Idaho’s Mineral Frontiers

By

E. F. COOK

State of Idaho
ROBERT E. SMYLIE, Governor
Idaho Bureau of Mines and Geology
E. F. COOK, Director
IDAHO'S MINERAL FRONTIERS

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IDAHO BUREAU OF MINES AND GEOLOGY
MOSCOW, IDAHO
FOREWORD

Originally prepared as a talk, this summary of current activities in Idaho's mineral industry and my estimate of what the future may hold for mineral development in Idaho appears as a publication at the suggestion of Governor Smylie, who writes "Would not an annual review of this sort prepared by yourself be useful to the industry and others...?"

I hope this review will be helpful, as a picture of the present and a window to the future, and that it may momentarily draw the mining reader from preoccupation with his problems to consideration of his opportunities. In recent years the miner has felt more the slings and arrows of Dame Fortune than her smile; but he has a hardy optimism, and while warning his sons away from the industry and his daughters from those who engage in it, the miner continues to hope and plan. I trust what he will find herein may cause the flame of his hope to burn a little brighter.

E. F. COOK, Director
Idaho Bureau of Mines and Geology
Symbol of the Idaho mineral industry's confidence in the future, the new Mines Building on the University of Idaho campus is now in use. The industry raised more than a quarter of a million dollars to match a state appropriation for the building.
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STATUS OF THE MINERAL INDUSTRY IN IDAHO

Production

The value of mineral production in Idaho dropped from $70 million in 1959 to $56 million in 1960, mainly because of a prolonged strike in the Coeur d'Alene district. Permanent closure of the Blackbird mine in Lemhi County and lower production of all non-metals except phosphate rock also helped reduce the State's mineral income. The principal decreases were in lead, silver, zinc, copper, and cobalt.

In this centennial year (1961) of the Idaho mining industry we see a nonmetallic mineral, phosphate, for the first time in a position of equality among the metals. During these first hundred years metals have dominated mineral production statistics in the Gem State to an extent greater than in most other states. In fact, Idaho is now one of only 5 states in the Union that derive the bulk of their mineral production from metals.

The four leading mineral commodities in Idaho in 1960 were silver ($11.8 million), phosphate rock ($9.8 million), zinc ($9.6 million), and lead ($9.5 million), in that order. Incidentally, a good case could be made for the proposition that phosphate rock is now Idaho's leading mineral commodity. Whereas value of metallic production is calculated on the basis of the price of the extracted, purified metal contained in the ore and thus includes the cost of processing and refining, the value of phosphate rock is calculated for the raw rock as it leaves the mine, and does not represent the value of the finished products (elemental phosphorus and fertilizer) made from the rock. It would not be unreasonable to estimate the value of phosphate in Idaho, calculated on the same basis as the metallic production at $20 million, or double the figure recorded in the 1960 statistics. Nonmetallic minerals like phosphate, sand and gravel, and pumice made up about 35 percent of the total production value, up from only 23 percent in 1958. Phosphate climaxed a spectacular rise that has seen production increase 18-fold since 1945. Gold, the discovery of which started the Idaho mining industry, now accounts for less than one-half cent of each dollar of mineral wealth produced in the State.

Although we may think of the bonanza days of Idaho's mining industry as those years around the turn of the century, more than half of the State's mineral production has come from the ground since 1938. Even the depressed production of 1960 exceeded in value that of 85 of the first hundred years. Until 1947 mineral production in Idaho had surpassed $56 million only once, in 1943. Incidentally, the total raw material value of minerals mined in the 11 Western States, Hawaii, and Alaska increased 655% in the score of years from 1939 to 1959.

A bright spot in the State's metal picture for 1960 was a 60 percent increase in iron ore shipments—to 8,807 long tons. Production went to an eastern Washington cement plant and to several steel plants in Oregon and Washington.
Of the 30 million ounces of silver produced in the United States during 1960, 13 million ounces came from Idaho, most of that from the Sunshine and Lucky Friday mines.

Of 14 states reporting mine production of uranium in 1960 Idaho placed 9th—after South Dakota, and ahead of Montana, Nevada, Alaska, Oregon, and California. Value of production cannot be revealed, but it increased over the previous year.

Development

Most of the dollars invested in new mineral facilities in Idaho during 1960 went into nonmetallics.

The clay beneficiation plant of the J. R. Simplot Company at Bovill in Latah County, representing an investment of $2 million, began to produce glass sand in February 1960. The clay section of the plant began test operations in October and commercial production of paper clay is expected to begin this summer.

In July, 1960 the same company announced a multimillion dollar expansion program that will double the capacity of its Pocatello phosphate fertilizer plant, making that plant the biggest producer of phosphate fertilizer this side of Florida. Simplot has purchased the Anaconda Company's fertilizer plant near Anaconda and will move it to Pocatello this summer. The plant will produce ammonium phosphate, a fertilizer widely used in the Pacific Northwest but never before manufactured here. The Simplot Company had already doubled the productive capacity of the Pocatello plant with a $2 million expansion program completed in 1959. The plant from Anaconda is expected to be in operation in September.

Also at Pocatello, Food Machinery and Chemical Corporation has started a $2.5 million expansion program at its elemental phosphorus plant.

In June, 1960, the Bunker Hill Company completed construction of a $2 million plant at Kellogg to produce phosphoric acid for fertilizer use; first shipment was made in February of this year. Sulphuric acid used in the process will be supplied from the company's plant which produced sulphuric acid as a byproduct of smelting operations. Phosphate rock used in the manufacture of phosphoric acid is shipped from southern Idaho by the San Francisco Chemical Company which opened its Diamond Gulch mine near Montpelier in May, 1960. Expansion of Bunker Hill's sulphuric acid plant, at an estimated cost of $5 million, is under consideration; the contemplated expansion would increase capacity by over 60 percent, to almost 200,000 tons of acid annually.

A new phosphate processing plant with a capacity of 150 tons a day has been placed in operation at Soda Springs by Valley Nitrogen Products, a California fertilizer manufacturer.
Monsanto Chemical Company at Soda Springs has an expansion plan on the drafting board and Central Farmers Fertilizer Company at Georgetown has an expansion program under way that will exceed $2 million in cost.

A newly discovered perlite deposit northwest of Malad in southeast Idaho, estimated to contain 6 million tons, was developed in 1960 by Oneida Perlite Corporation. The company constructed an expanding plant at Malad and in November began processing crushed ore from the mine.

Not all of the new developments are in the nonmetallics field, however. The Bunker Hill is starting a 5-year accelerated development program at its mine; most of the new development will be easterly and northerly from existing Bunker Hill workings, which extend down more than one mile beneath the surface to approximately 1400 feet below sea level and total more than 100 miles in length.

In the Sunshine mine a body of silver ore disclosed by diamond drilling is being developed on the 4000-foot level. A new sandfill system will be in operation by the end of this year.

Automatic sandfilling systems will be in operation shortly at both the Lucky Friday and Bunker Hill mines. The system involves pumping mill tailings called "sand" into the mine to fill abandoned stopes and other workings, a less expensive method than breaking and handling waste rock for fill. The Lucky Friday system practically automates the job of pumping "sand" to the stopes. By punching buttons on a small portable control board in the stope, one man starts and stops the sand flow, flushes and cleans the system, and regulates the mill tailing pump. Lights on the board tell the capacity of a sand storage tank on the main adit level of the mine. With this new remote control innovation, backfilling of horizontal cut and fill stopes in the Lucky Friday silver-lead mine is done more quickly and efficiently than ever before.

Sand filling of stopes became possible at the Lucky Friday when their new 500-ton mill was completed in February 1960. This assured a ready source of classified mill tailing that could be placed faster and cheaper than other materials, and made a tighter fill.

A large new hoist, being installed in the Lucky Friday, will allow increased production and exploration of adjoining ground from the lower levels of the mine.

Research and exploration

Over the years the mining industry has reinvested a niggardly fraction of its earnings in research and it has been only too ready to stop looking for new deposits and cut exploration staffs at the first cold wind of economic recession.
Today the industry is paying for its lack of foresight. The consumption of metals in this country has not kept up with the growth of the economy. Traditional metal markets have been invaded and captured by substitute materials. In most cases these substitute materials were developed through research and specifically designed to replace metals. Now we see within the industry a growing emphasis on research, to develop new uses for old metals like lead, zinc, and copper.

Both government and industry are increasing research efforts to find and develop structural materials, almost all of mineral origin, with which to build reactors, space vehicles, missiles, and a great variety of new objects and machines. The industrial minerals people, plagued, not by foreign competition and substitute materials, but by high freight costs and varying market specifications, are also putting a great effort into processing research and market analysis.

I shall briefly mention some of the current research or exploration programs that affect or may affect Idaho.

The Lead Industries Associations and the American Zinc Institute jointly sponsor many research projects, hoping to develop new uses and consequent greater demand for lead and zinc. Results to date are good. Some new, practical uses for these metals have been developed, but so far none of these new uses appears to give promise of greatly expanding the market for either lead or zinc.

The phosphate companies are engaged in unremitting research effort to develop an economical way of upgrading Idaho's submarginal phosphate rock. Should this effort be successful, minable phosphate reserves would be increased by many millions of tons overnight.

Interest grows daily in the iron-ore possibilities of Idaho. Only a little more than 100 miles from Idaho, at Atlantic City, Wyoming, a big new iron mine is being opened by U. S. Steel at a development cost of $73 million. The iron formation at Atlantic City is a taconite, a hard, low-grade iron ore similar to the magnetic taconites of the eastern Mesabi Range in Minnesota.

Based on recent technologic developments, two new steel plants will soon be built near Idaho. At Anaconda a plant to produce steel from copper smelter slag is to be constructed this year. At Kimberley, British Columbia, a steel plant will use the millions of tons of pyrite-rich tailings from the mill at the Sullivan lead-zinc mine.

Columbia-Geneva Steel Division of U. S. Steel recently dedicated a new $1.5 million research laboratory at Provo, Utah. The research center will study western iron ores, coal, coke, and various beneficiation processes.
In Idaho private companies are testing and developing iron deposits in Lemhi, Custer, Washington, and Latah Counties. The U. S. Bureau of Mines and the Idaho Bureau of Mines and Geology, under a cooperative agreement, are conducting during the coming year an extensive study of iron-ore resources in Idaho and the economic factors affecting the establishment of an iron-ore industry in the State. State agencies in Montana, Washington, and Nevada also have iron-ore resource investigations under way.

The Anaconda Mining Company continues pilot-plant research on high-alumina clay from Latah County, as a possible new source of aluminum.

The Federal Bureau of Mines and the Idaho Bureau of Mines and Geology in 1960 reported discovery of widespread beryllium occurrences in the Sawtooth Mountains and in the Yellowjacket Mountains 15 miles west of Cobalt. Beryllium metal is being used for special applications in nuclear energy, aircraft, missiles, and space vehicles. The Federal and State Bureaus are intensifying the beryllium search this summer by continued reconnaissance and sampling in the central part of the State and a special mapping and sampling program in the Sawtooth Mountains.

During 1960, research was conducted under a cooperative agreement between Porter Brothers Corporation and the Federal Bureau of Mines to develop a commercial process for treating the columbium-tantalum concentrates from the dredges in Bear Valley in Valley County. Should the research prove successful the two-boat dredging operation and the concentration plant at Lowman would be reactivated.

Exploration and testing of thorium properties in Lemhi County continued in 1960. Nuclear Fuels and Rare Metals Corporation mined several hundred tons of ore from a property near Tendoy and ran mill tests on it. Rare Metals Corporation of America explored properties leased in 1959 from Agency Creek Thorium and Rare Metals Corporation. The AEC research program for utilization of thorium as a nuclear fuel continued to gain impetus with the construction of test reactors to produce additional scientific and engineering data.

Exploratory work was resumed in 1960 by Salmon River Scheelite Corporation at its tungsten mine on Thompson Creek near Clayton.

Considerable interest is manifest in vanadium, not only in the possibility of producing that metal from phosphate rock but from other possible sources. Domestic mines established a record for production of vanadium in 1960 and consumption was up 8 percent over the previous year. It has been seriously proposed to recover vanadium from vanadium-bearing slags produced at the elemental phosphorus plants at Pocatello and Soda Springs.
Continued efforts are being made to profitably extract fluorine from the products of phosphate fertilizer plants. Fluorine consumption in the United States is steadily increasing.

Increased use of Idaho's volcanic construction materials may be the result of tests now being conducted by Boise-Cascade Concrete, a subsidiary of Boise Cascade Corporation, on pumice from 260 acres of claims near Fairfield in Camas County recently optioned by the company. This summer the Idaho Bureau of Mines and Geology initiates a long-range field and laboratory study of Idaho's volcanic construction materials such as pumice, perlite, volcanic ash, tuff, and lava rock.

WHAT THE FUTURE MAY HOLD

Silver and gold

Silver is now Idaho's leading mineral commodity. With resumption of full-scale operations at the Bunker Hill and Galena mines and increasing production at the Lucky Friday mine, silver in 1961 should set a new record of about $16 million dollars. Not only is new silver-bearing ore being found in the Coeur d'Alene district, but it is probable that the price of silver will advance within the next year or two. For many years, the U. S. Treasury has been obliged by the Silver Purchase Act to buy all domestically mined silver offered to it at a price above the world market. In recent years, however, the world price has risen to, and even exceeded the U. S. "support price" of 90 1/2 cents a troy ounce. Now the Treasury is selling its "free" silver stock—that which is not legally required as backing for silver certificates—on the open market at 91 cents, thus keeping the price from rising. Treasury personnel point out that such sales "stabilize" the market. They certainly do, but to the advantage of the silver consumer who otherwise would have to pay more for his silver, and to the disadvantage of the silver producer, who otherwise would receive more for the silver he sells.

Statistically, the silver picture is not complex. Free World silver production in 1960 was about 205,000,000 ounces; Free World consumption was 320,000,000 ounces! United States production was about 30,000,000 ounces in 1960; imports were estimated at 36,000,000 ounces. Mine production and imports totalled 66,000,000 ounces. Silver consumed in the arts and industries of the United States was estimated at 100,000,000, exceeding production plus imports by 34,000,000 ounces. The extra 34 million ounces came from the Treasury, whose silver stocks declined almost 68 million ounces during the year, because of sales to industry and subsidiary coinage requirements. The Treasury's stock of silver which can be sold is now down to 94 million ounces and is dropping at the rate of about half a million ounces daily. In other words, a six-month supply remains.
Because United States and world consumption of silver for industrial purposes and coinage is expected to continue to exceed world production by a substantial margin, and in view of the fact that the Treasury’s free silver stock is dwindling fast, a rise in the price of silver appears inevitable. When this rise occurs, substantial tonnages of silver-bearing rock, now bypassed in mining, can be mined: not only will the value of silver production rise but also the quantity produced should increase.

The outlook for gold is not as rosy. The present Administration is dead set against either (1) a rise in the price of gold or (2) a two-price system, such as we had for a number of years in silver—a higher price for domestically produced gold than for foreign gold. Indeed, this Administration wishes to remove gold as a monetary backing for currency. The conclusion is inescapable: if a gold mine can’t operate now at a profit, it won’t be able to in the foreseeable future.

**Lead and zinc**

A free-world oversupply of lead and zinc will probably keep prices at about the present levels for several years to come. Although consumption of both metals decreased in 1960, there is reason to believe that the consumption curve will start up again. It has even been predicted that U.S. consumption of lead and zinc will increase 30 percent in the next three years; although much of this increase will be supplied from foreign sources, prices should rise, giving a boost to Idaho mining. An increase of just one cent in both metals would add more than $2 1/4 million to Idaho’s mineral income!

**The rarer metals**

Idaho has substantial reserves of columbium, tantalum, thorium, cobalt, titanium, zirconium, the rare earth metals, and possibly of uranium and beryllium. The future in any one of these is difficult to predict, depending as it does on technologic developments and the security needs of the Nation. In the long run, however, production from within this group of metals will be substantial. The time scale is the unknown factor. It has been predicted by a scientist at Battelle Institute that within 100 years as much thorium will have been used for nuclear fuel as uranium; but when such use will start on a commercial scale he didn’t predict. Beryllium has as great commercial potential as thorium.

Outlook for tungsten is not as bad as it appeared when the government buying program was abruptly suspended several years ago. New uses, especially in high temperature applications, will hold consumption at a high level and keep present prices firm. Idaho has a lot of tungsten still in its hills; within a few years, tungsten should reappear in our mineral statistics.
The industrial and agricultural minerals

Nonmetallic mineral production in the Western States has increased phenomenally in the past 20 years. In addition, iron ore, classed as an industrial mineral although not a nonmetallic, increased its production rate in the West from 1 million to 10 million tons a year within the same time span. Continued population growth and industrial expansion in the West assure an upward trend in the production of agricultural and industrial minerals.

There is no plateau in sight for western phosphate production. Although the rapid rate of growth of the past 15 years will be slowed because of economic problems involved in opening new deposits (the high-grade, shallow deposits are all being mined now), I look for continued increases in annual production during the next ten years, as more fertilizer is used in the northwest and as the population grows in the northwest. Technologic advances in upgrading phosphatic shales and in economic recovery of vanadium, fluorine, and uranium from phosphate rock might send the production curve up at a steeper angle.

Clay production for paper and ceramic manufacture, for refractories, and for the aluminum industry is potentially the fastest-growing mineral industry in Idaho. Glass sand, mica, and feldspar are salable by-products of such clay production.

The use of volcanic materials, of which Idaho has abundant reserves, for construction, offers great possibilities for development of new industry. Important in any analysis of the commercial potential of such materials are: (1) a study of the markets, present and future, and (2) extensive sampling and laboratory testing of the materials to determine their physical and chemical characteristics. In the study of volcanic materials that the Idaho Bureau of Mines and Geology is starting this summer, we intend to test light-weight aggregate material such as pumice by measuring the weight, strength, porosity, permeability, and heat resistance of test blocks made with it; to run expansion tests on perlite and measure its insulation and aggregate characteristics; to try to economically put a protective glaze or coating on blocks of the soft but strong volcanic tuff that in early years was used in buildings in southeast Idaho. We intend to gather information from Mexico where both tuff and lava rock have been used as construction materials for hundreds of years; some of the early Spanish aqueducts made of volcanic tuff are still in use and the modern new buildings of the University of Mexico have made striking use of lava rock.

Agriculture increasingly needs mineral products; not only the mineral fertilizers like phosphate and potash; but soil conditioners like limestone and gypsum; and sources of metals like zinc and cobalt that are necessary, in trace amounts, for proper plant growth. Some Idaho soils have already become depleted in these "trace elements"; there is a need to look for economical sources of them.
Idaho's iron-ore potential now is impossible to predict, except that the production of this vital industrial material is certain to grow rapidly in the West in the next few years and Idaho will share in that growth, to an extent determined more by the size and nature of our iron deposits than by their location.

Oil and gas

Will oil ever be found in Idaho? The question, of course, can't be answered yes or no. After many years of exploratory effort, oil geologists have become somewhat discouraged about Idaho's oil prospects. But the status of oil exploration in Idaho was put in proper focus in an article in the authoritative Oil and Gas Journal in March of this year. After reviewing the drilling history derived from our records in Moscow, the author of the article pointed out that Idaho is still virtually untested for oil and gas.

The search has been long (the first test well was drilled in 1903 in Teton County) and fairly continuous. A big play occurred in 1955 in the southwestern part of the state; 9 wells were drilled that year and 4 in 1956. Small amounts of gas were found but none were long-lived. Since 1956, only a few wells have been attempted and last year only one wildcat was drilled. The state has had but 67 wells in 57 years. The average depth of these holes was only 2,594 feet. For all practical purposes, Idaho has hardly been tested, when one considers the very low well density and the possibility of a sedimentary rock section 20,000-30,000 feet thick in the southeast quarter of the state. The likeliest area is the southeast quarter, about 28,000 square miles in area; yet there have been only 23 tests in that area, for a well density of one test each 1,217 square miles. Only 6 test wells in the entire state have gone below 5,000 feet. (The deepest, incidentally, was a well in Oneida County that went 12,844 feet before being abandoned in February 1951; another deep well in Teton County, reached 12,720 feet in March 1953). The author of the Oil and Gas Journal article not only believes that Idaho will one day join the ranks of oil-producing states, but that helium gas will be found and that Idaho will some day prove to be a good helium reserve.

CONCLUSION

The problems facing Idaho's mineral industry arise (1) from continued competition from foreign metal producers; (2) from uncertainty of technical developments and rate of market expansion in such strategic metals as columbium, tantalum, cobalt, thorium, beryllium, titanium, and zirconium; (3) from the need to upgrade and process low-value, bulky mineral commodities like phosphate and clay in order to produce marketable products and overcome a somewhat unfavorable market location; and (4) from the unpredictability of government actions affecting the industry.

In the face of these problems the Idaho mineral industry is going ahead with expansion and improvement programs unprecedented in its history. In addition, exploration activity is again picking up; for example, Day Mines recently announced that it would double its exploration program in the coming year.
Along with these exploration and development programs, the industry has supported the training of earth scientists and mineral engineers in modern exploration, mining, and processing. The industry, in a time of recession for metal mining, raised more than a quarter of a million dollars to match a state appropriation for a new building for the College of Mines at the University of Idaho. The building is now complete and both the College and the Idaho Bureau of Mines and Geology will move into it this month. The College trains geological, mining, and metallurgical engineers; in addition it has non-engineering curricula in geology and geography. The Bureau is the state agency, not part of the University although housed by it, that is charged with research on Idaho minerals, with the aim of promoting their orderly, efficient, and complete utilization.

The need for more research in the earth sciences and minerals engineering is becoming more widely realized. Glenn Seaborg, Chairman of the U. S. Atomic Energy Commission, in a speech in March of this year said:

"Great discoveries in geology, oceanography, metallurgy... must be made if our wants are to be met in the face of diminishing supplies of rich pockets of raw materials."

Some of our mineral needs may be supplied from the ocean, but most will have to continue to be supplied from the land areas of the globe.

The future of Idaho's mineral economy consists of three elements:

1. the industrial and agricultural minerals, production of which will grow steadily but not spectacularly, as an increasing population in the West provides an expanded market;

2. the rare or strategic metals, the future in any one of which is difficult to predict; in the long run, production in this group can only go up, and in any one of these metals it may skyrocket, given a technologic breakthrough or a sudden need; and, finally,

3. the backbone of Idaho's mineral industry, the Big Three: silver, lead, and zinc, production of which will certainly increase this year, and should gradually increase over the next few years, led by silver.

The Idaho mineral industry is looking forward, not back. New mineral deposits are being found, new processes for extracting and processing mineral commodities are being developed. The application of increasing amounts of scientific and technical know-how to problems of mineral exploration, mining methods, mineral processing, uses of metals and minerals, and market analysis will keep the mining industry one of the major segments of Idaho's economy.
### VALUE OF IDAHO’S MINERAL PRODUCTION, 1860-1960

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<th>Commodity</th>
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<th>1960 preliminary values</th>
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<td>Zinc</td>
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<td>Others and values included in 1/</td>
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Totals $2,467,787,000 $55,769,000

1/ Figure withheld to avoid disclosing individual company confidential data.

2/ Includes estimate of $12.7 million for 1861-2