A SURVEY OF THE MINERAL RESOURCES
OF IDAHO
(With Map)

by
Charles R. Hubbard

IDAHO BUREAU OF MINES AND GEOLOGY
MOSCOW, IDAHO
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<td>Mineral Resources Map of Idaho</td>
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A SURVEY OF THE MINERAL RESOURCES OF IDAHO

By
Charles R. Hubbard

INTRODUCTION

Captain E. D. Pierce started Idaho on the way to mining fame when he discovered gold in 1860 near what became the town of Pierce in Clearwater County. Since that time the discovery and development of the vast mineral wealth of Idaho has been a dominating factor in the early settlement and the later economic progress of the state. The first settlers were principally prospectors attracted to the rich gold placer fields that were found in rapid succession after 1860. Until 1870, placer mining was Idaho's chief industry. Between 1862 and 1870 more than 2,500,000 ounces of gold valued at more than $50,000,000 came from Idaho diggings.

The state's mineral industry continued to expand after 1870 with the development of lode mining. At first it was the gold-silver deposits that were developed. Later, in Blaine and Shoshone Counties, the lead-silver and lead-zinc orebodies gained in productiveness until, about the turn of the century, lead became the most valuable. Zinc was a late arrival in importance but it gained rapidly during the two world wars and has occasionally exceeded lead in value of annual output. Silver recently has made a tremendous comeback in the state, mostly because of the success of one company in developing the most productive silver mine in the United States.

While it was the metals that attracted first attention, the industrial minerals have now become significant in Idaho. A prime example is phosphate rock, which has gained a leading position in the last 5 years. Idaho has tremendous known reserves of phosphate rock, and the large capital investments which have been made in plants and equipment indicate a substantial future industry.

Figures in the United States Bureau of Mines Minerals Yearbook (1951) show Idaho's position among the states in value of minerals. In 1951, Idaho, with a total mineral production valued at $82,793,000, ranked 27th among the 48 states. This figure includes mineral fuels (gas, oil, and coal), which are the chief mineral products of many of the states ranking above Idaho. Idaho produced none of these in 1951. On the basis of metallic minerals alone, Idaho ranked 8th in the United States with an output in 1951 valued at $75,079,000. Combining metallic and industrial minerals but excluding mineral fuels, Idaho ranked 17th. The state was first in silver and second in lead and zinc in the United States in 1951.

Furthermore, Idaho has provided quantities of strategic minerals which have been of inestimable value in the emergencies of World Wars I and II. Its tungsten, mica, and antimony were vital to the war effort. It shares vigorously with other western states the current search for radioactive minerals. Idaho potentially is among the first in the nation in importance of its mineral resources to the national economy.
FOREWORD

Continued interest in Idaho's great reserves of undeveloped mineral resources has exhausted the original printing of this Pamphlet, which is a compilation of information on the location and economic potential of the State's mineral deposits.

Although considerable new information has become available since 1955, it was decided to reprint rather than revise Mr. Hubbard's work. Pamphlet 105 and the later publications of this Bureau, reviewed together, will give a good picture of the present state of our knowledge of Idaho's mineral resources.

E. F. Cook, Director
Idaho Bureau of Mines & Geology
OUTLINE MAP OF PRINCIPAL MINERAL PRODUCING AREAS IN IDAHO
This pamphlet (with map) describing the mineral resources of Idaho has been prepared to acquaint the public with some of the historical background, the location, and the production of the known principal mineral deposits in the state. Its publication stems from the policy of the Idaho Bureau of Mines and Geology—as outlined by the Director in his annual report for 1954-55—of making information about Idaho's mineral wealth available and useful to all the people of the state.

ANTIMONY

History and Production (3, 4, 10, 11, 14)*

Antimony has long been recognized as an accessory metal in the silver-lead, the gold-silver, and the lead-zinc ores of Idaho but little effort has been made to recover it until recently.

The Sunshine Mining Company obtains antimony as a byproduct from its copper-silver-antimony concentrates at an electrolytic plant near Kellogg. This plant was reopened in 1953 after having been closed since 1944, the reason for resuming operations having been to reduce the charges of smelter penalties for excessive antimony.

Also, the Bunker Hill and Sullivan Mining and Concentrating Company formerly secured antimony-bearing lead as a byproduct of the smelting operations pursued to beneficiate ores from the Coeur d'Alene mining district.

In recent years, when the price of antimony has been favorable, Idaho has been the leading producer in the United States. Most of the output came from the gold-antimony-tungsten property of the Bradley Mining Company at Stibnite, Valley County, Idaho.

The earlier production of antimony in Idaho has been derived chiefly from deposits along Pine Creek in Shoshone County. Here the greatest activity was during the First World War years of 1914-18 when the high price of antimony stimulated abnormal discovery and exploitation. Total production of antimony up to 1920 is reported as more than 1,000 tons valued at $50,000, although early records are incomplete.

Almost all of the antimony deposits were discovered by prospectors seeking gold, silver, or lead. The veins along Pine Creek were found before 1885. The antimony and mercury deposits of the Yellow Pine district, Valley County, were revealed during the Thunder Mountain gold rush about 1900 but very little interest was taken in their development or exploitation until about 1932. The first deposits on Sevanholm Creek in Elmore County were located by gold seekers during the discovery of gold-silver lodes in the Atlanta and Rocky Bar districts between 1870 and 1880. However, the first mining development and production of antimony materials in Elmore County did not take place until 1947.

*Numbers in parentheses refer to bibliographic listings at end of paper.
(3, 4) TABLE 1 - Recorded annual production of antimony - Idaho - 1932-52

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
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<td>414</td>
<td>45,540</td>
<td>1944 (a)</td>
<td>1,680</td>
<td>532,906</td>
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<tr>
<td>1933</td>
<td>587</td>
<td>76,310</td>
<td>1945</td>
<td>1,872</td>
<td>545,334</td>
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<tr>
<td>1934</td>
<td>404</td>
<td>71,912</td>
<td>1946</td>
<td>2,455</td>
<td>784,489</td>
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<tr>
<td>1935 (a)</td>
<td>40</td>
<td>10,880</td>
<td>1947</td>
<td>5,187</td>
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<td>1936</td>
<td>729</td>
<td>177,875</td>
<td>1948</td>
<td>6,035</td>
<td>4,294,790</td>
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<tr>
<td>1937</td>
<td>754</td>
<td>280,724</td>
<td>1949 (a)</td>
<td>1,436</td>
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<td>1938 (a)</td>
<td>390</td>
<td>95,940</td>
<td>1950 (a)</td>
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<td>1939</td>
<td>209</td>
<td>51,414</td>
<td>1951 (a)</td>
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<td>1,459,200 (a)</td>
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<td>1940</td>
<td>302</td>
<td>84,560</td>
<td>1952</td>
<td>1,900</td>
<td>1,600,000 (a)</td>
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<tr>
<td>1941</td>
<td>655</td>
<td>183,400</td>
<td>1863-1952</td>
<td>44,000</td>
<td>18,918,180</td>
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<tr>
<td>1942</td>
<td>2,715</td>
<td>841,650</td>
<td>1943</td>
<td>5,291</td>
<td>1,663,458</td>
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</table>

(a) Estimated.

Location and Description of Deposits (10, 11, 12, 13, 14, 15)

An important source of antimony metal is the mineral tetrahedrite, which is essentially a copper antimony sulfide containing varying amounts of iron, zinc, arsenic, and silver. Tetrahedrite commonly is a vein mineral, and it is often associated with other copper, lead, and zinc minerals in the Coeur d'Alene district and in other parts of Idaho.

Although tetrahedrite is of consequence, Stibnite (Sb₂S₃), an antimony sulfide, is the principal ore mineral of antimony. Stibnite occurs in veins of economic value near Kingston, Shoshone County, in the Pine Creek area, in T. 48 N., R. 1 and 2 E. The veins contain stibnite, gold, pyrite, and arsenopyrite.

The most productive antimony deposits in Idaho occur in the Yellow Pine district of central Valley County. The ore mineral, stibnite, occurs associated with gold, pyrite, and arsenopyrite in veins and as disseminated deposits in more or less altered granodiorite-aplite country rock. Productive deposits are located in T. 18 N., R. 8 E. and T. 19 N., R. 8 and 9 E., Valley County.

The most recent exploitation of antimony deposits, the Hermada deposit, is on the East Fork of Sevanholm Creek in Section 13, T. 6 N., R. 9 E., Elmore County, 20 miles west of Atlanta. High-grade stibnite ore was discovered here in 1947 and the total production from 1947 through 1950 was 5,000 tons of ore containing 640 tons of antimony metal. The ore occurs in quartz-filled fissure veins with almost no precious metals and very minor amounts of other sulfides.

Antimony deposits in which stibnite is the chief ore mineral occur also in Owyhee, Boise, Blaine, Custer, Idaho, and Lemhi Counties, but they are of doubtful commercial value at this time.

Uses (3)

Antimony is used principally in alloys of lead and tin-base alloys. These alloys containing antimony are used for ammunition,
batteries, type metal, bearing metal, cable coverings, collapsible tubes and foil, and solder.

Compounds of antimony are used in fire-retardant paints, flame-proofed fabrics, medicine, ceramic materials, plastics, and rubber.

Reserves and Potential (5, 6)

Reserves of antimony-bearing material in Idaho are very large. However, in most cases, the minable reserves depend on the associated minerals and the condition of the market for antimony.

As before noted, the recovery of the metal from copper-silver-antimony concentrates at the Sunshine Mining Company's electrolytic plant is currently being done to reduce smelter penalties for excessive antimony content of the concentrates. The antimony is being stockpiled pending a more favorable market.

The future development and exploitation of antimony deposits in Idaho probably will be contingent on a more favorable market for the metal, and this depends basically on the reduction of foreign imports, development of new uses, and increased consumption by present users.

ASBESTOS

History and Production (7, 45)

Amphibole asbestos has been noted at several localities in Clearwater and Idaho Counties. Since 1909, intermittent operations have produced small amounts of mass fiber amphibole asbestos from deposits in T. 33 N., R. 5 E., Idaho County, about 14 miles southeast of Kamiah. Before 1918 a small but consistent annual output was maintained. During 1925 several small shipments were recorded. The mill that was operated in 1925 had a capacity of 240 tons of ore a day. Apparently there has been little activity since 1925. Amphibole and chrysotile asbestos has been reported from several other localities but little is known about the extent or quality of the deposits.

Location and Description of Deposits (7, 45)

The amphibole asbestos occurring in Idaho County in T. 33 N., R. 5 E. is found as ledges of lenticular shape. There are 6 or more ledges within a few square miles. The largest is about 200 feet in length by 35 feet in thickness. The lenses have been intruded in schist and gneiss. Also in Idaho County, in T. 37 N., R. 1 E. and T. 30 N., R. 4 E. are similar deposits, except that the asbestos is in small seams instead of lenticular masses.

Uses (45)

Asbestos has many uses in the industries and arts. However, the kind and quality are variable and limit each deposit to certain uses. The mass-fiber anthophyllite produced in Idaho County was used for pipe and boiler covering, in wall plaster and paint, and as a binder in cement and asphalts.
Reserves and Potential

The known asbestos deposits have not been exploited extensively and large reserves remain. However, the amphibole asbestos is not adapted to spinning and its use in cements, plasters, wallboard, shingles, and insulation materials makes it a low-priced product competing with more plentiful materials such as gypsum.

BARITE

History and Production (1, 46)

Deposits of barite in Blaine County were noted during the development of the lead-silver lodes in the early years of 1900 and something of the size of the deposits was known by 1906. However, there has been little demand for the mineral in western industry until recently and hence no interest in development of the deposits. Recent use by the oil industry of ground barite for drilling mud has stimulated sales of western barites so that shipments in 1953 in the Northwest exceeded $300,000 in value and were 9 times greater than those in 1950. The J. R. Simplot Company is the only Idaho producer. Its Sun Valley mine is in the deposits along Deer Creek west of Hailey in Blaine County. Mining is intermittent to supply a stockpile at the company processing plant near Pocatello. Mining was resumed in September, 1954, and it was planned to produce 40,000 tons for the stockpile.

Location and Description of Deposits (1, 7, 47)

The Deer Creek barite deposits are west of Hailey in T. 2 N., R. 17 E. The mineral barite (BaSO₄), barium sulfate, is white except where iron-stained from oxidation of pyrite occurring in bands. The lenslike ore body is reported as being 1,000 feet long by 50 feet thick in Pennsylvania quartzites and sandstones. Similar deposits are also reported near Huldoon and smaller occurrences of doubtful value are reported in Custer County.

Uses (3, 6)

Formerly barite was used chiefly to make lithopone, a white pigment composed of 70 per cent barium sulfate and 25 per cent zinc sulfide. Other uses for barite are in rubber, paper, and linoleum manufacture.

Recently the rapidly expanding oil industry has been demanding far more ground barite than any other industry and has created a market in the West for western barite.

Reserves and Potential

The mining of barite in Idaho is about 5 years old. Thus most of the reserves are still undeveloped. The deposits in Blaine County are regarded as large for western deposits and of very high grade.
Production was exceeding the demand in 1955 in this market area. The market area must be broadened or new manufactures and oil drilling must be introduced before an increased production will be profitable.

BERYLLIUM

History and Production (3, 5, 10)

The only commercial source of beryllium is the mineral beryl (Be$_2$Al$_2$Si$_4$O$_{12}$), a beryllium aluminum silicate which, when of good quality, is also the source of gem stones such as emeralds and aquamarines. Impure beryl is rather widely distributed. It occurs chiefly in pegmatites, but also is found in mica schists. Until recently beryl has been produced chiefly as a byproduct of feldspar and mica mining, as its presence is generally in such small amounts that the mining of pegmatites for the beryl content alone was uneconomic. The recent demand for beryllium as a strategic metal has stimulated activity in resurveying the low-grade deposits and studying methods of economic exploitation primarily for the beryl content.

The only beryl production in Idaho has been from the Mica Mountain deposits north of Avon in eastern Latah County. The Muscovite Mine, which has been the chief producer, is reported to have been first worked in 1888. Early production was devoted to mica with no attempt made to save the beryl content of the ore.

The first reported beryl shipment was 125 pounds in 1932. In 1953, the Idaho Beryllium and Mica Company, present operators of the Muscovite Mine, shipped 1,890 pounds of beryl concentrates containing about 10 per cent berylum oxide. One shipment was made in 1954 to the General Services Administration purchase depot at Custer, South Dakota.

Location and Description of Deposits (32)

The Mica Mountain deposits of mica and beryl are located in secs. 15, 22, 23, and 27, T. 51 N., R. 2 W., north of Avon in Latah County.

The beryl and mica are present as constituents of pegmatite dikes which have invaded micaeous schists and gneisses of the Belt series. The pegmatites are found in a belt about one mile wide extending for about 24 miles in a northeast-southwest direction. There are several prospects and old workings along the outcropping.

Uses (3, 32)

One of the most important uses of beryllium is as an alloying agent with copper. Beryllium-copper alloys have important military applications because of their adaptability to heat treatment, high tensile strength, resistance to wear and corrosion, and high conductivity. The demand for beryllium recently has been greater than the supply and government buying depots have been established offering a ready market at premium prices for domestic output.
Reserves and Potential (32)

The beryl content of pegmatites is generally low and mining seldom is profitable unless other economic minerals are produced. While beryl production in Idaho has been confined to Latah County, other pegmatites are known to be widely distributed over the state. However, little has been done to determine their value.

Cadmium

Production (3, 4, 5)

Cadmium metal is produced as a byproduct from the treatment of lead and zinc ores in the Bunker Hill and Sullivan smelter and in the Sullivan Mining Company electrolytic zinc plant in the Coeur d'Alene district, Shoshone County. There are no deposits of cadmium of sufficient concentration to be mined for the cadmium content alone. The most common mineral is greenockite (cadmium sulfide), which occurs chiefly as a yellow stain on the zinc sulfide. Zinc concentrates from ores of the western states average about 0.2 per cent cadmium. The origin of the metal produced by plants in the United States has not been recorded and production by states cannot be determined.

Uses (3)

The principal use of cadmium is as a protective coating for iron and steel and thus is commonly electroplated on nails, screws, rivets, bolts, nuts, and other small parts used in the construction of aircraft and automobiles. The next important use is as a bearing alloy for service under high pressure and temperature. Cadmium compounds are used also to color paint, soap, rubber, glass, and other products.

Cement Materials

Raw Materials of Portland Cement

Portland cement contains approximately 60 to 70 per cent lime, 20 to 25 per cent silica, and 5 to 12 per cent alumina and iron oxide. Since cement is a low-priced bulk product, a cement plant must be located near a source for the principal constituents. Sources of lime include limestone, marbles, chalk, marl, and oyster shells. Sources of silica and alumina are clays, shale, slate, and argillaceous limestones. Silica is sometimes added in the form of sand or sandstone and iron as low grade iron ore.

Location of Cement Plants and Cement Materials

Cement plants in Idaho have been operated at two locations, near Orofino in Clearwater County and south of Pocatello at Inkom in Bannock County.

The Idaho Portland Cement Company at Inkom produces portland cement from limestone and shale from nearby company quarries and purchases silica, gypsum, and iron ore from outside sources.
The cement plant near Orofino operated from 1935 to 1945 with a capacity of 465 barrels per day. It closed because of litigation over cement dust in the air from the kilns. Limestone was formerly obtained from nearby deposits. In 1950 the Orofino Lime Products Company produced some limestone and lime. The venture was unprofitable and closed down.

Limestone has been quarried along the shores of Pend Oreille Lake near Bayview and Lakeview and used for cement and lime manufacture at Spokane. These operations are no longer active.

Reserves and Potential

Cement materials are not as strategically located in Idaho as in some of the neighboring states, being at some distance from large centers of population needed for a steady market. Intermittent demand for larger quantities of cement for dam construction and other public works have been met mostly by shipment from outside the state.

Although many deposits are inconveniently located, reserves of cement materials in Idaho are very large and would supply any foreseeable future cement industry for many years. As urban centers grow and demand increases, the cement industry in Idaho will expand.

CLAY

Location of Deposits and Uses (7, 48)

Clays suitable for common brick and heavy clay products occur in virtually all the counties of Idaho. Four structural clay products plants are located in South Idaho and a firebrick plant is operating at Troy in Latah County. Clay for these operations is obtained from nearby clay pits.

Latah County has extensive deposits of residual and transported clays which are of excellent quality for refractory and pottery products and, in some cases, when washed, for chinaware. Some of the best known deposits in Latah County are in T. 39 N., R. 3, 4, and 5 W., and T. 40 N., R. 1 and 3 W.

Description of Deposits (7, 49)

The clays in Latah County and neighboring counties are derived from granitic, pegmatitic, and metamorphic rocks by weathering and other means of alteration. They are, in general, high alumina clays and have been examined by the U. S. Geological Survey and U. S. Bureau of Mines as possible sources of alumina. However, their chief value seems to be for manufacture of refractories.

Production

Formerly there were two producing firebrick plants in Latah County. The plant located at the county seat, Moscow, burned down several years ago and has not been rebuilt. The Idaho Firebrick and
Clay Company operates a firebrick plant at Troy, east of Moscow, and in the past has produced mostly boiler lining for locomotives.

<table>
<thead>
<tr>
<th>Year</th>
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<th>Value</th>
<th>Year</th>
<th>Short tons</th>
<th>Value</th>
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<td>1950</td>
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<td>1947</td>
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<td>33,282 (b)</td>
<td>1951</td>
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<td>27,000 (a)</td>
<td>1952</td>
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<td>1953</td>
<td>26,000</td>
<td>21,000 (a)</td>
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(a) Value of clay used in cement not included.
(b) Value of clay used in cement included.

**COAL**

**History and Production (52)**

Coal deposits which have yielded some commercial production are limited to the Horseshoe Basin in Teton County in Southeastern Idaho. William Hill discovered coal here in 1901 and shortly thereafter the Mormon tunnel was driven as an entry to the Horseshoe mine. The mine was abandoned in 1904 and it remained idle until 1916, when the Horseshoe and Brown Bear mines were consolidated and development work continued through the summer of 1916 and 1917. The Horseshoe has been operated intermittently since that time. The total coal production for the Teton coal field probably will not exceed 50,000 tons.

**Location and Description of Deposits (52)**

The Horseshoe coal basin is about 12 miles west of Driggs in parts of T. 4 N., R. 43 and 44 E., and T. 5 N., R. 43 and 44 E., in Teton County. There are approximately 6 square miles of coal land.

The coal is of Cretaceous age belonging to the Frontier formation and is enclosed by sandstones and shales. The two principal beds are the Horseshoe and the Brown Bear. The Horseshoe coal bed has an approximate thickness of 11 feet with a one-foot sandy clay parting at about the center of the bed. Above and below the coal are shale beds. The Brown Bear coal bed is about 4-5 feet thick with a 2-inch shale parting. It is overlain by a hard sandstone and underlain by sandy shale. In addition, Cretaceous coal occurs in parts of Bonneville, Madison, Caribou, Bingham, Fremont, and Clark Counties, but no commercial development has been started to date.

Lignite beds occur in the Goose Creek district in T. 15 and 16 S., R. 20 E., Cassia County. They are associated with the Tertiary sediments in the area. The lower bed, called the Worthington bed, is 3 to 5 feet in thickness and has produced a small amount of marketable coal in sec. 26, T. 16 S., R. 20 E.

Lignite and lignitic coal occur in other parts of Idaho, including Owyhee County on Reynolds Creek in T. 1 S., R. 3 W., in Boise.
Reserves and Potential

The Horseshoe Basin coal field has been estimated to contain possibly 11,000,000 tons of sub-bituminous coal which is low in ash and high in B.T.U. value. However, the coal is friable and the beds are steeply dipping, and both these conditions are unfavorable to low-cost production of lump coal. The coal here could become valuable for production of power should the need arise.

COBALT

History and Production (1, 3, 4, 16, 17, 18, 19)

The history of the discovery, development, and production of cobalt in Idaho centers in the exploitation of the Blackbird District in the west-central part of Lemhi County about 45 miles southwest of Salmon.

The district was discovered in 1893 and most of the deposits were located there in the following three years. The claims were held as gold properties until 1896-97, when copper was recognized in workable amounts. Cobalt and nickel first were recognized as possible valuable mineral constituents of the deposits in 1901, when John Beliel located a group of claims along the west fork of Blackbird Creek.

The first substantial exploration and development work was started on upper Blackbird Creek by the Blackbird Copper-Gold Mining Company in 1899. The claims were patented in 1901, but the work soon was suspended because of the inaccessible nature of the area and the resulting high transportation costs.

The group of claims located by John Beliel on the west fork of Blackbird Creek were acquired by the Haynes Stellite Company in 1915 and a mill was installed to produce cobalt concentrates. It is reported that about 4,000 tons of ore was milled but uneconomic transportation expenses and other difficulties caused the mine and mill to cease operations in 1920.

After the Haynes Stellite Company operation closed down, there was little activity in the district until 1938 when the Uncle Sam Mining and Milling Company obtained a lease and option on the old Blackbird Copper-Gold Company property. A 75-ton flotation plant was installed and about 563,859 tons of ore and concentrates were shipped before operating difficulties closed the plant and mine in 1941.

The United States Bureau of Mines, in its search for strategic metals during World War II, began investigations in the district. In 1948, the Howe Sound Mining Company took options on the Blackbird claims and began exploration, and since 1945 the Calera Mining
Company, a subsidiary of Howe Sound, has been actively engaged in development of the property. A 600-ton concentrator to produce cobalt and copper concentrates was installed in 1951 and it has since been enlarged; more than 25,000 feet of development work has delineated large reserves of minable ore; an all-weather trucking road has been built to Challis, and concentrates and supplies are trucked to and from the rail point at Mackay, 107 miles to the south. A town for company employees, called Cobalt, has been built about 9 miles east of the mine.

Concentrate produced in 1952 averaged 16.2 per cent cobalt. The concentrate was shipped to the company refinery at Garfield, Utah, where it has been planned to accomplish the recovery of 1,650 short tons of granules a year containing 95 per cent cobalt and 5 per cent nickel. However, mechanical difficulties incident to an entirely new chemical process have delayed full production schedules at this refinery.

In 1952, Calera Mining Company displaced Bethlehem Steel Company as the chief producer of cobalt ore in the United States.

The Sullivan Mining Company at Kellogg, Shoshone County, recovers cobalt as a byproduct at its electrolytic zinc plant. In 1951, it obtained 107 tons of residues containing 7,885 pounds of cobalt and, in 1952, recovery was 97 tons bearing 7,114 pounds of cobalt. Total production of cobalt in Idaho through 1952 is recorded as 993,422 pounds. Annual production figures are not available.

Location and Description of Deposits (1, 17, 18, 19, 20)

The Blackbird cobalt deposits are located on Blackbird Creek and Meadow Creek in T. 20 and 21 N., R. 18 E., Lemhi County.

The ore minerals are cobaltite (CoAsS), chalcopyrite (CuFeS2), pyrrhotite, and pyrite, which occur as replacement type pods in schists of the folded Belt series. The copper minerals are present in sufficient quantity to be of economic importance and the Calera Mining Company produces copper concentrates as well as cobalt concentrates at its mill.

The cobalt in Shoshone County occurs in small amounts associated with some of the lead-zinc-silver ores. It is probably present as a nickel-iron cobalt sulpharsenide.

Other occurrences of cobalt minerals associated with metalliferous deposits have been reported in Latah and Kootenai Counties but apparently they are of little economic value.

Uses (3, 4, 16, 20)

Within the last 5 years, increased uses have been found for cobalt, important enough to place the metal on the list of strategic materials under National Production Authority regulations. Chief new uses of cobalt are for high-temperature alloys and for preparation of cemented carbides. Other uses of less significance are for making hard-faced welding rods, high-speed steel, magnets, and
ground-coat frit for porcelain enamel and in pigments. Consumption in 1951 reached 9,933,000 pounds, which was a 20 per cent gain over 1950. In 1952 consumption for the first time exceeded 10 million pounds and it was 9 per cent more than in 1951.

Reserves and Potential (20)

The Calera Mining Company has developed reserves of ore containing more than 0.5 per cent cobalt which are large enough to sustain the present production rate of 1,000 tons a day for several years. Potential reserves of the Blackbird district as a whole are even greater and should support a much larger future production. The Calera Mining Company in 1955 was the largest producer of copper in Idaho, largely because of the cobalt development.

In the United States in 1955, only one other source of cobalt was under development which promised eventually to increase the domestic consumption, and the present dependence on foreign sources of supply all combine to make an encouraging outlook for cobalt mining in Idaho.

COPPER

History and Production (3, 21, 22, 23)

Most of the copper that has been produced in Idaho has been produced from ores mined primarily for their content of other metals.

The output of copper in Idaho in 1951 was 4,320,000 pounds, and this was 106,000 pounds more than the 1950 production. About 3,500,000 pounds or 83 per cent of that obtained in 1951 was recovered as a byproduct in the treatment of lead-zinc ores and silver ores from mines in the Coeur d'Alene region, Shoshone County. Approximately 300,000 pounds, or 7 per cent of the 1951 output, was derived from copper-cobalt ores yielded by the Blackbird-Chicago mine in the Blackbird district, Lemhi County.

(3) TABLE 3 - Production of copper by counties - Idaho - 1951

<table>
<thead>
<tr>
<th>County</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>9</td>
<td>$4,856</td>
</tr>
<tr>
<td>Blaine</td>
<td>48</td>
<td>23,232</td>
</tr>
<tr>
<td>Bonner</td>
<td>3</td>
<td>1,452</td>
</tr>
<tr>
<td>Custer</td>
<td>21</td>
<td>10,164</td>
</tr>
<tr>
<td>Gem</td>
<td>1</td>
<td>484</td>
</tr>
<tr>
<td>Lemhi</td>
<td>203</td>
<td>98,252</td>
</tr>
<tr>
<td>Shoshone</td>
<td>1,874</td>
<td>907,016</td>
</tr>
<tr>
<td>Total</td>
<td>2,159</td>
<td>1,044,255</td>
</tr>
</tbody>
</table>

The copper obtained from mining operations in Blaine and Custer Counties was recovered from ores containing lead-silver and zinc which were generally more valuable for the silver content than for the copper.
(3, 4) TABLE 4 - Recorded annual production of copper - Idaho - 1932-54

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>572</td>
<td>$72,033</td>
<td>1944</td>
<td>1,688</td>
<td>$455,760</td>
</tr>
<tr>
<td>1933</td>
<td>781</td>
<td>92,283</td>
<td>1945</td>
<td>1,543</td>
<td>417,950</td>
</tr>
<tr>
<td>1934</td>
<td>766</td>
<td>122,330</td>
<td>1946</td>
<td>1,638</td>
<td>336,312</td>
</tr>
<tr>
<td>1935</td>
<td>1,048</td>
<td>172,957</td>
<td>1947</td>
<td>1,940</td>
<td>668,800</td>
</tr>
<tr>
<td>1936</td>
<td>1,477</td>
<td>271,768</td>
<td>1948</td>
<td>1,624</td>
<td>704,816</td>
</tr>
<tr>
<td>1937</td>
<td>2,232</td>
<td>540,144</td>
<td>1949</td>
<td>1,438</td>
<td>566,572</td>
</tr>
<tr>
<td>1938</td>
<td>2,139</td>
<td>419,244</td>
<td>1950</td>
<td>2,107</td>
<td>876,512</td>
</tr>
<tr>
<td>1939</td>
<td>2,516</td>
<td>523,328</td>
<td>1951</td>
<td>2,160</td>
<td>1,045,440</td>
</tr>
<tr>
<td>1940</td>
<td>3,349</td>
<td>756,874</td>
<td>1952</td>
<td>3,213</td>
<td>1,555,092</td>
</tr>
<tr>
<td>1941</td>
<td>3,621</td>
<td>854,555</td>
<td>1953</td>
<td>3,134</td>
<td>1,800,064</td>
</tr>
<tr>
<td>1942</td>
<td>3,430</td>
<td>830,060</td>
<td>1954</td>
<td>4,500</td>
<td>2,732,400</td>
</tr>
<tr>
<td>1943</td>
<td>2,324</td>
<td>604,210</td>
<td>1863-1952</td>
<td>119,969</td>
<td>38,445,219</td>
</tr>
</tbody>
</table>

(a) Estimated

Location and Description of Deposits (21, 22, 23, 24)

Copper mineral ores occur chiefly in Custer, Lemhi, Blaine, and Adams Counties, with lesser occurrences in Bonner, Butte, Latah, Lewis, Idaho, Clearwater, Shoshone, and Washington Counties.

The copper deposits of the region near Mackay, Custer County, have intermittently produced copper ore for 50 years or more. These deposits were discovered after the rich lead-silver strikes in the Nicholai district in 1880 but were not exploited until some years later. Since 1900, copper mining in the region has essentially been limited to the Empire mine, which is located in T. 7 N., R. 23 and 24 E., about 8 miles southwest of Mackay. The ores are mostly oxidized copper minerals including chrysocolla, azurite, and malachite, with primary sulfides including chalcopyrite, pyrite, and pyrrhotite occurring at depth. The deposits are of contact metamorphic type.

Other deposits which have been worked primarily for their copper content occur near Salmon, Lemhi County, in T. 21 N., R. 21, 22, and 23 E.; T. 20 N., R. 21, 22, and 23 E.; T. 19 N., R. 23 E.; and T. 18 N., R. 23 E. These occurrences were found in the early days but little copper mining was attempted until about 1911. The copper-bearing masses occur in shear zones in quartzitic rock in which mineralization has been effected by replacement and vein filling. The ore minerals of the oxidized zone are chalcopyrite and in some cases bornite. Smaller zones of oxidized ore are found containing malachite, azurite, and cuprite. Ore bodies of commercial value are of relatively small size.

A third mining region where copper is the principal economic mineral is that of the Snake River copper belt, which extends along the Snake River for about 120 miles. It includes parts of Nez Perce, Lewis, Idaho, Adams, and Washington Counties and it encompasses the well-known Seven Devils mining district. The deposits occur as mineralized shear zones, fissure veins, disseminated deposits, and
contact metamorphic masses. The contact metamorphic occurrences have produced most of the copper ore in the past. However, the disseminated low grade deposits are of potential future importance. The common ore minerals are the sulfides of copper such as chalcopyrite and bornite and their oxidized products, namely malachite and azurite. Secondary enriched zones in the ore bodies often contain chalcocite and covellite.

Smaller and less important deposits of copper are known to occur in the Hoodoo district in Latah County, the Clark Fork district in Bonner County, the St. Joe district in Shoshone County, the Lolo district in Idaho and Lewis Counties, the Buffalo Hump district in Idaho County, the Ramsey Ridge district in northern Valley and southern Idaho Counties, and in numerous other counties in the state.

Reserves and Potential (21, 22, 23, 24)

Copper mining in Idaho, except as a byproduct of mining for other metals, has been retarded because of the exploitation of much more profitable lead-zinc and silver-lead ore bodies which have been more attractive to investors. This is because of the large amount of capital required to experience a profitable operation of such deposits. Another retarding factor is the inaccessible location of many of the deposits and the high cost of transportation. Finally, some of the deposits are uneconomical to mine because of the small-size erratic occurrence of mineralization, low average grade, or the refractory nature of the ore.

With a higher average price for copper, an increase in venture capital available for mine development, and the improvement of roads and other means of transportation, copper mining in Idaho eventually should show a substantial growth.

DIATOMACEOUS EARTH

Nature and Location of Deposits (48,55)

Diatomaceous earth or diatomite in its pure state consists of hydrous silicon dioxide containing 96 to 97 per cent silica. Some impurities are generally present in natural deposits consisting of organic matter, quartz, carbonates, volcanic ash, and clay.

More-or-less impure deposits of diatomite have been noted in Owyhee, Gooding, Elmore, Franklin, Fayette, Canyon, Idaho, Washington, Lewis, Nez Pce, and Camas Counties. A small amount has been shipped from Elmore, Gooding, and Idaho Counties for use in sugar refining, and recent production by White Earth Products Company came from its open pit mine near White Earth in Canyon County.

Uses and Potential

About 50 per cent of all diatomite produced is used for filter aids, 25 per cent for insulation, and 25 per cent for miscellaneous uses.
Diatomite is used to filter many liquids, including those in the refining of cane sugar and beet sugar. It is used as insulating material in the form of blocks, slabs, and brick and as an aggregate in cement mixtures. As a filler it is used in battery box and asphaltic compositions, roofing, paints, waxes, and varnishes.

The University of Idaho has successfully experimented with mixtures of cement, sawdust, diatomite, and clay to produce a building block of light weight and high insulating quality for wall, roof, and floor construction, especially for small structures.

The use of diatomite for filter aids requires a higher degree of purity than is obtainable from most of the Idaho deposits. However, its use for insulation and particularly for building blocks is not impaired by some impurities and the future development of a diatomite industry in Idaho hinges on development of a market in the building trades for diatomite products.

FLUORSPAR

History and Production (3, 4, 5, 53)

Although Idaho is not considered a fluorspar producing state, the Minerals Yearbook for 1951 for the first time listed Idaho among the states shipping fluorspar. Production totals are combined with Nevada’s and thus are not available for Idaho alone, but the state produced probably between 2,000 and 3,000 tons. Virtually the entire output of fluorspar (the mineral name for fluorspar) has come from the Chamac Mines near Meyers Cove in Lemhi County, which were operated from June, 1951, to April, 1953, by the Fluorspar Mines, Inc., a subsidiary of J. R. Simplot Company. Total production is reported as 10,979 tons of acid grade, 998 tons of ceramic grade, and 100 tons of metallurgical grade fluorspar. A small production was also reported from these deposits during World War II years.

The Lemhi County deposits were probably known to early prospectors but were ignored because of lack of metallic content. The potential value of the fluorite mineralization was not recognized until 1941 and the news of locations by Reese Miles and Roy Johnson of Salmon was not generally known until 1942. Shortly thereafter, the claims were acquired by A. E. Chambers and active exploration and development were started. A 100-ton daily capacity concentrator was erected in 1944 and given a six-day trial run. The mill was not operated after the test run. In 1947 Aluminum Company of America drilled about 6,500 feet of holes testing the extent of the ore bodies, but withdrew from the project before completing its exploration project. The property, by this time consisting of 75 claims and two mill sites, was acquired under bond and lease by the J. R. Simplot Company in 1949. Simplot succeeded in bringing the mine and mill into production in 1951 and operated continuously until the mill burned down in April, 1953. Since then Simplot has relinquished its lease and the property has reverted to the original owner, A. E. Chambers.
Another area containing potential economic fluor spar deposits occurs in the Bayhorse district near Challis. Here again the early silver and lead prospectors must have noted the presence of fluorite but it was not until fluor spar became a strategic mineral during World War II that reports of its existence in some of the silver lodes was thought worth investigating. A. E. Chambers spent several years immediately after the war mapping and acquiring possession of deposits on Keystone Mountain and the J. R. Simplot Company carried on active prospecting and development in Daugherty Gulch during the early 1950's. To 1954 the production from this mine has been only about 500 tons of high grade shipping spar and 250 tons of milling grade material.

Fluorspar also occurs associated with metalliferous deposits and has been noted in Clearwater, Idaho, Valley, Shoshone, Butte, Camas, and Owyhee Counties, In Shoshone County, the Coeur d'Alene Extension Mines, Inc., produced fluor spar as a byproduct of its treatment of lead-silver ores but production figures are not available.

**Location and Description of Deposits (53, 54)**

Deposits of fluor spar are located 2 to 3 miles northwest of Meyers Cove near Camas Creek in unsurveyed T. 18 N., R. 17 E., Lemhi County. The mineralization occurs as vein filling in composite lode-type veins in Challis volcanics and in Miocene porphyries. Fluorite (calcium fluoride) is the principal mineral with minor amounts of barite and quartz. The zones of fracturing may be traced for several thousands of feet in some cases, but the mineralization is localized in shoots separated by zones of almost barren rock.

The fluor spar deposits near Challis occur in a belt about 7½ miles long extending from the Pacific Mine near Bayhorse on the south to Mill Creek on the north, most of the deposits being in T. 18 N., R. 18 E., Custer County. The mineralization occurs as fissure filling and in some cases as breccia filling material. There is little or no evidence of replacement of the rock in which the deposits occur. The enclosing rock is Bayhorse dolomite, all the known deposits being found in the dolomite.

**Uses (3, 11)**

Most of the fluor spar marketed in the United States is used in the steel industry, principally in the open hearth process as a flux to gain fluidity in the slag. Approximately 7 to 8 pounds of metallurgical grade spar is required per ton of steel produced. Other metallurgical uses for fluor spar are in iron foundries, in electric furnaces for making ferro-alloys, in the production of nickel, in smelting the ores of gold, silver, copper, and lead, and in the extraction of aluminum from bauxite.

Acid grade fluor spar is used for the manufacture of hydrofluoric acid and the refrigerating medium known as Freon. Many other important uses for minor quantities of fluor spar are found in the chemical and ceramic industries.
Reserves and Potential (9)

Reserve figures for fluorspar in Idaho are not available. However, prospecting and exploration work so far has revealed large tonnages of milling grade ore and substantial amounts of direct shipping spar. Exploration and investigation are being continued.

A resumption of fluorspar production will probably be postponed until better prices prevail, as the current price is below the cost of most domestic production even in the older, well-established fluorspar producing states such as Illinois. Imports of fluorspar for 1954 amounted to about 64 per cent of the total consumption in spite of the fact that domestic production facilities are sufficient to take care of the entire consumption.

Fluorspar is a strategic mineral and is essential to the economy of the nation. It is therefore likely that some solution to the present economic difficulty will be found eventually and Idaho should then join the list of fluorspar-producing states.

GARNET

Production and Uses (1)

Garnets of gem quality are rare in Idaho and have never been produced on a commercial basis. A few have been reported from Adams, Nez Perce, and Boise Counties, most of them recovered in placer operations.

Garnet sands are quite plentiful and garnet is a common constituent of gold placers in Idaho. In the southeastern corner of Benewah County and northeastern corner of Latah County near Fernwood, T. 43 N., R. 1 E., the Idaho Garnet Abrasive Company is mining garnet sands from Emerald Creek and treating them in a jig and screening plant to produce abrasive garnet sand for sand blasting. The mill has a daily capacity of about 100 tons. Abrasive garnet is superior to silica sand for sandblasting and commands a higher market price. Idaho Titanium and Mining Company produced abrasive garnet as a byproduct of gold-monazite dredging operations at Ruby Meadows in Idaho County in 1953. This property was idle in 1954.

Location of Deposits

Garnet is widespread in the rocks of Idaho and in the placer sands derived from these rocks. Most of the garnet deposits are in the fringe zone around the Idaho batholith, the mineral being of the contact metamorphic type. Garnets occur in slaty micaceous schists, in pegmatites, and in lime silicate rocks adjacent to igneous intrusions. The composition of garnet is variable. It is a silicate of aluminum, calcium, iron, manganese, magnesium, or chromium and sometimes is a combination of two or more of these metals.

Reserves and Potential

Idaho's reserves of garnet for abrasive purposes are virtually inexhaustible. The market at present is limited in the western part
of the United States and freight rates do not permit western garnet to compete in the eastern market for abrasive material.

GOLD

History and Production (3, 4, 5, 6, 8, 26)

The discovery of gold and exploitation of the rich placer deposits were largely responsible for the first important immigration to Idaho. The first discovery was in 1860 near Pierce in Clearwater County, and in the next 10 years rich placer deposits were discovered in rapid succession and were almost as rapidly exhausted. The economy of the immediate area and of the whole Northwest Territory for those years was largely dominated by the wealth of gold pouring from the placer diggings. Between 1863 and 1870, according to the best available information, annual production from the Idaho region was nearly 300,000 ounces of gold with an estimated value of $6,000,000. Total reported production for the period of 1860-70 was 2,728,300 ounces with an estimated value of $50,000,000. This production far exceeds that of any subsequent 10-year period and is almost one-third of Idaho's total gold recovery to date.

After 1870 and the exhaustion of the bonanza placer ground, there was a 10-year depression period. The 20 years after 1880 were marked by a steady growth of gold lode mining and a small revival of placer mining. The discovery of lodes that contained silver, lead, zinc, and copper in addition to gold caused increased interest in the mining of silver and base metals. In some instances mining of the secondary metals proved more profitable than the recovery of the gold content of the lodes.

Since 1900 the value of gold production in Idaho has declined in importance as compared with the production of silver and base metals.

The largest recent gold producer in the state has been the Bradley Mining Company's Yellow Pine antimony-gold property in Valley County.

(3) TABLE 5 - Production of gold by counties - Idaho - 1851

<table>
<thead>
<tr>
<th>County</th>
<th>Fine ounces</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blaine</td>
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<td>$29,120</td>
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<tr>
<td>Boise</td>
<td>5,011</td>
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<tr>
<td>Bonner</td>
<td>245</td>
<td>8,575</td>
</tr>
<tr>
<td>Custer</td>
<td>5,513</td>
<td>192,955</td>
</tr>
<tr>
<td>Elmore</td>
<td>6,835</td>
<td>221,725</td>
</tr>
<tr>
<td>Gem</td>
<td>185</td>
<td>6,475</td>
</tr>
<tr>
<td>Idaho</td>
<td>1,801</td>
<td>63,085</td>
</tr>
<tr>
<td>Lemhi</td>
<td>568</td>
<td>19,880</td>
</tr>
<tr>
<td>Shoshone</td>
<td>2,684</td>
<td>93,940</td>
</tr>
<tr>
<td>Valley</td>
<td>19,614</td>
<td>686,490</td>
</tr>
<tr>
<td>Other counties (a)</td>
<td>2,276</td>
<td>72,660</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45,064</strong></td>
<td><strong>1,577,240</strong></td>
</tr>
</tbody>
</table>

(a) Includes Ada, Adams, Bingham, Jerome, Lewis, Nez Perce, Owyhee Twin Falls, Bonneville, Boundary, Butte, Cassia, Clark, and Clearwater
The production shown for Boise, Custer, and Idaho Counties resulted largely from dredging operations.

(3, 4, 6) TABLE 6 - Recorded annual production of gold - Idaho - 1932-53

<table>
<thead>
<tr>
<th>Year</th>
<th>Fine Ounces</th>
<th>Value</th>
<th>Year</th>
<th>Fine Ounces</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>46,885</td>
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<td>1944</td>
<td>25,008</td>
<td>$875,280</td>
</tr>
<tr>
<td>1933</td>
<td>64,592</td>
<td>1,650,977</td>
<td>1945</td>
<td>17,780</td>
<td>622,300</td>
</tr>
<tr>
<td>1934</td>
<td>84,817</td>
<td>2,964,361</td>
<td>1946</td>
<td>42,975</td>
<td>1,504,125</td>
</tr>
<tr>
<td>1935</td>
<td>83,823</td>
<td>2,933,807</td>
<td>1947</td>
<td>64,982</td>
<td>2,274,370</td>
</tr>
<tr>
<td>1936</td>
<td>80,291</td>
<td>2,810,199</td>
<td>1948</td>
<td>58,454</td>
<td>2,045,890</td>
</tr>
<tr>
<td>1937</td>
<td>81,861</td>
<td>2,865,135</td>
<td>1949</td>
<td>77,829</td>
<td>2,724,015</td>
</tr>
<tr>
<td>1938</td>
<td>103,513</td>
<td>3,622,955</td>
<td>1950</td>
<td>79,652</td>
<td>2,784,820</td>
</tr>
<tr>
<td>1939</td>
<td>115,662</td>
<td>4,083,170</td>
<td>1951</td>
<td>45,064</td>
<td>1,577,240</td>
</tr>
<tr>
<td>1940</td>
<td>146,480</td>
<td>5,126,800</td>
<td>1952</td>
<td>32,997</td>
<td>1,154,895</td>
</tr>
<tr>
<td>1941</td>
<td>143,816</td>
<td>5,243,560</td>
<td>1953</td>
<td>17,630</td>
<td>617,050</td>
</tr>
<tr>
<td>1942</td>
<td>95,020</td>
<td>3,325,700</td>
<td>1954</td>
<td>13,600</td>
<td>476,000(a)</td>
</tr>
<tr>
<td>1943</td>
<td>30,808</td>
<td>1,178,280</td>
<td>1863-1953</td>
<td>8,217,357</td>
<td>$190,746,848</td>
</tr>
</tbody>
</table>

(a) Estimated

Location and Description of Deposits (7, 25, 27)

Gold occurs in some form in nearly all the counties of Idaho. It occurs as placer gold in stream beds and terraces, as vein gold in quartz and other vein filling, and as an associated mineral in more complex deposits containing lead, silver, zinc, antimony, and other minerals.

Many of the gold deposits and gold mining districts which were formerly productive have long been inactive and some are almost forgotten. The principal gold mining counties in Idaho have been: Boise, Idaho, Owyhee, Lemhi, Shoshone, Elmore, Custer, Blaine, Valley, Clearwater, Cassia, Camas, and Gem.

The gold deposits in Boise County occur as placers near Idaho City along Mine Creek in T. 5 N., R. 4 and 5 E., and T. 6 N., R. 5 E.; near Horseshoe Bend along the Payette River in T. 7 and 8 N., R. 2 E. and T. 8 N., R. 3 E.; near Centerville and Placerville along Grimes Creek in T. 6 N., R. 4 and 5 E. and T. 7 N., R. 4 and 5 E.; and along the Boise River near Twin Springs in T. 3 N., R. 4 and 5 E., in T. 4 N., R. 5 and 6 E., and in T. 5 N., R. 7 E. Lode deposits are found near Quartzburg in T. 7 N., R. 4 E. and in the area around Grimes Pass and Pioneerville in T. 7 N., R. 5, 6, and 7 E. and T. 8 N., R. 5, 6, and 7 E.

The gold mining areas of Idaho County are located as follows: Placer deposits near Warren and Burgdorf south of the Salmon River in T. 22 and 23 N., R. 4, 5, and 6 E.; on the north side of the Salmon near Dixie along Sheep Creek and Crooked Creek in T. 25 and 26 N., R. 6, 7, and 8 E.; and on Wind River and along the Salmon from Wind River to a point about 6 miles north of White Bird which encompasses the towns of Riggins and Lucille and includes parts of T. 24 N., R. 1, 2, 3, and 4 E. and T. 25, 26, 27, 28, and 29 N., R. 1 E.;
near Elk City on the American River, Elk Creek, and the South Fork of the Clearwater near Harpster, Stites, and Kooskia in T. 30, 31, and 32 N., R. 4 E.; along the Middle Fork of the Clearwater and Maggle Creek in T. 33 N., R. 4, 5, 6, and 7 E.; on Lolo, Russellsell, and Eldorado Creeks in T. 34 N., R. 4, 5, and 6 E. and T. 35 N., R. 6 E. Lode deposits are located south of the Salmon River and north of Burgdorf in T. 23 and 24 N., R. 4 and 5 E.; near Orogrande and Golden in T. 26, 27, and 28 N., R. 6 and 7 E.

In Owyhee County, the placer deposits occur along the Snake near Grand View in T. 4 S., R. 2 E.; T. 5 S., R. 4 E.; and T. 1 S., R. 3 W., and on Jordan Creek near Silver City and De Lamar in T. 4 S., R. 3 and 4 W. The lode deposits occur near Silver City and De Lamar in T. 5 S., R. 3 and 4 W. and near Triangle in T. 7 S., R. 2 and 3 W.

There are gold placers in the northern part of Lemhi County on the Salmon River and its tributaries near Shoup and Gibbonsville in T. 24 N., R. 18, 19, and 20 E., and T. 26 N., R. 21 E. Lode deposits are in the same region but extend farther south near Loesburg and Salmon in T. 22 N., R. 20, 21, and 22 E. Lode gold is also found near Gilmore in T. 13 N., R. 26 and 27 E.

The principal gold mining district in Shoshone County, both lode and placer, is in the vicinity of Murray. The placer deposits are along Prichard Creek and its tributaries in T. 49 and 50 N., R. 4 and 5 E. Lode gold producing areas are the Coeur d'Alene district east of Wallace in T. 47 and 48 N., R. 4 and 5 E., and along the St. Joe River in T. 45 N., R. 3 and 9 E. Most of the present gold production from Shoshone County comes from ores mined primarily for silver, lead, zinc, and copper.

The Elmore County placer deposits are along the Boise River near Twin Springs in T. 3, 4, and 5 N., R. 5, 6, and 7 E.; on the Middle Fork in T. 6 N., R. 10 E.; and on the South Fork in T. 2 N., R. 10 E. Lode deposits are near Atlanta in T. 5 N., R. 11 and 12 E. and near Rocky Bar in T. 3 and 4 N., R. 10 E.

Custer County has placer deposits in the Stanley Basin in T. 10 and 11 N., R. 12 and 13 E. and along the Salmon River, particularly between Robinson Bar and Clayton in T. 11 N., R. 15, 16, and 17 E. The lode deposits are near Bonanza and Custer on the Yankee Fork in T. 12 and 13 N., R. 14 and 15 E.; near Clayton on Squaw Creek and Thompson Creek in T. 11 and 12 N., R. 16 and 17 E.; and around Bayhorse in T. 12 and 13 N., R. 18 E.

Most of the gold output from Blaine County has come from lead-silver-copper ores. A few small placers are located in the southwestern corner on Wood River or its tributaries in T. 1 S., R. 17 and 18 E. The lode deposits occur principally southwest of Hailey in T. 1 and 2 N., R. 17 E.

Similarly in Valley County gold is chiefly associated with production of other metals, particularly antimony. Placer gold is found along Big Creek and tributaries in T. 20 and 21 N., R. 9, 10, and 11 E. and near Warm Lake in T. 15 N., R. 6 and 7 E. Lode gold occurs
near Edwardsburg in T. 20 N., R. 9 E.; on Konumental Creek near Thunder Mountain in T. 18 and 19 N., R. 11 E.; and near Yellow Pine in T. 19 N., R. 8 E.

Clearwater County gold recovery has been almost entirely from placer deposits, principally in the vicinity of Pierce and along Orofino Creek between Orofino and Pierce in T. 36 and 37 N., R. 2, 3, 4, and 5 E. Other placer deposits are located along Kelly and Morse Creeks in T. 39 N., R. 10 and 11 E. and along the North Fork of the Clearwater and its tributaries in T. 37, 38, and 39 N., R. 1, 2, 3, and 4 E.

Cassia County's gold production came from placer deposits along the Snake River in T. 9 and 10 S., R. 24 and 25 E. A small recovery has been recorded from lead-silver and copper ores mined in T. 15 and 16 S., R. 21 E.

Camas County had formerly productive placer deposits along Little Smoky Creek near Carriecown in T. 2 and 3 N., R. 14 and 15 E. Lode deposits occur in T. 4 and 5 N., R. 13 and 14 E.

A gold area in Gem County extends northeastward from Pearl to the county line and includes parts of T. 6 and 7 N., R. 1 E. Another area occurs in T. 8 N., R. 1 E. along Squaw Creek.

Uses (3)

The United States government requires that all newly-mined gold be sold to the United States Mint at $35 a fine ounce. Gold is thereafter issued from the government stockpile for industrial use and for the arts. The arts require a much larger quantity of gold than does industry. Sale of jewelry, watches, and many other luxury items has increased with the prosperity of recent years. During 1951, the net consumption of gold in the arts and industry exceeded the total new gold produced in the United States.

Reserves and Potential (8, 26)

The bonanza placer deposits of gold and most of the ground which can be worked profitably by methods other than dredging are exhausted. Dredging still remains a potentially profitable method of working many placer deposits, particularly when economic conditions favor gold mining. In many placers some accessory minerals occurring with gold, such as monazite and ilmenite, contain metals of strategic importance. Their recovery will, no doubt, increase the economic value of many placer deposits with low gold content.

The nature of gold lode deposits precludes the possibility of developing large measurable ore reserves. Although the lodes or veins may be continuous over considerable distance, the individual ore shoots are generally relatively small and quickly mined out. An ore shoot, when discovered, is commonly worked until the ore of economic grade is exhausted. In some of the formerly productive districts, such as the Silver City and De Lamar districts in Owyhee County, some authorities believe undiscovered ore shoots remain which, by modern methods of prospecting, may be found and developed profitably in periods favorable for gold mining.
History and Production (59, 60)

The presence of gypsum along both sides of the Snake River a few miles north of Weiser has been known since before 1900. The deposits on the Oregon side were worked extensively from about 1895 to 1924 in the vicinity of the town of Gypsum. The deposits on the Idaho side, being less accessible, have produced little gypsum although considerable stripping and tunneling has been done and an access road has been bulldozed to the deposits.

Gypsum deposits have also been noted 3 miles east of Montpelier in Bear Lake County. A number of prospect holes have been put down and samples have been analyzed. The deposits are thought to be small, but they have never been completely delineated. There has been no reported production from the Montpelier deposits.

In most cases gypsum occurs interbedded with sedimentary formations.

Location and Description of Deposits (51, 59, 60)

The gypsum deposits on the Snake River are in secs. 7, 8, 17, 18, and 20, T. 13 N., R. 7 W., Washington County, Idaho, about 30 miles north of Weiser. The deposits occur as banded lenses of varying thickness ranging from a few inches to as much as 30 feet. The purity of the gypsum is variable within a lens. The most noticeable impurity is a greenish chloritic material which occurs in bands. The gypsum deposits exposed by tunneling and stripping are not more than 1,000 feet laterally and about 200 feet above the river level. The formations are of Eocene age composed of limestone, shale, and schists.

In Bear Lake County, 3 miles east of Montpelier, gypsum occurs in the Weels formation of Pennsylvanian age. The gypsum lies on and fills fissures in limestone and is fine-grained and massive. A prospect hole in sec. 32, T. 12 S., R. 45 E. exposes a bed at least 4 feet in thickness. The lateral extent is unknown.

Less important occurrences of gypsum have been noted in other counties, including Lemhi County.

Uses

Gypsum (CaSO$_4$·2H$_2$O) is a hydrous calcium sulfate and its chief use is in the building industry, mainly in the manufacture of plaster, plasterboard, and prefabricated lath. For this use, the gypsum is calcined or dehydrated into the product widely known as "plaster of paris." Raw gypsum is principally used as a constituent of portland cement, in which it acts as a retarder to setting. A lesser but important use of raw gypsum is as a fertilizer and soil conditioner. Agricultural gypsum is valued on the basis of its sulfur content and impurities do not impair its use unless they are sufficient to materially lower the sulfur content.
Reserves and Potential

The small amount of exploration work has not delineated the deposits of gypsum to an extent that any estimate of total reserves is feasible. The deposits in Washington County have some economic significance as a source of agricultural gypsum on the basis of present knowledge of size and quality of the deposits.

IRON ORE

History and Reserves (6, 40, 41, 42)

Iron ore for use in iron and steel making has not been produced commercially in Idaho. A few tons of iron ore have been mined in Washington County for use in cement manufacture at Lime, Oregon, near the Snake River, and for smelter flux in the former smelter at Cuprum.

The Washington County iron deposits around Iron Mountain were explored in the 1890's by prospectors seeking gold-silver-copper bearing sulfides in the belief that iron deposits grade in sulfide ores at depth. A survey was made in 1938 for a report on "Available Raw Materials for the Pacific Coast Iron Industry" for the North Pacific Division Engineer Office, U. S. Army, in which 100,000 tons of iron ore was estimated in the Washington County deposits. A later open file U. S. Geologic Survey report released June 6, 1947, gives the results of a more comprehensive analysis with an estimate of 244,000 tons of "measured, indicated, and inferred" ore.

There are iron ore deposits of possible economic significance near Grangeville in the Clearwater district, Idaho County. These deposits are relatively small but high grade. The largest, known as the Smith Creek deposit (or Strom-Anderson and Woodrat Mountain deposit), is estimated to contain 50,000 tons. An open file report of June 6, 1947, by the U. S. Geologic Survey on "The Iron Ore Deposits in the Clearwater District, Idaho County," gives a comprehensive summary of each of these occurrences.

Location and Description of Deposits

The Iron Mountain district, which includes a group of closely related iron deposits, is in Washington County six miles east of the Snake River and 20 miles north of Weiser, Idaho. The belt is about two and one-half miles long in a north-south direction and one mile wide and includes parts of sections 11, 12, 13, 14, and 23, T. 14 N., R. 6 W. The deposits are of three principal types: (a) deposits of chiefly magnetite, (b) deposits of specular hematite, and (c) ores of red earthy hematite.

The magnetite and specular hematite ores are irregular-shaped bodies in a metamorphic marble near the intrusive contact. The red hematite ores are in gossan-like bodies in some cases overlying massive sulfide deposits.

The iron deposits in Idaho County consist of small pods of high grade magnetite. The Smith Creek deposit (containing the largest
estimated reserves in the district) is in sec. 29, T. 33 N., R. 6 E., on Smith Creek, a tributary of the Middle Fork of the Clearwater River. A few hundred tons of ore from this deposit have been mined for use by the former cement plant of the Washington-Idaho Lime Products Company. Similar occurrences are in T. 30 N., R. 4 E., and T. 24 N., R. 4 E., in Idaho County. Other occurrences have been reported in Latah and Benewah Counties.

**KYANITE-ANDALUSITE-SILLIMANITE**

*Location and Description of Deposits (64, 65)*

Deposits of the sillimanite group of minerals (aluminum silicates) occur in Latah, Shoshone, Blaine, and Cassia Counties.

In Latah County, a sillimanite deposit is located in T. 39 N., R. 2 W., about 5 miles east of Troy. The mineral occurs in a zone about one-half mile square within Belt series schists and gneisses appearing to have been formed chiefly by contact metamorphism. Beneficiation tests indicate that the material can be upgraded by flotation to a product acceptable to the refractory industry.

The kyanite-andalusite deposits on the southern border of Shoshone County are in secs. 9, 15, and 16, T. 42 N., R. 5 E., on the southern flank of Goat Mountain. These deposits are a recent discovery. Exploration and development was started about 1953 by a group of men from Tekoa, Washington, and Desmet, Idaho, who are the locators of the claims. Three zones of potentially commercial deposits have been recognized; two of the zones contain kyanite-andalusite mica schist and the third is andalusite gneiss. The deposits occur in metamorphosed pre-Cambrian Belt sediments. Estimated reserves in the three zones are reported as about 350,000 tons and beneficiation tests indicate that the ore is amenable to flotation concentration.

*Uses and Potential*

The sillimanite group, particularly kyanite-andalusite, has been mined in several localities in the United States for use in the manufacture of high grade porcelain, spark plugs, and similar products requiring high heat resistance, low coefficients of expansion, and good insulating capacities.

Most of the refractory companies operate their own deposits of sillimanite-group materials. The utilization of these minerals results from their property of converting to an artificial mullite ($3Al_2SiO_5+2SiO_2$) when heated above 1545°C. Since artificial mullite can now be produced synthetically by mixing the correct proportions of silica and alumina and heating above 2012°F, only those sillimanite deposits that are readily accessible to centers of consumption have commercial value.
LEAD

History and Production (3, 4, 5, 6, 8, 27, 28, 29, 35)

Idaho ranks second in lead production in the United States. Missouri is first and Utah third. The largest individual lead mine in the country is the Bunker Hill mine near Kellogg, Shoshone County. Lead accounts for more than 40 per cent of the value of the mineral output of the state.

Lead production first attained prominence about 1884 with the development of the Wood River district in Blaine County. At about the same time lead ore was discovered in the Coeur d'Alene district. Since 1889 Shoshone County has been the leading lead producer in the state.

(3) TABLE 7 - Production of lead by counties - Idaho - 1951

<table>
<thead>
<tr>
<th>County</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bear Lake</td>
<td>7</td>
<td>$2,422</td>
</tr>
<tr>
<td>Blaine</td>
<td>3,182</td>
<td>1,100,972</td>
</tr>
<tr>
<td>Donner</td>
<td>114</td>
<td>39,444</td>
</tr>
<tr>
<td>Custer</td>
<td>2,101</td>
<td>726,946</td>
</tr>
<tr>
<td>Gem</td>
<td>6</td>
<td>2,076</td>
</tr>
<tr>
<td>Idaho</td>
<td>1</td>
<td>346</td>
</tr>
<tr>
<td>Lemhi</td>
<td>549</td>
<td>189,954</td>
</tr>
<tr>
<td>Owyhee</td>
<td>3</td>
<td>1,035</td>
</tr>
<tr>
<td>Shoshone</td>
<td>70,570</td>
<td>24,417,220</td>
</tr>
<tr>
<td>Washington</td>
<td>13</td>
<td>4,498</td>
</tr>
<tr>
<td>Other Counties (a)</td>
<td>167</td>
<td>57,782</td>
</tr>
</tbody>
</table>

(a) Other counties include Bonneville, Boundary, Butte, Cassia, Clark, Clearwater.

The Triumph Mining Company's North Star mine near Ketchum produces 95 per cent of the lead mined in Blaine County. The Clayton mine and Red Bird mine, both in the Bayhouse district, produce 80 per cent of the Custer County output.

(3, 4, 6) TABLE 8 - Recorded annual production of lead - Idaho - 1932-54

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>72,117</td>
<td>$4,327,052</td>
<td>1944</td>
<td>83,530</td>
<td>$13,364,800</td>
</tr>
<tr>
<td>1933</td>
<td>74,849</td>
<td>5,502,888</td>
<td>1945</td>
<td>68,447</td>
<td>11,772,884</td>
</tr>
<tr>
<td>1934</td>
<td>71,324</td>
<td>5,277,984</td>
<td>1946</td>
<td>59,887</td>
<td>12,077,155</td>
</tr>
<tr>
<td>1935</td>
<td>79,020</td>
<td>6,321,610</td>
<td>1947</td>
<td>78,944</td>
<td>22,735,872</td>
</tr>
<tr>
<td>1936</td>
<td>91,339</td>
<td>8,403,186</td>
<td>1948</td>
<td>84,644</td>
<td>21,698,752</td>
</tr>
<tr>
<td>1937</td>
<td>103,711</td>
<td>12,237,898</td>
<td>1949</td>
<td>79,299</td>
<td>23,058,484</td>
</tr>
<tr>
<td>1938</td>
<td>92,177</td>
<td>8,480,284</td>
<td>1950</td>
<td>100,025</td>
<td>27,006,750</td>
</tr>
<tr>
<td>1939</td>
<td>90,981</td>
<td>8,552,214</td>
<td>1951</td>
<td>76,713</td>
<td>26,642,698</td>
</tr>
<tr>
<td>1940</td>
<td>104,834</td>
<td>10,483,400</td>
<td>1952</td>
<td>73,719</td>
<td>23,738,000</td>
</tr>
<tr>
<td>1941</td>
<td>104,914</td>
<td>11,960,196</td>
<td>1953</td>
<td>74,610</td>
<td>19,548,000</td>
</tr>
<tr>
<td>1942</td>
<td>113,393</td>
<td>15,263,806</td>
<td>1954 (a) 68,626 (a)</td>
<td>16,470,000</td>
<td></td>
</tr>
<tr>
<td>1943</td>
<td>98,437</td>
<td>14,448,550</td>
<td>Total -- 1863-1953</td>
<td>6,512,238</td>
<td>$832,206,824</td>
</tr>
</tbody>
</table>

(a) Estimated.
Location and Description of Deposits (27, 28, 29)

Ores may be classified by content as lead-silver, lead-zinc, and lead-silver-zinc. Ores in which the lead content is of major economic importance occur in the northern and south-central parts of Idaho. In the north, Shoshone County has by far the most important lead deposits, but lesser amounts occur in Boundary and Bonner Counties. In central Idaho, the lead-producing counties are Blaine, Custer, Camas, Lemhi, and Butte. Lead, associated with other metals, also occurs in Ada, Adams, Bear Lake, Benewah, Boise, Cassia, Clark, Elmore, Gem, Idaho, Kootenai, Oneida, Owyhee, Valley, and Washington Counties.

The ores of the famous Coeur d'Alene district in Shoshone County occur as replacement deposits in faulted and folded pre-Cambrian quartzites and slates. The ore minerals are galena, sphalerite, and argentiferous tetrahedrite. Associated minerals of little economic value are siderite, pyrrhotite, pyrite, and barite. The most productive lead deposits are in T. 46 N., R. 2 and 5 E.

The principal lead deposit in Boundary County is 26 miles southeast of Porthill in T. 64 N., R. 4 W. The ore is similar in character and occurrence to those of the Coeur d'Alene district. Other deposits are known in T. 64 N., R. 2 E. in the Moyie-Yaak district.

Lead deposits which have been productive recently in Bonner County are near Clark Fork in T. 55 and 56 N., R. 2 E. Other deposits occur near the shores of Pend Oreille Lake in T. 53, 54, and 55 N., R. 1 W.

Although Kootenai County has not been an important mineral producer, there are some lead occurrences in the Hayden Lake area in T. 51 and 52 N., R. 1 and 2 W. and in T. 48 and 49 N., R. 2 W.

The productive lead deposits in Blaine County are near Ketchum in T. 4 N., R. 17, 18, and 19 E. The ore occurs as fissure veins and replacement bedded deposits in altered sediments. The ore minerals are galena, sphalerite, and argentiferous tetrahedrite. Associated non-commercial minerals are arsenopyrite and siderite. Other Blaine County deposits containing lead in commercial quantity are in T. 2 N., R. 17 and 18 E. near Bellevue and in T. 3 N., R. 21 E. near Muldoon.

Custer County produces lead ore from the area near Clayton in T. 11 and 12 N., R. 17 E. Deposits containing lead minerals also occur near Bayhorse in T. 12 and 13 N., R. 18 E.

The lead-bearing deposits in Camas County are more or less continuous from adjacent deposits in Blaine County. They are located on Little Smoky Creek in T. 3 N., R. 15 E.

Butte County adjoins Blaine County on the east and deposits of lead-bearing ore are located near the boundary in T. 3 N., R. 23 and 24 E.

Most of the lead produced in Lemhi County comes from the southeastern part of the county in T. 16 N., R. 26 E. near Leadore, in
T. 13 N., R. 27 E., near Gilmore, and in T. 10, 11, and 12 N., R. 29 and 30 E. in the Birch Creek area and near Nicholia.

Uses (3)

Lead is one of the most essential metals in the industrial arts, and the United States is fortunate to have extensive deposits and a large domestic production. The principal use is in the manufacture of metal products such as ammunition, bearing metal, cable covering, pipes, collapsible tubes and foil, solder, and type metal. Manufacture of storage batteries is the next largest user. Then come pigments (white lead, red lead, and litharge), and chemicals, including tetraethyl lead used in gasoline for anti-knock properties.

Reserves and Potential

Lead mining and smelting is well established and one of the most stable industries in Idaho. Although some ore bodies have become exhausted, others have been developed by well-planned exploration and indications are that there is sufficient ore for many years at the present rate of consumption.

MANGANESE

History and Production (5, 30, 31)

Manganese mining recently has been made more attractive in Idaho by government stockpiling, premium prices paid for the ores, and a buying depot in Butte, Montana, that is willing to accept low-grade ore.

Production reported for 1954 was nearly 750 dry short tons of manganese oxide ore valued at approximately $37,000.

In 1955 production was in three widely separated areas: the deposits on Sturgill Creek in Adams County, those near Lava Hot Springs in Bannock County, and those in the Lava Creek district in Butte County. Idaho is not considered a manganese producing state and there are few historical references to manganese deposits or production.

According to Hewett (31), float manganese minerals were found near Cleveland, Bannock County, in 1922 and development by the Idaho Manganese Company was started about 1924. By May, 1927, production amounted to 1,200 dry short tons of ore containing 40 to 50 per cent manganese. These deposits were non-productive in 1954.

Location and Description of Deposits

The Cleveland deposits are described as on the east side of Bear River, about one mile southeast of Cleveland. They are bedded, flat-lying deposits one to four feet thick and mixed with sand, clay, and marl. The ore is composed of soft wad ore and hard nodules of mixed psilomelane and pyrolusite (both oxides of manganese). The extent of the deposit is estimated as a few acres.
The deposits near Lava Hot Springs are in T. 9 S., R. 38 E., in Bannock County. They occur as lenses in quartzite and limestone and the ore minerals are a mixture of psilomelane and pyroslusite.

Production in Adams County is east of Sturgill Creek in T. 15 N., R. 6 W., and other occurrences are in T. 17 N., R. 5 W. The ore occurs interbedded with slate and in some instances as fissure veins in schist. The ore minerals are mixed oxides.

In Shoshone County, deposits are near Murray in T. 50 N., R. 4 E. The manganese occurs as cementing material in crushed and brecciated quartzite. No recent production has been recorded here.

Additional occurrences are known in Lemhi, Owyhee, and Washington Counties.

Uses (3)

Most of the manganese output is used to make the alloys ferro-manganese and spiegelisein, which are in turn used in the steel furnaces to deodorize and to impart special qualities to steel. Manganiferous iron ore is generally added directly in blast furnaces as a "sweetener" in production of pig iron and manganiferous pig iron. Manganese also is used in making cell batteries and in the chemical industry. The United States, the largest steel producer in the world, depends on imports for 90 per cent of the manganese it requires. Current government activity in establishing buying depots and in purchasing low-grade ores which can be concentrated is designed to encourage the expansion of domestic manganese mining.

Reserves and Potential

No information is available on the size of manganese deposits in Idaho. Reserves are thought to be small, but a field study will be necessary to determine the potential.

MERCUY

History and Production (3, 4, 5, 6, 15, 30, 33)

The most productive and best known deposits of mercury occur in Valley County near Yellow Pine. Pringle Smith found the Hermes deposit and located three claims about 1902 during the Thunder Mountain gold boom. After the boom died this area was nearly deserted and only assessment work was done until 1917. In that year the Fern group of claims was located on the other side of the ridge from the Hermes and a retort furnace was erected for extracting mercury from the cinnabar ore. Also at this time J. J. Oberbillig of Boise bonded the Hermes property and began producing a small amount of mercury. The mine was later taken over by the United States Mercury Mines Company, organized in 1921 with Mr. Oberbillig as president, and it is still under the same ownership. In 1942-48 the Bonanza Mines Inc. erected two large rotary furnaces on the property and developed the mine on a large scale with resulting substantial production of mercury. Soon after the war the plant was closed and Bonanza Mines Inc., eventually
sold its interest back to Oberbillig, who operated the mine and plant on a reduced scale in 1951-54.

The only other mercury deposits of known economic value are in Washington County near Weiser. The deposits here were recognized in 1936 by Harry Brown and 17 claims were located in 1937. The Idaho-Almaden Mines Company under L. K. Regua leased the property in 1938 and erected a mercury reduction plant. It started operating in 1939 and produced a substantial quantity of mercury but it closed in 1943 and eventually was dismantled. The Rare Metals Corporation of Boise, J. R. Reynolds, manager, has recently been drilling and sampling at the property. Rare Metals is a subsidiary of El Paso Natural Gas.

(3, 4, 6) TABLE 9 - Recorded annual production of mercury - Idaho - 1932-54

<table>
<thead>
<tr>
<th>Year</th>
<th>76 pounds</th>
<th>Value</th>
<th>Year</th>
<th>76 pounds</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>-</td>
<td>-</td>
<td>1943</td>
<td>4,261</td>
<td>$831,790</td>
</tr>
<tr>
<td>1933</td>
<td>-</td>
<td>-</td>
<td>1944</td>
<td>(a)</td>
<td>(a)</td>
</tr>
<tr>
<td>1934</td>
<td>-</td>
<td>-</td>
<td>1945</td>
<td>627</td>
<td>84,876</td>
</tr>
<tr>
<td>1935</td>
<td>-</td>
<td>-</td>
<td>1946</td>
<td>868</td>
<td>85,272</td>
</tr>
<tr>
<td>1936</td>
<td>-</td>
<td>-</td>
<td>1947</td>
<td>886</td>
<td>74,194</td>
</tr>
<tr>
<td>1937</td>
<td>-</td>
<td>-</td>
<td>1948</td>
<td>543</td>
<td>41,534</td>
</tr>
<tr>
<td>1938</td>
<td>-</td>
<td>-</td>
<td>1949</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1939</td>
<td>(a)</td>
<td>(a)</td>
<td>1950</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1940</td>
<td>(a)</td>
<td>(a)</td>
<td>1951</td>
<td>357</td>
<td>75,016</td>
</tr>
<tr>
<td>1941</td>
<td>(a)</td>
<td>(a)</td>
<td>1952</td>
<td>887</td>
<td>177,000</td>
</tr>
<tr>
<td>1942</td>
<td>(a)</td>
<td>(a)</td>
<td>1953</td>
<td>(a)</td>
<td>(a)</td>
</tr>
<tr>
<td>1954</td>
<td>650</td>
<td>170,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) "Undistributed"

Location and Description of Deposits (6, 33, 34)

The mercury deposits in Valley County are east of Yellow Pine in T. 19 N., R. 9 and 10 E., and are distributed over an area of about 4 square miles. The ore occurs in limestone beds of supposed Cambrian age which have been metamorphosed and silicified in some places. The ore mineral is cinnabar, the most common sulfide of mercury, and the ore bodies are irregular in shape with indefinite boundaries.

The Idaho-Almaden deposit near Weiser is on Nutmeg Mountain in T. 10 and 11 N., R. 3 W. It is typical of the so-called opalite type deposits in which cinnabar is closely associated with opal and chalcedony.

Opal, chalcedony, cinnabar, and a little pyrite have impregnated and cemented openings in the sandstone beds of the Payette formation. The mineralized area extends over more than 100 acres, but only a part of the mineralized rock contains enough cinnabar to be classed as ore.

Cinnabar has been recognized in the gravel of several placer deposits. Perhaps the best known are the Ruby Meadows placers in T. 22 N., R. 5 E., Idaho County. No commercial production of mercury has come from placers.
Occurrences of cinnabar have also been noted in Blaine, Cassia, and Custer Counties.

Reserves and Potential

The Rare Metals Corporation's explorations at the Idaho-Almaden deposits near Weiser in Washington County in 1954-55 were reported as so encouraging that a mercury reduction plant using a rotary furnace was ordered.

Undoubtedly this area contains large reserves of low grade cinnabar material, part of which may be mined at a profit at the present price of mercury.

The Hermes mine in Valley County was closed in 1955 and in process of changing ownership. There were indicated reserves of ores sufficient for several years' operations at current capacity, but problems of mining and furnacing of the ore remained to be solved.

Some cinnabar may be recovered in dredging for monazite and other heavy alluvial minerals in some of the state's placer deposits.

The 1955 price of mercury, approximately $4 a pound as compared with $1 a pound a few years ago, called for a reassessment of the value of the Idaho mercury deposits. Much of the reserves can be mined profitably at 1955 prices, but not without capital expenditures for exploration, rehabilitation, and new plant construction. Unsuitable prices for mercury in the past have discouraged capital expenditures. The United States government has placed a temporary floor under the mercury price structure by offering to buy domestic production at $225 per flask, or about $3 a pound. This floor and the present high price probably will encourage a greater output from Idaho in the next two years.

MICA

History and Production (1, 2, 3, 5, 7, 63, 32)

Mica mining and production in Idaho has been concentrated in the Avon district a few miles north of Avon in eastern Latah County. The Muscovite mine, the largest producer, was the first opened in 1888, and it has been worked intermittently to the present time. Among the early operators were Woody and Lamb, Muscovite Mica Company of Spokane, Alexander Munro of Moscow, and Producers' Mica Company of Chicago. At least 920 tons of crude mica valued at $100,000 was produced before 1942. War demand for mica stimulated renewed activity and the Muscovite mine was rehabilitated in 1942 by V. A. Christensen of Salt Lake City, who operated the property until December, 1944. During this period, 1942-45, more than 1,500,000 pounds of crude mica was produced and 99,000 pounds of sheet and punch mica valued at $434,000 was sold from the Avon district. Most of the production came from the Muscovite mine.

Other mines in the Avon district include the Last Chance, the Silver White, the Steelsmith, the Luella, the Olson, and Doerr. The
Doerr and the Steelsmith were reopened and produced some mica during 1943-44. The U. S. Bureau of Mines explored deposits by bulldozer trenching at the same time and several new discoveries were made and briefly worked. The price of mica decreased at the end of 1944 and by the end of 1945 all the mines in the district were closed.

The Muscovite mine was reopened and operated from 1951 to 1955 by the Idaho Beryllium and Mica Corporation, which shipped mica and beryl concentrates to government depots for the stockpile. However, a foreclosure order in federal court was issued in May, 1955, and the plant was closed pending sale to satisfy government liens on the property.

Olson and Vennigersholz produced a small amount of block mica from the Steelsmith property during 1953-54.

Although pegmatites containing mica are known to occur in Idaho outside the Avon district, very little mica mining has been done in other areas. The Vaught prospect in Boise County has reportedly produced small quantities of mica and columbite from small mining operations. A small production of mica was obtained from the Mica Queen mine in Adams County and the Myers mine in Idaho County in 1949-44 and some unsuccessful attempts have been made to work prospects in other counties of Idaho.

(3, 5, 6) TABLE 10 - Recorded Annual Production of Mica - Idaho - 1943-53

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
<th>Value</th>
<th>Pounds</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1943</td>
<td>(a)</td>
<td>(a)</td>
<td>5,136</td>
<td>$25,554</td>
</tr>
<tr>
<td>1944</td>
<td>356</td>
<td>$7,161</td>
<td>48,787</td>
<td>247,149</td>
</tr>
<tr>
<td>1945</td>
<td>199</td>
<td>3,178</td>
<td>48,018</td>
<td>111,008</td>
</tr>
<tr>
<td>1946</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1947</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1948</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1949</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1950</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1951</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1952</td>
<td>180 (b)</td>
<td>121,000 (b)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1953</td>
<td>173 (b)</td>
<td>135,000 (b)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(a) Figure included under Miscellaneous
(b) Crude mica

Location and Description of Deposits

The deposits of mica in Latah County are on the flanks and crest of Mica Mountain in secs. 15, 22, 23, and 27, T. 41 N., R. 2 W., about 6 miles north of Avon.

The mica and beryl are present as constituents of pegmatite dike: which have invaded micaceous schists and gneisses of the Belt formations of pre-Cambrian age. The pegmatites found in a belt about 1 mile wide and about 2½ miles long in a northeast-southwest direction.
A deposit of mica in Adams County, the Mica Queen property, is in sec. 8, T. 15 N., R. 2 E., about 10 miles southeast of Council.

The mica is in a pegmatite which is a mixture of quartz and plagioclase and is 4 to 10 feet thick striking north and dipping 30 to 40 degrees east.

The Vaught prospect in Boise County is in sec. 19, T. 8 N., R. 5 E., about 11 miles southeast of Banks. Mica and some columbite are constituents of a pegmatite which is exposed over an area 130 by 160 feet and is intruded into granodiorite of the Idaho batholith.

The Myers mine in Idaho County is in secs. 20-21, T. 34 N., R. 4 E., 4 miles northeast of Kamiah on the George Myers farm. Here the pegmatite is probably a lens or pipe in foliated micaceous schist.

Other mica prospects are known in pegmatites in Boundary, Bonner, Latah, Clearwater, Idaho, Adams, Valley, and Boise Counties.

Uses

The widest use of mica is for heat and electrical insulation. Sheet mica is for electrical insulation in condensers and tubes for radio, radar, and television. Large sheets are used for electric heating elements. Bonded mica is used for many of the same purposes.

Wet-ground mica is used in wall paper, paints, filler for rubber and some plastics. Dry-ground mica is used for roofing materials, rubber dusting powders, and molded electric insulation.

Mica is an essential strategic mineral for many military and civilian industries and, during war periods, is also a critical mineral since domestic production cannot supply the demand. The United States government seeks to stimulate domestic production by purchases for stockpiling and help to operators through exploration loans and technical advice.

Reserves and Potential

Virtually no reserves of mica are known except in the Mica Mountain deposits of Latah County. The U. S. Geological Survey estimated 1,260,000 to 2,000,000 pounds of crude sheet-bearing mica reserves in Idaho in 1945.

The future of mica mining in Idaho depends to a large extent on the continued support of government agencies since the nature of the deposits in Idaho and the long distance from centers of consumption and markets make most operations of a marginal character.

OIL AND GAS

Possible Oil and Gas Resources (7, 56, 57, 58)

The oil and gas possibilities in southeastern, south-central, and southwestern Idaho have been noted by geologists in numerous
reports for 30 years or more. Several wells have been drilled and showings of oil have been reported but no productive oil well had been drilled in Idaho by mid-1955.

Considerable gas has been developed in wells drilled in Payette and Washington Counties. One of the most successful has recently been reported in the southeast one-fourth of sec. 27, T. 8 N., R. 4 W., Payette County. It is the Oroco Oil and Gas Company's J. R. Simplot-Virgil Johnson No. 1, and it was estimated as capable of 350,000 cubic feet. The well casing collapsed and operations were suspended; however, another well was to be put down in sec. 26, T. 8 N., R. 4 W.

Most of the wells drilled in southwestern and south-central Idaho have been in Payette, Canyon, Washington, Gem, and Ada Counties. Some drilling has been done in Owyhee and Cassia Counties and interest has been shown in Twin Falls and Boise Counties. The formations penetrated by the wells in this part of Idaho are Tertiary clastic beds comprising tuffs, sandstones, shales, and conglomerates. The thickness of the Tertiary beds where well developed will total several thousand feet. The beds lie in areas of subsidence or downwarp with local flexures producing gentle anticlines. Many of the Tertiary beds are satisfactory reservoir rocks for oil and gas but lack source material.

Wells drilled in search of oil and gas in southeastern Idaho are in Teton, Bannock, Bonneville, Caribou, Power, Oneida, Bear Lake, Butte, Jefferson, Madison, and Bingham Counties. The most favorable source beds for oil and gas in this part of Idaho are Mesozoic, especially of Cretaceous age. These beds are similar lithologically and no more metamorphosed than beds of similar age in Wyoming that have yielded oil in commercial quantities. Both gas and oil showings have been found, particularly in Teton County, but no commercial producing well as of mid-1955.

PHOSPHATE ROCK

**History and Production (3, 4, 5, 7, 35, 50, 51)**

First discovery of phosphatic rock in the western phosphate field is credited to Albert Richter, who identified phosphatic beds near La Plata, Cache County, Utah, in 1889 and traced them as far as Bear Lake. C. C. Jones traced the outcrops throughout southeastern Idaho. In 1908 phosphate lands on public domain were withdrawn from entry by the Secretary of the Interior.

Many enterprises were started in the early 1900's for the mining and grinding of the raw phosphate rock for direct application to the soil. The high cost of transportation because of the remoteness of the region at that time and the small benefit derived from direct application of raw rock resulted in a short life for most of these ventures.

The Anaconda Mining Company started exploration work at Conda north of Soda Springs in Caribou County in 1915 and in 1920 started producing phosphate rock for its fertilizer plant located at Anaconda, Montana. The output is from 50,000 to 100,000 tons of rock a year.
Production has been continuous since the start. Since the end of World War II, the sales of western phosphate products has increased many fold. The J. R. Simplot Company started its phosphate fertilizer plant at Pocatello in 1944 and its mining operations at the Fort Hall deposit in 1946. The fertilizer plant is now one of the largest in the world. Much of the production from the Fort Hall deposit is a low grade phosphate shale which goes to the elemental phosphorus plant of the Westvaco Chemical Division of the Food Machinery Corporation, which is now capable of handling 700,000 tons of rock a year.

The Monsanto Chemical Company, a recent entry into the phosphate field has just completed the largest elemental phosphorus furnace of its kind in the world at Soda Springs and it stepped up its mining operations near Soda Springs in 1954. The San Francisco Chemical Company has been operating an open pit mine 5 miles east of Montpelier.

(3, 5, 6) TABLE 11 - Recorded annual production of phosphate rock - Idaho - 1932-52

<table>
<thead>
<tr>
<th>Year</th>
<th>Long tons</th>
<th>Value</th>
<th>Year</th>
<th>Long tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>23,172</td>
<td>$103,243</td>
<td>1942</td>
<td>114,079</td>
<td>$511,249</td>
</tr>
<tr>
<td>1933</td>
<td>19,751</td>
<td>80,622</td>
<td>1943</td>
<td>108,916</td>
<td>561,630</td>
</tr>
<tr>
<td>1934</td>
<td>37,151</td>
<td>140,397</td>
<td>1944</td>
<td>112,565</td>
<td>548,400</td>
</tr>
<tr>
<td>1935</td>
<td>41,796</td>
<td>176,877</td>
<td>1945</td>
<td>123,380</td>
<td>673,627</td>
</tr>
<tr>
<td>1936</td>
<td>47,113</td>
<td>203,254</td>
<td>1946</td>
<td>(a) 312,658</td>
<td>1,805,103 (a)</td>
</tr>
<tr>
<td>1937</td>
<td>53,436</td>
<td>356,087</td>
<td>1947</td>
<td>(a) 845,045</td>
<td>4,077,885 (a)</td>
</tr>
<tr>
<td>1938</td>
<td>66,014</td>
<td>296,595</td>
<td>1948</td>
<td>(a) 434,875</td>
<td>2,122,089 (a)</td>
</tr>
<tr>
<td>1939</td>
<td>95,451</td>
<td>431,938</td>
<td>1949</td>
<td>(b) 471,305</td>
<td>1,915,125 (b)</td>
</tr>
<tr>
<td>1940</td>
<td>99,086</td>
<td>444,898</td>
<td>1950</td>
<td>(c) 579,044</td>
<td>2,125,065 (c)</td>
</tr>
<tr>
<td>1941</td>
<td>97,274</td>
<td>444,154</td>
<td>1951</td>
<td>694,446</td>
<td>1,748,074</td>
</tr>
<tr>
<td>1952</td>
<td>(a) 620,551</td>
<td>2,163,608 (a)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Includes Utah production  
(b) Includes Wyoming  
(c) Includes Utah and Wyoming

Location and Description of Deposits (7, 50)

The phosphate rock occurs as bedded sedimentary deposits. All the commercial deposits are in the phosphoria formations of Permian age. From outcrops and other criteria, phosphate deposits are known to underlie parts of 7 counties in southeastern Idaho, namely: Bear Lake, Caribou, Bannock, Bingham, Bonneville, Teton, and Fremont.

The phosphoria formation has been divided into two members, the upper or Rex member and lower or phosphatic shale member. Most of the mineable rock is in the lower member. In Idaho, the thickness of the phosphatic shale member ranges from 125 to 230 feet. Within the phosphatic shale member all of the beds contain phosphate. However, the most important commercially are two beds of oolitic textured rock, one near the top and one near the bottom of the member called the hanging wall and the footwall beds, respectively.

Besides phosphate, the shale member contains vanadium and fluo-

rune compounds and very small amounts of uranium minerals. The Ana-
conda Company is producing vanadium as a byproduct of its phosphate fertilizer plant from rock containing from 0.19 to 0.28 per cent $V_{2}O_{5}$.  

-34-
Uses

The phenomenal growth of the phosphate industry in Idaho in the last 10 years is an example of what can be done with a mineral resource when a market for the product is created. For years after the Anaconda Company opened its mine at Conda in 1920 and started making phosphate fertilizer, the company spent large sums of money promoting use of phosphate by western farmers. Improvements which lowered transportation costs per unit of plant food helped to increase acceptance. Phosphate rock must contain a minimum of 30 per cent $P_2O_5$ to be commercially useful for production of superphosphate fertilizer by acid treatment methods. Lower grade rock is now being used in the production of elemental phosphorous by treatment in electric furnaces at two plants in southeastern Idaho. The combined production of fertilizer and elemental phosphorous makes use of a larger part of a phosphate deposit, thus lowering the cost of mining.

Reserves and Potential

Total phosphate rock reserves have been placed at from 5 billion to 15 billion long tons, depending on the minimum grade used in the calculations. The phosphate deposits in Idaho have been estimated to contain as much as 85 per cent of the total United States reserves.

The industry is in an era of rapid expansion. Additional facilities are being installed and new entries have come in, such as the Jefferson Lake Sulphur Company, which has announced plans to erect a multimillion-dollar plant in Bear Lake County to manufacture 80,000 tons of triple superphosphate a year. The phosphate mining and treatment industry in Idaho, in its infancy a few years ago, may soon become one of the top two or three industries in annual dollar value in Idaho.

PUMICE

Production and Uses (61)

The major pumice operations in Idaho are near Ammon a few miles east of Idaho Falls in Bonneville County. Here several pits have been worked extensively and four or five operating companies are putting out a variety of products. In 1954 and early 1955 Pumice Inc. and Gemstone Insulation Products Company produced lightweight concrete aggregate; the Clark Concrete Construction Corporation manufactured acoustic plaster aggregate; and Pumice Inc, made thermal insulation material, acoustic plaster, fertilizer and insecticide filler, and traction granules. Facilities were installed in 1954 to produce natural puzzolan from pumice at the rate of 25 to 50 thousand tons a year. The Idaho Falls Brick and Tile Company mines small quantities of pumice to mix with clay in brick manufacture.

Pumice is also mined and processed in Blaine County by the Sun-ite Corporation of Salt Lake City, Utah. The mine is in a deposit of pumice just north of the Magic Reservoir in T. 1 S., R. 17 E., and the recently completed plant is at Bellevue.
Reserves and Potential (61)

Pumice is widely distributed around Ammon, Bonneville County, and reserves are probably large. The deposit near Magic Reservoir is estimated to contain more than 15,000,000 tons of pumice. There is a promising deposit near Teton in Teton County and less important deposits have been examined in Owyhee, Twin Falls, and Power Counties.

The pumice industry in Idaho has expanded many fold in the last 5 years and, with increasing acceptance of pumice products by the building industry and discovery of new uses such as in the manufacture of pizzolam, the immediate future seems to be one of continued growth.

SILICA

Location of Deposits and Uses (48)

Special sands high in silica content have been reported in Bonner, Kootenai, Benewah, Latah, Boise, Gem, Lemhi, Cassia, Caribou, and Bear Lake Counties.

The only silica sand operation in the state in 1955 was at Emmett in T. 6 N., R. 1 W., Gem County. The Gem Silica Company produces foundry sand and ground sand for blast and plaster sand from an extensive silica sand deposit containing about 30 per cent feldspar. The company planned to install a flotation plant to separate the feldspar and produce glass sand, chemical-grade silica, and feldspar as a byproduct.

In Caribou County near Soda Springs and in Power County near Pocatello, quartzite is being processed for silica for use in the electric furnaces of the phosphorous plants. Also in Bonner County, a few miles east of Newport, Washington, a quartz deposit is being quarried by the Pacific Northwest Alloys, Inc., to produce silica for use in its ferro-alloy plant in Spokane.

Reserves and Potential

Idaho's reserves of quartzite and quartz are virtually unlimited, and there are doubtless large tonnages of silica sand as yet undeveloped. However, the quartzite and quartz require crushing, grinding, and sizing to produce a salable product and most of the silica sand deposits would require some method of beneficiation to produce a suitable product for glass or chemical-grade sand.

The glass industry in the Pacific Northwest in 1955 was limited to the manufacture of glass containers. A cheap source of fuel, preferably natural gas, is an essential need for glass manufacture and this was not available in many parts of the Northwest. The problems involved in establishing a glass industry are not insurmountable and will be solved once the need becomes apparent.
**SILVER**

History and Production (3, 4, 5, 35, 36, 37)

Idaho ranks first in silver production among the states, and the Sunshine Mining Company operating the Sunshine Mine and adjoining properties in Shoshone County is the largest single producer of silver in the United States.

Silver was discovered in Idaho almost as early as gold. After the discovery of rich silver lodes near Silver City, Owyhee County, in 1863, this district was second only to the Comstock lode of Nevada in silver output. However, the bonanza days were short-lived. In the 1870's activity dropped because of the failure of the Bank of California and the lower market price of silver.

Idaho production revived in the early 1880's with the discovery of the lead-silver ores in Blaine County, and by 1882 the value of Idaho silver exceeded the value of the gold produced. Shoshone County became a major producer of silver after 1885. Since 1890 the lead-silver ores have yielded the greater portion of the silver production and the silver output has followed closely the ups and downs of lead production.

The now famous Sunshine mine was a late entry in silver production. It was not until the late 1920's that regular production was established and not until 1931 that the Sunshine became the large producer it is today. However, during its productive period Sunshine Mine has accounted for more than 20 per cent of all the silver Idaho has produced. The Coeur d'Alene district regularly yields more than 90 per cent of the annual silver output of the state.

(3) **TABLE 12 - Production of silver by counties - Idaho - 1951**

<table>
<thead>
<tr>
<th>County</th>
<th>Fine ounces</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>232</td>
<td>$210</td>
</tr>
<tr>
<td>Bear Lake</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>Blaine</td>
<td>528,650</td>
<td>479,455</td>
</tr>
<tr>
<td>Boise</td>
<td>1,306</td>
<td>1,182</td>
</tr>
<tr>
<td>Bonner</td>
<td>84,066</td>
<td>76,084</td>
</tr>
<tr>
<td>Custer</td>
<td>215,462</td>
<td>195,004</td>
</tr>
<tr>
<td>Elmore</td>
<td>37,378</td>
<td>33,829</td>
</tr>
<tr>
<td>Gem</td>
<td>1,074</td>
<td>972</td>
</tr>
<tr>
<td>Idaho</td>
<td>1,053</td>
<td>952</td>
</tr>
<tr>
<td>Lemhi</td>
<td>94,292</td>
<td>85,339</td>
</tr>
<tr>
<td>Lewis</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Owyhee</td>
<td>1,232</td>
<td>1,115</td>
</tr>
<tr>
<td>Shoshone</td>
<td>13,639,808</td>
<td>12,344,715</td>
</tr>
<tr>
<td>Valley</td>
<td>141,044</td>
<td>127,652</td>
</tr>
<tr>
<td>Washington</td>
<td>148</td>
<td>134</td>
</tr>
<tr>
<td>Other Counties (a)</td>
<td>7,247</td>
<td>6,559</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,753,023</strong></td>
<td><strong>13,352,231</strong></td>
</tr>
</tbody>
</table>

(a) Includes Bonneville, Boundary, Butte, Cassia, Clark, and Clearwater Counties.
The production from Blaine County was virtually all from the Triumph Mine. In Custer County the Clayton Silver Mine was the chief producer, and in Valley County the Yellow Pine Mine produced nearly all the silver.

(3, 4, 6) TABLE 13 - Recorded annual production of silver - Idaho - 1932-54

<table>
<thead>
<tr>
<th>Year</th>
<th>Fine ounces</th>
<th>Value</th>
<th>Year</th>
<th>Fine ounces</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>6,716,968</td>
<td>$1,694,185</td>
<td>1944</td>
<td>9,393,614</td>
<td>$7,062,481</td>
</tr>
<tr>
<td>1933</td>
<td>6,887,360</td>
<td>2,445,786</td>
<td>1945</td>
<td>8,142,667</td>
<td>5,790,441</td>
</tr>
<tr>
<td>1934</td>
<td>7,394,145</td>
<td>4,780,052</td>
<td>1946</td>
<td>6,491,104</td>
<td>5,244,812</td>
</tr>
<tr>
<td>1935</td>
<td>10,240,953</td>
<td>7,360,685</td>
<td>1947</td>
<td>10,345,779</td>
<td>9,382,930</td>
</tr>
<tr>
<td>1936</td>
<td>14,537,530</td>
<td>11,259,317</td>
<td>1948</td>
<td>11,448,875</td>
<td>10,361,810</td>
</tr>
<tr>
<td>1937</td>
<td>19,587,766</td>
<td>15,151,187</td>
<td>1949</td>
<td>10,049,257</td>
<td>9,095,085</td>
</tr>
<tr>
<td>1938</td>
<td>18,993,676</td>
<td>12,278,740</td>
<td>1950</td>
<td>16,095,019</td>
<td>14,566,805</td>
</tr>
<tr>
<td>1939</td>
<td>17,222,370</td>
<td>11,690,386</td>
<td>1951</td>
<td>14,753,023</td>
<td>13,352,231</td>
</tr>
<tr>
<td>1940</td>
<td>17,562,240</td>
<td>12,461,523</td>
<td>1952</td>
<td>14,923,155</td>
<td>13,506,212</td>
</tr>
<tr>
<td>1941</td>
<td>16,672,410</td>
<td>11,855,936</td>
<td>1953</td>
<td>14,689,740</td>
<td>13,249,704</td>
</tr>
<tr>
<td>1942</td>
<td>16,444,890</td>
<td>10,414,144</td>
<td>1954</td>
<td>15,813,440</td>
<td>14,311,962</td>
</tr>
</tbody>
</table>
| 1943 | 11,709,180  | 8,329,128  | 1863-1954 | 628,553,710|$456,838,738

Location and Description of Deposits (35, 36, 37)

The gold-silver deposits of the Silver City-DeLamar area in Owyhee County may be divided into the War Eagle and Florida Mountains veins located in T. 4 and 5 S., R. 3 and 4 W.; the De Lamar veins located in T. 5 S., R. 4 W.; and Flint veins in T. 6 S., R. 4 W. They are fissure type deposits. Mineralization occurs as ore shoots, and parts of the veins are virtually barren of valuable minerals. The ore minerals include argentite (Ag₂S), cerargyrite (AgCl), electrum (AuAg), jamesonite (4PbS·FeS·3Sb₂S₃), pyrargyrite (3Ag₂S·Sb₂S₃), stibnite (Sb₂S₃), and silver-bearing tetrahedrite (4Cu₅S·Sb₂S₃). This area, though one of the longest sustained producers in Idaho, is virtually abandoned.

The principal silver production in Blaine County has come from the Warm Springs and Hailey areas near Hailey and Ketchum in T. 2, 3, and 4 N., R. 17 and 18 E. The deposits here are replacement type in altered sediments and fissure veins. The ore minerals are galena, sphalerite, and argentiferous tetrahedrite.

Custer County deposits containing silver are near Clayton in T. 11 and 12 N., R. 17 E. and near Bayhorse in T. 12 and 13 N., R. 18 E.

Shoshone County's so-called silver belt, an area in which the chief product is silver, extends about 6.5 miles east-west and 2.5 miles north-south in T. 48 N., R. 3 and 4 E. The deposits are mostly fissure veins along minor fractures and faults, and the ore minerals are argentiferous tetrahedrite, galena, and sphalerite.

The southeastern part of Lemhi County near Leadore, Gilmore, and Nicholla is the silver-producing area in this county.
Silver-bearing lodes of lesser importance occur in Ada, Adams, Bannock, Bear Lake, Bonewah, Bonner, Bonneville, Boundary, Butte, Boise, Camas, Cassia, Clark, Clearwater, Elmore, Gem, Idaho, Kootenai, Latah, Lewis, Nez Perce, Oneida, Valley, and Washington Counties.

Reserves and Potential

The present importance of Idaho as a silver-producing state depends to a large extent on one operation, the Sunshine Mining Company group of mines in the so-called dry or silver belt of the Coeur d'Alene district. Most of the bonanza silver lodes worked in the 1880's in other parts of the state have been exhausted of high grade ore. Lower grade material remains in some cases, usually at a depth that adds to the cost of mining.

An estimate of the ore reserves of the Sunshine Mining Company is not available. However, it is believed that reserves are sufficient for several years operation at the present rate. Skillful use of modern methods and equipment in prospecting, developing, mining, and treating ores will, without doubt, make the reopening of other deposits economically feasible in the future.

STONE

Uses and Production (6, 7)

The Boise Stone Company's quarry on Table Rock Mountain in T. 3 N., R. 2 E., about 3 miles east of Boise, is the largest building stone quarry in Idaho. The deposit is a feldspathic sandstone and it has been used in the construction of the State Capitol building and also has been shipped to other states for use in large buildings. For the most part, building stone has been quarried in Idaho for local consumption. The kind of stone used is generally that which is most suitable that can be obtained nearby. Among the rocks quarried for building use are: tuff, tuffaceous sandstone, feldspathic sandstone, basalt, quartzite, and possibly some limestone and marble.

 Crushed stone (except limestone for cement) is produced to some extent in nearly all Idaho counties for use in concrete and for road metal; some production in southeastern Idaho is used for sugar refineries, and minor amounts are used for asphalt filler, railroad ballast, etc. Basalt, limestone, quartzite, and granite are used more for crushed stone than sandstone or tuffs.

Production figures for stone do not segregate building and crushed stone. Thus, the following table includes both. Counties in which stone was a principal mineral product in terms of value in 1953 are: Bannock, Benewah, Bonner, Bonneville, Camas, Clearwater, Idaho, Kootenai, Latah, Lewis, and Nez Perce.
TABLE 14 - Recorded annual production of stone - Idaho - 1934-53(a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Short tons</th>
<th>Value</th>
<th>Year</th>
<th>Short tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1934</td>
<td>764,730</td>
<td>$875,103(b)</td>
<td>1944</td>
<td>323,000</td>
<td>$413,805(c)</td>
</tr>
<tr>
<td>1935</td>
<td>686,480</td>
<td>631,050(b)</td>
<td>1945</td>
<td>247,140</td>
<td>293,980</td>
</tr>
<tr>
<td>1936</td>
<td>348,150</td>
<td>688,860</td>
<td>1946</td>
<td>543,870</td>
<td>568,159</td>
</tr>
<tr>
<td>1937</td>
<td>891,270</td>
<td>700,627</td>
<td>1947</td>
<td>1,024,780</td>
<td>991,559</td>
</tr>
<tr>
<td>1938</td>
<td>1,047,280</td>
<td>795,895</td>
<td>1948</td>
<td>1,061,050</td>
<td>1,000,358</td>
</tr>
<tr>
<td>1939</td>
<td>1,063,250</td>
<td>1,236,735</td>
<td>1949</td>
<td>1,440,680</td>
<td>1,878,801</td>
</tr>
<tr>
<td>1940</td>
<td>967,300</td>
<td>807,797</td>
<td>1950</td>
<td>644,000</td>
<td>861,000</td>
</tr>
<tr>
<td>1941</td>
<td>767,750</td>
<td>644,006</td>
<td>1951</td>
<td>1,457,000</td>
<td>1,811,000</td>
</tr>
<tr>
<td>1942</td>
<td>470,590</td>
<td>586,289</td>
<td>1952</td>
<td>1,793,000</td>
<td>2,714,000</td>
</tr>
<tr>
<td>1943</td>
<td>91,330</td>
<td>127,092</td>
<td>1953</td>
<td>1,100,000</td>
<td>2,300,000</td>
</tr>
</tbody>
</table>

(a) Except limestone for cement.
(b) Exclusive of sandstone.
(c) Exclusive of granite.

SULFUR

Location and Description of Deposits (62)

The sulfur deposits in Idaho are located a few miles south of Soda Springs in secs. 2, 11, 13, and 14, T. 9 S., R. 42 E. and sec. 14, T. 10 S., R. 43 E. in Caribou County.

The sulfur, associated with gypsum, occurs as cementing material in a fault breccia of tuff, limestone, and quartzite. The surrounding formations are tuff, limestone, quartzite, shale, and sandstone of Carboniferous, Triassic, and Cretaceous age. The fault zone trends northwest-southeast and the exposures in T. 9 S., R. 42 E. cover a belt about 2½ miles long. The deposit in Rattlesnake Canyon in T. 10 S., R. 43 E. is about 8 miles from the exposures in township 9 and on the strike of the fault.

Reserves and Potential (62)

The exposures of sulfur-bearing material cover 4 to 5 acres in T. 9 S., R. 42 E. and have been estimated to contain 1,000,000 tons of ore averaging 10 per cent sulfur content. Further exploration work will be needed to determine the depth of the deposits. There is a probability that the belt of sulfur deposits may extend to Rattlesnake Canyon with a vast increase in the total reserves.

These deposits have been known since before 1900 and investigations were started about 1910. Several unsuccessful attempts have been made to produce sulfur from the deposits. With improved transportation facilities, better mining and processing equipment, and expanding markets, the sulfur deposits may attain economic significance.
THORIUM

History and Production (3, 43)

The chief source of thorium in Idaho is in monazite sands found in placer deposits scattered over the state. Recent discovery of vein deposits of thorite and monazite in Lemhi County gives promise of another future source of thorium.

Although monazite sands were recognized as early as 1898 in the placer deposits of the Boise Basin and have since been noted in many places over the state, it has only been in the last 10-15 years that any attempt has been made to dredge some of the placer ground for its monazite content.

Recent dredging activity for monazite has been centered in the Warren mining district and Ruby Meadows north of McCall and in Long Valley near the mouth of Big Creek south of Cascade. The monazite concentrates are sent to Boise for treatment to separate the various constituents.

A similar operation was being made ready to start during the 1955 season in Bear Valley, Valley County. Production figures for monazite sands and thorium are not disclosed at the request of the Atomic Energy Commission.

Location and Description of Deposits (43)

Among the richest monazite placers in Idaho are those in Long Valley near the mouth of Big Creek in T. 13 N., R. 4 E., Valley County. A large dredge belonging to the Baumhoff-Marshall Company is operating in this deposit. The dredge product is sent to a separation plant at Boise where monazite, ilmenite, zircon, and garnet concentrates are produced. Only the monazite, chiefly valuable for its thorium, is currently marketed. The other products are being stockpiled.

The Warren placers contained abundant monazite sands, much of which has been buried beneath the dredge tailings of the former operators as of no value. Nearby Ruby Meadows sand is especially rich in monazite. These placers are located in T. 22 N., R. 4, 5, and 6 E., Idaho County.

A monazite-rich placer of commercial significance is reported along Musselshell Creek in T. 35 N., R. 6 E., in Clearwater County, but the extent of the deposit has not been delineated and reserves are unknown.

A deposit of placer material containing commercial amounts of uranium minerals as well as monazite and heavy minerals is located in Bear Valley, T. 12 and 13 N., R. 9 E., Valley County. A dredging operation was under way in 1955 which would be the first production of uranium minerals from a placer deposit in the world. The monazite was to be recovered also as a commercial product.

In 1950, monazite lode deposits were discovered on the north side of the Salmon River between the towns of Shoup and North Fork in T. 2
N, R. 19 and 20 E, and T. 25 N., R. 19 E., Lemhi County. The monazite occurs in thin-bedded pre-Cambrian marble of the Belt series. The extent and value of the deposits are not known but preliminary examination indicates they are worth further exploration.

Also in Lemhi County, recent discoveries of the mineral thorite have been made at the old Copper Queen mine on Agency Creek near Lemhi Pass in T. 19 N., R. 25 E.

Monazite placer deposits have also been noted in Ada, Boise, and Owyhee Counties.

Uses (3, 44)

The progress made in adapting thorium to uses in the atomic energy program have not been revealed. However, the exploration, mining, and treatment of monazite deposits is under strict supervision of the Atomic Energy Commission with licensing required for all extractive operations. It can, therefore, be assumed that use may be anticipated soon. Heretofore, thorium has been used chiefly in the manufacture of incandescent mantles. The oxide is used in radio tubes, high temperature refractories, and optical glass, and as a catalyst in the petroleum industry.

Reserves and Potential

The total reserves of monazite sands in Idaho are very large. Production has only recently been established on a substantial scale and reserves have hardly been touched. Thorium should be just now coming into its own as part of the materials needed in the atomic energy program. The future for recovery of monazite from Idaho placers and production of monazite and thorite from lode deposits in the state seems bright at this time and should encourage expansion.

TUNGSTEN

History and Production (3, 4, 5, 6, 9, 35, 38, 39)

Prospecting and exploitation of tungsten deposits were stimulated in 1940-46 by high prices and war needs. After the war, prices and production declined. A purchasing program was announced by the General Services Administration on May 10, 1951. It provided for the purchase of standard grade tungsten concentrates by the government at $63 per short-ton unit for 5 years, and it was later amended to limit purchase to 3,000,000 units or to terminate on July 1, 1956, whichever occurred first. Since the world price of tungsten is $28 per unit, much below the government price of $63, all domestic production is being shipped to government buying depots. It is doubtful that any domestic producers could continue to operate at the current world price.

Tungsten was first noted in Idaho as early as 1881 in the Blue Wing district near Patterson, Lemhi County, but little development was done before 1911. War demands in 1914-17 brought some production at the Patterson and the Boise-Ima mines at Patterson, and the
tungsten deposits near Murray in Shoshone County and at Tungsten Hill in Boundary County were productive. The Lemhi County deposits were again worked in the late 1920's and output has been continuous since 1934.

During World War II the largest output of tungsten came from the Yellow Pine mine of the Bradley Mining Company in Valley County. The presence of tungsten in this antimony-gold deposit was discovered in 1941. During 1942-44 the mine was the largest tungsten producer in the nation and by 1945 the tungsten ore body was exhausted. The Bradley firm then took over the Ima property near Patterson and has since developed it into the largest tungsten producer in Idaho and one of the largest in the nation.

In 1954, tungsten concentrates were produced for the first time by the Cordero Mining Company near Mackay, Custer County, as well as from the Salmon River Scheelite Corporation's property in Custer County and from custom concentrates shipped to the Big IT mill near Pinehurst in Shoshone County. Small shipments were recorded in 1954 from the Alaska mine near Cuprum in Adams County and the Springfield mine near Yellow Pine in Valley County.

Table 15 - Recorded annual production of tungsten - Idaho - 1932-53

<table>
<thead>
<tr>
<th>Year</th>
<th>Short tons (60% WO₃ basis)</th>
<th>Value</th>
<th>Year</th>
<th>Short tons (60% WO₃ basis)</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>1</td>
<td>$720</td>
<td>1942</td>
<td>2,132</td>
<td>3,986,369</td>
</tr>
<tr>
<td>1933</td>
<td>11</td>
<td>2,787</td>
<td>1943</td>
<td>4,878</td>
<td>7,316,825</td>
</tr>
<tr>
<td>1934</td>
<td>99</td>
<td>115,830</td>
<td>1944</td>
<td>1064,460</td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>154</td>
<td>159,844</td>
<td>1945</td>
<td>222</td>
<td>376,290</td>
</tr>
<tr>
<td>1936</td>
<td>226</td>
<td>234,000</td>
<td>1946</td>
<td>401</td>
<td>1,464,000</td>
</tr>
<tr>
<td>1937</td>
<td>242</td>
<td>289,200</td>
<td>1947</td>
<td>382</td>
<td>1,332,000</td>
</tr>
<tr>
<td>1938</td>
<td>663</td>
<td>931,878</td>
<td>1948</td>
<td>443</td>
<td>1,646,000</td>
</tr>
<tr>
<td>1939</td>
<td>2</td>
<td>3,986,369</td>
<td>1949</td>
<td>16,735</td>
<td>28,295,850</td>
</tr>
<tr>
<td>1940</td>
<td>2</td>
<td>3,986,369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Location and Description of Deposits (24, 38, 39)

Tungsten deposits are more widespread in Idaho than was anticipated several years ago. A government guaranteed price has stimulated prospecting and revealed many new deposits. The occurrences of economic significance so far explored are in Lemhi, Valley, Custer, Adams, and Shoshone Counties.

In Lemhi County the tungsten ore bodies occur in the Blue Wing district on the west slope of the Lemhi Range in T. 14 N., R. 23 E. The Ima, the only producing mine, is in section 23. The district contains a complex system of quartz veins occurring in pre-Cambrian quartzites of the Belt series. The largest veins are near the granite border and the ore shoots are confined to the wider parts of the veins. Most of the vein material contains small amounts of metallic
minerals but economic concentrations are confined to a few ore shoots, most of which do not extend to the surface. The principal ore mineral is huebnerite (MnWO₄), a manganese tungstate. Other minerals of economic value as byproducts are tetrahedrite, chalcopyrite, galena, sphalerite, and scheelite.

The largest ore body found in Idaho was discovered by the United States Bureau of Mines and the Geological Survey in Valley County's Yellow Pine antimony-gold deposit in 1941, and by August of that year the Bradley Mining Company had started producing tungsten concentrates. The ore occurred in only one section of the mine and was exhausted by the end of 1945. It occurred as a disseminated deposit in altered granodiorite. The ore mineral was scheelite, a calcium tungstate associated with antimony and gold. Other discoveries of tungsten in Valley County are on Quartz Creek north of Yellow Pine in T. 19 N., R. 8 E. and on Little Pistol Creek, probably in T. 16 N., R. 9 E.

Tungsten occurs in Custer County near Thompson Creek northwest of Clayton in T. 12 N., R. 16 E., along Fourth of July Creek in T. 8 N., R. 15 E., and near Wild Horse and Summit Creeks in the Alto district in T. 6 N., R. 19 E. Mining is active in the Alto district near Wild Horse Creek. The deposits are of contact metamorphic type and the principal ore mineral is scheelite.

In Adams County, the Alaska Tungsten mine is located 5 miles north of Cuprum in the Seven Devils region, in T. 21 N., R. 2 W. The ore mineral, a molybdenum-rich scheelite, occurs in a tactite band about 5 feet wide in a quartz diorite adjoining an engulfed slab of limestone. Other similar prospects exist in the same area.

In Shoshone County, in T. 48 N., R. 2 E, section 5, the Big IT mill, under lease to Schmitroth and Ethington, produces tungsten concentrates from ores shipped from several small operations and treated on a custom basis.

Other tungsten occurrences are known in Boundary, Shoshone, Idaho Camas, Blaine, and Butte Counties. Some are being actively explored, but no ore bodies of commercial importance have been developed.

Reserves and Potential

The recent discoveries of tungsten minerals in areas which have been prospected in the past indicates that, in the search for gold, silver, lead, and other metals, the possible occurrence of tungsten was largely overlooked. The increased activity in prospecting, developing, and exploiting tungsten deposits and in erecting concentrators to treat low grade material reflects United States government efforts to encourage domestic production.

URANIUM

History and Production (5, 48)

Uranium-bearing minerals were recognized in Idaho as early as 1910, when pitchblende was noted near Leonia in eastern Boundary County.
In the Coeur d'Alene district, Shoshone County, uranium-bearing minerals have been found in some of the lead-silver-zinc mines. In 1949 uraninite was recognized in the lower workings of the Sunshine mine and in 1954 pitchblende was found in the upper workings of the Bunker Hill and Sullivan Company's Crescent mine. Explorations continued but no uranium ore had been shipped by mid-1955.

An initial shipment of 11 tons of uranium ore was made in April, 1955, by the G. and G. Mining Company from the McConnell-Sargent claims about 6 miles south of Salmon, Lemhi County. This is the first reported shipment of uranium ore from Idaho.

Considerable exploratory work has been done in 1954-55 on a deposit of uranium about 12 miles southwest of Hailey, Blaine County. The development was started in early 1954 by the Primitive Exploration and Finding Company and later the company holdings were consolidated with others in the area under the name of Hailey Trust Company and exploration was continued by a Wyoming concern.

Exploration work was continued in 1954-55 at the Garm-Lamoreaux mine 11 miles north of North Fork near Gibbonsville, Lemhi County. Location and Description of Deposits (43)

Uraninite and pitchblende (both uranium oxide) are found as vein deposits in some of the ore bodies of the Coeur d'Alene district in T. 48 N., R. 3 and 4 E., Shoshone County. The veins vary from paper-thin to 18 inches in width and are in pre-Cambrian quartzite.

In Lemhi County, near Gibbonsville in T. 25 N., R. 21 E., and T. 26 N., R. 21 E., torbernite (copper uranium sulfate) and autunite (calcium uranium phosphate) occur with pyrite, hematite, and a little galena and gold in quartz veins associated with pre-Cambrian quartzites. Also, in Lemhi County south of Salmon near the common corner of secs. 5, 6, 7, and 8, T. 20 N., R. 22 E., is a deposit of uranophane (calcium uranium silicate) with some autunite occurring as stringers in rhyolite of the Challis volcanic formation. This is the deposit from which a shipment of ore was made in April, 1955. A similar occurrence has been noted in sec. 12, T. 20 N., R. 21 E., on Williams Creek.

The uranium occurrences in Blaine County are south of Croy Creek in T. 1 N., R. 17 E., southwest of Hailey. The ore mineral, uraninite, is found in quartz veins which also contain some gold, galena, and sphalerite. The veins are in fractured granitic rock called monzonite.

Recently reported discoveries of radioactive material east of Naples in Boundary County suggest connection with much earlier reports (1910) of radioactive material at Leonia a few miles to the east.

Discovery of autunite in mica schist has recently been reported in the Orogrande-Buffalo Hump area in Idaho County and radioactive black minerals are found in most of the gold placers of the county.

Uranium mineralization occurs in the City of Rocks area in T. 15 S., R. 23 and 24 E. in Cassia County. Some work was done on state
land and a pile of ore was reported ready for shipment pending arrange-
ment with the State Land Commissioner for a lease.

Some uranium-bearing material occurs in pegmatites in Garden
Valley, Boise County, and autunite has been found in the pegmatites
on Mica Mountain in T. 41 N., R. 2 W., Latah County.

The Bear Valley placer deposits in southeast Valley County con-
tain uranium minerals together with columbite-tantalite mineraliza-
tion which, in the aggregate, is considered to be of economic value.
A dredging operation was being installed in 1955 to recover these
minerals.

Uses

All uranium ores are required by law to be sold to the United
States government for use by the Atomic Energy Commission in produc-
tion of fissionable material. An established price schedule, togeth-
er with bonuses and other payments, is designed to encourage pros-
ppecting and exploration of uranium deposits.

Reserves and Potential

The Atomic Energy Commission considers the uraninite and pitch-
blende veins in the Coeur d'Alene district as minable reserves. Also,
the radioactive beds found in lignite and carbonaceous shale, particu-
larly in the Goose Creek district in southern Cassia County, are pos-
sibly a low-grade source of uranium. Some beds of phosphate rock in
the phosphoria of southeastern Idaho contain small amounts of uranium,
probably in fluorapatite, a phosphate mineral. A method of recovery
of the uranium content in phosphate treatment is a possibility.

Recent discoveries of commercial deposits of uranium ore in
neighboring states, particularly in Washington near the Washington-
Idaho boundary, lend increased support to the possibility that com-
mercial uranium deposits will be found in Idaho.

Commercial Ores of Uranium and Thorium

Pitchblende - uranium oxide - gray-black.
Uraninite - uranium oxide - gray-black.
Brannerite - uranium titanium oxide - jet black.
Thorianite - uranium thorium oxide - brownish-black.
Samaraske - uranium plus rare earths - liver-brown.
Thorite - thorium silicate - reddish brown, orange.
Carnotite - potassium uranium vanadate - canary yellow.
Tyuyumunite - calcium uranium vanadate - greenish yellow.
Autunite - calcium uranium phosphate - apple green, sulphur
yellow.
Uranophane - calcium uranium silicate - lemon yellow.
Gummite - uranium oxide with lead and water - orange.
Torbernite - copper uranium phosphate - bright green.
Monazite - cerium, thorium rare earth phosphate - reddish yellow.
ZINC

History and Production (3, 4, 5, 6, 85)

Zinc was known to be associated with lead ores in Idaho from the earliest days of the discovery of base metal deposits. However, it was generally regarded as a detriment to the recovery of lead and silver and was discarded in the mill tailing for many years.

First recorded zinc production, in 1904, was 2,600 pounds valued at $130. The production of zinc was a byproduct of lead and silver smelting until World War I, when better prices brought a big jump in production in the Coeur d'Alene district. Production of zinc in 1916 was 86,500,000 pounds but by 1921 it had dropped to 33,000 pounds. It did not assume importance again until 1929, when production reached a new high of 91,000,000 pounds. Since the start of World War II, Idaho has boomed as a zinc producer. For several years it has led the nation in zinc output and it ranked second in 1954.

The Coeur d'Alene district accounts for 90 per cent of the state's production. Most of the rest comes from the Triumph mine in Blaine County and the Clayton mine in Custer County. In Shoshone County the Star Mine has been the largest producer with Bunker Hill, Page, Morning, Sidney, Frisco, and Day mines all being important contributors.

(3) TABLE 16 - Production of zinc by counties - Idaho - 1951

<table>
<thead>
<tr>
<th>County</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blaine</td>
<td>1,931</td>
<td>$ 702,884</td>
</tr>
<tr>
<td>Bonner</td>
<td>27</td>
<td>9,828</td>
</tr>
<tr>
<td>Custer</td>
<td>1,040</td>
<td>378,560</td>
</tr>
<tr>
<td>Gem</td>
<td>3</td>
<td>1,092</td>
</tr>
<tr>
<td>Lemhi</td>
<td>110</td>
<td>40,040</td>
</tr>
<tr>
<td>Owyhee</td>
<td>13</td>
<td>4,732</td>
</tr>
<tr>
<td>Shoshone</td>
<td>74,989</td>
<td>27,295,996</td>
</tr>
<tr>
<td>Other Counties</td>
<td>8</td>
<td>2,912</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>78,121</strong></td>
<td><strong>28,436,044</strong></td>
</tr>
</tbody>
</table>

(3, 4, 5, 6) TABLE 17 - Recorded annual production of zinc - Idaho - 1932-54

<table>
<thead>
<tr>
<th>Year</th>
<th>Short Tons</th>
<th>Value</th>
<th>Year</th>
<th>Short Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>10,252</td>
<td>$ 615,127</td>
<td>1944</td>
<td>31,373</td>
<td>$ 20,832,816</td>
</tr>
<tr>
<td>1933</td>
<td>20,958</td>
<td>1,761,311</td>
<td>1945</td>
<td>83,463</td>
<td>19,196,490</td>
</tr>
<tr>
<td>1934</td>
<td>24,800</td>
<td>2,132,742</td>
<td>1946</td>
<td>71,507</td>
<td>11,447,708</td>
</tr>
<tr>
<td>1935</td>
<td>31,053</td>
<td>2,732,645</td>
<td>1947</td>
<td>83,063</td>
<td>20,102,698</td>
</tr>
<tr>
<td>1936</td>
<td>49,100</td>
<td>4,910,000</td>
<td>1948</td>
<td>86,267</td>
<td>22,947,022</td>
</tr>
<tr>
<td>1937</td>
<td>54,199</td>
<td>7,045,870</td>
<td>1949</td>
<td>76,555</td>
<td>18,985,640</td>
</tr>
<tr>
<td>1938</td>
<td>44,083</td>
<td>4,226,880</td>
<td>1950</td>
<td>87,890</td>
<td>24,960,760</td>
</tr>
<tr>
<td>1939</td>
<td>47,544</td>
<td>4,945,096</td>
<td>1951</td>
<td>78,121</td>
<td>22,436,044</td>
</tr>
<tr>
<td>1940</td>
<td>70,801</td>
<td>8,995,726</td>
<td>1952</td>
<td>74,317</td>
<td>24,673,244</td>
</tr>
<tr>
<td>1941</td>
<td>79,084</td>
<td>11,862,600</td>
<td>1953</td>
<td>72,163</td>
<td>16,595,190</td>
</tr>
<tr>
<td>1942</td>
<td>87,256</td>
<td>16,229,616</td>
<td>1954</td>
<td>60,740</td>
<td>13,484,280</td>
</tr>
<tr>
<td>1863-1954</td>
<td>1,912,784</td>
<td>381,413,503</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Location and Description of Deposits (35)

The principal zinc producing deposits in Idaho are the famous lead-zinc ore bodies in the Coeur d'Alene district of Shoshone County. Some of the ores contain a larger proportion of zinc to lead than do others even in the same mine. The Wallace-Burke-Mullan area, mostly in T. 48 N., R. 5 E., which includes the Star mine, is the most productive zinc area at this time. The Bunker Hill mine on the south edge of Kellogg and the Pine Creek area in T. 48 N., R. 2 E. are also major producing areas. The principal ore mineral is sphalerite (ZnS), a zinc sulfide which is closely associated with the lead mineral galena.

Zinc also occurs as one of the principal economic minerals in the ore bodies of the Triumph mine in T. 3 and 4 N., R. 18 E., Blaine County. This mine is the largest zinc producer outside the Coeur d'Alene district.

The only other important zinc producer now is the Clayton mine in the Mayhorse district in T. 11 N., R. 17 E., Custer County. Other deposits containing zinc occur in Lemhi County near Nicholai in T. 12 N., R. 29 E.; in Butte County in the Lava Creek district in T. 3 N., R. 24 E.; in Boise County in the Grimes Pass area, in T. 9 N., R. 5 E.; in Washington County north of Heath in T. 17 N., R. 4 W.; and in Bonner County near Clark Fork in T. 56 N., R. 2 E. There are a number of small deposits scattered over northeastern Benewah and Kootenai and Boundary Counties. Zinc has been noted, associated with other metals in Ada, Adams, Camas, Elmore, Gem, Idaho, Owyhee, and Valley Counties.

Uses

The principal uses of zinc are for zinc-base alloys (for making die castings) and for galvanizing in the manufacture of galvanized sheets, wire rope, tubes, and pipe. In the first quarter of 1955 (January through March) consumption of slab zinc in the United States was: die casters 101,799 tons; galvanizers 101,887 tons; brass mills 35,721 tons, and other uses including zinc oxide 21,505 tons.

Reserves and Potential

No estimate is available on total recoverable zinc reserves in Idaho but there is ample evidence that reserves are large. Zinc production in Idaho probably will be affected more by prices and available market in the near future than by any shortage of reserves. In periods of low zinc prices, operators turn to mining ore with more lead and silver in proportion to zinc and thus reduce the output of zinc.

MISCELLANEOUS MINERALS

Arsenic (3)

Arsenic occurs widely in Idaho associated with the ores of gold, silver, copper, lead, and zinc. The chief minerals are arsenopyrite,
enargite, realgar, and arsenides of silver and lead. Arsenic is principally used in compounds of lead and calcium for insecticides. White arsenic (As₂O₃) is marketed as a weed killer and arsenic com-

pounds serve in sheep dip and in wood and leather preservatives. All the arsenic output comes from smelter smoke as a byproduct of the smelting of lead, silver, copper, gold, and zinc ores.

Supplies are generally greater than consumption. Sweden alone could supply world needs and has difficulty disposing of the poisonous material.

Bentonite (3, 6, 9, 48)

Undeveloped bentonite deposits are reported in Lemhi, Clark, Owyhee, and Custer Counties. Bentonite is altered volcanic ash and is composed principally of the clay mineral montmorillonite. It is used as bleaching clay in oil refineries and as an ingredient of mold-
ing sands. The huge deposits in Wyoming and South Dakota northwest of the Black Hills are the chief producing area in the United States.

Bismuth (3, 6)

Bismuth occurs in Blaine County as a sulfide, in Boise County associated with gold ores, and in other areas including the Coeur d'Alene district as lead-bismuth minerals. Most of the bismuth pro-
duced is a byproduct from the smelting of lead ores. Bismuth is con-
sumed in the pharmaceutical industry and it has recently become of strategic importance in alloys for aircraft metals and in the production of nuclear energy. No production of bismuth was recorded for Idaho in the Minerals Yearbook for 1951.

Feldspar (3, 6, 48)

Virtually all commercial feldspar occurs as a constituent of peg-
matites. Deposits of possible value have been reported in Bonner, Latah, Idaho, Adams, Valley, Boise, Custer, Fremont, and Cassia Coun-
ties. High grade orthoclase feldspar has been examined in Latah and Adams Counties. There was no reported feldspar production in Idaho to mid-1955.

Two-thirds of the feldspar produced goes into glass manufacture. The other important use is in ceramics (chinaware and other burned clay products). Feldspar mining in Idaho probably will await the local establishment of these industries.

Gem Stones

The Northwest annually produces more than $2,000,000 in gems, mostly through vacation and weekend amateur collectors, and Idaho shares in this activity. No organized companies produce gem material in the state. Latah County is known to have yielded white opals, Valley and Cassia Counties have topaz, Nez Perce County has produced a few garnets, and Adams County is reported to have yielded sapphires and zircons.
Graphite (3, 6)

Graphite has been reported in Lemhi and Camas Counties and there are deposits of possible commercial significance in Blaine County. The low price of graphite has limited mining to the most favorably situated deposits, and Idaho deposits have received little attention. Graphite is used for foundry facings, crucibles, lead pencils, lubricants, electrodes, and brushes for motors and generators.

Molybdenum (3)

Molybdenum occurring as the sulfide molybdenite (MoS₃) and as lead molybdate is reported in Elmore, Boundary, Custer, Idaho, Lemhi, and Valley Counties. A deposit in Boundary County (T. 64 N., R. 4 W.) recorded a small output of 1,044 pounds of molybdenum in 1938. There has been no other recorded production of molybdenum from Idaho. The main use for molybdenum is in alloy steel. Recently it has been used in special high-temperature non-ferrous alloys and as special lubricants. A small production of molybdenum as a byproduct of the smelting of Idaho's lead ores seems feasible if sufficient demand should develop.

Nitrate (3)

Nitrites are widespread in southern Idaho and have been reported from Bannock, Bingham, Bonneville, Camas, Caribou, Clark, Custer, Elmore, Fremont, and Owyhee Counties. Some attempts have been made to mine the most favorable occurrences for fertilizer material but the size and quality of the deposits has not supported a mining operation. In general the deposits are of the cave type.

As far as is known, the United States is without natural deposits of nitrate of size and quality to support a nitrate mining industry in competition with the production of ammonium sulphate and other ammonia fertilizers from petroleum and coal.

Nickel (3)

Small amounts of nickel are associated with the cobalt-copper deposits in the Blackbird district of Lemhi County. The deposits along Blackbird Creek have the highest nickel content, but the nickel is not present in commercial quantities and there is no recorded production in Idaho.

Salt (7)

Saline springs in southern Caribou County provided salt for early settlers. Some rock salt has been mined from beds in the same area and the product was above the average in purity. No estimate of quantity present is possible in view of the small amount of exploration work. Competition is strong among the old, well-established salt producing companies and reserves in active mining areas are very large. It is therefore doubtful that a salt industry in Idaho could flourish at this time.
Talc (3, 6)

A commercially significant occurrence of talc has been reported in T. 26 N., R. 2 E., Idaho County. Talc is a hydrous magnesium silicate and the softest of minerals. In the ceramics industry, ground talc is used in tile, porcelain dinnerware, and insulators. Toilet powders and face cream, polishes, floor wax, and paints require talc.

Thermal Springs

"Hot springs" are widespread in Idaho and have been used therapeutically. However, they are no longer as popular as before the advent of the many new drugs and vitamin preparations.

Tin (30)

Tin has been found in the placer diggings along the Salmon River west of Shoup in Lemhi County. The occurrence has some mineralogic interest but the amounts have been insufficient for commercial production.

Titanium (3)

A rutile occurrence, titanium oxide (TiO₂) has been found in Clearwater County in T. 39 N., R. 6 E. Little is known of the extent of the deposit.

The chief ore of titanium is ilmenite, a ferrous titanium oxide (FeTiO₃) which is associated with monazite in Idaho placer deposits. The Badmoff Marshall Company is stockpiling ilmenite from its dredging operations near Cascade. It has been estimated that 3 placer deposits in Long Valley, Valley County, contain 150 to 200 million cubic yards of gravel containing 8 to 10 pounds of ilmenite per cubic yard.

The manufacture of pigments consumes 99 per cent of the ilmenite produced. Welding rod coatings and production of titanium metal are other uses.

Tuff

Tuff is compacted rocklike volcanic ash composed of pyroclastic materials. It is used for building stone in some localities. A deposit of rhyolite tuff is being mined in T. 1 S., R. 3 W., Owyhee County, for fertilizer material.

Vermiculite (3, 48)

Vermiculite is a hydrous magnesium, iron, aluminum silicate and is an alteration product of biotite and phlogopite mica. Its value lies in its property of exfoliation and expansion. When heated it increases 8 to 12 times in volume. It is commercially useful for thermal insulation because of its light weight, fire resistance, and granular form.
Some of the largest vermiculite deposits in the United States are in Montana near the Idaho boundary. Occurrences have been reported in Idaho but no test has been made of the material.

**Volcanic Ash (3)**

Volcanic ash is unconsolidated pyroclastic material deposited from volcanic action in which the particles are smaller than 4 millimeters in size. Often referred to as pumicite, it is used in scouring powders and soaps.

Undeveloped deposits are reported in Bingham and Power Counties.
Selected Bibliography

8. Catalog, Survey and Directory Number, Mining World, April 15, 1955


