Idaho Mining and Exploration, 2020-2021

Virginia S. Gillerman
Earl H. Bennett
Mark Barton

Staff Report 23-02
September 2023
Updated April 2025

Idaho Geological Survey
Morrill Hall, Third Floor
University of Idaho
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INTRODUCTION

The year 2020 will be known as the "Covid year" due to the arrival of the Covid-19 pandemic to the world and Idaho in early 2020. The Idaho mineral industry, like everyone, scrambled to find ways to cope with effects of the global pandemic. Mining was classified as a "critical industry," but it still needed to keep workers safe and productive at underground mines, open-pits and quarries and plants. By the second half of 2020, operations had implemented innovative ways to keep operating under Covid protocols, and by the end of 2020 and into 2021, Idaho mining was at essentially full production and mineral exploration companies were very busy with a return to grass roots exploration as well as drilling several advanced projects.

An added but positive incentive was Idaho's 8th place survey ranking in the investment attractiveness category of the Fraser Institute in 2019. This category is a combination of mineral potential and public perception, and the high ranking relative to dozens of country and state jurisdictions brought renewed attention to Idaho and its mineral industry. This staff report summarizes developments in the minerals and energy sectors for the calendar years of 2020 and 2021. Additional details and photographs are in the supplemental material for this report which is available on the Mines and Minerals page of the Idaho Geological Survey (IGS) website: www.idahogeology.org.

The actual value of Idaho's mineral production during this period varied due to pandemic effects and the strike at the Lucky Friday mine which ended in January 2020. The Lucky Friday mine ramped up to full production by the end of 2020. For Idaho, the U.S. Geological Survey reported a value of non-fuel mineral production in 2020 of $553 million. In 2021, the value for Idaho was listed at $655 million. These updated "final" values differ significantly from the preliminary numbers available in the annual Mineral Commodity Summary (MCS) publications. Because of legal concerns over proprietary information, the individual commodity production values are no

longer available to state surveys or the general public. A timeline of the total non-fuel mineral production value is shown in Figure 1. Ten commodities were only reported as "concealed" in 2021 for Idaho. They were: feldspar, garnet (industrial), lead, lime, perlite, phosphate rock, pumice, sand and gravel (industrial), silver, and zeolites. Two of those, phosphate rock and silver, are Idaho's most important and well-known mineral commodities. Relative to the other states, Idaho's mineral production value ranked 36th in 2020 and 35th in 2021, based on the USGS tabulation. Value added by in-state processing of phosphate rock is not included in the USGS values.

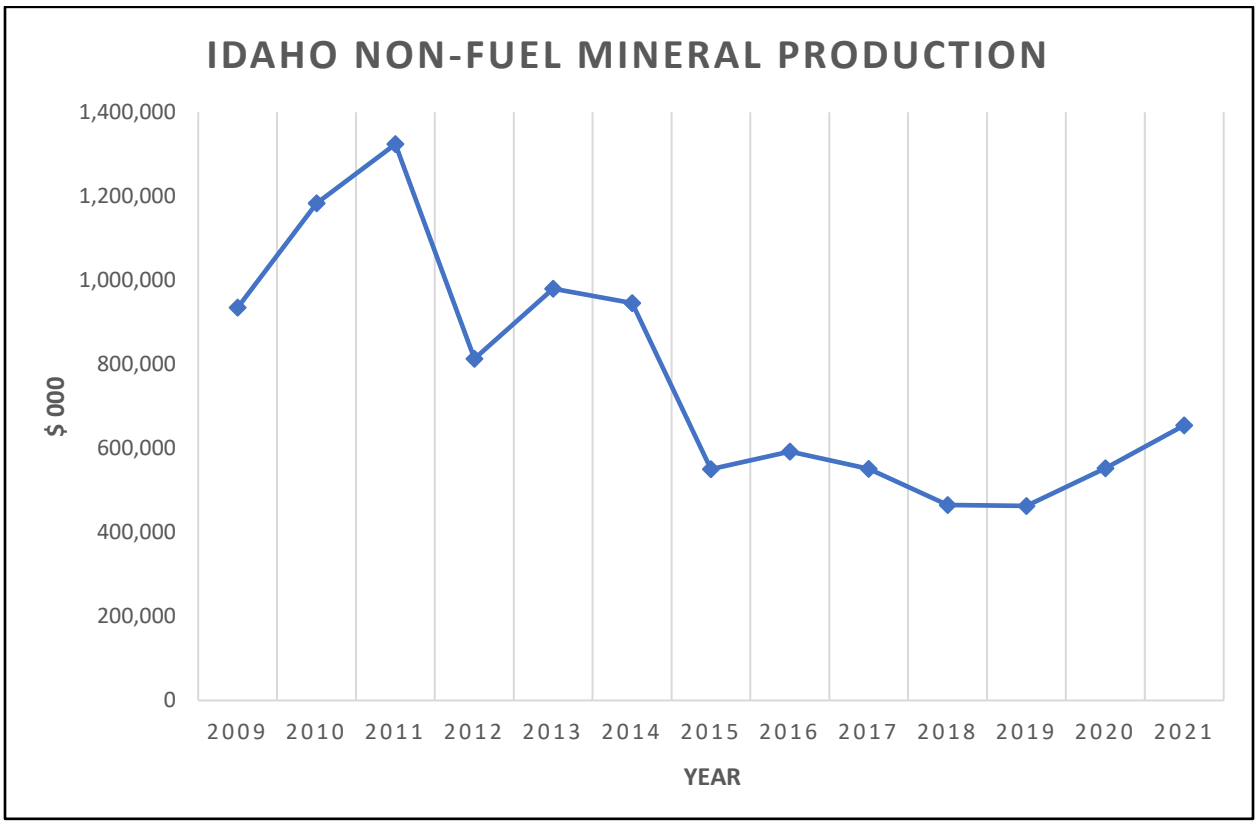

Figure 1. Total value of non-fuel mineral production in Idaho for the period 2009 to 2021, based on data from the U.S. Geological Survey.

Metal and commodity prices dictate production targets at operating mines and influence the level of exploration activity. In 2020, precious metal prices were in the $1,900 per troy ounce range for gold and $24 per ounce for silver. The silver market reached an 8-year high in March 2021 with futures prices just over $30 per ounce for a short time. Silver traded in the $25 per troy ounce range for the first half of 2021 before trending lower to about $22 per ounce by year's end. Gold was less volatile, staying close to $1,900 an ounce for most of 2021. Prices levels of the two precious metals were high and stable relative to historical trends. Base metal (Pb, Zn, and Cu) prices reached a low in early 2020 but rose steadily throughout 2021 with copper reaching over $4 per pound. On the other hand, molybdenum stayed low (circa $10 per pound) for most of the period but jumped to near $20 per pound in the second half of 2021. Cobalt showed a similar pattern; its price skyrocketed in 2021 to $20 per pound by July and closed the year over $30 per

pound. The result in Idaho was a staking rush in the Idaho Cobalt belt in 2021-2022. Neodymium prices showed a similar pattern. The commodity price increases in 2021 were in part a consequence of increased global economic activity following the pandemic-related slump in 2020.

Idaho is historically one of the nation's top silver producers. In 2021, the IGS collaborated with mines in the Coeur d'Alene district to tabulate silver production for the past 20 years and prior. GeoNote 47 was published by IGS in 2022 and records mine production in the Coeur d'Alene District, 2000 – 2020. It is available for download at https://www.idahogeology.org/product/G-47 . Figure 2 shows Idaho silver production and silver prices for the period 1978 – 2000. It demonstrates the variable production and the common lag time or mismatch when higher production coincides with lower metal prices. This cyclic industry pattern can inhibit a company's ability to reinvest profits back into a mine in the form of exploration drilling or infrastructure improvements.

Another highlight of 2021 was the increased awareness both globally and at the federal government of the importance of critical minerals to the forthcoming "green economy" and their use in many renewable power sources, electrification, consumer electronics, and high-tech defense applications. Rare earths, cobalt, antimony, copper and even zinc, are all commodities which have been produced in Idaho historically and were of great interest to government and exploration companies.

Figure 3 shows the location of active mines and plants in 2021. The Coeur d'Alene district in Shoshone County in north Idaho and the Phosphate district of southeastern Idaho are Idaho's two world-class districts. Both have operated for over 100 years.

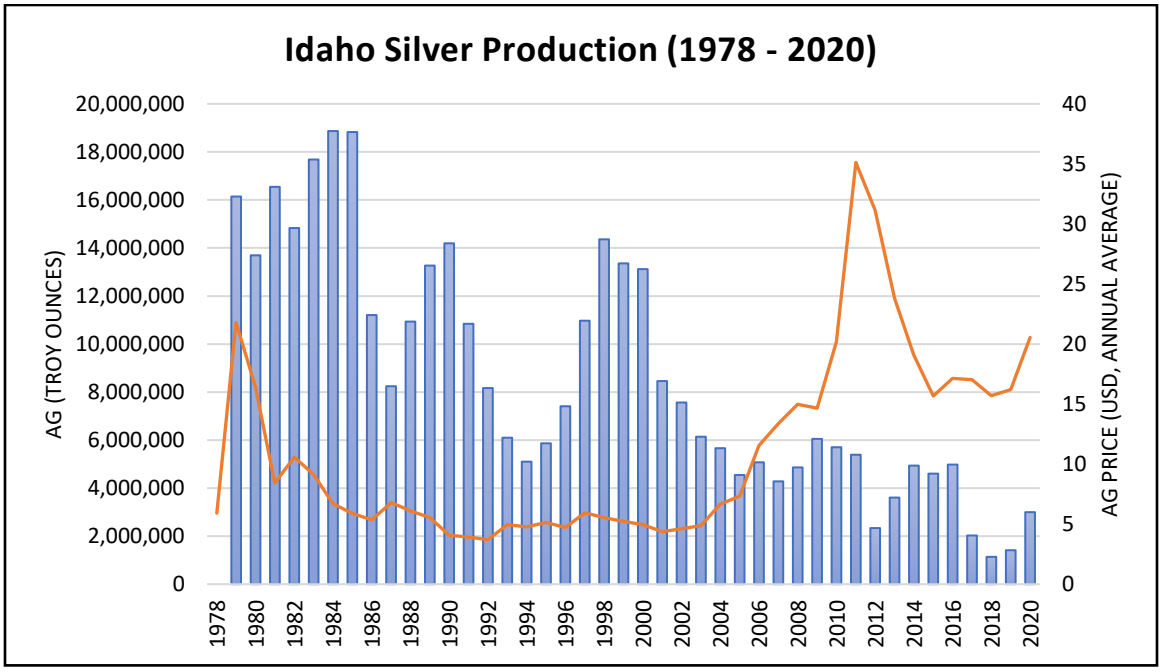

Figure 2. Idaho silver production and commodity price, 1978 – 2020. Compiled by IGS from USBM and company data. Price is yearly average from kitco.com.

METAL MINING

COEUR D'ALENE AND MURRAY DISTRICTS

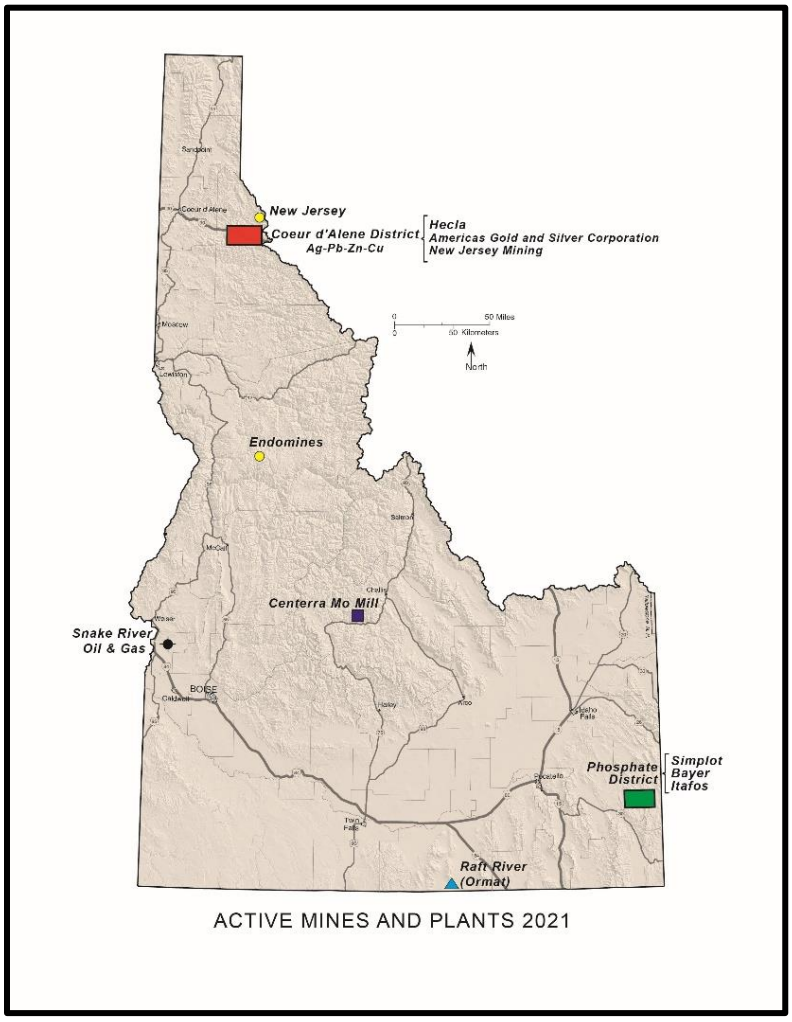

Figure 3. Location of active mines and plants in 2021. Yellow dots are small gold mines; the dark purple square is the inactive Thompson Creek mine; the black cross hair is for oil and gas production, and the blue triangle indicates a geothermal power plant.

The big news in the Coeur d'Alene district, also known as the Silver Valley, was the end in January 2020 of the 2½ year-long strike at Hecla's Lucky Friday mine in Mullan. The strike had commenced on March 14, 2017. By a narrow vote of United Steelworkers Local 5114, the mineworkers approved a settlement between Hecla and the union which allowed 164 miners to return to work. Hecla ramped up operations quickly with a goal of full production by the end of 2020. Hecla had been working with a Swedish company, Epiroc, to test a remote vein miner, but

Covid delayed bringing it to the US, and a test was conducted in a Swedish limestone mine. The machine is essentially a longwall miner turned vertical. Hecla's geologists also updated their 3-D geologic and structural models by digitizing older hand-drawn geologic maps and drilling closely spaced exploration core holes to examine the stratigraphy in more detail. The mine produced 2,031,874 troy ounces of silver in 2020 and 3,564,128 troy ounces in 2021 according to Hecla's annual report. The mine staff was also testing a new long hole blasting method which they called underhand closed bench (UCB) mining. Production at the Lucky Friday was from the steeply dipping Gold Hunter quartz-siderite-sulfide vein system.

Americas Gold and Silver Corporation operated the Galena mine and mill but production was greatly reduced because of the new joint venture. With the influx of capital from the 2019 joint venture with Eric Sprott, the mine focused on rehabilitation efforts on the 4300 and 5500 levels and an extensive exploration program. The company purchased a new Hagby 1000 drill to use for the exploration work (Fig. 4). The Galena's geologists and drill crews completed over 48,000 feet of diamond drilling in 2020 and 120,000 feet in 2021on Phase 1 and the start of Phase 2. Over 7,500 feet of drift was rehabilitated, and work commenced to replace the hoist and purchase new equipment.

Figure 4. Underground drilling at the Galena mine, 2000, with their new Hagby drill.

Actual production at the mine was down due to the combined effects of Covid and the needed rehabilitation work and exploration emphasis. Silver production at the Galena was probably less than 1 million ounces per year in both 2020 and 2021. The exploration effort was very successful; it increased the proven and probable reserve by 38%, and the measured and indicated resource by 72% as of mid-2021 with work on multiple vein targets from several levels during Phase 1 (Fig. 5). A new discovery on the Silver vein included a 2.8-foot intercept of 22 oz./ton Ag and 0.7% Cu in hole 55-144.

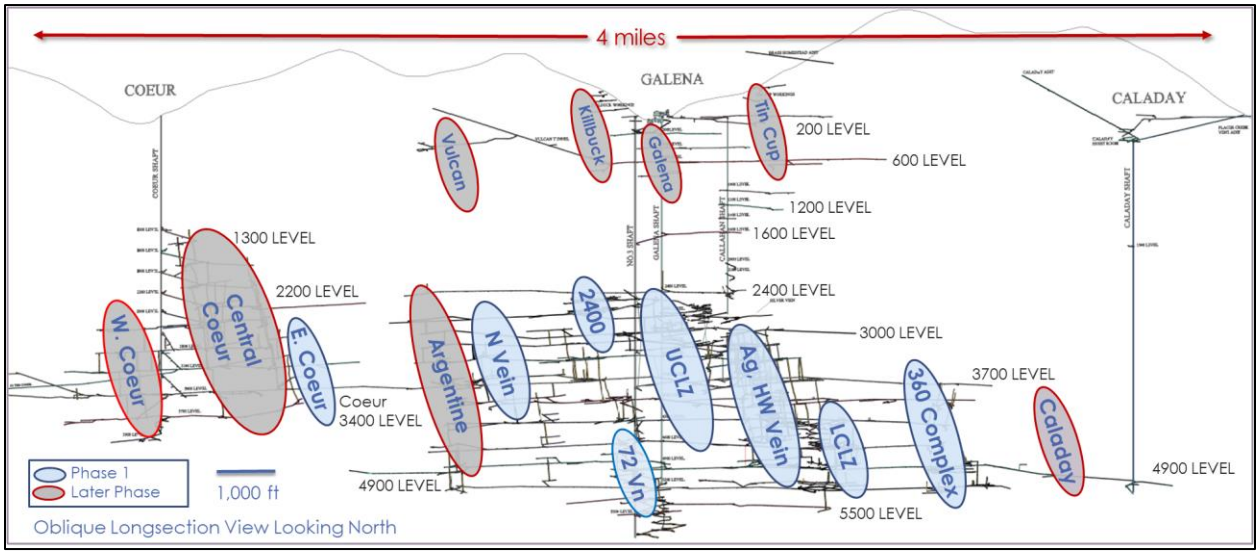

Figure 5. Targets of the Galena mine exploration in 2021. The mine has both silver-copper (tetrahedrite-rich) veins and lead-silver veins with silver-bearing galena. The new discovery is labelled Ag. HW vein in the deeper levels of the mine.

Rich gold placer and lode deposits at Murray in north Idaho were discovered in 1883, bringing prospectors who soon traveled south a few miles to discover the silver-lead lodes of the Coeur d'Alene district proper along the South Fork of the Coeur d'Alene River. Since 2016, an Idaho-based company, Idaho Strategic Resources, Inc., formerly named New Jersey Mining Company, has mined gold from their Golden Chest mine at Murray. The Golden Chest open pit and underground mine worked a series of gold-quartz veins adjacent to the Idaho fault (Fig. 6). The veins are interpreted as either an orogenic system or possibly related to igneous activity. The Idaho Pit ceased operations in 2020 after producing 121,300 metric tons of ore at an average gold grade of 3.12 g/t gold and an additional 101,700 tonnes of lower grade stockpile. The company was transitioning to a new area and raised $2.7 million in 2020 to drill down dip on the Idaho vein. They also solidified their land position in the Murray district. In 2021, they increased tonnage mined and discovered new high-grade shoots on the Klondike and other veins by completing 25 core holes for 6,507 meters of drilling. The Golden Chest ore is sent to their New Jersey mill at Kellogg.

Figure 6. Gold-quartz vein underground at the Golden Chest mine, 2020.

OTHER METAL MINING

A Finnish company, Endomines, had reopened the small Friday mine along the Orogrande shear zone near Elk City in Idaho County. They did ship out gold concentrate in early 2020 but continued to have start up issues at the mill and closed down. They reopened again in 2021. Gold mineralization is associated with zones of intense shearing and sericitization between or near the Friday fault and another structure, the Monday fault. The company had also acquired other past-producing small precious metal mines in the state, including the Kimberly mine near Riggins, the Rescue mine at Warren, and the Buffalo Gulch and Deadwood properties near Elk City.

The large Thompson Creek molybdenum mine in Custer County remained on extended care and maintenance following its closure in December 2014. The previously permitted Phase 8 resource remained in situ. The large concentrator was being used for limited beneficiation of concentrates from 3rd parties in 2020.

PHOSPHATE MINING

The southeast Idaho phosphate district is regarded as the state's second "world-class" mining district (Fig. 7). Three large open pit mines and plants extract and process phosphate rock of the Meade Peak member of the Permian Phosphoria Formation. Phosphorus is a component of the mineral apatite, and the strata are also enriched in C, V, U, Mo, Se, and rare earth elements (REEs). Phosphorites are associated with phosphatic black shales. According to the U.S. Bureau of Land Management (BLM), the primary regulatory authority for the mines, southeast Idaho supplied 22% of the nation's phosphate and 4% of global demand in 2020, and the mining industry there supported 4,500 jobs. An estimated 4-5 million short tons per year are mined.

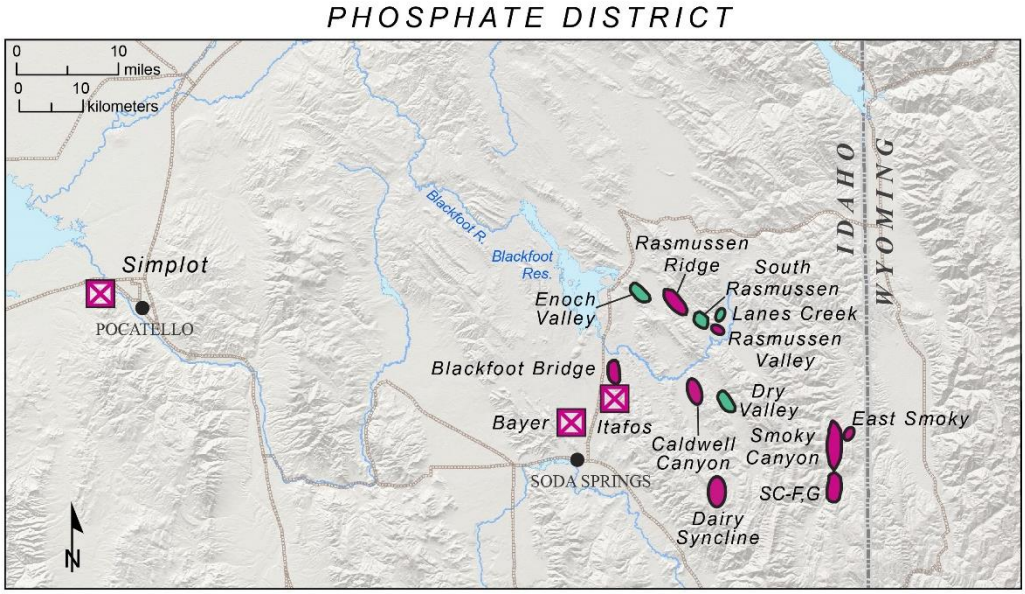

Figure 7. Location map of Idaho phosphate mines (ovals) and plants (squares). Mines are colored red if active or in permitting; green ovals if reclaimed.

J.R. Simplot Co. mined in the F and G panels at its Smoky Canyon mine near the Idaho – Wyoming border. Reclamation in the F1North pit was ongoing to segregate leachable Se from benign waste rock. The seleniferous material is covered to limit infiltration of oxidized water and reduce environmental impacts. A Record of Decision was released in July 2020 for a new mine panel at the East Smoky site; that will extend the mine life. Development work for mining East Smoky was active in 2021. On April 7, 2020, a Record of Decision to allow mining at the Dairy Syncline property was released by the BLM. The Dairy Syncline project covers 2,767 acres and would have a 30-year mine-life; it will require moving the mine facilities when the Smoky Canyon mine nears the end of its mine life. Ore from Smoky goes by slurry line to Simplot's Don Plant in Pocatello where it is transformed into a variety of phosphoric acid fertilizers.

Bayer and its mining partner, P4, operated the Blackfoot Bridge mine. Bayer had purchased Monsanto and its phosphate operations in 2018. They were mining in the Mid-pit and backfilling

and reclaiming the North-pit. In 2020, Bayer drilled 54 holes for over 10,000 feet at its newly permitted (August 2019) Caldwell Canyon property. The company also started construction on a haul road connecting Caldwell to the closed Dry Vally mine, and they were building HDPE-lined stockpile areas and water management facilities. Caldwell Canyon is a large site with an expected 40-year mine-life. Most of the land is private and owned by P4, but there are 160 acres of federal land. However, on April 27, 2021, a lawsuit was filed against the BLM by three environmental NGOs (non-governmental organizations) who claimed the EIS analysis of sage grouse and potential selenium contamination was flawed. No stay was issued, and construction work continued while the litigation progressed in court. One complaint was that proposed mine is part of the "greater Yellowstone area" and ecosystem, though Yellowstone Park is approximately 110 air-miles and several mountain ranges away from the proposed mine. Bayer's ore feeds their elemental phosphorus plant in Soda Springs, which is the only such facility in North America. The elemental product goes into its trade-marked Roundup herbicide and a variety of food and chemical products.

Itafos, who purchased Agrium's phosphate leases in 2018, is the third major company in the district. They had a challenging 2020 as they started mining the Rasmussen Valley mine in addition to completing mining of the private Lanes Creek lease. By 2021, mining operations at Rasmussen Valley were well underway (Fig. 8) and the company welcomed a tour by IGS geologists to review the exposed geology and stratigraphy. Mined areas are concurrently backfilled.

Figure 8. Rasmussen Valley mine in August 2021 with blasthole rig on left and shovel and truck at lower right. White spots are sample bags to analyze ore bed values.

Itafos also completed reclamation work in 2021 at both Lanes Creek and the South Rasmussen Ridge mine, which it inherited from Agrium. The company was also permitting the Husky 1/North Dry Ridge project, a proposed new, 14-year mine on 1,145 acres. A Draft EIS was released on October 22, 2021, by the BLM/USFS.

OTHER INDUSTRIAL MINERALS

Numerous Idaho quarries and pits extract other industrial minerals, including pumice, industrial garnet, lime, dimension stone, feldspar, gemstones, zeolites, and most importantly aggregate (Fig. 9). Business was a bit slower but still strong through the pandemic of 2020 to 2021. Treasure Canyon Calcium submitted a plan to expand their limestone quarry in Franklin County to public land in mid-2020. Steelhead, a producer of zeolites along the Oregon-Idaho border, was sold to PDZ. Emerald Creek Garnet, now owned by Opta Minerals Inc., continued to mine alluvial garnets, though the US Forest Service tourist garnet dig was closed due to Covid. Also in north Idaho, i-Minerals submitted an amended plan of operations and reclamation to the Idaho Department of Lands in September 2020. The company released a pre-feasibility study for a smaller clay-only operation at the Bovill project in Latah County in March 2020. Hess Pumice reported a good year for their pumice and perlite business in 2021. Oakley stone producers in Cassia County were hit hard in 2020 by the Covid pandemic and federal visa restrictions which prohibited workers from starting until the seasonal quarry work was almost over.

Aggregate, principally sand and gravel, along with some crushed stone, was one of Idaho's top five commodities by value. In southwestern Idaho, three new pits were approved, with additional leases requested. The value of construction sand and gravel extracted in Idaho jumped from $118 million in 2018 to $158 million in 2019 and rose to $169 million in 2020 and $179 million in 2021, according to data from the USGS. Values of crushed stone also rose 24% from 2019 to 2021. Increased housing construction and roadwork, particularly in the Treasure Valley of southwestern Idaho, drove the demand for new aggregate sources (Fig. 10). The Idaho Department of Lands maintained over 100 reclamation plans for gravel pits and quarries across the state, and it received $1.1 million in royalties from operations on state lands in fiscal year 2019.

ENERGY RESOURCES

SOUTHWEST IDAHO OIL AND GAS ACTIVITY

On January 24, 2020, High Mesa, Inc., and its subsidiaries, including AM Idaho, LLC, filed for Chapter 7 Bankruptcy in the United States Bankruptcy Court, Southern District of Texas. Prior to this filing, Snake River Oil & Gas LLC notified the Department of Lands that they would assume operations for properties previously managed by AM Idaho LLC.

In the spring of 2020, six wells drilled by Bridge Resources in 2010—Espino #1-2, State #1-17, ML Investments #1-10, Island Capitol #1-19, White #1-10, and Korn #1-22—were plugged and abandoned. Later, in the fall of 2021, two new exploration wells, Harmon 2-14 and Fallon 1-11, were drilled near Payette. Both wells were completed following production tests that indicated commercial accumulations of wet gas at depths between 3,600 and 4,000 feet.

Due to falling oil and gas prices and disruptions caused by Covid pandemic, Snake River Oil and Gas decided to shut in the field effective March 20, 2020. By mid-December 2020, five wells in Willow Field were returned to production. Additionally, the Barlow 1-14 well began production, marking the first output from Harmon Field since its discovery in 2018. Together, these six wells produced an average of 4 million cubic feet of gas per day (MMCFGD), 42 barrels of condensate per day (BCPD), and 6 barrels of water per day (BWPD).

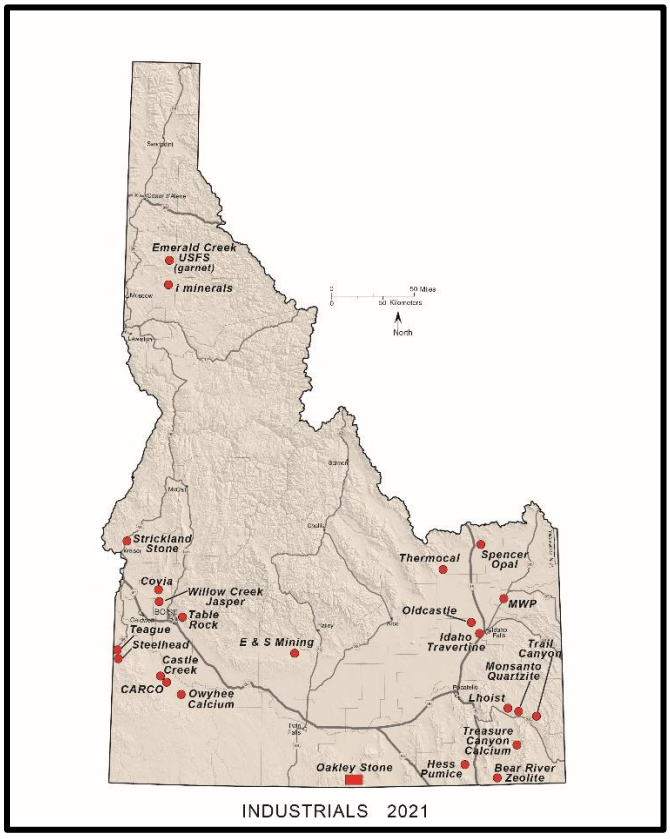

Figure 9. Location of industrial mineral operations, excluding phosphate rock and aggregate, in Idaho for 2020 – 2021.

Figure 10. Cope Sand and Gravel Pit, Canyon County, March 2020.

MINERAL EXPLORATION

The first half of 2020 was slow due to Covid, the resulting uncertainty and lower metal prices. Prices started to rise significantly midway through the year and continued into 2021. Thus, the overall 2020 – 2021 period was quite busy with numerous active exploration projects (Fig. 11). Both gold and critical minerals were of particular interest.

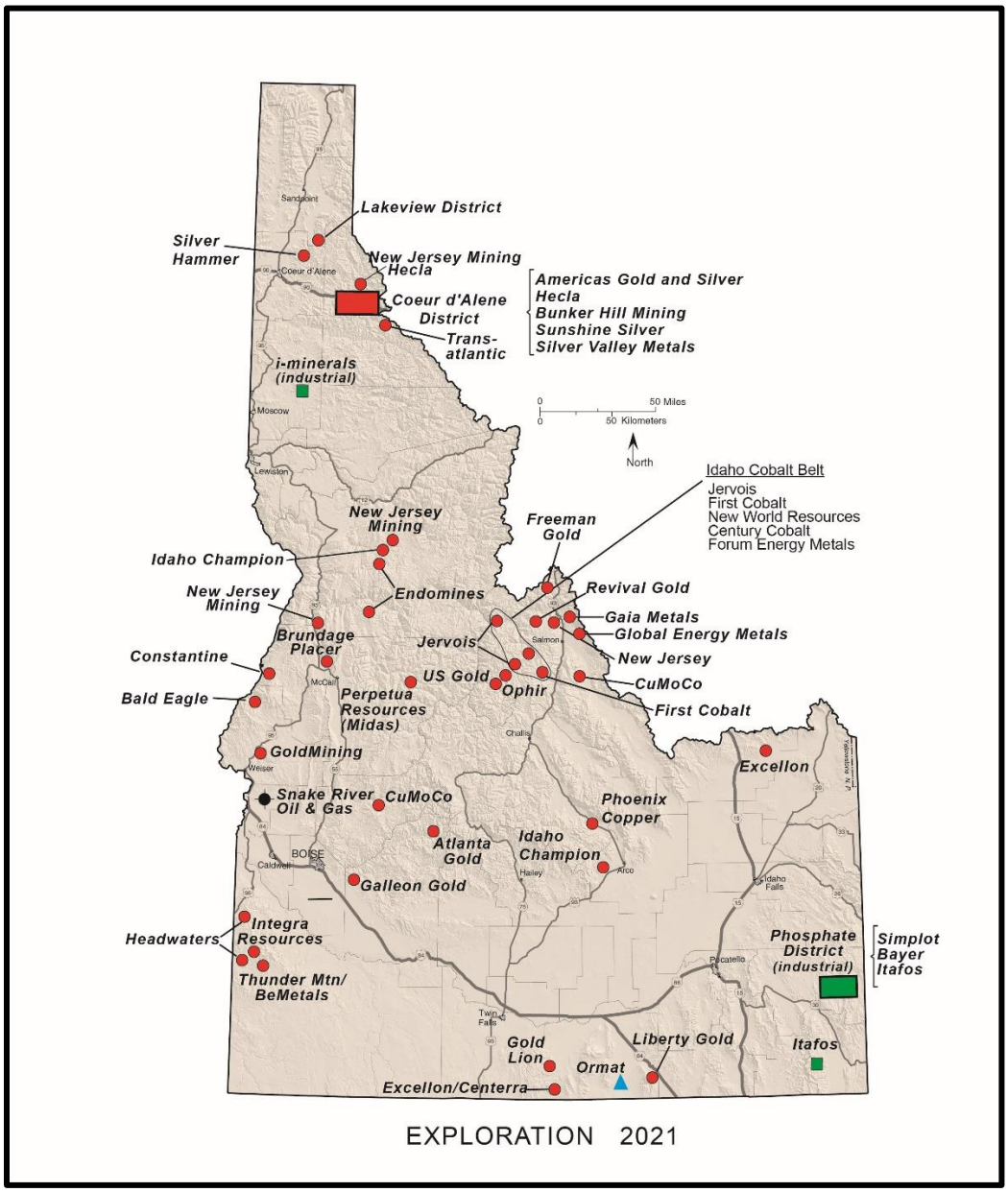

Figure 11. Location of mineral exploration in Idaho, 2021. Green boxes are for industrial minerals; blue triangles are geothermal; black crosshair is for oil and gas. Red dots or boxes are all other commodities.

Bunker Hill Mining Corporation negotiated with owner Placer Mining Corporation to reduce the option price by 30% on the Bunker Hill mine on the west end of the Coeur d'Alene district. The company did 3-D modelling of the historic stopes, the known 8-million-ton Quill zinc-rich orebody, and to define other targets. The mine was open for 95 years, and there were 3,500 historic drill holes to input in the model. In 2020, Bunker drilled ten core holes from surface and underground (Fig. 12). In 2021, they completed 16 core holes, totaling 3000 feet, from underground on the 9-level and a 23-line IP/resistivity survey at the surface. With the higher silver price, Bunker Hill focused more on the silver content of the lead-zinc veins. The company also worked on a water management plan which is a necessary component of their rapid restart goal. The company completed a 43-101 report and a favorable preliminary economic analysis (PEA) for a rapid restart of the mine above the water table.

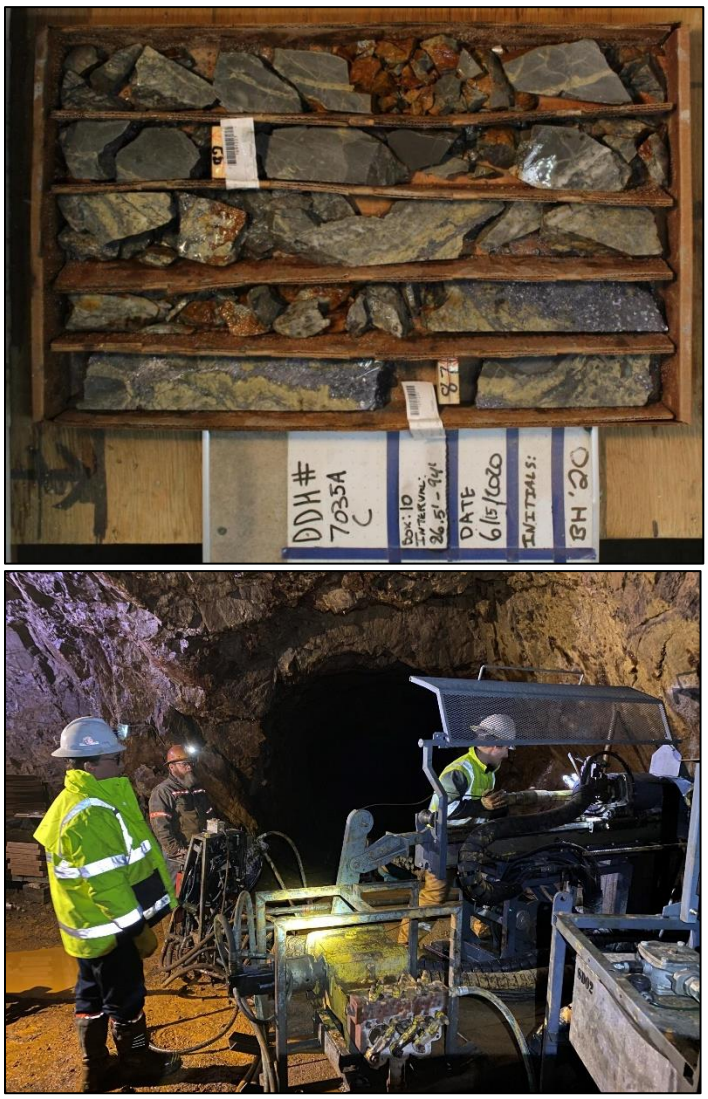

Figure 12. Drilling underground at the Bunker Hill mine, 2020. Hole DDH # 7035A intercepted 1.5 m at 648 g/t Ag and 8% Pb; core is shown in the top photo.

Silver Valley Metals acquired the Ranger-Page project located just west of the Bunker Hill mine in 2021. Several historic mines and multiple target opportunities were identified on the property which has had little prior exploration.

The Silver Strand mine is located closer to the city of Coeur d'Alene and west of the main Silver Valley. The mine, which was explored several years ago by New Jersey Mining Company, was driven on a quartz vein hosted in Revett Quartzite. A small company, Silver Hammer Mining Corp., formerly Lakewood Exploration, explored the property in 2021 for its precious metal potential. Grab samples from the underground adit assayed as much as 2744 g/t Ag and 4.8 g/t Au. Silver Hammer did minor rehabilitation work on the adit and started a drill program in October 2021 to test the veins below the adit level. Drilling used a wooden platform for less ground disturbance.

The Elk City area hosts large placer gold deposits and several lode deposits along the Orogrande shear zone which extends north-south for 20 kilometers. Idaho Champion was one of several small companies exploring the area in 2020. Outcrop is poor, but the geology generally consists of metamorphic rocks, intruded by the Idaho batholith and small Tertiary plugs. Idaho Champion acquired the old Baner mine and conducted a 2018 drill program based on IP work. An $8 million financing package in 2020 allowed additional work including soil geochemistry and mapping as well as 2,200 meters of core drilling. Drilling intersected gold-bearing quartz-pyrite veins in altered and fractured granodiorite. The Baner mine is on a subsidiary structure to the Orogrande shear zone.

For the first time in decades, there was exploration interest within the western Idaho accreted terranes. In 2021 a small company, Bald Eagle Gold Corp. acquired the shares of Anglo-Bomarc, US, Inc., which had held claims for many years at the Hercules Silver Property in Washington County. From 1965to 1988, Anglo-Bomarc completed considerable drilling of the 866-hectare property on the west side of Cuddy Mountain. From the extensive surface work and drilling, Anglo-Bomarc delineated a shallow silver resource within the Hercules Rhyolite values in the 300 to 950 g/t Ag range. Maps and files from the historic work were later donated to the Idaho Geological Survey. In mid-2022, Bald Eagle changed their name to Hercules Silver Corporation. Another small company, Constantine, was rumored to be exploring for volcanogenic massive sulfides in the accreted terranes.

YELLOW PINE AREA, VALLEY COUNTY

Permitting for Midas Gold's proposed Stibnite gold-antimony mine was ongoing and a topic of significant interest and importance for Idaho's mining industry in 2020 – 2021. The Plan of Restoration and Operations (PRO) calls for mining the resource of 4 to 5 million troy ounces of gold plus significant antimony as a way of paying for the clean-up and restoration of the brownfields site which supplied antimony and tungsten for military efforts in World War I and World War II. The Payette Forest released a Draft EIS in August 2020 followed by a 75-day public comment period on the plan for three open pits, a $1 billion capital expenditure, 15-year project life, and restoration of fish passage up the East Fork of the South Fork Salmon River at

the end of the mine. Paulsen and Company investors purchased a substantial stake in the company in early 2020. The proven and probable reserve on the project was 4.8 million troy ounces of gold (at 1.43 g/t Au grade) plus 148 million pounds of antimony.

A large number of public comments on the project were received, and the analysis prompted Midas Gold and the Forest Service to write a supplemental EIS to address a modified mine plan. That document was anticipated to be released in 2022. In February 2021, Midas changed its name to Perpetua Resources and moved the corporate headquarters to Boise. They negotiated an agreement with Ambri to use the antimony for manufacturing batteries. They also reached an agreement with the Environmental Protection Agency (EPA) to initiate pre-mining emergency removal actions designed to remediate historic World War II era waste and tailings that were affecting waterways. Another issue was the Nez Perce tribe's new declaration that mine development would violate their treaty rights for fishing and potentially degrade water quality.

Just to the west of Stibnite and south of the town of Yellow Pine, Stallion Gold worked on their Horse Heaven project located along the Golden Gate Shear zone on Antimony Ridge, another historic antimony-gold-tungsten producer. IGS files contain considerable historical data on the property. Stallion's claims go back to 2012. As at Stibnite, several geologic models, including intrusion-related gold and orogenic-style veins, were being assessed during exploration.

SALMON AREA, LEMHI COUNTY

In 2020 -2021, the region around the town of Salmon was a hotbed of exploration activity. Three principal commodity groups were of interest: cobalt-copper, gold and rare earth elements (REEs). Geologic settings in Lemhi County vary from Mesoproterozoic metamorphosed clastic sedimentary rocks and bimodal igneous suites to Paleozoic and Cretaceous intrusions to Tertiary volcanics and orogenic-style veins. The combination has generated one of Idaho's most mineralized and prospected regions with multiple target types and mineral deposits (Fig. 13).

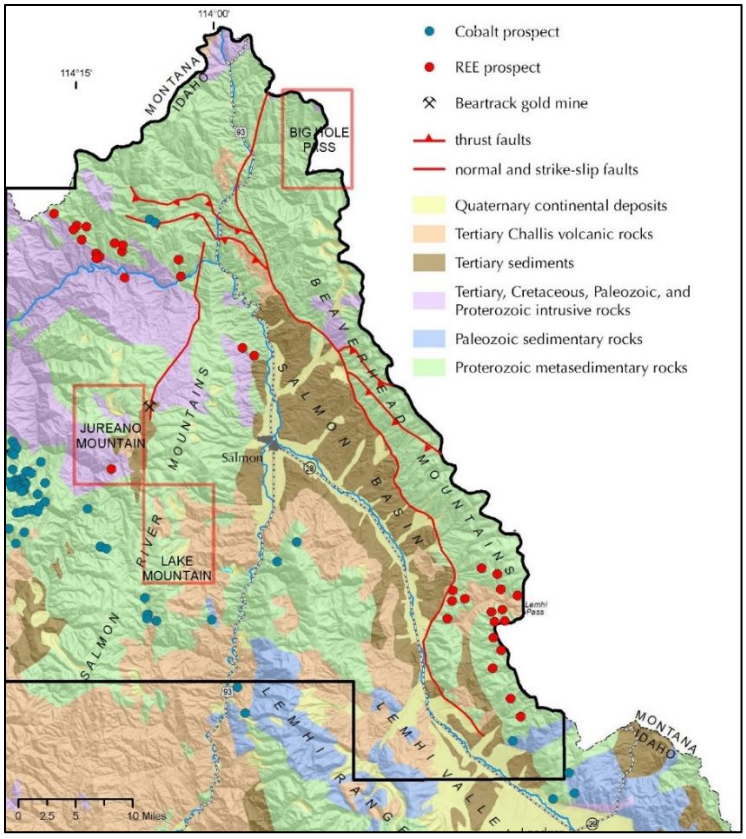

Figure 13. Simplified geologic map of the Salmon area with outlines of STATEMAP-funded mapping quadrangles in 2020 and locations of rare earth and cobalt occurrences.

In 2020 – 2021, only surface mapping and sampling were completed on the REE prospects in Lemhi County. New Jersey Mining expanded their interests by acquiring the Diamond Creek and Roberts claims north of Salmon and west of North Fork, respectively.

Near the old placer town of Leesburg, Revival Gold implemented a 10,000-meter diamond drill program at their Beartrack mine and adjacent Arnett Creek gold properties, abbreviated as BTAC. The Beartrack gold mine (Fig. 13), formerly operated by Meridian Gold, is along a hydrothermal system that extends over 5 km along strike. Revival had three drill rigs working to infill mineralization between the historic pits and ran a new IP-Resistivity survey combined with new structural mapping (Fig. 14). Mineralization is localized along the north-south Coiner Fault and the adjacent northeast-trending Panther Creek regional lineament, newly interpreted as part of a single structural zone. Revival's new 43-101 resource, released in February 2020, was 36 Mt indicated resource at 1.16 g/t Au plus another 47 Mt inferred at Beartrack. Revival's second target was the nearby Arnett Creek property. In 2020 they drilled 30 holes and conducted 65 line-km of IP-Resistivity. In November, they released a Preliminary Economic Analysis for a Phase 1 leach operation at Arnett. Oxidized gold mineralization is hosted in a Paleozoic intrusive complex.

Work at BTAC continued in 2021 with an additional 20 core holes drilled for 4,880 meters. Fifteen of those were at the Haidee mine at Arnett Creek and five were at the Joss area on the

south end of the Beartrack system. Intercepts on deep mineralization at Joss assayed 4 to 12 g/t Au. Gold mineralization is hosted in highly sheared and altered Yellowjacket Formation host rocks.

Figure 14. Core drilling at Revival's Beartrack gold mine project, 2020.

Freeman Gold explored for gold at their Lemhi Gold Project by North Fork north of the town of Salmon. The property includes historic placers and was drilled by FMC and AGR in the late 1980s as the Ditch Creek or Humbug oxide gold projects. Freeman added new claims and drilled 16 core holes for 3,328 meters in 2020. Visible gold was noted in core from several holes. They returned the following year and finished with 35 holes for 7,149 meters drilled into quartz-veined and highly faulted quartzites. Freeman found and sampled a new zone of mineralization to the west and released an NI 43-101 report in July 2021.

Several smaller gold projects were acquired and drilled in 2020 – 2021. Most of these explored historic, high-grade, underground mines without recent exploration. Companies and projects included Gaia Metals drilling four core holes at their Gold Dyke property near Carmen and Freeman Creeks northeast of Salmon, Hawkstone Mining at the Lone Pine project near the King Solomon mine, US Gold at Johnny's Point on Musgrove Creek, and Ophir Gold at the Breccia project near the historic Gahsmith mine south of Musgrove Creek. Ophir discovered a silicified breccia zone in 2020 and planned a 3,200-meter drill program in 2021 along with a CSAMT geophysical survey. Gold mineralization there is part of a low sulfidation, epithermal system along Musgrove Creek.

The Idaho Cobalt belt is a northwest-trending, 55-km long linear belt defined by multiple copper-cobalt occurrences. The deposits are all hosted in banded or coarse siltite members of the Mesoproterozoic Apple Creek Formation, suggesting a first-order stratigraphic control, though many details of the genesis are uncertain. The Blackbird district was the largest historic producer of copper and cobalt and is the location of Jervois Mining's wholly owned Idaho Cobalt Operation (ICO). Mineralization is present as cobaltite plus chalcopyrite. The fully permitted ICO was acquired from eCobalt in 2019 to mine the RAM deposit discovered in 1997 by eCobalt (formerly Formation Capital Corp.). The 2020 43-101 report listed a Measured and Indicated resource of 5.24 Mt at 0.44% Co, 0.69% Cu, and 0.53 g/t Au plus additional inferred material and exploration potential at the ICO. Jervois released a bankable feasibility study in 2020 and started mill design and renewed initial construction. In 2021, the construction was approved and additional facilities, including mill foundations, tailings storage facilities, portal benches and components were being built. In mid-October, Jervois blasted the first round to open the West Portal for the new underground mine, where they anticipated initial production in 2022 (Fig. 15).

Figure 15. New East and West portals at ICO, December 2021.

On the southeast end of the Idaho Cobalt belt, First Cobalt, a Canadian company had an extensive drill program at Iron Creek in 2018-2019. The updated 43-101 resource from that work was approximately 4.8 Mt at 0.3 % CoEq. In late 2020 the company completed an IP/Resistivity survey over the property (Fig. 16). It was partly designed to trace mineralized zones under Tertiary volcanic cover. They also sampled a newly recognized zone, named the Ruby, of copper-cobalt mineralization on a logging road east of the No Name adit. Five-foot channel samples of the Ruby roadcut assayed up to 0.48% cobalt, and the company doubled their land position. Mineralization at Iron Creek is cobaltiferous pyrite with associated magnetite. They drilled six core holes for 8,500 feet to the east and west of the Iron Creek resource to test chargeability anomalies and continued metallurgical work with researchers at the Colorado School of Mines (Fig. 16). In November 2021, First Cobalt changed its name to Electra Battery Materials, to better reflect their ownership of a hydrometallurgical facility in Cobalt, Ontario. Electra plans to make battery grade Co-sulfate needed for the Li-ion batteries used in electric vehicles (EVs).

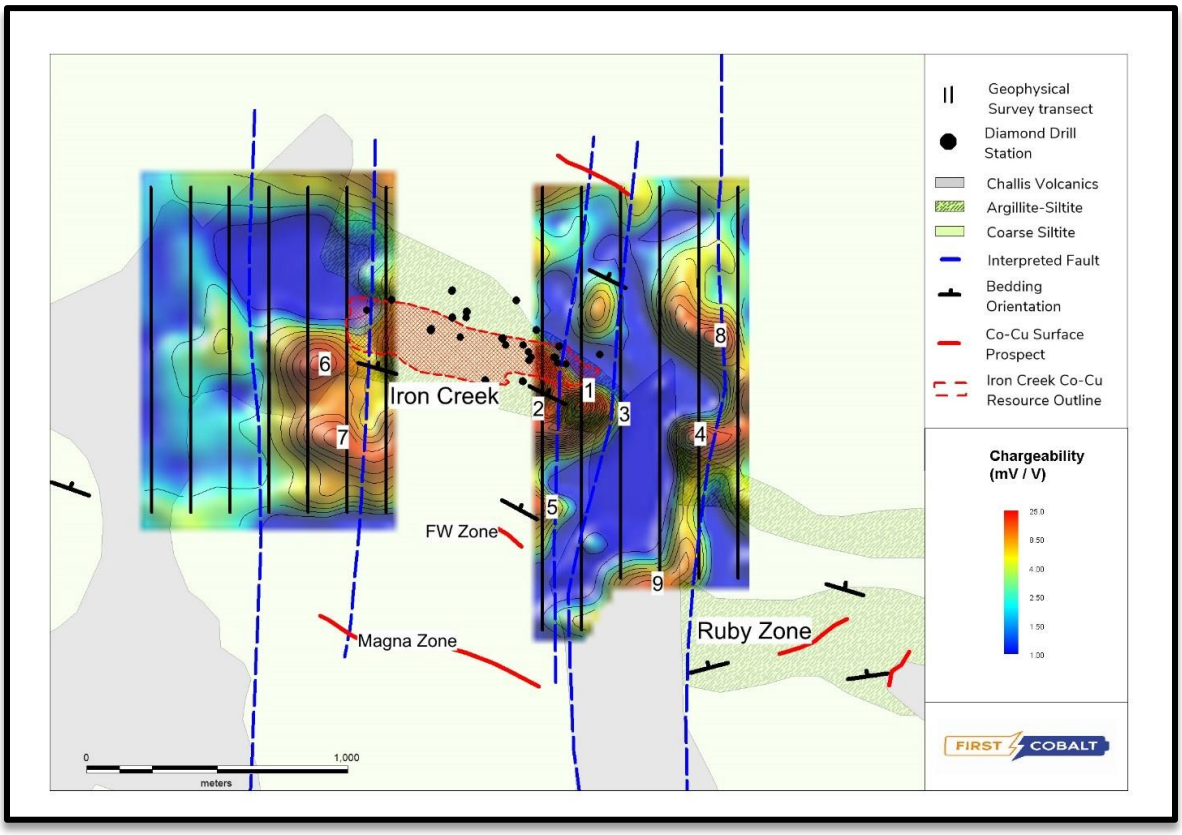

Figure 16. Map of chargeability results from survey over the Iron Creek property in 2020. From a press release and corporate presentation by First Cobalt. Numbers refer to specific anomalies to be tested.

EASTERN IDAHO

Two epithermal precious metal districts were being explored in eastern Idaho during 2020 - 2021. Excellon Resources acquired Otis Gold in February 2020. The all-shares acquisition included the Kilgore project in Clark County and the Oakley project in Cassia County. Kilgore, which hosts a 1-million-ounce gold resource, is a young volcanic and sediment-hosted system. The Oakley claims at Cold and Blue Hill Creeks were optioned to Centerra Gold. In late 2021, Excellon received a permit for additional drilling at Kilgore.

On the north edge of the eastern Snake River Plain, Idaho Champion acquired claims over the Champagne gold mine in Butte County, a few miles west of Arco. The open pit mine was operated by Bema in the early 1990s as a heap leach operation, and it closed in late 1992. Idaho Champion started a 5,000-meter drill program and conducted surface geophysics and geochemistry. The deposit is hosted in altered Tertiary volcanic rocks with a high-sulfidation signature, and one objective was to explore for a deep copper porphyry underneath the mine and the Lava Creek district (Fig. 17). In 2021, they completed 10 diamond drill holes for 3,432

meters and added two IP lines. The geophysics detected a large chargeability anomaly, but it also suggested the system was structurally detached. Initial drill results were compatible with peripheral porphyry-style alteration.

Figure 17. View to northwest of the reclaimed Champagne mine, 2021, with argillic alteration. Historic workings of the Lava Creek district are visible in the distance.

To the north of Arco is the historic mining town of Mackay in Custer County. Phoenix Copper Ltd., formerly ExGen Resources and Konnex Resources, continued to explore the polymetallic and copper skarns within a 23 sq. km claim block around the scenic Empire mine. In 2020, Phoenix commenced a 32-hole program of mostly reverse circulation holes with a few core holes; in 2021 they added another 4,500-meter program to test for deep sulfides below the pit. They were working on a preliminary economic analysis for an open-pit, oxide copper mine as well as hydrologic characterization and other environmental baseline studies. The late 2020 updated 43-101 resource included 238,000 ounces of Au, 7.6 M ounces of Ag, and good grades of copper and zinc. They also explored a newly discovered prospect named Red Star.

Liberty Gold owns the flagship project in eastern Idaho at the Black Pine property in Cassia County, and they had another extensive drill program in 2020 - 2021. Black Pine was mined by Pegasus but closed in 1997 during low gold prices, and without conducting much district exploration. Liberty drilled 46,000 meters in 2020 on the Carlin-type disseminated gold district which covers 14 sq. km. They submitted an amended drill plan over 50 acres in January and had 3-4 drill rigs turning most of the year. Drilling in 2020 focused on the D-1 and D-2 areas and a new discovery area, D-3. Initial metallurgical results were favorable, and the company started looking for mine water supply sources. Drilling continued the next year with a 70,000-meter RC program and that work intercepted a new discovery at the Rangefront target area, a down-faulted pediment play (Fig. 18). In July 2021, Liberty released an initial indicated mineral resource of

1.7 million ounces gold at a grade of 0.5 g/t Au. The district geology consists of structurally stacked plates of Oquirrh Formation clastic rocks and limestones.

Figure 18. View to southeast at new Black Pine Rangefront D-4 discovery, located approximately with the white arrow, on flat, tan-colored flat area just at base of hills in left-center of photo. Hole LBP358 assayed 1.23 g/t Au over 24 m and 1.37 g/t Au over 50 m.

SOUTHWEST IDAHO

South Mountain in Owyhee County is an isolated peak with outcropping limestone and clastic sedimentary rocks of presumed Paleozoic age intruded by felsic to intermediate plutons. Mineralization includes a zinc skarn and high-grade replacement deposits, known largely for their prized ilvaite crystals. Owner, Thunder Mountain Gold, optioned the private property to Be Metals. Be Metals continued Phase 2 fall 2020 drilling program of 25 holes for 8,000 feet, all drilled from underground workings. Drilling extended the length of the Texas zone and was infilled the DMEA zone. Intercepts included up to 21% Zn plus precious metals over 15 meters. In 2021, they added an additional 3,500 feet of core drilling from surface and started metallurgical work and a preliminary economic analysis. Mineralization is open at depth.

Integra Resources kept three rigs busy most of 2020 at their large DeLamar project in Owyhee County. The site of Kinross' mine which closed in 1998, the classic epithermal Silver City district includes three mineralized centers: DeLamar, Florida Mountain, and War Eagle

Mountain, from west to east, plus numerous greenfield targets referred to as the Black Sheep area. Integra used 3D modelling to delineate ore types for engineering and metallurgy work and conducted environmental baseline studies and water sampling. They also funded a 2-year geologic mapping effort by the Idaho Geological Survey for two 7.5' quadrangles encompassing the area. In 2021, Integra drilled all year and continued permitting and engineering studies with a goal of having a prefeasibility study (PFS) by the end of the year. The company evaluated heap leach and milling options. Deep drilling under Florida Mountain intersected high-grade silver mineralization like that described by the historic literature (Fig. 19). The geologic map of the DeLamar and Swisher Mountain quadrangles was released by IGS in mid-2021 as DWM-193.

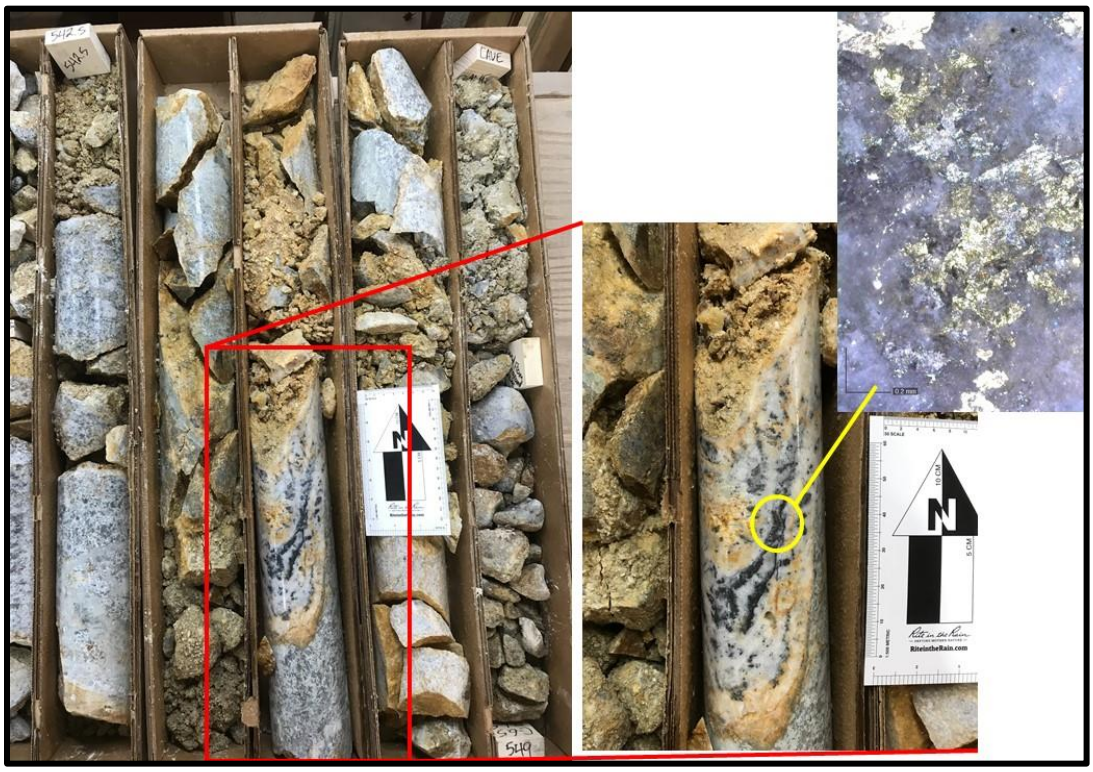

Figure 19. Drill core from FME-21_127 with 544' – 545' (red box, enlarged on right side) assaying 28.3 g/t AuEq in crustiform quartz vein with Ag sulfide and pyrite infilling (yellow circle enlargement). From Integra Resources drilling on Florida Mountain.