 1,043 tons of copper in 1980. Net profit for the mine, filed with the assessor's office, was $20.4 million in 1981 compared with a record $59.5 million in 1980. Although the tonnage increased in 1980 and 1981, there was a decrease in silver production from the record 4,084,868 ounces of silver in 1979.

Asarco also operates the Coeur mine under a 50-year lease arranged with Coeur d'Alene Mines, Inc., in 1964. The Coeur reached a record production of 2,592,700 ounces of silver and 1,171 tons of copper from 164,385 tons of ore for a net profit, filed with the assessor's office, of $19.2 million in 1981. The

Table 4. Ownership, Production Interests, and Estimated Reserves in the Various Areas of the Sunshine Mine, as of January 1, 1981, Prior to the Merger. *(From Sunshine Proxy Statement/Prospectus, 1981, p. 19)*

Area	Sunshine's Interest and Estimated Recoverable Ounces	Silver Dollar's Interest and Estimated Recoverable Ounces	Sun Con's Interest and Estimated Recoverable Ounces	Syndicate's Interest and Estimated Recoverable Ounces	Big Creek's Interest and Estimated Recoverable Ounces	Other Interest Holders
Unit Area	57.14%	9.61%	—	—	—	Hecla Mining Company
	21,266,000 oz.	3,577,000 oz.	—	—	—	(33.25%)
X Area, Rambo Area*	50%	—	—	50%	—	None
	2,391,000 oz.	—	—	2,391,000 oz.	—	
Sunshine Consolidated Area	50%	—	50%	—	—	None
	1,201,000 oz.	—	1,201,000 oz.	—	—	
S Area	50%	—	—	—	—	Silver Surprize, Inc.
	857,000 oz.	—	—	—	—	(50%)
Big Creek Apex Area	50%	—	—	—	50%	None
	917,000 oz.	—	—	—	917,000 oz.	
Snowstorm Area	50%	—	—	12½%	37½%	None
	347,000 oz.	—	—	87,000 oz.	260,000 oz.	
Yankee Girl Area	84%	—	—	—	—	Metropolitan Mines
(Metropolitan)	620,000 oz.	—	—	—	—	Corp., Ltd. (16%)
Metropolitan Area	50%	—	—	—	—	Metropolitan Mines
	None	—	—	—	—	Corp., Ltd. (50%)

*This area is sometimes referred to as just the Rambo Area.

mine was the third major silver producer in the district. During 1980, 2,467,460 ounces of silver and 1,094 tons of copper were obtained from 164,966 tons of ore for a net profit of $44.5 million (Table 3).

On January 14, 1981, Asarco negotiated a new three-year contract with the United Steel Workers. This extends labor harmony at the Galena mine to 15 years, an enviable achievement in a district which has been marked by numerous labor disputes.

The Galena shaft was deepened to 5,100 feet during 1981. Development work continued on the 4,900-foot level. A new flotation circuit was installed in the Galena mill replacing an older system.

The American Silver project, negotiated in 1980 by Asarco, was underway in 1981. The three original participants, Asarco, Coeur d'Alene Mines, Inc., and the American Silver Mining Company, were joined in the $3.5 million effort by Callahan Mining Company and Day Mines, Inc. The project area includes the American Silver Mining property and Coeur d'Alene Mines' Silver Standard and Coeur d'Alene Consolidated properties. Asarco is exploring and will develop this ground from the 3,400-foot level of the Coeur mine. By year's end Asarco had penetrated approximately 2,300 feet into American Silver's ground and had started underground drilling.

Asarco signed an agreement with Idaho Goldfields to explore Goldfields' claims above the old Jack Waite mine near the Idaho-Montana border east of Murray. The work was completed and the project terminated later in the year.

Asarco announced at year's end that a new assay office located just east of Osburn on old Highway 10 would be built and completed in 1982. The 7,000-square-foot building will replace the assay office at Wallace and will assay ore from the Coeur and Galena mines and concentrates from the company's Leadville, Colorado, mine and new Troy mine near Troy, Montana.

The old Osburn tailing impoundment, that was completely filled and abandoned late in 1980, was totally reclaimed during the summer of 1981. The tailing was buried under a minimum of one foot of soil, graded for drainage, and the area seeded.

Hecla Mining Company and Day Mines, Inc. In 1980 Hecla enjoyed an excellent year with profits, reported to the county assessor's office, of nearly $43 million (Table 3) from its mines in Idaho. The 1980 figures were adversely affected by the 8½-month Sunshine strike, because Hecla has a 33.25 percent interest in the Sunshine unit area production. In 1981, lower silver prices produced a net loss of $1,094,479. This loss also reflects a nine-week strike at the Lucky Friday mine and a major consolidation in the history of the Coeur d'Alene mining district—the merger of Day Mines into Hecla on October 20, 1981.

Two important Hecla-Day relationships had a strong influence on the merger. One was the Hunter Ranch agreement and the other concerned Atlas Mining Company's North Atlas property.

Hecla has mined some ore from the North Atlas ground under the claims of extralateral rights on the adjacent Lucky Friday vein (Lucky Friday mine) since 1977. At times, the company discussed joint ventures with Atlas concerning the North Atlas property. In December 1980, Atlas filed suit against Hecla disputing the company's claims of extralateral rights on veins in the Lucky Friday mine that extend into North Atlas property. Day Mines entered a long-term operating agreement with Atlas in March 1981 and joined Atlas as a plaintiff in the Atlas suit.

The Hunter Ranch agreement was signed by Hecla and Day in 1965. This agreement gave Hecla the right to develop and mine ore on the Hunter Ranch property owned by Day adjacent to Hecla's Lucky Friday mine. Hecla has owned the surface rights on the property since 1967. In 1980 Hecla started sinking the $26.5 million "Silver Shaft," on the Hunter Ranch property; the shaft will be the deepest in the world outside of Africa. Hecla notified Day Mines that by the Hunter Ranch agreement Day should pay part of the cost (estimated $1 million) of sinking the shaft. Day claimed that such charges were invalid and commenced litigation against Hecla, claiming that the shaft-sinking on Hunter Ranch subsurface was in violation of the Hunter Ranch agreement and asking that the agreement be terminated.

Hecla reported on February 27, 1981, that it had obtained 5.69 percent of Day's outstanding stock and had increased its holdings to 7.51 percent by March 13, 1981. On March 20, Hecla offered to merge with Day Mines. Day turned down the offer, but requested more information about the North Atlas property. After several weeks of negotiation it was announced on July 8, 1981, that the two companies would merge. Hecla issued 1.8 shares of stock for each share of Day's and now owns all of Day. All lawsuits filed against Hecla by Day were dropped. The total cost of the merger to both companies was approximately $6.2 million.

The resulting company is the largest U. S. domestic silver producer. Table 5 summarizes the holdings of the new company. Hecla now owns the Lucky Friday mine, Knob Hill Gold mine (Republic, Washington), 50 percent of the Star mine, and 64 percent of the Consolidated Silver lease. The company also receives 60 percent of the profits from the Sherman mine in Leadville, Colorado, 12½ percent of the profits from the Galena mine, 5 percent of the profits from the Coeur mine, and 33.25 percent of the profits from the Sunshine unit area, which constitutes about 80 percent of the mine. In addition to the mining properties, Hecla now has control of 21,800 acres of mining claims throughout the western United States and British Columbia including 17,300 acres that were previously owned by Day Mines.

The Lucky Friday mine was closed by a strike from March 21 to May 23, 1981. The Lucky Friday yielded 2,253,818 ounces of silver, 1,337 ounces of gold, 1,200 tons of zinc, 374 tons of copper, and 12,344 tons of lead in 1981 from 148,864 tons of ore and was the number four silver producer in the district. Lead concentrates are shipped to Asarco's East Helena smelter in Montana.

Operations continued at the Star mine, owned 50 percent by Hecla and 50 percent by the Bunker Hill Company. Hecla's interest was increased from 30 percent to 50 percent in May. Because the ore from the Star mine was processed at the Bunker Hill smelter, concerns were expressed about the continued operation of the Star when Bunker Hill announced the closure of its facilities. However, production has continued from the Star, and zinc concentrates are shipped to the Cominco smelter at Trail, British Columbia. Production in 1981 from the Star

mine was 16,087 tons of zinc, 13,992 tons of lead, and 877,123 ounces of silver from 302,521 tons of ore.

Progress continued on the "Silver Shaft," and sinking is ahead of budget and 44 weeks ahead of schedule, having passed the 4,900-foot mark at year's end. The Silver Shaft will bottom at 6,100 feet, although plans call for eventual sinking to 7,700 feet with the deepest operating level at 7,500 feet. Approximately $26.5 million will have been expended in sinking to the 5,500-foot level. Completion to the 6,100-foot level will allow a production increase of 35 percent.

Hecla continued as operator and 64 percent owner of the Consolidated Silver Corporation joint venture. Exploration and development continued on the DIA project (Day, Independence, Abot) and the North Abot property. The DIA ground is being explored from the 4,050 level of the Lucky Friday mine. Exploration from the Star mine into the West Independence project ground found a 15-foot long zone of low-grade silver mineralization on the 5,300-foot level.

Hecla opened a regional exploration office in Denver, Colorado, in midyear. The company signed a contract with Rampart Exploration of Colorado to initiate a uranium exploration program; however, Hecla decided to discontinue this effort due to adverse market and economic conditions for uranium.

A dispute with the Sunshine Mining Company over ore mined in the Syndicate-Chester vein system was settled in Hecla's favor in December. Production from this zone was judged to be subject to the "Unitized Area" agreement signed in 1958. Hecla is entitled to 16.6 percent of the production from the Syndicate-Chester vein and could receive over $1 million as its share from previously mined ore, pending appeal of the decision.

Table 5. Hecla-Day Premerger Holdings.

HECLA MINING COMPANY		DAY MINES, INC.	
Property	Ownership of Production In Percent	Property	Ownership of Production In Percent
Mines in Idaho			
Lucky Friday mine	100	Galena mine	12.5 of profits
Sunshine unit area	33.25 of production	Coeur mine	5 of profits
Star Morning unit area	50	Tamarack mine	100
Consolidated Silver Corporation	50.04 of the stock & 64 of the lease	—	—
Exploration and Development in Idaho			
DIA project (Day, Independence, Abot)		DIA project	
North Abot property		North Abot property	
Lucky Friday extension		Lucky Friday extension	
West Independence project		Hunter Ranch	50
Hunter Ranch	50	Atlas North lease	lease
		Caladay project	13.8
		Hornsilver project	100
		American Silver project	4.6 of profits
Holdings Outside Idaho			
Granduc Mines, Ltd. (B.C.)	35.4	Knob Hill mine, Republic unit	100
Lisbon Valley project	lease 50	Leadville unit (Sherman mine)	lease 60
Red Bird property (B.C.)		Victoria property (Nevada)	100
Union mine property (B.C.)		London project (near Sherman mine)	lease
Ruby Hill property (Nevada)		Hercules Oil and Gas	100
		Permian Potash project	lease
		Day Mines controls 17,300 acres of patented and Crown grant claims in six states and British Columbia and is the largest claim owner in the Coeur d'Alene district.	

The company continued its reclamation and revegetation program at the Star, Consolidated Silver, and Lucky Friday properties. The program consists of hydro-seeding old mine tailings with sixteen species of plants, grasses, legumes, and wild flowers.

Callahan Mining Corporation. Callahan Mining Corporation enjoyed returns from its ownership and 50-percent share of cash flow from the Galena mine and its 4.8-percent share of profits from the Coeur mine. Both mines are leased and operated by Asarco. Callahan profited from ore stockpiled at the Galena mine during the copper strike in 1980 and sold in 1981, although lower silver prices reduced earnings. The company also profited from the sale of Hecla and Day mine stock that increased third quarter earnings over 1980. The company expended $10 million for exploration in 1981, up from $6.4 million in 1980. Most of the exploration expenditures were for the Caladay project, a major mining venture located east of the Galena mine in the "Silver Belt."

Shaft sinking continued at the Caladay project and had reached 1,570 feet by November. A pump station was installed at 1,500 feet, and some diamond drilling will be done from this level. The shaft, located at the end of the 5,000-foot Caladay tunnel, will eventually go to 5,100 feet. Installation of a 2,700-horsepower Nordberg hoist was completed and is being used for the shaft-sinking project. The company plans to find and develop ore veins similar to those in the Galena mine from operating levels developed as shaft sinking commences.

Callahan also participated in the American Silver project. This project is described under Asarco's operations.

Coeur d'Alene Mines Corporation. Coeur d'Alene Mines Corporation owns the Coeur mine operated by Asarco. A record silver production of 2,467,452 ounces reached in 1980 was topped in 1981 when the mine produced 2,662,956 ounces from 164,385 tons of ore. The decline in 1981 silver prices adversely affected earnings that totaled approximately 19.2 million, down from a

record $44,504,492 in 1980—the company's best year ever.

The company advanced the Chilcott tunnel on the CAMP project to 1,200 feet and conducted an underground diamond-drilling program. The CAMP project is a joint venture between Coeur d'Alene Mines (75.7 percent), Merger Mines Corporation (17.2 percent), and Plainview Mining Company (7.1 percent). The project area adjoins the Coeur mine and American Silver properties to the west.

An extensive drilling project was carried out on the Harlow property of Royal Apex Silver, Inc. Early in the year diamond drill holes intercepted several zones of silver-bearing mineralization. Coeur d'Alene Mines owns 27 percent of Royal Apex Silver and has a stock exchange option to gain up to 49.7 percent of Royal Apex' outstanding shares. Royal Apex would hold approximately 16.5 percent of Coeur d'Alene's outstanding shares if the exchange option is exercised.

The company signed an agreement with Capitol Silver Mines, Inc., to expend $150,000 during the first two years of an exploration venture on Capitol Silver's three hundred claims. The company may terminate the agreement after the expenditure of $100,000 if they wish. Coeur d'Alene Mines will receive 65 percent of any ore found on the property after recovering preproduction costs.

Another exploration agreement was signed with Highland Aurora Mining Company to examine the company's thirty-seven mining claims. A minimum of $75,000 will be spent on the property by the end of 1982, and if commercial ore is ever mined, Coeur d'Alene Mines will own 65 percent of the ore and pay 65 percent of costs after recovering its preproduction investment.

Coeur d'Alene Mines is a partner in the American Silver project with Day Mines, Callahan Mining Corporation, American Silver Mining Company, and Asarco, Inc. (the operator). The company is also involved in the Consolidated Silver project with Hecla Mining Company, Sunshine Mining Company, and Silver Dollar Mining Company.

Consolidated Silver Corporation. The Consolidated Silver project, a joint venture formed between Consolidated Silver Corporation, Hecla Mining Company, Coeur d'Alene Mines, Silver Dollar, and Sunshine Mining Company, operated throughout the year. Hecla owns 50.1 percent of Consolidated Silver Corporation and is the operator of the property.

The venture was formed to explore for veins in the Silver Summit mine that contain typical Silver Belt ore. The first ore from the project was shipped in January 1981 to the Asarco smelter in El Paso, Texas. Production is currently limited to the 4,000-foot level and is sufficient to supply the refurbished 300-ton Polaris mill with over 100 tons of ore per day. Shaft sinking continued from the 4,590-foot level to 4,950 feet. A target depth of 5,524 feet is planned when the project is completed. Exploration of the upper workings of the mine was also continued throughout 1981. The 5-year exploration and development program will cost approximately $11 million. The project produced 336,525 ounces of silver from 27,584 tons of ore during 1981.

Other Coeur d'Alene Mining Operations. Ore was found on *Independence Lead Mining Company*'s property as miners pushed into Independence ground from the 5,300-foot level of the Star mine. This western part of Independence ground is covered by a royalty operating agreement with Hecla, the operator of the Star mine. The significance of the find is being evaluated. Several years ago, Independence ground was reached from the 4,300-foot level of the Lucky Friday mine. High grade ore was found in the Wallace Formation in this venture, but the ore soon died out.

Helena Silver Company signed an option to a lease agreement with Bear Creek Mining Company (a subsidiary of Kennecott Copper). Bear Creek has conducted detailed geologic and geochemical work on Helena Silver's 30-claim, Wonderful Creek property and plans to do deep diamond drilling. The lease agreement, if optioned, will give a $200,000 minimum advance to Helena Silver and, after preproduction payback, 30 percent of net operating profit. In April, Helena Silver sold its Wallace Creek flotation mill to Viking Exploration of Denver, Colorado, for $435,000. Viking plans to use the mill to process ore from its Spotted Horse mine near Lewiston, Montana.

Shoshone Silver Mining Company also signed options and exploration agreements with Bear Creek Mining Company for its seventy-five claims that are adjacent to Helena Silver's. Bear Creek has 10 years to exercise the agreement, and if it does it will pay Shoshone $200,000. The exploration agreement will run for 50 years with a 50-year renewal period. Net profits from any mining operation would be split 70 percent Bear Creek and 30 percent Shoshone. The option agreement provides for up to $500,000 worth of exploration effort from 1985 to 1991.

Bear Creek Mining Company also signed option agreements with Beacon Light Mining Company, Border Silver Mines Company, Idaho Copper and Gold, Inc., Idora Silver Mines, Inc., Park Copper Company, Reindeer Queen Mining Company, and Silver Crest Mines, Inc. This gives the company a very large land holding east of the "Silver Belt." Bear Creek plans deep tests of this little-explored area in a "wildcat undertaking."

Beacon Light Mining Company prospected a discovery at the Beacon Light mine in east Shoshone County near the state line. The No. 1 portal at the mine was opened and explored, after being caved for over 50 years.

Cominco American, Inc., continued its exploration program in the Pine Creek district. The company holds leases on the Lookout, Signal Silver and Gold, and New Era properties through an arrangement with Epic Silver. Final agreements were reached during the year with Hypotheek, Constitution, Sidney Mining Company, and Mascot Mining Company. Zinc was the primary metal extracted from mines in the Pine Creek district in the past. Cominco did some rehabilitation of the Liberal King mine workings for a detailed geologic study and also conducted some surface drilling in the area. A geologic mapping and geochemical survey was carried out over the area. Plans call for the possibility of a geophysical survey in 1982.

Intermountain Mineral Engineers, Inc., continued operation of the Nabob mill on Pine Creek. The company did some development work on the Sidney, Nabob, Mascot, and Cougar properties and custom-milled ore for several companies, including the Bunker Hill Company and the Black Pine Mining Company.

Metropolitan Mines Corporation was still involved in litigation with Sunshine Mining Company over ownership and extralateral rights on the "Copper Vein." The company suffered a net loss of $51,444 during fiscal 1981 because of costs involved with the legal action. Metropolitan controls sixty-three claims adjacent to the Sunshine mine, and fifty-one of these are subject to an operating agreement with Sunshine.

United Mines signed a lease agreement with Sunshine Mining Company and will receive 35 percent of profits if commercial ore is found on its ground north of the Sunshine mine. United will get advance royalties ranging from $3,500 to $5,000 per year starting in 1985.

Newmont Exploration, Ltd., paid Capitol Silver Mining Company $27,000 for the right to terminate an exploration agreement under which $65,000 was spent on a surface and diamond drilling program during the year. Coeur d'Alene Mines Corporation signed an exploration agreement with Capitol Silver in November and will expend a minimum of $100,000 on the program. Coeur d'Alene Mines can terminate the agreement after the minimum expenditure. Capitol Silver will receive 35 percent of net profits from commercial ore if discovered.

The 116th Engineering Battalion of the Idaho National Guard continued work at the Jack Waite mine. The Guard, as part of its summer training, is stabilizing old mine tailings that have been a concern to the U. S. Forest Service and the public for years. Fears are that the unstable tailings could be washed into Eagle Creek during a flood and cause damage and contamination.

A three-year, $827,000 research program conducted by the U. S. Geological Survey and the University of Idaho's College of Mines and Earth Resources started during the summer. The program will involve surface mapping, remote sensing, and geochemical studies (including isotope and fluid inclusion work). The goal of the project is to further the geologic knowledge of the district in the search for more mineralization.

Other Mining Operations in the State

Cyprus Mining Corporation. Progress has been dramatic at the site of what eventually will be the largest open-pit mining operation in Idaho's history. Cyprus' Thompson Creek molybdenum deposit was the scene of a massive construction effort during the year. Cyprus is a wholly-owned subsidiary of Amoco Minerals, Inc. (Standard Oil of Indiana). Approximately 450 workers of the Gilbert Industrial Company were engaged in site preparation and earth moving, and 700 employees of Brown and Root Construction were building the site facilities. In addition, some 300 Cyprus employees were at the mine location.

A three- to four-month gain on construction schedules and a 20-percent cost overrun by primary contractors caused Amoco to shut down the operation for the winter. The company plans to use the time to renegotiate contracts and complete project engineering. The first year's budget for the anticipated $350 million venture was $172 million.

Work during the year consisted in removing overburden from the mine site. Overburden thicknesses range from 600 feet to 50 feet. The mill site and the tailings impoundment were being excavated. A series of 60-inch conveyor belts will carry the ore over 7,000 feet from the mine to the mill. Mining will be done by using four 25-yard electric shovels and a fleet of twenty-three 170-ton diesel-electric trucks. It takes only four scoops from one of the giant shovels to fill one of the big trucks. Approximately 2,500 acres will be disturbed by the operation, and over 1.5 million yards of topsoil has been stored for reclamation. Erosion is temporarily controlled in the disturbed areas by hydroseeding.

The mine will eventually produce 25,000 tons of ore a day and employ approximately 550 persons. The annual payroll should exceed $9 million.

The population of Challis, the closest town to the mine site, doubled from 750 people in 1980 to over 1,500 in 1981. Cyprus had prepaid $600,000 in 1980 taxes to help the community prepare for the rapid growth and to enable a $1.2 million, twelve-room addition to be built onto the elementary school. Cyprus did not, however, prepay $1.1 million in taxes in 1981 because the year's project funds had been exhausted. The delay in payment until 1982 will postpone passage of a bond issue to build a new, much needed high school. The current school, built to house 350 students, is overcrowded and inadequate to accommodate the rapid rise in student population.

Cyprus has built 262 houses to be purchased by its future employees, and it has also constructed a 162-unit trailer park in Challis. A new 95-mile power transmission line to serve the new mine was under construction during the year. The 230-kilovolt line will cost approximately $15 million.

Molybdenum prices declined sharply during the year from nearly $10 a pound in January to under $7 late in the year. The primary reasons for the decline were the falloff in the automobile industry, a prime user of the metal, the increased production from older mines, and the anticipated production from new mines now beginning operation in the United States and Canada. Several large, new molybdenum projects in the planning stages in the United States and Canada have been curtailed or halted. Cyprus intends to complete the Thompson Creek mine in spite of the adverse economic conditions.

Noranda Mining, Inc. Cobalt prices followed other metals in a drastic price decline from over $25 a pound early in 1981 to under $10 late in the year. High interest rates combined with the declining price and the lack of a U. S. government floor for guaranteed cobalt prices have placed Noranda's plans for reopening the Blackbird mine located in east-central Idaho in jeopardy. The company is currently seeking a joint-venture partner to share the estimated $250 million cost of reopening the mine and building a new cobalt refinery.

Work continued at the mine during the year, and the lower two levels were dewatered. Sampling and underground drilling programs continued. The work force was reduced to 90 men in October, and further curtailments in manpower occurred by the year's end. If placed in operation, the mine will produce 2,000 tons of ore daily. This would provide approximately 20 percent of the United States' need for cobalt.

Exploration outside the immediate mine area continued, and several new target areas were delineated near the mine site. Exploration was also conducted in the 40,000-acre special

management area of the River of No Return Wilderness Area located northwest of the mine. Several surface targets were delineated, but there are no plans to drill these areas in the near future.

Noranda announced early in the year that a $50 million cobalt refinery would be built on a 212-acre site near Moreland in southeast Idaho. It was planned to complete the plant by 1985. The facility would employ 180 people with an annual operating budget of $14 million. A favorable zoning decision in April by the Bingham County planning and zoning commission cleared the way for the project, but a suit filed by forty-seven local residents in July seeks to reverse this decision. Some of the local populace have expressed concern about the facility and possible associated environmental and pollution problems. Plans for the new refinery, however, have been delayed.

Mapco Minerals Corporation. In January, Mapco Minerals Corporation purchased all mining and mineral-related properties of Earth Resources Company. This included the Delamar mine in Owyhee County near the Idaho-Oregon border. Mapco controls the majority interest and operates the property. Canadian Superior Mining (U. S.), Ltd., is a major partner in the mine.

In the first nine months of 1981, the mine produced 1 million ounces of silver and 21,500 ounces of gold. Ongoing development drilling has guaranteed a 20-year mine life. The capacity of the closed cyanide leach system mill was increased to 2,100 tons a day. A new open pit called the Glen Silver, located northwest of the Sommercamp pit, was developed during the year. The company employs 200 people and is proud of its excellent safety record, maintained since operations began.

Clayton Silver Mines, Inc., continued normal production from its mine near Clayton, Idaho. Estimated 1981 production will be 52,000 tons of lead-silver ore. Ore was mined during the year from the new 950- and 1,100-foot levels and processed in the company's 250-ton-per-day mill. In 1980, Clayton produced 71,900 ounces of silver, 510,888 pounds of lead, and 19,790 pounds of copper. The company's stock was listed on the Pacific Stock Exchange in April.

Canadian Superior Mining (U. S.), Ltd., started construction of the production pads at its Stibnite property. An Environmental Impact Statement was completed early in the year for a cyanide heap-leach gold operation. Construction is 90 percent complete on the facility, including five 250-feet by 325-feet leach pads which will hold 25,000 to 30,000 tons of ore per pad. The company hopes to recover 1 ounce of gold per 10 to 20 tons of ore. Six large trucks will haul about 2,000 to 3,000 tons of ore a day from the mine to the leach pad site. The company employed 60 people during construction and will employ about this number when production starts next year. The mine has a seven- to ten-year life span, and operations will be carried out for only six months of each year because of severe winter conditions. The cyanide leach process will use carbon-filled towers to reclaim gold from the pregnant cyanide solution. Preproduction costs for the new mine are estimated at $10 million.

A pilot heap-leach test on 3,000 tons of gold ore was carried out at the Yellowjacket mine in east-central Idaho. The operation is on patented ground owned by *Yellowjacket Mines, Inc.* The company plans to start full-scale production next year at an estimated 50,000 tons yearly. Reserves are approximately 400,000 tons of ore, averaging .1 ounce of gold per ton. The company also continued experimental work in an attempt to reclaim copper and cobalt from streams that drain the Blackbird mine site. They attempted to use ion exchange resins in a pilot operation several years ago, but the technique was too costly.

A dynamite explosion took the life of three miners at the Warrior mine near Marshall Mountain, 38 miles east of Riggins. The mining operation is being conducted by the *Havlah Group*, a California limited partnership.

Cominco American continued detailed geologic studies at its Bobcat Gulch prospect on Napolean Ridge east of Leesburg. Over 10,000 feet of new road was built on the porphyry copper-molybdenum prospect, and a new zone of secondary copper mineralization was discovered. Molybdenite mineralization in quartz veins occurs across a 1,000- to 2,000-foot zone. Bear Creek is a joint venture partner on this project.

Inspiration Development Company dropped its option on the Ramshorn mine but continued with its drilling program with favorable results on the Keystone property in the Bayhorse mining district. The company purchased the Bayhorse during the year. The mine has been transferred from the exploration stage to the development stage. The Bayhorse may be mined for fluorite, silver, and lead mineralization.

The Ima mine also passed from the exploration stage to the development stage, and a 300-pound bulk sample was run through a pilot plant for testing. Inspiration is driving a new adit on the property and developing a new haulage level. Last year the mine was operated as a molybdenum prospect; however, this year the company has decided to look at the Ima as a tungsten mine. The mine was a major producer of tungsten during World War II.

Inspiration dropped the Salmon River Copper Company mine on the main Salmon River west of Shoup. The company also staked a large claim block in the Trinity Mountains area in Elmore County during the summer.

A new heap-leach cyanide program was proposed by *Resource Engineering and Development Company*. The operation would be active for only four to six months and would process old mine tailings from the Buster mine and mill located one-half mile north of Elk City. The plan calls for using a cement agglomeration technique on 20,000 to 25,000 tons of tailings.

U. S. Antimony Corporation processed dump material from the Charles Dickens mine at its 300-ton-per-day mill located at Preachers Cove on the Yankee Fork of the Salmon River. Production in 1981 was approximately 400 ounces of gold and 10,000 ounces of silver. The company also started a tunnel on the Charles Dickens vein and another tunnel at its property on Estes Mountain.

Center Star Gold Mine, Inc., began work on thirty-eight gold claims placed on standby in 1971. The Center Star mine is near Elk City. A consultant estimated that there could be as much as 128,000 tons of ore, averaging .47 ounces of gold, on the property. An extensive sampling program was conducted during the year, and a $500,000 contract

was signed with Ruddock Resources, Inc., of Reno, Nevada, and World Tech, Inc., of Oklahoma City, Oklahoma, for the rehabilitation, exploration, and development of the mine. Part of the rennovation will include dewatering 2,700 feet of drifts and collecting 2,200 samples from the three old working levels.

The *Sunbeam Mining Corporation* (a subsidiary of Geodome Petroleum Company, Vancouver, B. C.) plans to start a heap-leach gold operation on Sunbeam Mountain above Jordan Creek in Custer County. The old Golden Sunbeam mine was a major producer in the early 1900's. The company conducted pilot testing on 10,000 tons of ore during 1980 on three test leach pads. A trommel is used to help separate clay from the ore, and carbon towers were installed to recover the gold from the cyanide solution. Coarse gold is recovered with a sluice box and washing plant. The operation will employ 40 to 50 people and cover 140 acres on the mountain. Approximately 7 million tons of ore will be moved during the proposed 10-year-plus mining operation.

An extensive exploration project was conducted by *Canadian Superior (U. S.), Ltd.*, at the Sunnyside mine east of Stibnite in Valley County. Early reports noted that an ore zone 60 feet thick containing .06 ounces of gold per ton had been found in a diamond drill hole near the Hawkeye patented claim group. Canadian Superior paid the owner of the company, Thunder Mountain Gold, Inc., $144,530 in advanced royalties in August and plans to continue work next year.

Gold production continued at the Golden Reef mine (old Dewey mine) in the Thunder Mountain district in central Idaho. The 600-ton-per-day mill operated throughout the summer, and gold recovery (estimated at 85 percent) was excellent. Production was curtailed for a short time in midyear because of leakage from a tailings impoundment pond. The operation yields 40 to 50 ounces of electrum per day. This occurrence is a unique geologic phenomenon in that the gold in electrum occurs in coal layers in a sequence of volcaniclastic sediments (Dewey Formation). Ore reserves are 2 to 3 million tons of .07 to .10 percent gold. The mine is being operated by *Golden Reef Ventures, Inc.* The *Copper Lake Company* is a joint venture partner.

The *Napias Mining Company* of Idaho Falls plans to install a washing plant for placer gold recovery near the old mining town of Leesburg. The company employed twelve people during the year and plans to placer mine approximately 170 acres of gold-bearing gravel on its 198-acre claim block.

Molycorp, Inc., staked claims in the Copper Basin area and initiated a geology, geophysics, and geochemistry program in the Starhope Canyon and Muldoon Canyon area in Custer County.

Utah International drilled a porphyry copper-molybdenum deposit near the Copper Basin mine. The company was also active on a claim block near Leadore.

A 600-foot drift was completed by *Rocky Mountain Energy* at its uranium property located on Bartlett Creek on the North Fork of the Big Lost River. The company also drilled three diamond drill holes in the adit. Rocky Mountain was very active in the state and conducted a large exploration program for uranium.

Myko, Inc., continued mining lead, zinc, and silver from the Phi Kappa mine. The ore is shipped to the old Empire mill at Mackay. The company is planning to build a small mill at the Silver King mine on Beaver Creek near Sawtooth City in 1982.

Sunshine Mining Company drilled three holes in the Pearl district north and west of Boise. *Monica Mines*, active in the same area last year, was building a cyanide heap-leach facility in early 1981. Loss of funding forced the operation to shut down in midyear. The Golden Gate tungsten property near Yellow Pine (another Monica venture) also suffered the same fate.

Twelve holes were drilled with good results on the Hercules silver prospect owned by *Anglo Bomarc*. TRV Minerals sold its option on the property to the *Copper Lakes Company*. Work ceased in midyear due to funding shortages.

Ventures West reportedly drilled five holes at the Triumph mine, located east of Hailey. The property was under lease to Bear Creek Mining Company last year and was an active lead-silver producer many years ago. Ventures West is reportedly interested in a target below the 800-foot level in the mine. In previous operations the mine produced approximately 1.7 million tons of ore averaging .05 ounce of gold, 7.6 ounces of silver, 4.0 percent lead, and 5.3 percent zinc.

Conjecture Mines considered the feasibility of sinking an incline shaft at its silver mine near Lakeview.

Shoshone Silver Mining Company closed its mill and mining operations in the Lakeview district because of declining metal prices. The mill processed $54,000 worth of ore before closing.

Amax continued a long-standing exploration program at the Cumo molybdenum deposit near Grimes Pass north of Idaho City. A small drilling program was conducted during the summer.

Approximately 6,000 to 7,000 tons of ore was shipped from the *Silver Strand* mine near Lakeview to the Asarco smelter at Tacoma. The company did 500 feet of underground work, including driving a new tunnel and some drifting.

Bear Creek Mining continued exploration at the Chilco Mountain molybdenum prospect. The project is a joint venture with Union Carbide and Noranda. A deep diamond-drill hole is tentatively planned for next year.

The *Turtle Mining Company* examined the Big Turtle mine near Clayton. The mine is in the Bayhorse Dolomite. The company estimates reserves of 40,000 tons of 21-ounce silver and 8 percent lead. The year's work included a geochemical survey and a detailed geologic mapping program. A drilling program is planned for next year.

Work continued at the *Princess Blue Ribbon* mine in the Willow Creek district. Activity included rennovation of the old mine workings. Plans call for building a mill at the site in the spring. This property was mined for lead, silver, and gold.

Exploratory work was done in the *Croesus* mine on the Heine claim group and at the *Silver Strike* mine, in the Mineral Hill district west of Hailey. The properties are being examined for lead, zinc, and silver.

The mill at the *Hoodoo* mine on Slate Creek near Clayton was sold to the Ensign Coil Company of Salt Lake City. There was no production from the zinc mine during the year.

The New York mine near Elk City was being rennovated by *Havlah Mining*

Company. The company bought the Lone Pine patented mill and mine site and hopes to rehabilitate the old mill and put it into operation next year.

The *Missouri* mine near Idaho City was in operation throughout the year. Three men were employed in underground operations, and four more were employed at the mill site. The mine is a 50- to 100-ton-per-day operation.

A feasibility study was underway at the *Banner* mine northwest of Idaho City. Over $1 million was spent on this property last year, but the mine is now under new management. No underground work was done during 1981.

A two-man crew was at work extending the tunnel at the *Red Horse* mine located on Bear Creek north of Fairfield. About 70 to 80 feet of new tunnel was added to the 800-foot adit. There was also some activity at the *El Oro* mine, and a new prospect was being worked on Tyrannus Creek.

Silver King Mines, Inc., continued its copper-silver mining operation at the Copper Cliff open-pit mine at Cuprum, but closed down in December because of adverse metal prices. A potential merger between Silver King and a German company was called off. The company also processed ore from the Iron Dyke mine located across the Snake River in Oregon. The Iron Dyke is a joint venture between Silver King and Texasgulf. Exploration and development work will continue at the Iron Dyke after the Idaho operation closes.

Texasgulf conducted a large helicopter-supported drilling program during the year at the *Red Ledge* mine.

Key Milling announced that its custom closed-vat cyanide mill was in operation near Riggins. The mill will process ore from three properties north of the Delamar mine in Owyhee County and will custom mill ore from small operations near Riggins.

Gulf Mineral Resources and *Day Mines Company* were reportedly exploring for uranium east and west of Priest Lake in Bonner County.

Placer operations continued at numerous locations throughout the state. The *Napias Mining Company* operated a 1,000-yard-per-day operation near Leesburg and a 1,200-yard-per-day trommel was tested in Warren Meadows. Smaller operations were underway near Murray, Elk City, and Atlanta, on both sides of the Salmon River between Lucile and Riggins, and on the Yankee Fork of the Salmon River.

NONMETALLIC MINERALS

Phosphate

Idaho's phosphate industry provides about 12 percent of the phosphate produced in the United States. Phosphate is a major ingredient in agricultural fertilizer, and elemental phosphorus has many applications in industrial and food products. High energy costs and declining prices for diammonium phosphate, from $215 a ton early in the year to $160 later in the year, were a concern to the industry in 1981. Falling prices were related to the U. S. grain embargo in 1980, overproduction of agricultural products, high interest rates that kept farmers from obtaining agricultural loans, and a resulting increase in phosphate stock inventories due to lower agricultural sales. The decrease in domestic phosphate sales is termed a recession or depression by industry spokesmen.

Production of phosphate continued from the Conda mine owned by *J. R. Simplot*, the Gay mine owned by *FMC Corporation* and *J. R. Simplot* (the operator), the Maybe Canyon mine owned by *Conda Partnership* (a joint venture of Beker Industries and Western Coop Fertilizer), the Wooley Valley mine operated by *Stauffer Chemical Corporation*, and the Henry mine operated by *Monsanto*. All of these are open-pit operations. *Conda Partnership* closed the Maybe Canyon mine in December due to a soft market and an oversupply of phosphate.

Wet acid plants for the production of phosphoric acid were operated by *J. R. Simplot* (Pocatello) and *Beker Industries* (Conda). The *Bunker Hill Company* also operated an acid plant at its facility near Kellogg in north Idaho. Bunker Hill receives its phosphate from Stauffer Chemical Corporation and ships sulphuric acid to Beker Industries. Elemental phosphorus plants were operated by *Monsanto* (Soda Springs) and *FMC Corporation* (Pocatello). Beker closed its ammonia plant during the year, citing the high cost of natural gas.

Kerr-McGee processed vanadium at its plant near Soda Springs. The vanadium is extracted from ferro-phosphorus slag, a by-product of the elemental phosphorus production at Monsanto's facility.

The draft Environmental Impact Statement for *J. R. Simplot*'s Smoky Canyon mine was released in September 1981. The new mine, located on federal phosphate lease I-012890, will eventually replace diminishing resources at the company's Conda mine. The new mine site lies 25 miles east of Soda Springs, and the lease area covers 2,520 acres. The company plans to mine approximately 2 million tons of phosphate rock annually during the mine's projected 30-year life. Preproduction costs are estimated at near $20 million. The mine will be an open-pit operation, utilizing electric shovels and 170-ton haul trucks. A unique feature of the operation will be a 25-mile, 8-inch pipeline for transporting slurried phosphate from the mine site to Simplot's processing plant at Conda.

The Smoky Canyon project will employ 95 people during the peak construction period and 95 people during full operation. Construction is scheduled to begin early in 1982; the mill, slurry pipeline, and tailings dam will be completed by 1984.

A south Idaho rancher brought suit against the J. R. Simplot Company and FMC Corporation alleging that fluoride emissions from phosphate processing plants near Pocatello had destroyed his cattle raising operation. The company denied the damage.

Other Industrial Rocks and Minerals

Oneida Perlite had its best business year ever in 1981. The company installed the largest vertical furnace manufactured for expanding perlite. Oneida already had the largest available horizontal furnace in operation. A new filler plant was completed, and several large warehouses were built. Expanded perlite is used for insulation, as a light-weight aggregate, as a filtering medium for all types of edible fluids such as alcoholic beverages and cooking oil, and as a fireproof filler for doors and firewalls. The company markets all sizes of industrial-grade perlite and hopes to branch out into the pre-cast panel construction business shortly.

Hess Pumice Products did well in the industrial abrasives market, but poorly in construction-related items such as lightweight aggregate. The company mined pumice from the Wrights Creek mine located 22 miles northwest of Malad.

The largest placer operation in the state was run throughout the year on Carpenter Creek and Emerald Creek near Fernwood by *Emerald Creek Garnet, Inc.* Approximately 15,000 tons of finished garnet product was processed. The garnets are used for industrial abrasives and as a filtration medium.

Cash Industries processed barite from a stockpile at the Bonnie Barite open-pit mine. Most of the barite is used for drilling mud. The company processed 60,000 tons of barite during the year at its mill outside Ketchum. Next year Cash Industries plans to open its own mine when the stockpiled ore is exhausted. A drilling and exploration program was conducted on new barite claims close to the open-pit mine. The mill at Ketchum was operated as a custom mill during the year, processing lead-silver ores.

N. L. Baroid (National Lead) owns the Bonnie Barite mine in Blaine County (Cash Industries owns only the stockpiled ore). Baroid submitted a mining plan to the state Department of Lands and the U. S. Forest Service for operations to begin next year. The company has plans to build a processing plant in the Hailey-Bellevue area sometime in 1982.

Consumers Co-op Association mined and crushed 5,000 tons of gypsum from its open-pit mine near Iron Mountain in Washington County. The Co-op sells about 3,000 tons of gypsum a year for agricultural use in the Weiser, Cambridge, and Midvale area. Gypsum sales have increased during the past two years according to company officials.

Business was about the same as last year (a very good year) for *Idaho Portland Cement* at Inkom. The company is the only cement producer in the state and mines lime at its open-pit operation next to the Inkom plant. The company has put expansion plans on hold because of the slow economy. Part of the year's effort included overhauling and repairing equipment and facilities.

A. P. Green had a slow year due to the depressed timber industry. The Troy-based company makes firebrick used extensively by the lumber and paper industry in the Pacific Northwest. The company obtains its refractory clay from pits located near Helmer.

Building stone was quarried from several sites on the Snake River Plain. Slab basalt and quartzite were the most common type of rock sold. The center for stone production is Oakely, Idaho, where several small firms quarry quartzite for

Table 6. Exploratory Oil and Gas Wells in Idaho for 1981.

Operator	Well Name	Location	Permitted or Total Depth (Ft.)	Status
Amoco Production Co. Salt Lake City, Utah	Bald Mountain Federal No. 2	NW¼NE¼ Sec. 6 T. 4 S., R. 45 E.	15,600	Drilling (Permitted 1980)
Cities Service Co. Denver, Colorado	Federal DI No. 1	NE¼SW¼ Sec. 22 T. 15 S., R. 45 E.	10,262	Plugged and abandoned dry hole
Chevron USA, Inc. Denver, Colorado	Dunn's Canyon Federal No. 1-22	SE¼NW¼ Sec. 22 T. 11 S., R. 44 E.	13,546	Plugged and abandoned dry hole
Phillips Petroleum Co. Cut Bank, Montana	Idaho State A No. 1	NE¼NE¼ Sec. 16 T. 6 S., R. 44 E.	16,300	Drilling
Champlin Petroleum Co. Denver, Colorado	Upper Deer Flat No. 11-19	NW¼NW¼ Sec. 19 T. 2 N., R. 2 W.	9,022	Plugged and abandoned dry hole
Exxon Corp. Denver, Colorado	Meyers Federal Unit No. 1	SW¼NE¼ Sec. 14 T. 14 N., R. 35 E.	19,000	Drilling
Amoco Production Co. Salt Lake City, Utah	Idaho State No. 1	SE¼NW¼ Sec. 16 T. 12 N., R. 28 E.	6,700	Plugged and abandoned dry hole
Juniper Petroleum Co. Denver, Colorado	State No. 12-31	SW¼NW¼ Sec. 31 T. 1 S., R. 42 E.	9,780	Plugged and abandoned dry hole
High Plateau Oil & Gas Springfield, Utah	Idaho-Barsen No. 1	SE¼NE¼ Sec. 26 T. 16 S., R. 37 E.	5,000	Drilling
James M. Forgotson Shreveport, Louisiana	Elkhorn Canyon No. 1	SW¼SE¼ Sec. 32 T. 13 S., R. 34 E.	10,000	Permitted

use as a building material. The three main companies involved are *Northern Stone*, *Idaho Quartzite*, and *United States Rock Company*. Sales were lower in 1981 due to the slowdown in the construction industry.

The Nez Perce Indians planned to reopen their limestone quarry located on the reservation. Among other markets, the tribe will provide Potlatch Corporation with 18,000 tons of crushed limestone for use in the company's pulp mill.

Occidental Petroleum continued with plans to produce zeolites from its claims near Sheaville. A primary crushing plant is to be built at the site and the product will then be shipped to a new processing plant tentatively to be constructed in Nampa.

OIL & GAS

The Overthrust belt continues to be a most successful area for oil and gas exploration in the United States. To date, six giant fields have been discovered in the Wyoming and Utah parts of the belt (giant fields—100 million plus barrels recoverable).

The Idaho part of the belt continues to be heavily shot by seismic crews for future drilling. Nine wells were permitted during 1981. Five were drilled, plugged, and abandoned as dry holes. Four wells are currently being drilled. All but one well was drilled in the Overthrust belt of southeast Idaho. Champlin Petroleum drilled a well in Canyon County southwest of Boise. The Exxon well, drilling in Clark County, is projected to 19,000 feet and will set a depth record in Idaho.

Idaho had its first oil and gas lease sale since the moratorium imposed three years ago. The sale of 145,374 acres brought in $1.31 million for an average bonus of $9.03 per acre. Teton County averaged $54.94 per acre. High bid was $107 per acre from Wexpro Company for a Teton County lease. The next lease sale is scheduled for February 1982.

A continued increase in drilling activity is expected in southeast Idaho. Recent lease activity in southwest Idaho suggests more wells will be drilled in the western part of the state. A summary of the wells drilled during 1981 is shown in Table 6.

Rule changes were proposed by the U. S. Geological Survey for oil development and production from leases on federal and Indian lands. These are the first revisions since 1942, and they set more realistic assessments for rule violations, provide for environmental review during development, and allow for more accurate production statistics. BLM announced fee increases from $10 to $25 for filing oil and gas lease applications beginning in October.

The Idaho Bureau of Mines and Geology published an updated version of its oil and gas map showing the location of 133 dry holes drilled in the state. A study by Mont Warner of Boise State University for the Idaho Office of Energy suggested that Idaho might have potential for oil shale in the Succor Creek Formation in southwest Idaho.

The Pacific Gas Transmission Company completed its gas pipeline during the year. The 592-mile-long line extends from the Canadian border through north Idaho, eastern Washington, and Oregon.

Desert Geomorphology

(continued from page 1)

ment, basins filling with sediment, and the relative antiquity of landscapes has given scientists better approaches to Quaternary and surficial geologic mapping, water and waste management, and engineering geology.

The study of soil development on different landscapes has also been a fundamental part of the Desert Project. One of the missions of the field study sessions last fall was to familiarize and integrate geologists with soil studies. Many of the participants were U. S. Geological Survey (USGS) geologists. A growing part of the USGS' regional geology program includes studies of soil properties, genesis, and correlation. Just as with the USGS, the New Mexico Bureau and the geologic agencies from other states, IBMG's Environmental Geology Section is also incorporating soil studies in its own program.

Soil stratigraphy is an important part of Quaternary geologic research. Soils are the manifestation of the weathering of rocks and deposits on stable surfaces, and they constitute an important aspect of any surficial geologic material. Soils may provide the only relative-dating tool for unraveling the age of faulting in earthquake-prone areas. On older, more stable and less eroded land surfaces, the development of hard soil caliches and other hardpans of desert soils, as well as desert pavements and clay-rich subsoils, makes the relative importance of soils to the properties of surficial geologic units very high.

The lack of published surficial and Quaternary maps on Idaho has led environmental geologists at IBMG to use research techniques that provide efficient mapping of large areas over which field work must be spread. The knowledge and methods proven effective in the Desert Project have facilitated this research. The geologists have been able to map broad areas of the state from their own interpretations derived from aerial photographs, topographic maps, and Landsat images. Combined with actual ground checks of deposits and soils, this integrated method of mapping has been reliable in developing a coherent relationship between landscape, deposit, climate and tectonic events, and time.

OIL DRILLING INTO BASALT

Oil and gas drilling activity on the western edge of the Columbia Plateau has stirred interest in other border areas of the widespread Columbia River basalts. Drilling will help determine if the basin-filling basalts and associated structures have possibly trapped oil and gas either from older rocks below the basalts or from clastic interbeds between the basalt flows.

In 1981, the first known serious oil and gas exploration attempt to drill deeply into or through the basalts of northern Idaho was begun. Located just northwest of Nez Perce, Lewis County, the test well was drilled by Gascome Oils, Inc., of Calgary, Alberta. The company has previously conducted seismic exploration in the area. Drilling began December 10, and ended in the Spring of 1982. Although the hole was dry to its total depth of 5,867 feet, it will provide valuable information for any future exploration.

PHOSPHATE STUDY UPDATE

The $250,000 federally funded 2½-year study to evaluate phosphate resources in southeastern Idaho was completed in August 1982. Maps of phosphate resources were compiled by the Idaho Bureau of Mines and Geology under a contract with the U. S. Geological Survey's Conservation Division (now the Minerals Management Service). The phosphate study was featured in the Spring 1980 issue of the *Gem State Geological Review*.

Twelve 7½-minute quadrangles covering a part of southeastern Idaho were used for compiling the phosphate resources of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation. A map set and a geologic report were prepared for each of the following quadrangles: Diamond Flat, Dry Valley, Fossil Canyon, Harrington Peak, Henry, Johnson Creek, Meade Peak, Sage Valley, Snowdrift Mountain, Stewart Flat, Upper Valley, and Wayan East.

These maps and reports should be useful to those interested in phosphate and other mineral resources in this area of southeast Idaho. In addition to phosphate, the Meade Peak Member contains 0.01 to 0.02 percent uranium in the thicker, rich phosphatic beds. Several other elements—arsenic, cadmium, chromium, copper, molybdenum, nickel, antimony, selenium, vanadium, zinc, and possibly silver—occur in the organic fraction of the phosphorite.

The map set for each quadrangle consists of three sheets. Sheet 1 displays on a topographic base selected geology, the structure contours of the top of the Meade Peak Member, the locations of drill holes and trenches used to derive resource tonnage values, and the open-pit phosphate mines. Sheet 2 plots on a township and range base selected geology, the identified phosphate resources, overburden isopachs on top of the Meade Peak Member, the locations of drill holes and trenches, and the open-pit phosphate mines. Sheet 3 shows another grouping of the mineral information on a township and range base: the outcrop of the Meade Peak Member, identified phosphate resources, overburden isopachs, phosphate and surface ownership, federal and state leases, patented phosphate claims, Preference Right Lease Applications (PRLAs), Known Phosphate Leasing Areas (KPLAs), and open-pit phosphate mines.

Phosphate resources were computed for phosphate rock containing 16 or more percent P_2O_5 within the upper and lower phosphate units of the Meade Peak Member. The resources are identified according to three categories of overburden thickness: 0 to 300 feet, 300 to 600 feet, and 600 to 1,500 feet.

Resource blocks were constructed to calculate the amount of resource within the three overburden categories. Each resource block outlines an area of the phosphate-bearing unit that is structurally consistent. The area of each block on the map was measured with an electronic graphics calculator and then multiplied by the secant of the average dip of the Meade Peak to get the true area of the inclined unit. The true area multiplied by the cumulative average thickness of the upper and lower phosphate units of the Meade Peak gives the volume of phosphate resource. To convert the volume of phosphate resource into short tons, an average phosphate-rock density factor of 0.0787 short tons per cubic foot was applied. Resource tonnages for each category of overburden thickness were then totalled and listed for each quadrangle.

The phosphate project was under the general supervision of Bill Bonnichsen, supervisor of IBMG's Mineral Resources and Engineering Section, and Peter Oberlindacher of the Minerals Management Service. The project director, until March 1982, was Pamela Derkey, senior geologist, who did much of the planning and organization after the contract was awarded. In addition to working on the geologic interpretations and map constructions for many of the quadrangles, Derkey researched and wrote the geologic reports for eleven of the twelve map sets. Pamela Palmer, who became project director in March, compiled the geologic maps and identified resource blocks for all the quadrangles. Palmer also worked on geologic interpretations for several quadrangles. David Taylor, senior draftsman, planned the layout of the sheets and did much of the extensive drafting on scribe coat. Gibb Johnson, who replaced Taylor in the fall of 1981, is completing the drafting and final photographic work.

The full-time staff was assisted by numerous part-time geologic aides, many of whom were University of Idaho graduate students in geology. Warren Barrash, Ken Paul, and Bea Johnston assisted in interpreting the geology and constructing structure contour and overburden isopach maps for several of the quadrangles. Nancy Wotruba and Alexandra Zemanek compiled the ownership, lease, mining claims, PRLA, and KPLA data. They also, along with Mahasti Fakourbayat, interpreted the drill hole and trench logs to determine the thickness of phosphate rock for calculation of resource tonnages. Margie Lane, Susan Cooper, Peggy Keller, and Pamela Peterson provided various support services.

NEW FACES AT IBMG

In June 1981, **Elizabeth Harmon** came to work for the Idaho Bureau of Mines and Geology as a Senior Clerk in the Administrative Support Section replacing Pam Peterson. Before joining IBMG Elizabeth was employed by the Lewiston School District and the North Central District Health Department in Lewiston.

Her principal duties are handling the sales of IBMG publications and U. S. Geological Survey topographic maps. Elizabeth graduated from Lewis and Clark State College with a degree in bookkeeping in May 1979. Her hobbies include drawing and she recently designed the cover illustration for the bureau's 1982 publications list. She was born in Idaho and has lived most of her life in the Idaho, Nezperce, Latah county area.

Also in June 1981, **Susan Smith** began working for IBMG's Administrative Support Section as a temporary employee. Her position was made permanent in May 1982 when the secretary's position, held vacant since September 1980, was reopened and then reclassified to that of general typist. Susan's main duties are bookkeeping and typing. She has spent most of her life in the Northwest and has chosen to locate in Moscow, where she lives with her husband and two small children and enjoys the close proximity to the area's year-round outdoor recreation.

Surficial Geologic Maps for Idaho

Statewide geologic mapping continues at the Idaho Bureau of Mines and Geology with the recent release of three maps detailing surficial geology in parts of the state. The areas mapped cover the Idaho part of the Baker, Grangeville, and Pullman 1° × 2° AMS quadrangles, scale 1:250,000. The author of these three maps is Kurt L. Othberg, senior geologist with IBMG. The maps are the first products of the new *Surficial Geology Map Series*, planned and developed by Othberg and Roy M. Breckenridge, supervisor of the Environmental Geology Section.

The *Surficial Geology Map Series* is an outgrowth of a cooperative project with the U. S. Geological Survey to compile maps of Quaternary deposits nationwide. The IBMG geologists found in working on Idaho that few Quaternary studies and surficial geologic maps had been published for the state. They realized that considerable original mapping was necessary to produce maps with enough detail for statewide use. The idea of a series of Quaternary geologic maps for Idaho evolved naturally as the lack of this information became more apparent. The surficial geology will eventually be prepared for all twenty 1° × 2° quadrangles covering the state. The *Series* is not intended to be restricted, however, to only the 1:250,000-scale quadrangles but may include maps at larger scales.

Units portrayed on the maps emphasize texture, lithology, and geomorphic setting. Deposits of streams, glaciers, landslides, and wind are shown on the maps. Bedrock is mapped only where surface deposits are virtually absent, and large areas of glaciated bedrock are shown as a complex of glacial deposits and ice-scoured rock.

A major difference between these maps and more traditional geologic maps is that large expanses of many uplands and mountains are mapped according to the accumulations of residuum and colluvium on the surface of the bedrock.

The emphasis on surficial deposits, or regolith, makes the maps valuable to engineering geology, hydrology, geomorphology, soils, agriculture, and Quaternary and environmental geology. The information on the maps is directly applicable to the management of farm and timber land, the planning and construction of highways, pipelines, and commercial and residential buildings, the study of surface and ground water, and the evaluation of waste disposal. Surficial deposits are widely used by the mineral industries as construction materials and as mineable placers for precious metals and gems. The maps will also benefit the assessment of geologic hazards such as landslides and other ground failures, earthquakes, and floods.

Mining Sites

(continued from page 1)

gram came from four major resource managing agencies: U. S. Bureau of Mines, U. S. Geological Survey, U. S. Forest Service, and U. S. Bureau of Land Management.

Each map accompanies a book that lists the names of the mineral properties, the corresponding CRIB and MILS reference numbers, the commodities at each property, a bibliographic citation for each property, a list of commodities for each map, and a separate alphabetical list of all mineral property names on the map. The twenty 1° × 2° quadrangles and an alphabetical index to the *Series* are now available (see *IBMG Releases Latest Studies* for the listing and prices).

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