GeoNote 40

Idaho Mining and Geology

Idaho's rich tapestry of landscapes reflects an incredible mineral wealth and geologic diversity. It was the allure of gold that first drew miners to the Idaho Territory in the 1860s. Mining camps sprang up overnight, but most lasted only a short while. By 1869, Idaho's first gold rush was over, but all the commotion had aroused the rest of the country to the region's mineral promise as well as abundant timber and farm land.

Dreams of quick wealth launched an ever-widening search for other minerals. Signs of placer gold at Murray first brought prospectors to northern Idaho, but that brief excitement turned out to be more flash than substance. What did prove lasting was the discovery in 1884 of rich silver and lead ore. This remarkable find at Kellogg sparked the industry that built the region and nearby Spokane, Washington, into a Western mining capitol. New mines began developing deposits scattered from Pinehurst to Mullan, paralleling the South Fork of the Coeur d'Alene River and today's Interstate-90.

The valuable ores in this area known as the Coeur d'Alene Mining District consist mainly of silver, lead, and zinc along with some copper and a little gold. The metals are found in 1.4-billion-year-old Precambrian rocks of the Belt Basin. These rocks are composed of weakly metamorphosed argillite, siltstone, and quartzite that originally formed as sediments in the shallow waters of a giant sea that covered northern Idaho and extended into parts of Canada and Montana. Geologists have long debated how these deposits formed. An explanation currently accepted is that metals were first deposited or enriched during the original sedimentary process. Later, the metals were leached out of the rock and redeposited in veins along faults during a period of folding and metamorphism. One theory is that this second concentration process was related to the formation of granites in the massive Idaho batholith approximately 100 million years ago. The resulting veins are composed of quartz, iron-bearing carbonate, and metal sulfide minerals.

The district, also known locally as the "Silver Valley," became one of the largest silver-producing areas in the world. By the 1980s, after only a hundred years of mining, it had produced over a billion ounces of silver and significant amounts of lead, zinc, and copper worth over 5½ billion dollars. The mines of the Silver Valley are some of the deepest in the world, extending as much as 8,000 feet below the surface. The Sunshine Mine, sitting over the largest deposit, has alone produced 350,000 ounces of silver. By 2000, only three major mines remained active in the Silver Valley—the Sunshine, the Lucky Friday, and the Galena. In 1999, they mined 13 million troy ounces of silver.

Mining in the Silver Valley has been in decline for a number of years. The famous Sunshine mine closed in February 2001 because of low metal prices, declining amounts of ore, and a smelter shutdown due to high energy costs. The public may be more aware now of the Bunker Hill Superfund Site and the environmental legacy of early mining activities during which tailings and all types of waste were routinely flushed down river. The district's future will be shadowed by these past practices and also impacted by unpredictable international metal prices, environmental concerns and legislation, limited ore reserves, and always uncertain geology.

Idaho has another world-class mining region, perhaps less well known, but much more of an economic force today. This is the Phosphate Mining District, located in the southeast near Soda Springs. At present, phosphate is the largest mineral industry in the state, contributing nearly a half billion dollars to Idaho's economy. This production comes from just four large open-pit mines and four processing plants.

The phosphate is found as apatite, a calcium phosphate mineral. The phosphorus contained in the phosphate is an essential element in plants and animals. Apatite is a major constituent of an unusual sedimentary rock identified by geologists as the Permian-age Phosphoria Formation. The rock formed 260 million years ago in a large marine basin that extended from this part of Idaho into adjacent parts of Utah and Wyoming. One unit of the Phosphoria Formation, the Meade Peak Member, has within it layers of mineable phosphatic shale. The ore layers, which are only 30-60 feet thick, contain 25-30 percent phosphate, far more than that found in ordinary marine sediments. Scientists think the deposits formed on a continental shelf where sandy sediment was limited and abundant planktonic life was stimulated by upwelling currents carrying phosphorus-rich cold water. The phosphorus-rich remains fell to the bottom of the sea where changes in an oxygen-

IDAHO GEOLOGICAL SURVEY

MAIN OFFICE AT MOSCOW
MORRILL HALL, THIRD FLOOR
UNIVERSITY OF IDAHO
PO BOX 443014
MOSCOW, ID 83844-3014

BRANCH OFFICE AT BOISE
MATH-GEOLOGY, ROOM 223C
BOISE STATE UNIVERSITY
BOISE, ID 83725-1535

BRANCH OFFICE AT POCATELLO
PHYSICAL SCIENCE, ROOM 235
IDAHO STATE UNIVERSITY
CAMPUS BOX 8072
POCATELLO, ID 83209-8072

www.idahogeology.org 208-885-7991 email: igs@uidaho.edu
SINCE 1919, SERVING THE STATE THROUGH GEOLOGIC RESEARCH

deficient environment allowed release of the phosphorus. Within these soft sediments, the phosphorus combined with calcium to form apatite accumulations. Pieces of bones and fish scales are found as fossils in the Phosphoria, illustrating the marine origin. Much later, the sedimentary strata were uplifted, tilted, folded, and stacked into repeated layers by thrust faulting. These tilted layers of hard chert or limestone and softer shale form the region's curving ridge and valley landscapes.

The sedimentary processes were also responsible for enriching these shales in other elements, such as zinc, organic carbon, uranium, vanadium, silver, and selenium. Vanadium has been recovered as a byproduct, but the presence of uranium and especially selenium are environmental concerns that must be reckoned with during reclamation.

The phosphate ore is sent to two types of processing plants: one for elemental phosphorus at Soda Springs and Pocatello, where the phosphorus is separated from the ore and purified for use in food additives and chemicals; and the other for fertilizer at Conda and Pocatello, where the phosphate is combined with sulfuric acid to form phosphoric acid for making fertilizer. Currently, Idaho is the only producer of elemental phosphorus in the nation. Few consumers realize how commonly phosphate is used as an ingredient in everyday products such as soaps, soft drinks, and lawn fertilizers. Companies have been responsive to remedying the environmental impact of their activities. The phosphate industry's commitment to reclaiming the disturbed land and to maintaining pollution controls at the plants is an essential part of operations today.

Gold, particularly placer gold, has always been the public's favorite in Idaho's mining history. Prospectors first found gold near Pierce in 1860. Other discoveries quickly followed at Boise Basin, Atlanta, Silver City, and Warren. Boise owed much of its early growth to furnishing supplies for the mines on Grimes and Mores creeks near Placerville and Idaho City. The Boise Basin produced an estimated 3.3 million ounces of gold, most of it from placers but some from lode or vein deposits in granite and porphyry rocks of Cretaceous and Tertiary age. Other operations in districts such as Florence and Warren mined gold with house-sized, bucket-wheel dredges floated on dammed sections of streams where veins in granite had mostly been eroded. In the 1980s, high gold prices reawakened considerable interest in historic sites, like the old mining town of Leesburg. Here, the modern gold boom spurred the opening of the present-day Beartrack mine, only a stone's throw from the old placer diggings.

Stibnite, another historic district, also underwent renewed interest for gold, which is associated in this geologic setting with tungsten and antimony. These metals are found near blocks of metasedimentary rocks in the roof of the Cretaceous-age granite of the Idaho batholith. Major faults cut the area and control ore deposition. This isolated part of central Idaho provided strategic supplies of antimony and tungsten during World War II. Molybdenum, another metal used in specialty steels, has recently been mined near Challis at the giant open-pit Thompson Creek mine, where the ore is found in granodiorite.

Silver City in Owyhee County, now a popular tourist spot, is just a ghost of its former self. The town once served as the community center for gold-silver mines located in Tertiary volcanic rocks of southwestern Idaho. The ore-bearing veins formed about 15 million years ago when super-hot water, heated by volcanism, carried these metals in suspension through fractures in the rock where they precipitated into concentrated deposits. The recently closed DeLamar mine was a modern open-pit mine and mill in a rural area otherwise devoted to ranching.

Gold and silver may be the glamorous commodities, but the industrial minerals—the nonmetallics—are presently the consistent, solid performers in the state's economy. Besides phosphate, Idaho has a diverse suite of very useful nonmetallics. Sand and gravel is the second most valuable industrial mineral. It is mined for aggregate in concrete, ballast in roadbeds, and other construction purposes. Idaho is also a leading producer of industrial garnets, which are extracted from placer deposits at Emerald Creek in the north. Other commodities being mined commercially throughout the state are pumice, feldspar, zeolite, clay, decorative stone, clay, perlite, limestone, and gemstones.

Mining continues to probe the unique geologic puzzle that is Idaho. The mineral diversity may be further appreciated by citing just three other areas of past interest: silver-lead mines near Ketchum, copper mines in the Seven Devils, and cobalt mines at Blackbird. Over 8,000 mines and prospects are documented in the state. Information on mining and geology can be found in publications of the Idaho Geological Survey and at the Survey's Web site *(http://www.idahogeology.org)*.

Prepared by Virginia S. Gillerman
0201