Idaho Mining and Exploration, 2018-2019

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Staff Reports present timely information for public distribution. This report may not conform to the agency’s publication standards.
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Annual Idaho Regional Development presentation to American Exploration and Mining Association, 2018

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Idaho Mining and Exploration 2018

Virginia S. Gillerman
Idaho Geological Survey, Boise
Acknowledgements

- AEMA
- Idaho Dept. of Lands Staff
- BLM and USFS Minerals Staff
- Mining Industry Personnel
- Idaho Geological Survey (IGS)
- Idaho Mining Association and Boise SME
2018 Mining Trends and Potential

• Summary of Idaho geology and mineral potential
  – *Forward-looking Statement*: No guarantees; any opinions expressed are solely those of the speaker, not the agency.
  – Discussion Encouraged.
  – Mining is a Global Enterprise and Outlooks Change Weekly.
  – **Gold is Where You Find It!** (and other commodities also)

• IGS is non-regulatory: Research and Public Service
Mining in Idaho:
1860-1862

Discovery!

N. Fk. Clearwater – Feb. 20, 1860
Pierce - Sept. 30, 1860
Elk City – June 14, 1861
Florence – Aug. 12, 1861
Warren – July 22, 1862
Boise Basin – Aug. 2, 1862
(John Grimes)
More Gold and Silver and Base Metals

Gold and Silver
Rocky Bar: May, 1863
Atlanta: June, 1863
Banner: Aug. 1863
Silver City: Aug. 1863
Yuba Dist.: Sept. 1863
Leesburg: July, 1866
Loon Creek: July, 1869
Caribou: Sept. 1870

Silver and Base Metals
Yankee Fork: Aug., 1876
Vienna: July 1878
Wood River: Apr. 1879
Minnie Moore: Sept., 1880
Coeur d’Alene: Apr. 1882
Murray: Jan. 1884
Burke (CDA): May 1884
Florence: Aug., 1894
Thunder Mountain: July, 1896

Phosphate: Discovered 1899; production 1906 to today.
Phosphate:
Discovered 1899; production 1906 to today.
**Historical Legacies**

- Mining Past – Historic
- Reclamation Needs
- Inactive or Abandoned Mines (AMLs)
  - Inventory
  - Closures
- Phosphate – Se
- Open Pits
- Modern Reclamation – H$_2$O
Idaho Non-fuel Mineral Production

Data from USGS
Favored Idaho Commodities

• 2016 Idaho Leaders
  – Phosphate Rock
  – Sand and Gravel
  – Silver
  – Lead
  – Crushed Stone

• In 2015, metals 26% of value, due to loss of Mo production at Thompson Creek at end 2014.
Precious Metal Prices: 28 yr. graphs
Two World Class Mining Districts

- **Coeur d’Alene District:**
  - Over 1.24 billion troy ounces Ag (38,568 metric tons)
  - Pb, Zn, Cu, Sb
  - Quartz-Siderite-Sulfide veins in PC Belt metasedimentary rocks

- **SE Phosphate District:**
  - Also over 100 years production
  - Permian Phosphoria Formation
  - Sedimentary apatite-rich black shale of regional extent
Coeur d’Alene District

Host: 1.4 to 1.47 billion year old Belt rocks. Argillites to quartzites. Intracratonic Rift.

Wallace Fm.
St. Regis
Revett
Burke
Prichard Formation

2018-013
Hecla Mining Company

Nov. 2018:
- Still on strike!
- 3.6 Moz. Ag in 2016.
- 2018 3rd Qtr.: 31,639 ounces Ag by salaried workers.

3/13/2017:
USW Local 5114 out on strike. Major issue is control of miner’s work assignments.

RVM (Remote Vein Miner)
Swedish company – 2019 Set-up at Hecla? R and D this year.
Hecla – Lucky Friday mine

• R and D for RVM.
• Salaried employees (including geologists) doing limited mining and milling at mine during strike.
• Hecla 3rd Qtr. Results – loss from lower Ag price, production decline.
• Large resource remains; #4 shaft to 8300 level is fully operational.
Americas Silver Corporation: Galena Complex

- Galena Mine
- Coeur Mine
- Caladay
- 2 mills

- 2017 production: 1.135 million troy ounces Ag, plus 19.7 million pounds Pb.
- Concern over lower Ag prices in 2018.

Dan Hussey sampling some of the 230 million ounces Ag produced at the Galena mine
Galena mine – Americas Silver Corp.

- Extended UCS LZ from 3700 to 2400 level. Multiple Ag-Pb veins. Good drill results. 2400 level.
- Deep levels about half of production. Working to re-establish hoisting from 5500 level to mine new discoveries on 5200 level.
- 2018 2nd quarter No. 3 hoist repairs impacted production.
- 4-year collective bargaining agreement ratified in August.
- Agreement to combine with Pershing Gold in 2019.
New Jersey Mining: Golden Chest mine

- Murray, Idaho
- Property paid off in 2018.
- Placers in next gulch over.
- Open pit production with some underground.
- Production started Nov., 2017.
- Multiple NW-trending ore shoots along Idaho Fault.
- Gold-quartz veins; grade about 4 g/t Au.
Golden Chest mine

• Ore to New Jersey’s mill at Kellogg
  – 360-tonne/day flotation (also cyanide leach). Flotation concentrate.
  – Recovered 6700 ounces Au to date and reporting revenue.

Belt Association Field Trip (Sept. 2018)

Expanded claims in district.
GEOLOGY OF THE IDAHO PHOSPHATE DISTRICT

- Permian Phosphoria Fm.
- Meade Peak Member (5 m.y. of deposition about 265 m.a.?)
- Phosphatic black shale – restricted marine basin with upwelling organic-rich currents
- P, + C, V, U, Mo, Se, etc.
- Apatite

(Piper, 2001)
The Phosphate Cycle

- Mineral: Apatite \( \text{Ca}_5(\text{Cl, F})(\text{PO}_4)_3 \)
- Rock: Phosphoria Formation (265-275 million years old).
- Mining – large, open pit mines with ore assaying about 25-30 % \( \text{P}_2\text{O}_5 \).
- Processing - Phosphoric Acid for fertilizer, and Elemental Phosphorus for chemicals, foods, herbicides, and other high purity uses.
  - Elemental P: Bayer (Monsanto) at Soda Springs (Roundup)
  - Fertilizer: Simplot (Pocatello) and Itafos (Agrium) at Conda
Phosphate Processing Plants

Itafos Conda Fertilizer Plant

Monsanto Elemental P Plant, 2014

3 Large Plants
Over 300 workers at each
Economic anchor to SE Idaho

Simplot Don Plant, 2014
J.R. Simplot Company
Smoky Canyon mine

- Mining Panel F (Manning Creek lease) and newest Panel G (Deer Creek).
- Waste Rock to West dump and East Overburden pile.
- Concurrent Reclamation.
- Pit F1N reclamation almost complete.
- Waste Rock Segregation.

G Pit, March 2018
Smoky Canyon mine

- Environmental:
  - Waste rock segregation – to minimize footprint of Se-bearing waste.
  - Chert wedge - assist synthetic covers on slopes.
  - Backfilling old pits and concurrent reclamation of waste dumps.
P4/Bayer (Monsanto) Blackfoot Bridge mine

- P4 mining Mid Pit. North pit finished in spring.
- Waste rock goes to backfill North pit and external overburden pile (EOP).
- Reclamation on EOP is monitored by lysimeters.
- GCLL cover on disturbed areas.

Mining in Mid Pit; backfilling North Pit in distant right.
Rasmussen Ridge mine reclamation

- Agrium now Nutrien.
- Agrium Conda Phosphate Operation Sold to Itafos (late 2017).
- Agrium/Nutrien responsible for reclamation of older South/Central Rasmussen Ridge.

Backfilling Panel B, Rasmussen Ridge mine, 2018
Itafos
Rasmussen Valley mine

- Late 2018: Itafos purchased Agrium’s Conda Phosphate Operations, including Conda plant, leases and newly permitted Rasmussen Valley mine.
New Phosphate Mine Plans

- **Simplot** – Dairy Syncline (2800 acres on NF land). Land exchange proposed. DEIS anticipated release late-fall 2018.

- **Simplot** – East Smoky Panel expansion (3-12 yrs.). DEIS to public review in September, 2018.

- **Itafos** – working with BLM to restart Husky1/N. Dry Ridge EIS process.


Other Exploration – not really.
Industrial Minerals

Smaller
Rural
Stable (some operating for decades)
Varied Commodities:
  - Dimension Stone
  - Calcium
  - Clay
  - Gemstones
  - Abrasives
  - Zeolites
  - Landscaping Rock

SAND and GRAVEL
CRUSHED STONE
(multiple aggregate locations statewide)
Industrials – north Idaho

• Emerald Creek Garnet
  – Opta Minerals Inc.
  – Almandine garnet alluvial deposits
  – Water filtration
  – Abrasives
  – Producing garnets from Emerald and Carpenter Creek basins near Fernwood since 1930.

• i-minerals Bovill Project
  – Development Stage
    • Metakaolin Pilot Plant at FLSmidth - flash calcination for natural pozzolan.
    • Halloysite, Kaolin, Quartz, K-Feldspar testing and process optimization.
  – 2016 Feasibility – 25% after tax IRR.
  – Amended State operation and reclamation plan issued May, 2017.
Dimension Stone

• **Oakley Stone**
  – Northern Stone Supply
  – Sawtooth Stone – 2 new pit areas will open in 2019 at Sawtooth #4 quarry.
  – Scrivanich/Oakley Mtn. Corp.
  – Sold outside Idaho as high-end stone.
  – On Middle Mountain, Cassia County

• **Table Rock Sandstone**

• **Idaho Travertine**
  • **Three Rivers Quarry** – inactive
  • Other small operations

Scrivanich Rock Garden Quarry
Northern Stone in background
Hess Pumice Products

IDAHO COMPANIES:
- Hess Pumice
- Hess Perlite
- Hess Pozz
- US Grout
Energy Resources

• Oil and Gas: SW Idaho (Payette County)
  – Alta Mesa
  – Tertiary Lake Sediments (sands)
  – Gas and Condensate dominant
  – Source bed unknown
  – Conventional wells

• Geothermal
  – US Geothermal Raft River Plant
  – Exploration
2018 State Survey Activities and Staff

- Stibnite Au-Sb-W District: Geology & Geochronology Research
- Petroleum Models & Assessments
- Geologic Mapping (Statemap)
- Data Preservation and Mining Databases
- Current Mining & Exploration
- Geologic Hazards
- Hydrogeology
- Geologic Information for Idaho

**USGS STATEMAP FUNDING**

Since 1993 IGS has received $4.3 M for geologic mapping. Published 208 maps. Many maps with GIS coverage.

Interim Director (Nov.): Dr. Peter Isaacson
Mines Web Application on Redesigned IGS website

Web Application Content: 8,871 properties

Work in Progress – designed for public and industry use.

- Search by:
  - Mine name
  - Commodity
  - Location
  - Ownership (surface management)

- Choice of layers & base maps

Contact: Christopher Tate, IGS-Moscow: cstate@uidaho.edu
SW IDAHO OIL AND GAS PLAY

Targets include:

Upper Chalk Hills: Hamilton Sands
- 1,500-2,500 feet in depth
- 44 drills, numerous shows
- State 1-17 producing dry gas from a biogenic source
- Production from Hamilton Field pending flow-line

Lower Chalk Hills: Willow Sands
- 3,600-to-4,500 feet in depth
- 16 drills, wildcat success rate between 20-to-40 %
- Commercial production of gas, condensate, and oil from thermogenic source at Willow Field
- Production pending flow-line at Willow Step-Out

Payette Formation
- 3,800-6,500 feet in depth
- 11 drills
- Shows and/or hydrocarbon indicators but no successful production tests

CURRENT IGS WORK:
- Basin Analysis
- Reservoir Characterization
- Sequence Stratigraphy
- Field Studies

Area of interest covers 1,000 square miles and includes portions of Payette, Gem, Washington, Canyon, and Ada counties.

Mark Barton, Idaho Geologic Survey, 208-364-4598
Exploration 2018

2018:
✓ Uptick in Major Drilling Programs.
✓ Development and Advanced Projects.
✓ Gold and Cobalt – Priority Commodities.
✓ Grass Roots.
✓ Precious Metal Prices – down slightly, still healthy.
✓ Rediscovering Old Properties.
✓ More Stability on Governmental and Regulatory Environment.

BLM saw over 6,000 new mining claims filed in 2018 in Idaho. About 5,000 of those were in the Idaho Cobalt Belt.
Bunker Hill Mining Corporation
(formerly Liberty Silver)

- New group formed Liberty Silver – August 2017 agreement with owner of Bunker Hill to lease-purchase mine ($30 million).
- Aim - to reopen Pb-Zn mine.
- Financing problems and defaulted on lease. Nov. 2018 –reinstatement of lease from owner (Placer Mining Corp.) to reduce lease payment in 1 year agreement.
- Working with EPA to resolve water treatment plant issues and costs.

Bunker Hill glory hole, 1907

1887–1981: 36 million tons @ 8.7% Pb, 3.7% Zn, 4.5 opt Ag
Hecla: Little Baldy project

- Murray, Idaho
- East Fork, Eagle Creek
- Purchased Tobbogan claims from NJMC and staked more area.
- 2018 drilling - 11 core holes
- Orogenic-style Au hosted in Belt metasediments?
Endomines Idaho LLC
(Finnish company)

- Acquired TVL Gold LLC (5Au projects)
- Known resources > 500,000 ounces Au
- Developing Friday project.
  - Underground Decline, Mill construction.
  - Orogrande Shear Zone
  - Private Land, State Small Mine Exemption
  - Near Elk City, Idaho Co.
- End of 2018 Start-up Anticipated
  - 8 g/t and 9,000 oz./yr.
Idaho Champion: Baner Project
Revival Gold: Beartrack / Arnett Creek

- Salmon, Lemhi County, Idaho
- Meridian Gold mine (1994-2000; 600,000 tr. ounces and reclaimed)
- Phase 1 exploration
- 2018 drilling to date: 13 core holes for 6,500 meters. Targets along structure between old pits.
- Metallurgical Work

North Pit – Drilling at award-winning reclamation.
Drill S of South Pit

43-101 (July):
Indicated 33 M tonnes @ 1.13 g/t Au, plus 17 Mt inferred.

Nov. 2018 Beartrack Long Section
Core drilling at Arnett Creek now.
Idaho Cobalt Belt

Why Idaho? Geology.

5,000 NEW CLAIMS IN 2018
Geologic Setting of The Idaho Cobalt Belt

Regional geologic-map inset (after O’Neill & others, 2007), showing the Belt-Purcell basin, the Lemhi sub-basin, and the Idaho cobalt belt.

Geologic Map of the Eastern Salmon River Mountains, (after Evans and Green, 2003), showing Co-Cu deposits and Cu-Co prospects of the Idaho cobalt belt. From SE to NW, prospects and deposits are:
- IC = Iron Creek prospect (p)
- BP = Black Pine deposit (d)
- CNC = CoNiCu (p)
- HS = Haynes-Stellite mine (d)
- B = Blackbird Deposit (D)
- SR = Sweet Repose (p)
- TP = Tinkers Pride (p)
- EHC = Elkhorn Cr. (p)
- SCC = Salmon Canyon Cu (p)

Metamorphic grade increases from SE to NW (Nold, 1990).
Blackbird District

Cob-chlorite ore along S₂ layering in transposed banded siltite, hinge zone of the Sunshine F₂ syncline.

Chl after Bt (after argillite), mosaic Qtz (after siltite)

From Art Bookstrom
eCobalt Solutions
(Formation Capital Corp.)

- RAM discovery (1997)
- Mine Permitted
- Site for Hydrometallurgical Processing Plant at Blackfoot (by rail)
- Site Construction, Road Work

Cobaltite with Erythrite

October 2018 Site Overview
eCobalt: Idaho Cobalt Project

Construction at RAM Portal Bench, November, 2018

Concentrator Foundation, Oct. 2018
First Cobalt: Iron Creek Project
(formerly US Cobalt)

• June – First Cobalt acquired US Cobalt and Iron Creek project. $9 million program.
• Underground and surface drilling – 2018: 18,000 meters.
• Multiple horizons: No Name, Waite Zones
• Co-Cu as cobaltiferous pyrite, chalcopyrite stratabound zones.
• Sept.: NI 43-101 report filed. Resource estimate of 45 million pounds Co and 175 million pounds Cu. Open along strike and depth.

First Cobalt has permitted refinery in Ontario.
International Cobalt, others

• **International Cobalt**
  - Grass roots discovery? Co-rich soils/rocks
  - Extension of Blackbird strata

• **New World (Colson Project)**
  - Salmon Canyon Copper mine above Salmon River.
  - Drilled July to Oct.

• **Century Cobalt** – surface expl.

• Many others; land conflicts?

  Stay Tuned
Otis Gold: Kilgore Project

- Epithermal Au-Ag; Late Tertiary age, low sulfidation
- Clark County, eastern ID
- Sept.: filed NI 43-101
  - Indicated: 825,000 ounces Au in 44.6 million tonnes (0.58 g/t Au)
- Received exploration permit (grizzly bear issue?)
Midas Gold: Stibnite Au-Sb Project

- World-class deposit in Valley County. > 5 million ounces Au.
- “Restore the site.”
- 100 years of mining in district, including strategic war-time metals.
- Barrick bought interest.
Midas Gold: Stibnite Au-Sb-W Deposit

• 2018 Activities
  – Permitting
  – Feasibility-level metallurgy
  – Seismic and drilling for geotech
  – New geologic models and resource estimates (grades up, less tonnes, 20% more Sb)

• Geology
  – 3 Overprinted systems
  – New radiometric ages: Au at approx. 61 Ma and 51 Ma; Sb 45 Ma.
  – Au in arsenian pyrite, arsenopyrite.
  – Potassic Alteration; carbonates.
  – Stibnite is late.

• IGS publication on Stibnite
  – January 2019?
Integra Resources: DeLamar Project

  - Historic 1.6 million ounces Au, 100 million Ag.
  - Low sulfidation, epithermal deposit, 15 Ma.
  - Over 20,000 meters drilling
  - Acquired Florida Mountain project (permitted by Kinross but barely mined) in Jan. 2018 for $1.6 million USD.
Integra Resources: DeLamar

- **Press release (11/8/18):**
  - Florida Mtn. drill intercept in ‘IFM18_001A hit 5.2 g/t AuEq over 21.3 meters inc. 3 m of high grade) in Trade Dollar-Black Jack vein. Below current resource boundary.
  - 9 holes for 2,920 m on Florida.
  - More drilling in early 2019

- **Metallurgical Work**
- **Geophysics and Soil Geochemistry**
- **DeLamar** – one drill onsite.

June press release: 2.16 g/t AuEq over 220 m at DeLamar.
The Rest

- Cumoco: Cumo Cu-Mo Project
  - Huge Tertiary porphyry system
  - Boise County, ID
- Empire mine project
  - Mackay, Custer County
  - Skarn (Cu-Zn)
  - PG Mining
  - Drill program
- Several smaller Co projects
- I-minerals clay project at Bovill
- Grass roots work
- South Mountain (Thunder Mtn. Gold)
  - NI 43-101 report in May
  - Underground Zn-Pb-Ag-Cu, private property
- And many more!
Comments and Idaho Trends
(i.e. random musings at end of long day)

• 2018 activity for multiple commodities in Idaho:
  – Metals, industrials
• Healthier balance of large, advanced projects with small ones. Need more grass roots.
• Geographic diversity.
• Permitting times = mining times.

• Modern reclamation still not well-known/trusted by public.
• Geologic diversity is f(great Idaho geology).
• State’s political climate supportive, but strong concern for environment essential.
• Good data and expertise at agencies, including IGS.
• **THANK YOU!**

• [www.idahogeology.org](http://www.idahogeology.org)

• Virginia S. Gillerman, PhD, P.G.
  – Idaho Geological Survey, Boise
  – 208-332-4420
  – vgillerm@uidaho.edu
Slide 2

**Acknowledgements**

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Slide 3

**2018 Mining Trends and Potential**

- Summary of Idaho geology and mineral potential
  - Forward-looking statement: No guarantees, any opinions expressed are solely those of the speaker, not the agency.
  - Discussion Encouraged.
  - Mining is a Global Enterprise and Outlooks Change Weekly.
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Mining in Idaho: 1860-1862

Discovery:
- N. Pl., Clearwater - Feb. 1860
- Pierce, feat. in 1860s
- Elk City - Aug. 22, 1861
- Florence - Aug. 12, 1861
- Warren - Aug. 7, 1861
- Boise Basin - Aug. 2, 1862

More Gold and Silver and Base Metals

Gold and Silver
- Rocky Bar: May, 1863
- Atlanta: June, 1863
- Silver City: Aug. 1863
- Yankee Fork: Aug., 1876

Silver and Base Metals
- Tuxar Fork: Aug. 1876
- Wood River: Aug. 1876
- Minnie Moore: Sept., 1880
- Thunder Mountain: July, 1896

Phosphate
- Tons

Historical Legacies
- Mining Past – Historic
- Reclamation Needs
- Inactive or Abandoned Mines (AMLs)
  - Inventory
  - Closures
- Phosphate – Se
- Open Pits
- Modern Reclamation – H₂O

2018-060
USGS preliminary value for 2016 is about $600 million ($594 million), up from last year (2015 = $537 million) but large drop since Thompson Creek molybdenum mine ceased production. Note tracking of total and metals value – gap in between reflects relatively constant industrial minerals. Peak production 2011 at about $1.3 billion value.

2017e (MSC 2018) is partial total of $191 million. Due to proprietary exclusion of ? Commodities.

Favored Idaho Commodities

- 2016 Idaho Leaders
  - Phosphate Rock
  - Sand and Gravel
  - Silver
  - Lead
  - Crushed Stone

- In 2015, metals 26% of value, due to loss of Mo production at Thompson Creek at end 2014.
Two World Class Mining Districts

- Coeur d'Alene District:
  - Over 1.24 billion troy ounces Ag (38,568 metric tons)
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Coeur d'Alene District:
Host: 1.4 to 1.47 billion year old Belt rocks. Argillites to quartzites.
Intracratonic Rift.
Wallace Fm. St. Regis Revett Burke Prichard Formation
Age of Belt Sedimentation is 1.4 to 1.47 BY.
Ore deposits located in the Middle-Upper Prichard associated with white quartzite strata in the dark gray to black argillites. These zinc rich deposits are in Pine Creek and in upper NineMile Creek.
Deposits located in the Burke-Prichard interface like the zinc-lead orebodies near Burke.
Silver rich deposits in the Revett-St. Regis zone. Tetrahedrite rich deposits of the Silver Belt.
Deposits in the Wallace that are rich but spotty.
Bunker Hill and Morning mine have the largest tonnage and may be double orebodies.

Geology, Age and Extent of Belt Supergroup
The Belt Supergroup is an immense package (15-20 km thick) of sedimentary rocks that were deposited on Archean and Paleoproterozoic crystalline basement from 1470 to 1400 million years ago. Figure 1 shows the geographic extent of the Belt Supergroup. The Belt Supergroup extends southward from

2018-062
Canada, where it is called the Purcell Supergroup, through western Montana and into northern and central Idaho. The Belt Supergroup extends westward into eastern Washington. Most of the spectacularly glacially sculpted rocks in Glacier National Monument are Belt Supergroup.

**Geologic History of Belt Supergroup**

**Belt Supergroup Tectonic Setting**

The Belt Supergroup rocks were deposited in the largest Middle Proterozoic basin on the North America continent. The Belt-Purcell basin was intracratonic and periodically connected to the world ocean. At other times, it was enclosed and formed lacustrine deposits (Ross and Villeneuve, 2003). The current accepted model, based on geochemistry and sedimentology, is that the basin formed as a result of hinterland rifting inboard of a compressional orogenic belt, within a 1.45 Ga Middle Proterozoic supercontinent, the precursor of Rodinia (Winston and Link, 1993). Plate reconstruction for this time period is not easy and is an active area of research.

As rifting initiated and the basin formed, rapid subsidence of the basin was caused by loading the crust with basaltic sills that intruded the Pritchard Formation. Subsequent faulting and folding within the Idaho-Montana thrust belt, plus intrusion of Neoproterozoic, Ordovician, Cretaceous and Eocene magma (covered in following modules) have affected the Belt Supergroup.
Hecla Mining Company

Nov. 2018
3rd Qtr.

- 3.6 Moz. Ag in 2016.
- 2018 3rd Qtr.: 31,639 ounces Ag by salaried workers.

3/13/2017: USW Local 5114 out on strike. Major issue is control of miners' work assignments.

Lucky Friday mine

Nov. 2018: Still on strike.

RVM (Remote Vein Miner)
Swedish company – 2019 set up at Hecla? R and D this year.

No Change.

Hecla – Lucky Friday mine

- R and D for RVM.
- Salaried employees (including geologists) doing limited mining and milling of mine during strikes.
- Hecla 3rd Qtr. Results – loss from lower Ag price, production decline.
- Large resource remains; #4 shaft to 8300 level is fully operational.

2018 photo of LF 6200 sublevel of 16 stope, 30 vein. Left wall rock is green silty argillite with minor veinlets, white is quartz, gray is argentiferous galena, orange-brown is siderite, black is sphalerite. Will this be feed for continuous miner by end of 2019 test?
Slide 14

**Americas Silver Corporation: Galena Complex**

- Galena Mine
- Coeur Mine
- Caladay
- 2 mills
- 2017 production: 1.135 million troy ounces Ag, plus 19.7 million pounds Pb.
- Concern over lower Ag prices in 2018.

Dan Hussey sampling some of the 230 million ounces Ag produced at the Galena mine.

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**Galena mine – Americas Silver Corp.**

June 14, 2018 announcement: No. 3 shaft had 10-day suspension of hoisting in late April for repair of steel sets in shaft. 17-day shutdown in June to repair mechanical failure in hoist brake mechanism. Repairs completed by end of June 2018 and Galena complex back to normal operations in Q3 of 2018.

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**New Jersey Mining: Golden Chest mine**

- Murray, Idaho
- Property paid off in 2018.
- Pleasant in good weather.
- Open pit production with some underground.
- Production started Nov., 2017.
- Multiple NW-trending ore shoots along Idaho Fault.
- Gold-quartz veins, grade about 4 g/t Au.

Bought a drill rig; doing some development drilling at Golden Chest and also exploration on other targets in district. Veins dip about 45 degrees, with slope, so reasonable stripping ratio.
Slide 17

Golden Chest mine
- Ore to New Jersey’s mill at Kellogg
- 360-tonne/day flotation (also cyanide leach) Flotation concentrate
- Recovered 6700 ounces Au to date and reporting revenue.

Belt Association Field Trip (Sept. 2018)

Slide 18

GEOLOGY OF THE IDAHO PHOSPHATE DISTRICT

- Permian Phosphoria Fm.
- Meade Peak Member (5 m.y. of deposition about 265 m.a.)
- Phosphatic black shale – restricted marine basin with upwelling organic-rich currents
- $P, + C, V, U, Mo, Se, etc.$
- Apatite (Piper, 2001)

Phosphoria and black organic shales enrich other elements: $P$, plus $C$, $V$, $U$, $Mo$, $Se$, etc.
Selenium enriched in center waste shales and easily released if material is oxidized and has water flowing through old waste dumps, etc. Quite a problem.

Slide 19

The Phosphate Cycle

- Mineral: Apatite $Ca_5(\text{Cl,F})(PO_4)_3$
- Rock: Phosphoria Formation (265-275 million years old).
- Mining: large, open pit mines with ore assaying about 25-30% $P_2O_5$
- Processing: Phosphoric Acid for fertilizer, and Elemental Phosphorus for chemicals, foods, herbicides, and other high purity uses.
- Fertilizer: Simplot (Pocatello) and Itafos (Agrium) at Conda

Crustal Abundance of P2O5 is only 0.23%, so the ore is enriched by factor of 130x typical crustal rock.
Permian Phosphoria Formation: Covered SE Idaho and parts of Utah, Wyoming and Montana. Black phosphatic shale. Idaho third largest phosphate producing state – after Florida and North Carolina. Squares = 3 large processing plants. Monsanto is only elemental phos plant in Western Hemisphere. Agrium and Simplot have fertilizer (phosphoric acid) plants. Global competitors are China and Morocco. Phosphate rock accounted for just over 50% of Idaho non-fuel production value in 2015. (since Thompson Creek Mo ceased ops.) markets OK but prices down a bit for fertilizer.

NEW THIS YEAR 2018: Monsanto acquired by Bayer; Agrium acquired by Itafos. Simplot remains an Idaho-based private company.
Slide 22

J.R. Simplot Company
Smoky Canyon mine

- Mining Panel F (Manning Creek lease) and newest Panel G (Deer Creek).
- Waste Rock to West dump and East Overburden pile.
- Concurrent Reclamation.
- Pit F1N reclamation almost complete.
- Waste Rock Segregation.

Slide 23

Smoky Canyon mine

- Environmental:
  - Waste rock segregation - to minimize footprint of Se-bearing waste.
  - Chert wedge - axial synthetic covers on slopes.
  - Backfilling old pits and concurrent reclamation of waste dumps.

Slide 24

P4/Bayer (Monsanto)
Blackfoot Bridge mine

- P4 mining Mid Pit. North pit finished in spring.
- Waste rock goes to backfill North pit and external overburden pile (EOP).
- Reclamation on EOP is monitored by lysimeters.
- GCLL cover on disturbed areas.

Monsanto/Bayer may be sending some ore to Itafos plant.
Slide 25

Rasmussen Ridge mine reclamation

- Agrium now Nutrien.
- Agrium Conda Phosphate Operation Sold to Itafos (late 2017).
- Agrium/Nutrien responsible for reclamation of older South/Central Rasmussen Ridge.

Slide 26

Itafos Rasmussen Valley mine

Late 2018: Itafos purchased Agrium’s Conda Phosphate Operations, including Conda plant, leases and newly permitted Rasmussen Valley mine.

Rasmussen Valley mine: 500-acres of disturbance. Ore production began early 2018 to supply fertilizer plant at Conda for 6 years. Will collaborate with P4s South Rasmussen mine (just to N) to put initial overburden from mine into South Rasmussen remaining mined out pit. Thus avoids need for external overburden disposal area. Win-Win.

Itafos also mining the Lanes Creek Mine (all private) – on year 3 or 6-year plan. High wall issues. Stockpiling.

Slide 27

New Phosphate Mine Plans

- Simplot – East Smoky Panel expansion (5-12 yrs.). DEIS to public review in September, 2018.
- Itafos – working with BLM to restart Husky1/N. Dry Ridge EIS process.
Industrial Minerals

Smaller Rural Stable (some operating for decades)

Varied Commodities:
- Dimension Stone
- Calcium
- Clay
- Gemstones
- Abrasives
- Zeolites
- Landscaping Rock
- SAND and GRAVEL
- CRUSHED STONE

Industrials – north Idaho

- Emerald Creek Garnet
  - Opta Minerals Inc.
  - Almandine garnet alluvial deposits
  - Water filtration
  - Producing garnets from Emerald and Carpenter Creek deposits near Fernwood since 1930.

- i-minerals Bovill Project
  - Development Stage
  - Metakaolin Pilot Plant at FLSmidth – flash calcination for natural pozzolan
  - Halloysite, Kaolin, Quartz, K-Feldspar testing and process optimization
  - 2016 Feasibility – 25% after tax IRR.
  - Amended State operation and reclamation plan issued May, 2017.

- Also USFS Emerald Creek Garnet dig. I-minerals clay-quartz-feldspar deposits in historic Bovill-Helmar district in Latah County. State leases. Working on producing high value products – ex. Would be only metakaolin producer in Pac NW. High K2O feldspar. All very competitive markets. Main competition is in SE US.

Dimension Stone

- Oakley Stone
  - Northern Stone Supply
  - Northern Stone Quarry - active
  - Oakley Stone
  - Scrivanich/Oakley Mtn.

- Table Rock Sandstone
  - Idaho Travertine
  - Three Rivers Quarry - inactive

Micaceous quartzite that splits into thin slabs. Very durable. Facing stone, stacked rocks. Cut into tiles as well. Full production.
Slide 31

Hess Pumice operates several companies out of their facility in Malad. Based on high purity pumice at Wrights Creek mine north of town. Hess Pumice uses special screens to split out various sizes of highly pure pumice. Markets include lightweight aggregate and artificial stone, pozzolan for cement, abrasives, filtration, horticulture, paint fillers? Also operate Hess Perlite (formerly Idaho Minerals) that produces an expanded perlite product prized for horticulture and lightweight concrete use.

Slide 32

Energy Resources

- Oil and Gas: SW Idaho (Payette County)
  - Alta Mesa
    - Tertiary Lake Sediments (sands)
    - Gas and Condensate dominant
    - Source bed unknown
    - Conventional wells
  - Geothermal
    - US Geothermal Raft River Plant
    - Exploration

2018-071
For more about IGS Data Preservation of mining files and databases, contact Reed Lewis or Christopher Tate in Moscow Office. Or myself. at ctate@uidaho.edu or 208-885-7540. Or myself.

Peter Isaacson is new interim Director.

Christopher A. Tate 11/6/2017
I removed 'Driven by Digital Database 1' because now DD-1 is a derivative of the Mines App, which has improved and new locations, attributes, and references. Added PLSS grid because many agencies and the public understand and use Township-Range-Section descriptions.

3 regions of active leasing in state. SW Idaho is only producing field.
Exploration 2018

- Uptick in Major Drilling Programs.
- Development and Advanced Projects.
- Gold and Cobalt – Priority Commodities.
- Grass Roots.
- Precious Metal Prices – down slightly, still healthy.
- Rediscovering Old Properties.
- More Stability on Governmental and Regulatory Environment.

BLM saw over 6,000 new mining claims filed in 2018 in Idaho. About 5,000 of those were in the Idaho Cobalt Belt.

Reality Check for those in audience who are not exploration geologists or insiders. It is a long road from a prospect or high grade assay to an operating mine. Major permitting and economic hurdles to overcome. And Mining is a global industry. Lots of international competition. However, we can’t move what Nature put here. It is in Idaho to stay.

Roughly from North to South.

Bunker Hill Mining Corporation

- New group formed Liberty Silver – August 2017 agreement with owner of Bunker Hill to lease/purchase mine ($30 million).
- Aim to reopen Pb-Zn mine.
- Financing problems and defaulted on leases. Nov. 2018 – reinstatement of lease from owner (Placer Mining Corp.) to reduce lease payment in 1 year agreement.
- Working with EPA to resolve water treatment plant issues and costs.


At its peak, The Bunker Hill Company operated the mine, lead smelter and refinery, electrolytic zinc reduction plant, cadmium plant, zinc fuming plant, sulfuric acid plant and even a phosphoric acid plant at Kellogg. Check new website for more on current plans.

Narrow High grade gold vein: orogenic-style target hosted in Belt Seds. Nice when you can see the mineralization!!

150 tonne/day ore processing. Under construction.
Idaho Champion Gold Mines Ltd. – small company that picked up property on northern and eastern margin extension of Orogrande Shear Zone. Drilled 5200 m of core in 19 holes. Some good results. Quartz-sericite-pyrite alteration. Deep oxidation.

Hole ICG2018-13 had 5.76 g/t Au over 12.65m at less than 40 meters depth.

Revival Gold:

- Salmon, Lemhi County, Idaho
- Meridian Gold mine (1994-2000: 600,000 t, ounces and reclaimed)
- Phase 1 exploration
- 2018 drilling to date: 13 core holes for 6,500 meters. Targets along structure between old pits.
- Metallurgical Work

Check Website – not enough time to go into details. Started drilling at Arnett Creek

Revival:

Beartrack mine project

November, 2018 drilling: 25,000 feet of core at Beartrack and 3,000 feet of diamond drilling at Arnett.

At 0.61 g/t gold mill cut-off and 0.26 g/t cyanide soluble Au heap leach cut-off, Beartrack resource: Indicated Mineral Resource of 33.4 million tonnes at 1.13 g/t Au (1,214,000 ounces Au); total Inferred Mineral Resource of 16.9 million tonnes at 1.41 g/t gold containing 765,000 ounces gold.
Beartrack extended mineralization at depth and along strike in Ward’s Gulch and South Pit areas, and expanded it at Joss (south of townsite of Leesburg).

Cobalt prices have skyrocketed this year. Around $30 per pound. Use in batteries. Other companies staking claims as well. Well-defined NW-trending belt of occurrences in Lemhi County. Trend cuts across geology and may be basement flaw.

NW-trending belt of Co occurrences: ~30 miles long by 5 miles wide. Host is Mesoproterozoic “Yellowjacket” metaseds. Siltites, argillites with biotitites (possible exhalative stratabound zones). Minerals: cobaltite, chalcopyrite with gold, and minor pyrite, arsenopyrite, and pyrrhotite. Mineralogy changes on belt. Metamorphic grade increases to NW along belt, as get closer to Cretaceous intrusions and more regionally metamorphosed rocks. Not sure about origin of mineralization or trend. May reflect orientation of
original Proterozoic rift????
Structurally complex. Blackbird District is largest. Noranda defined about 18 million ton reserve there in ~1970s before Co prices collapsed and it was never mined. Now patented district has permanent water treatment plant and old tailings reclaimed. See 2016 paper on district by Bookstrom and others in GSA Special Paper.

A mess. Tightly folded Mesoproterozoic Belt metasediments, assigned to Yellowjacket, Apple Creek, or other formations. Probably on several thrust plates (Cretaceous) with varying metamorphic intensity but well into garnet facies in places. Debated origin. Stratabound but also along fold hinges. Multiple horizons and district zoning. Cobaltite (CoAsS2) with pyrite, chalcopyrite. Gold credit. Best age dates from recent USGS work suggest initial cobalt introduced early in system, possibly syngenetic or at 1370 Ma intrusive event. Clearly deformed, metamorphosed and remobilized in Cretaceous. Controversial.
Formation Capital Corporation, US, is wholly owned subsidiary

First Cobalt: Iron Creek Project
- June – First Cobalt acquired US Cobalt and Iron Creek project. $9 million program.
- Underground and surface drilling.
- 2018: 18,000 meters.
- Multiple horizons: No Name, Waite Zones
- Co-Cu as cobaltiferous pyrite, chalcopyrite stratiform zones
- Cu credit for iron cobalt oxide
- CoEq = % Co + (%Cu)/10. Low As.
- 2017: 40 DDH over 10,000m
- 2018: 22 DDH (ug) and 30 surface holes for 18,000 m.

0.11% Co Eq and 30 million tonnes at underground cutoff. Cu credit. Have permitted refinery in Ontario.
Slide 49

International Cobalt, others

- International Cobalt
  - Grass roots discovery? Copper
  - Extension of Blackbird strata
- New World (Colson Project)
  - Salmon Canyon Copper mine above Salmon River
  - Drilled July to Oct.
- Century Cobalt – surface expl.
- Many others, land conflicts?
- Stay Tuned

Slide 50

Otis Gold: Kilgore Project

- Epithermal Au-Ag; Late Tertiary age, low sulfidation
- Clark County, eastern ID
- Sept.: filed NI 43-101
  - Indicated: 825,000 ounces Au in 44.6 million tonnes (0.58 g/t Au)
- Received exploration permit (grizzly bear issue?)
- 2018 – soils, Lidar, permitting, resource modeling

Slide 51

Midas Gold: Stibnite Au-Sb Project

- NEPA – Plan of Restoration and Operations (PRO) initiated 2016. Joint Review
  - DEIS May, 2019; ROD 2020.
- World-class deposit in Valley County, > 5 million ounces Au
  - “Restore the site.”
- 100 years of mining in district, including strategic war time metals
- Barrick bought interest
Slide 52

Midas Gold: Stibnite Au-Sb-W Deposit

- 2018 Activities
  - Permitting
  - Feasibility level metallurgy
  - Seismic and drilling for geotech
  - New geologic models and resource estimates (grades up, less tonnes, 20% more Sb)

- Geology
  - 3 Overprinted systems
  - New radiometric ages: Au at approx. 61 Ma and 51 Ma; Sb 45 Ma.
  - Au in arsenian pyrite, arsenopyrite.
  - Potassic Alteration; carbonates.
  - Stibnite is late.

- IGS publication on Stibnite
  - January 2019?

IGS, USGS, UNR geos doing research?

Slide 53

Integra Resources: DeLamar Project

  - Historic 1.6 million ounces Au, 100 million Ag.
  - Low sulfidation, epithermal deposit, 15 Ma.
  - Over 20,000 meters drilling
  - Acquired Florida Mountain project (permitted by Kinross but barely mined) in Jan. 2018 for $1.6 million USD.

Slide 54

Integra Resources: DeLamar

- Press release (11/8/18):
  - Florida Mtn. drill intercept in IFM18_001A hit 5.2 g/t AuEq over 21.3 meters inc. 3 m of high grade) in Trade Dollar - Black Jack veins.
  - Below current resource boundary.
  - 9 holes for 2,920 m on Florida.
  - More drilling in early 2019

- Metallurgical Work
- Geophysics and Soil Geochemistry
- DeLamar mine site lease.

2018-080
The Rest

- Cumuco: Cumo Cu-Mo Project
  - Huge Tertiary porphyry system
    - Boise County, ID
- Empire mine project
  - Mackay, Custer County
    - Skarn (Cu-Zn)
    - PG Mining
    - Drill program
- Several smaller Co projects
- Li minerals clay project at Bovill
- Grass roots work
- South Mountain (Pound Mtn, Idaho)
  - Mt. 43-50 report in May
  - Underground Zn-Pb-Ag-Co, private property
- And many more!

Comments and Idaho Trends

- 2018 activity for multiple commodities in Idaho:
  - Metals, industrials
- Healthier balance of large, advanced projects with small ones. Need more grass roots.
- Geographic diversity.
- Permitting times = mining times.
- Modern reclamation still not well-known/trusted by public.
- Geologic diversity is great (Idaho geology).
- State’s political climate supportive, but strong concern for environment essential.
- Good data and expertise at agencies, including IGS.

THANK YOU!

www.idahogeology.org

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Annual Idaho Regional Development presentation to American Exploration and Mining Association, 2019

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www.idahogeology.org

American Exploration and Mining Association
Reno, NV
December 4, 2019
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- Idaho Dept. of Lands staff
- BLM and USFS minerals staff
- Industry geologists
- IGS and Claudio Berti (new IGS Director)
- Earl Bennett
2019 Trends and Highlights

- Phosphate Reigns in Idaho
- Lucky Friday strike?
- Gold Renaissance –
  - North, South and in between!
- Cobalt/Critical Minerals
- Price Matters
- Social License and Public Perception
- Exciting Development Projects
- Idaho-based Companies
Idaho Non-fuel Mineral Production

2018 Leading Commodities: Phosphate rock, Sand and Gravel, Crushed Stone, Pb and Ag

Idaho Non-fuel Mineral Production (USGS data)

Dec. 2014: Thompson Creek Mo on care and maintenance; large resource remains.

March 2017: Lucky Friday miners go on strike.
Metal prices (5-years)

Mo: $ 9.70/lb. (LME, Platt’s, 11/20/2019) vs. >$ 11 at end of 2018.
Two World Class Mining Districts

- Coeur d’Alene District:
  - Over 1.24 billion troy ounces Ag (38,568 metric tons)
  - Pb, Zn, Cu, Sb
  - Quartz-Siderite-Sulfide veins in PC Belt metasedimentary rocks
  - Deep mines, ore extends vertically

- SE Phosphate District:
  - Also over 100 years production
  - Permian Phosphoria Formation
  - Sedimentary apatite-rich black shale of regional extent
Coeur d’Alene district (Silver Valley)

2019

Active:
Lucky Friday
Galena Complex (inc. Coeur)

Inactive, but resource in ground:
Sunshine
Bunker Hill – Zn, renegotiated lease
Hecla Mining Company: Lucky Friday mine

- 2019 production by salaried employees up (115,682 oz. in Q3 2019 vs. 169,041 oz. in 2018).
  30 vein, Gold Hunter, 6400 level.


3/13/2017: USW Local 5114 out on strike. Major issue is control of miner’s work assignments.

RVM (Remote Vein Miner): Testing in Sweden; Idaho in 2020

2018 Sentinels of Safety Award by NMA
Americas Gold and Silver Corporation

2019

- April: Acquired Pershing Gold
  - Name Change
  - Relief Canyon (NV) development
- September: JV with Eric Sprott on Galena Complex
  - $20 million investment in new equipment, upgrades, development and exploration
  - Sprott earns 40% interest in Galena
Galena Mine - 2019

- Jan. – Oct. 2019: 636,000 ounces Ag, 10 million lbs. Pb.; cons to Trail, BC.
- Conventional with jacklegs, slushers on 4 upper levels.
- Mechanized on lower (4900 and 5200 levels; 70%.
- Drilled 23,000 feet.
- Discovered 2 new production areas on 4900.
- 3D modelling and planning.

Driving drift with jumbo to new 075 vein, 4900 level
Galena Mine - 2019

- Recapitalization Plan (Sprott JV):
  - New hoist to replace Galena hoist
  - Repairs and develop 5500 level and others
  - Increased exploration, production
  - Reduce costs
- Large resource:
New Jersey Mining: Golden Chest mine

- Murray Gold District
  - Open pit & Underground
    - Open Pit: 1003 down to 994 bench in 3rd qtr.
    - UG: 848 South stope/836
  - Gold-quartz veins
  - Multiple ore shoots along Idaho fault
  - Grades of 3 to 6 gpt Au
    - Also W, sulfides
  - Orogenic System
  - Pritchard Fm. host rock
Golden Chest mine, Murray Au Belt

Kellogg Mill: ~ 5000 tonnes/month. Bulk sulfide con, shipped overseas. Also did column leach tests of lower grade material. 24 employees

Stope 836N: Idaho Fault and vein
Endomines: Friday mine (Elk City area)

- Finnish company – acquired TVL Gold LLC
- Orogrande and Petzsite shear zones; other deposits in area
- Development/Pre-production
  - Underground: 150 tpd; mine life 7 years, good grades
- Mill - SE of Elk City. Ramping up after tailings pond damaged last winter. Will produce sulfide concentrate.
Endomines: Friday mine (Orogrande Shear)

Friday mine portal

Phosphate Mining in Idaho: 2019

Permian Phosphoria Formation: Meade Peak Member (phosphatic black shale)

Apatite (P), + C, V, U, Mo, Se, REE
Phosphate Processing Plants

Nov. 2019:
J.R. Simplot Company: Smoky Canyon mine

- Mining in F and G panels

F2 panel

G1 pit, November: last ore mined
J. R. Simplot Co.: Smoky Canyon

- Mining Panels F and G
- Concurrently reclaiming F1 pit as F2 and F3 pits mined.
- Segregating waste rock to “lock up” more Se-rich contaminant shale into infiltration-limited covered area.
- Permitting new panel East Smoky.

New Mine Plan Approval:
- Dairy Syncline mine, plus reclamation, land exchange
  - 2,767-acres; 30-year mine life
- Final EIS released Nov. 8, 2019
  - Preferred Alternative – proposed action with modifications
- Anticipate RODs in March 2020.
Bayer (P4), formerly Monsanto

- **Blackfoot Bridge mine**
  - Actively mining the Mid Pit
  - Backfilling North Pit and EOP
  - Working on cover design and construction

- **Exploration Drilling:**
  - Trail Creek Lease
  - 28 drill holes
  - 8,900 feet
  - Roads and sites reclaimed

- **New Mine Approved:**
  - Caldwell Canyon ROD issued August 2019
  - 40-year mine life
  - Initial overburden to Dry Valley mine
Blackfoot Bridge 2019: Phase 8 sequence

- March
- June
- July - backfill
- October - backfill

2019-022
Bayer – Caldwell Canyon

September 2019: Topsoil salvage, pit area pre-construction activities, roadwork
Itafos, formerly Agrium

- Agrium merged in Jan. 2018 with Potash Corp. of Saskatchewan to form Nutrien.
  - Nutrien (Nu-West) – retained ownership of mined out properties, legacy, reclamation etc.
  - Operating assets (inc. Conda plant, working mines (Ras. Valley and Lanes Creek), and exploration/development properties) divested – bought by Itafos in late 2018.

Reclamation: Backfilling North Rasmussen Ridge mine
Itafos

October 30, 2019:

- Itafos Conda Technical Report
  - By Golder Assoc. Ltd.
  - Conda properties
  - Paris Hills (underground)
  - Husky1/North Dry Ridge deposits
- Increased resource estimates
  - H1/NDR: 38 M short tons, 24% P₂O₅.
  - RV mine: 15 M short tons
- Conda Plant: 550 kt per year, MAP, SPA, specialty products

Mining at Rasmussen Valley mine, 2019
Also mining Lanes Creek mine
Itafos: Husky/North Dry Ridge Permitting Resumed

Itafos drilled Husky 1 in 2019

Aerial View of Husky 1 permitting vicinity (from south looking north)

May, 2019: Restarted EIS process.

2019-026
Other Industrial Mineral Operations

- **Aggregate** $$$
- **Others** – diverse commodities & uses
  - Industrial garnet and pumice
  - Dimension stone
  - Lime
  - Zeolites and Clays
  - Industrial sand
  - Landscaping rock
  - Gemstones
- **Stable, rural, smaller**
Second most valuable commodity in Idaho

**Aggregate:** Construction Sand & Gravel, Crushed Stone

- IDL Surface mine reclamation plans: 100+ gravel pits and quarries
- State Royalty Revenue (FY19): Sand & Gravel
  - $1.1 million
  - State leases
- Roadwork, Concrete, Construction
- Urban Areas – construction/roadwork up
Industrials – north Idaho

- **Emerald Creek Garnet**
  - Opta Minerals Inc.
  - Almandine garnet alluvial deposits
  - Water filtration
  - Abrasives
  - Producing garnets from Emerald and Carpenter Creek basins near Fernwood since 1930.

- **i-minerals Bovill Project**
  - Reorient to lower CAPEX, focus on metakaolin and halloysite
  - **Pilot plant testing:**
    - Pilot Plant Production at Ginn Mineral Technologies – halloysite and kaolin testing of 6 tons sample
    - Kaolin to FLSmidth – flash calcination to metakaolin
  - New prefeasibility – Millcreek Engineering (halloysite, kaolin)
  - **43-101 by SRK:** April, 2019 – ample resource of clay
Dimension Stone: Southern Idaho

- **Oakley Stone (Middle Mtn.)**
  - Northern Stone Supply
  - Sawtooth Stone
  - Scrivanich/Oakley Mtn. Corp.
  - American Stone
- **Table Rock Sandstone**

Idaho Travertine

Rocky Mtn. Quartzite Quarry
Northern Stone

Oakley stone exported outside Idaho – high-end natural stone
Oakley Stone Quarries

Drill for “Rocky Mtn. Gneiss”
Northern Stone Supply

Also using diamond saws instead of explosives

Oakley Mtn. Corp.
Splitting and stockpile areas
Idaho State Activities

- **IDL – Regulatory Reform**
  - HB-141 (IMA sponsor):
    - Surface impacts of underground mines
    - Actual cost estimation of reclamation
    - Update of financial assurance methods
    - Modest fees

- **Wilderness and Forest Plan Revision** – Mineral Assessments and Comments (IGS, OEMR)

- **100th Anniversary of Idaho Geological Survey** (aka Idaho Bureau of Mines and Geology since 1919)

- **Dr. Claudio Berti** – New IGS Director and State Geologist
IGS Mineral Deposit Research

- Geology and Temporal Evolution of Alteration and Au-Sb-W Mineralization, Stibnite Mining District, Idaho

- **IGS Bulletin 31**

- Online: February, 2019
  - 163 pages
  - 31 MB of digital appendices (7 appendices)
  - Free pdf download or print purchase
IGS Programs and Research - 2019

- Geologic Mapping -
  - Salmon, Weiser, Preston, Elk City (USGS Statemap)
  - Cobalt Belt (USGS MRI)
- Data Preservation –
  - New Geochem Database
  - Expanded Mines DB (DD-1), References
- DeLamar/Swisher Mtn. – regional geologic mapping (new project)
  - Near Integra’s Au-Ag deposit, Owyhee County
Goal is to establish a 3D stratigraphic-tectonic framework of the Western Snake River Plain and its evolution through time. Framework will define the petroleum system in terms of reservoirs, seals, and source rocks (SR).

Reservoir Characterization and Performance
- Work combines information from 2D seismic with drone imagery from outcrop analogs to document the facies architecture of reservoir analogs. Data will be integrated with field production to help risk and rank future subsurface targets.

Source Rock Evaluation
- Geochemical characterization of produced hydrocarbons and potential source rocks. Information will help identify the origins of oil and gas and hydrocarbon generating capabilities of SR.
More IGS Research

Geologic Hazards Projects:
- State landslide database
  - Landslide mapping, N. Idaho
- Bear Lake faults mapping
- Active faults database
  - Bear Lake fault mapping
  - New paleoseismic investigations
- Boise Foothills mapping
- Organizing earthquake working group meeting
- Multiple Collaborators/Sponsors

Hydrogeology Projects:
- Big Lost River Basin *(IDWR, USGS)*
  - Characterization, groundwater modeling for INL, ESPA
  - Data to decision makers
- Raft River Basin *(IDWR, Phase 1)*
  - Hydrogeologic data compilation/GIS
  - Field reconnaissance
  - Future phases – instrumentation, monitoring, gw budget

[www.idahogeology.org](http://www.idahogeology.org)
Exploration 2019

- Multiple major drilling programs.
  - Advanced/development projects.
- Known districts; multiple commodities; diverse geology.
- Difficulty raising money?
- Less grass roots exploration.
- Gold is shining; silver too.
- Cobalt fever abated some, but claims kept. Critical mineral interest.
Bunker Hill Mining Corporation

- New group formed Liberty Silver – August 2017 agreement with owner of Bunker Hill to lease-purchase mine ($30 million).
- Aim - to reopen Pb-Zn mine; working with EPA on water treatment issues.
- Financing problems and defaulted on lease. Nov. 2018 – reinstatement of lease from owner (Placer Mining Corp.) to reduce lease payment in 1 year agreement.
- **October, 2019:** Amended lease / option for additional 9 months with more favorable terms.
- Large zinc resource.

1887–1981: 36 million tons @ 8.7% Pb, 3.7% Zn, 4.5 opt Ag

Bunker Hill glory hole, 1907
North Idaho

- **Idaho Champion, Baner Gold Project**, Elk City/Orogrande: Drilled 1–9 g/t Au, got permits, need $.
  - Very positive 2018 drill results over 500m strike; Good metallurgy; was planning program. Not implemented.
  - Same shear zone as Endomines, Friday mine.
  - Also Champagne mine, south ID.
- **Hecla** — Mapping and sampling, Murray (Au).
- **NVH** — New Vulcan Hill mine, Lakeview District

**Recent drilling returned:**
- ICG2018-1: 1.39 g/t over 18.00 metres (from 83m to 101m)
- ICG2018-8: 8.66 g/t over 6.30 metres (including 0.3 m of 146.75 g/t (from 115 m to 121.3 m)
- ICG2018-9: 1.32 g/t over 12.80 metres (from 47 m to 59.8 m)
- ICG2018-13: 5.76 g/t over 12.65 metres (from 8.65 m to 21.30 m) and 9.02 g/t over 2 metres (32.2 m to 34.2 m)
Midas Gold: Stibnite Project

  (USFS/Joint Review Process)
  - Public Comment on PRO – 45 days?
  - Final EIS- late 2020 (mining + restoration)
- Successful financing ($30 million in bank at end Q3).
- Formed Stibnite Foundation
- Drilled wells for large volume pump tests, water quality studies, engineering, environmental work.
- **August:** Nez Perce Tribe lawsuit against Midas over water quality, alleging responsible for prior environmental damage of 100 years of mining (inc. WWII).

October, 2019 Pump Test Wells

~ 5 million tr. ounces Au, + Sb

CORE SHACK
Since well before the suit was filed, Midas Gold has been working closely with the Idaho Department of Environmental Quality and the United States Environmental Protection Agency to gain permission to take immediate action and learn more about the specific causes of degraded water quality in a number of locations. Midas Gold firmly believes that it is not legally responsible for cleanup of site legacy impacts caused by previous mining companies or directed by government agencies. However, the Company wants to be part of the solution. Subsequent to quarter end, in the normal progression of such litigation, Midas Gold filed a request for a stay of proceedings based on the progress in respect of ongoing discussions with Federal and State regulators on a path that would end the litigation as well as a request for a dismissal of the suit based on other considerations. Both motions have been consolidated for judicial review in mid-December and are expected to be ruled on as early as late Q4 2019.
Revival Gold: Beartrack gold project

Two Projects:
Beartrack and Arnett Creek, Lemhi County

**Beartrack:**
- 3 DDH for 1,230 meters (Joss area)
- Resource Estimate (Q1 2020)
- Metallurgical work on sulfide – optimize flotation results and recovery
- Historic placers at Leesburg on Napias Creek; former open pit mine of 600,000 oz. Au

Talk by Steve Priesmeyer on Thursday AM

2019-042
Revival Gold: Arnett Creek

- 22 DDH totaling 3,830 meters
- Working on prelim resource of leachable Au
- Soil sampling (12 km²) and mapping
- 404 line-kilometer airborne magnetics
- Expanded land position (Oct/Nov.)
Otis Gold: Kilgore Project

- **Completed PEA:** 5-yr mine life at 112,000 ounces/yr. Attractive IRRs.
- **Still drilling** on 12-hole RC program with 2 rigs.
Idaho Cobalt Belt

- Mesoproterozoic banded siltite, Apple Creek Fm.
- NW-trending 30-km linear belt.
- Co price down: critical mineral
  Also Cu, Au, sniffs of REEs.
- Two large projects:
  - eCobalt/Jervois (Blackbird)
  - First Cobalt (Iron Creek)
- Others – compilation of 2018 work, permitted, not drilled.

Largest US resource; primary Co district

Bookstrom, et al., 2016: GSA Special Paper 522
First Cobalt: Iron Creek

2019 Summary

- Phase 2 drilling completed Feb. 2019
  - 43 DDH, 44,000 feet
  - Surface and mostly underground
  - Co and Cu: Co-pyrite; chalcopyrite
- Geologic model and lithgeochemical interpretation
- Co-Cu resource update (NI 43-101; Q4 2019)
- Water quality monitoring
- Property exploration: Ruby Zone
- Refinery at Cobalt, Ontario
Iron Creek: 2018-2019 DRILLING HIGHLIGHTS

• Post-Resource drilling (Fall/Winter 2018 – 2019)
• 43 diamond holes totalling 44,000 feet
• Infill and Extension drilling targets

Result
• Expanded the resource along strike to over 3000 feet and down-dip extensions to over 1000 feet

New resource estimate in Q4 2019

West Extension
0.22% Co, 3.90% Cu over 12 ft (ICS18-21)

Depth Extension
0.13% Co, 0.01% Cu over 59.5 ft (ICS18-14)

East Extension
0.20% Co, 0.10% Cu over 22.8 ft (ICS18-20)

Depth Extension
0.20% Co, 0.01% Cu over 39.4 ft (ICS18-28)
Jervois Mining (eCobalt Solutions): Idaho Cobalt Project

- Idaho Cobalt Project
  - 1997 Discovery of RAM deposit by Formation Capital (renamed eCobalt)
  - Outer Blackbird District ore zones
  - Permitted UG mine, > $100 million spent to date
- July, 2019: eCobalt acquired by Jervois Mining, an Australian company.
- Renamed Idaho Cobalt Operations (ICO)
  - Complete construction, update Feasibility, Scoping study on Processing Facility
Initiated Bankable Feasibility Study:
- DRA Global, M3 Engineering
- Scoping Study for Co refinery (Wood)

Infill Drilling

Footwall Drilling Program:
- 2 Deep DDH - intersected previously unknown Cu-Co mineralization below main RAM zone footwall -
  Blacktail North zone Metallurgical Drill Holes (PQ)

Dec. 2, 2019 Release: Infill drilling intercepts
4.6 m @ 1.14 % Co and 2.75 % Cu, 1 g/t Au Co up to 2.8 % Co
New World Cobalt: Colson Creek Project

- **New World Cobalt:**
  - Colson Creek Co-Cu
  - 100% Salmon Canyon Cu
  - 3 other blocks in belt
  - **Colson Creek 2018**
    - Soils, IP Survey
    - Drilling: 12 holes, 4,953 m
    - Extend strike of SCC zones 1.1m @ 0.18% Co, 1.43% Cu, 0.74 g/t Au
  - Permitted future drilling

Phoenix Copper Ltd.: Empire Mine

- PG Mining/Konnex
- Empire mine, Mackay
  - Custer County
  - Polymetallic Skarn
  - (Cu,Pb,Zn + Au, Ag)
- May, 2019: NI 43-101 resource, SX-EW Cu
  - Zn, Au-Ag too
- Bankable Feasibility
- Environmental Baseline
- Drilling early 2020

2018 Drilling
Phoenix Copper: Empire mine

Red Star Prospect: outcrop peripheral to Empire mine area, high Ag-Pb. N-S fault of regional extent.

Silicified Fault, Navarre Prospect, 2019: Au

Land acreage increased.
BLACK PINE 2019 PROGRAM

New Plan of Operations (PoO) with USFS for 141 acres of disturbance in up to 370 drill sites and 49 km of new roads within 7.3 km² cleared boundary received February 2019

- Extensive ROW Grant with BLM for water well and property access
- Drilling commenced April 2019 with up to 2 RC rigs and 1 core rig running 24 hrs/day
- 65,000 feet/20,000 metres RC Drilled in ~90 holes
- 4,100 feet/1,250 metres Core Drilled in 6 holes
- 5 large-diameter core holes and 6 bulk samples for metallurgy, mineralogy and structural and stratigraphic information

Leaping mineralization models showing modeled gold mineralization >0.2 g/t Au. To compensate interpolated points and are unwindowed in a robust geologic model. A thin buffer around drillholes limits the model from pore overestimation. The intended purpose is to illustrate the relative position of gold mineralized zones to historic mining and topography to drive drill targeting. Models are subject to change with ongoing study and modeling.

There is no current internal resource estimate as defined by NI 43-101 for the Black Pine Project and it is uncertain if further exploration will result in these targets being delineated as a mineral resource.
Here's to finding the sweet spot.

BLACK PINE SCHEMA

TIC FENCE SECTION

Looking West

Mined Head Grades

Looking Northwest

E Pit 1.5 g/t Au
B Pit 1.38 g/t Au
A Pit 0.6 g/t Au

Looking West

2019 Drill Focus Area

Black Pine Stratigraphy

Upper Plate
Sandstone and Siltstones

Middle Plate
Limestone Member
Limestone & Dolomite Member
Limestone & Siltstone Member

Lower Plate
Detachment fault

2019-054

C/D Pit 0.58 g/t Au
E Pit
B Pit

Leach Pads

SW ESE

SE N

2019-054

A Pit
B Pit

Tallman Pit

2019 Drill Focus Area

Looking NorthWest

2019-054
Here’s to finding the sweet spot.

BLACK PINE 2019 DRILL FOCUS – CROSS SECTION

Multiple subparallel high grade gold discoveries beneath historic drilling

Two new discoveries in 2019

Ridgeline Focus Area with Au outcropping/mined on 3 sides of ridge:
Drill: 47.2m @ 1.78 g/t oxide Au
90 holes now

Lower unit (dk. Green) not drilled till 2019

Thursday AM TALK: Will Lepore

2019-055
Integra Resources: DeLamar Project

- Two Development Projects
  - DeLamar mine
  - Florida Mountain mine
- Exploration
- Owyhee County, SW Idaho
- Past-producer till 1998 (+ 1.5 M oz. Au and > 100 M oz. Ag)

- Resource: 3.9 Moz AuEq (M & I) plus 500 K oz AuEq (Inf.)
  - October: NI 43-101 Report by MDA
- Nov. 25: Coeur invests $ 5.5 million
Integra Resources: DeLamar Project

Drill at Sullivan Gulch, DeLamar Mountain, June, 2019

Drilling at Stone Cabin mine, July, 2019

Fall 2019: Exploring entire district:
3 Centers of epithermal Au-Ag mineralization, plus regional targets
Fast-track
BeMetals: South Mountain

- Thunder Mountain Gold - owner
  - Idaho-based company
  - Private land

- 2019: 20 UG holes
  - Intercept: 12.2 m at 18% Zn, 122 g/t Ag, 4.4 g/t Au, and 1.5% Pb.
BeMetals: South Mountain

Resource (M & I): 170,000 short tons grading 17.66% Zn-eq.
IDAHO 2019: Brownfield to Minefield

- www.idahogeology.org
- Questions:
  - vgillerm@uidaho.edu
  - 208-332-4420

THANKS

Alberta Tunnel, 700 Level Empire mine, 1913
Idaho Mining and Exploration, 2019

Virginia S. Gillerman
Idaho Geological Survey (Boise)
www.idahogeology.org

American Exploration and Mining Association
Reno, NV
December 4, 2019

Acknowledgements

- AEMA
- Idaho Dept. of Lands staff
- BLM and USFS minerals staff
- Industry geologists
- IGS and Claudio Berti (new IGS Director)
- Earl Bennett

2019 Trends and Highlights

- Phosphate Reigns in Idaho
- Lucky Friday strike?
- Cobalt/Critical Minerals
- Price Matters
- Social License and Public Perception
- Exciting Development Projects
- Idaho-based Companies
Precious metal prices stable and at reasonably high level the past 5 years. Base metals less so, Co volatile. Way off 2017-2018 peak at $16/lb. REE prices moved as well – concern over use as political weapon if there is potential China – US trade war.

Both districts active for past 120 years approximately. Definition of “world-class”
Slide 7

Coeur d'Alene district (Silver Valley)

2019

Active:
Lucky Friday
Galena Complex (incl. Coeur)

Inactive, but resource in ground:
Sunshine
Bunker Hill – Zn, renegotiated lease

Slide 8

Hecla Mining Company: Lucky Friday mine

2019 production by salaried employees up (115,682 oz. in Q3 2019 vs. 169,041 oz. in 2018). Gold Hunter, 6400 level.

Nov. 2019:
Tentative settlement between Hecla and union. Ballots out to union members; count on Dec. 13, 2019.

3/13/2017:
USW Local 5114 out on strike. Major issue is control of miner’s work assignments.

Lucky Friday mine, Mullan

RVM (Remote Vein Miner):
Testing in Sweden; Idaho in 2020

2018 Sentinels of Safety Award by NMA


Slide 9

Americas Gold and Silver Corporation

April: Acquired Pershing Gold
Name Change
Relief Canyon (NV) development
September: JV with Eric Sprott on Galena Complex
$20 million investment in new equipment, upgrades, development and exploration
Sprott earns 40% interest in Galena

Operational difficulties related in part to downtime from hoist problems.

Galena Hoist problems for years have hampered production. 78 M ounce Ag resource

Open Pit production 1,185 metric tonnes per day (ore and waste) in 3rd quarter. NJMC had net income in 3-months of 3rd quarter.
First 6 months of 2019: revenue up and costs down. New CAT AD22 haul truck and loader helped efficiency in UG mining and backfilling stope. 3rd Quarter Au sales about 1,400 tr. ounces. So 4-5,000 ounces Au per year produced from Kellogg mill. 3rd quarter head grades 3.46 g/t Au.

Endomines: Friday mine (Elk City area)
- Finnish company – acquired TVL Gold LLC
- Orogrande and Petzsite shear zones, other deposits in area
- Development/Pre-production
  - Underground: 150 tpd, mine life 7 years, good grades
- Mill: SE of Elk City. Ramping up after tailings pond damaged last winter. Will produce sulfide concentrate.

Grades said to be in 0.2 opt Au range with some multi-ounce narrow intercepts. Instituting rigorous grade control methods to minimize dilution. Tried to open in early 2019 but winter problems, especially with tailings pond at mill site, which is about 25 mile haul from mine. Ore between Monday and Friday faults. Au up to 65 feet from hanging wall and footwall contacts of Monday fault (intruded by barren dacite dike). Au is disseminated and associated with pyrite. Mill – flotation of sulfides to concentrate plus gravity circuit.
Endomines also picked up Buffalo Gulch deposit near Elk City and the Deadwood project at Elk City/Orogrande. Plus Rescue mine (Warren district) and the Kimberly Gold Project in the Marshall Mtns. (Marshall Lake district, 20 miles east of Riggins.)

3 companies: Bayer, formerly Monsanto; Itafos, formerly Agrium, and J.R. Simplot Co., giant Idaho-based agribusiness company (private). Plants employ several hundred persons each.

FMC must pay Shoshone-Bannock Tribes $20 million in back fees plus $1.5 million annually in perpetuity. FMC had agreed to the annual payment but tried to argue that it was not obligated to pay it after plant closed. Plant operated, partly on tribal lands, for over 50 years till 2001. Left 22 million tons of hazardous waste stored onsite. EPA says would cost $4.7 billion to remove and is not technologically feasible.
Slide 18

J.R. Simplot Company: Smoky Canyon mine

- Mining in F and G panels

Slide 19

J. R. Simplot Co.: Smoky Canyon

- Mining Panels F and G
- Concurrently reclaiming F1 pit as F2 and F3 pits mined.
- Segregating waste rock to help lock-up Se-rich contaminant shale into infiltration-limited covered area.
- Permitting new panel East Smoky.

New Mine Plan Approval:
- Dairy Syncline mine
- Final EIS released Nov. 8, 2019
- Anticipate RODs in March 2020.

Slide 20

Bayer (P4), formerly Monsanto

- Blackfoot Bridge mine
  - Acid tailing re-use at P4
  - Backfilling North Pit and EOP
  - Working on cover design and construction

- Exploration Drilling:
  - Trail Creek Lease
  - 28 drill holes
  - 8,900 feet
  - Roads and sites reclaimed

New Mine Approved:
- Caldwell Canyon ROD issued August 2019
- 40-year mine life
- Initial overburden to Dry Valley mine

2019-067
Blackfoot Bridge 2019: Phase 8 sequence

- March
- June
- July - backfill
- October - backfill

Bayer – Caldwell Canyon

September 2019: Topsoil salvage, pit area

Itafos, formerly Agrium

- Agrium merged in Jan. 2018 with Potash Corp of Saskatchewan to form Nutrien
  - Nutrien (Nu-West) – retained ownership of mined out properties, legacy, reclamation etc.
  - Operating assets (inc. Conda plant, working mines (Ras, Valley and Lanes Creek), and exploration/development properties) divested – bought by Itafos in late 2018.
Itafos

- October 30, 2019:
  - Itafos Conda Technical Report
  - Conda properties
  - Paris Hills (underground)
  - Husky1/North Dry Ridge deposits

- Increased resource estimates:
  - H1/NDR: 38 M short tons, 24% P2O5
  - RV mine: 15 M short tons
  - Conda Plant: 550 kt per year, MAP, SPA, specialty products

Itafos Drilled Husky 1 in 2019

Aerial View of Husky 1 permitting vicinity (from south looking north)

Markets: Construction, Home and Landscaping, Abrasives, Filtration, Soil Amendments, Cattle Food Supplements, Glass-making

Slide 27

Aggregate: Construction Sand & Gravel, Crushed Stone

- IDL Surface mine reclamation plans: 100+ gravel pits and quarries
- State Royalty Revenue (FY19): Sand & Gravel
  - $1.1 million
- State leases
- Roadwork, Concrete, Construction
- Urban Areas – construction/roadwork

Slide 28

Industrials – north Idaho

- Emerald Creek Garnet
  - Handpicking garnet alluvial deposits
  - Pilot plant testing:
    - Emerald and Carpenter Creek, Fernwood since 1932
- I-minerals Bovill Project
  - New plant testing:
  - Pilot Plant Production at Ginn
  - Kaolin to FLSmidth – flash calcination to metakaolin
- New prefeasibility – Millcreek Engineering (halloysite, kaolin)
- USFS family-fun garnet collecting

Also USFS Emerald Creek Garnet dig. I-minerals clay-quartz-feldspar deposits in historic Bovill-Helmar district in Latah County. State leases. Working on producing high value products – ex. Metakaolin and halloysite. Would be only metakaolin producer in western US. Leaving feldspar and quartz sand resource off plan for now. All very competitive markets. Main competition is in SE US.

Slide 29

Dimension Stone: Southern Idaho

- Oakley Stone (Marsh Mtn.)
- Northern Stone Supply
- Sawtooth Stone
- Schwartz/Oakley Mtn. Corp.
- American Sandstone
- Table Rock Sandstone

Idaho Travertine

Oakley stone exported outside Idaho – high-end natural stone.
Slide 30

Oakley Stone Quarries

- Drill for "Rocky Mtn. Gneiss"
- Northern Stone Supply
- Also using diamond saws instead of explosives

Slide 31

Idaho State Activities

- IDL – Regulatory Reform
  - HB-141 (IMA sponsor)
  - Surface impacts of underground mines
  - Actual cost estimation of reclamation
  - Update of financial assurance methods
  - Modest fees

- 100th Anniversary of Idaho Geological Survey (aka Idaho Bureau of Mines and Geology since 1919)
- Dr. Claudio Berti – New IGS Director and State Geologist

Slide 32

IGS Mineral Deposit Research

- Geology and Temporal Evolution of Alteration and Au-Sb-W Mineralization, Stibnite Mining District, Idaho
- IGS Bulletin 31
- Online: February, 2019
- 163 pages
- 31 MB of digital appendices (7 appendices)
- Free pdf download or print purchase

2019-071
Slide 33

IGS Programs and Research - 2019

- Geologic Mapping -
  - Salmon, Presket, Payette, Elk City (USGS Statemap)
  - Cobalt Belt (USGS MRI)
- Data Preservation -
  - New Geochem Database
  - Expanded Mines DB (DD-1), References
  - DeLamar/Swisher Mtn, regional geologic mapping (new project)
  - Near Integra’s Au-Ag deposit, Owyhee County

Slide 34

IGS Oil and Gas Program

- Willow Field
  - ML Investments 1-10
  - Payette Co. Idaho

- Basin Analysis
  - Goal is to establish a 3D stratigraphic-tectonic framework of the Western Snake River Plain and its evolution through time. Framework will define the petroleum system in terms of reservoirs, seals, and source rocks (SR).

- Reservoir Characterization and Performance
  - Work combines information from 2D seismic with drone imagery from outcrop analogs to document the facies architecture of reservoir analogs. Data will be integrated with field production to help risk and rank future subsurface targets.

- Source Rock Evaluation
  - Geochemical characterization of produced hydrocarbons and potential source rocks. Information will help identify the origins of oil and gas and hydrocarbon generating capabilities of SR.

Slide 35

More IGS Research

- Hydrogeology Projects:
  - Big Lost River Basin
  - Characterization, groundwater modeling for ID, EPA
  - Raft River Basin

- Geologic Hazards Projects:
  - State landslide database
  - Landslide mapping, N. Idaho
  - Bear Lake fault mapping
  - Active faults database
  - Bear Lake fault mapping
  - New paleoseismic investigations
  - Boise Foothills mapping
  - Organizing earthquake working group meeting
  - Multiple Collaborators/Sponsors

2019-072
**Slide 36**

Exploration 2019

- Multiple major drilling programs.
- Advanced/development projects.
- Known districts, multiple commodities, diverse geology.
- Less grass roots exploration.
- Gold is shining, silver too.
- Cobalt fever abated some, but claims kept. Critical mineral interest.

BLM: In 2018, 6,000 new mining claims filed in Idaho. About 5,000 of those in Idaho Cobalt Belt. In 2019, mining claims increased to 25,356 versus 23,205 claims in 2018. Not sure what date goes with those counts, but the interest in Idaho’s geology and ores is still there.

**Slide 37**

Bunker Hill Mining Corporation

- New group formed Liberty Silver – August 2017 agreement with owner of Bunker Hill to lease-purchase mine ($30 million).
- Aim - to reopen Pb-Zn mine; working with EPA on water treatment issues.
- Financing problems and defaulted on lease. Nov. 2018 – reinstatement of lease from owner (Placer Mining Corp.) to reduce lease payment in 1 year agreement.
- October, 2019: Amended lease / option for additional 9 months with more favorable terms.
- Large zinc resource.


BH produced about 38 million tons of ore between 1885 and 1981. Mine and smelter closed in 1981 when owner Gulf Resources Corp. went bankrupt. 2200 workers lost jobs then. Site cleanup completed under CERCLA. New company is negotiating with EPA to resolve issues with water treatment at mine. On west side of Coeur d’Alene District. Great address. Working to upgrade resources to 43-101: Quill Zone, Newgard, UTZ (UTZ accessed via Russell Tunnel.

1500 tpd Mine Plan. Negotiating with EPA over assuming water treatment plant costs in return for permit. EPA working with Bunker Hill. Stay tuned. At its peak, The Bunker Hill Company operated the mine, lead smelter and
refinery, electrolytic zinc reduction plant, cadmium plant, zinc fuming plant, sulfuric acid plant and even a phosphoric acid plant at Kellogg. Check new website for more on current plans.

Idaho Champion – example of how had good results and discovery, good metallurgy, good property. Received permits to drill from Forest Service. But no work on ground in 2019. Most likely due to lack of funding. NVH – also interesting property. Polymetallic, maybe porphyry related.
Slide 40

Nez Perce lawsuit: Midas response

Since well before the suit was filed, Midas Gold has been working closely with the Idaho Department of Environmental Quality and the United States Environmental Protection Agency to gain permission to take immediate action and learn more about the specific causes of degraded water quality in a number of locations. Midas Gold firmly believes that it is not legally responsible for cleanup of site legacy impacts caused by previous mining companies or directed by government agencies. However, the Company wants to be part of the solution. Subsequent to quarter end, in the normal progression of such litigation, Midas Gold filed a request for a stay of proceedings based on the progress in regard to ongoing discussions with Federal and State regulators on a path that would end the litigation as well as an application for a dismissal of the suit based on other considerations. Both motions have been consolidated for judicial review in mid-December and are expected to be ruled on as early as late Q4 2019.

Slide 41

Revival Gold: Beartrack gold project

Creek, Lemhi County

Beartrack:
• 3 DDH for 1,230 meters (Joss area)
• Resource Estimate (Q1 2020)
• Metallurgical work on sulfide – optimize flotation results and recovery
• Historic placers at Leesburg on Napias Creek; former open pit mine of 600,000 oz. Au

Talk by Steve Priesmeyer on Thursday AM

Beartrack: Meridian Gold, closed 2000 and produced 600,000 tr. ounces from heap leach

Results (Oct. 22 press release): Hole AC19-38D (Haidee) 10.7 meters of 0.56 g/t Au
AC19-36D had 13.6 meters of 0.86 g/t Au (Haidee)

Slide 42

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• Working on premin resource of Arnett Creek, Au
• Soil sampling (12 km²) and mapping
• 404 line-kilometer airborne magnetics
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- NW-trending 30-km linear belt.
- Co price down: critical mineral. Also Cu, Au, and REEs.
- Two large projects:
  - eCobalt/Jervois (Blackbird)
  - First Cobalt (Iron Creek)
- Others – compilation of 2018 work, permitted, not drilled.

NW-trending belt of Co occurrences: ~30 miles long by 5 miles wide. Host is Mesoproterozoic “Yellowjacket” metaseds. Siltites, argillites with biotitites (possible exhalative stratabound zones).


Metamorphic grade increases to NW along belt, as get closer to Cretaceous intrusions and more regionally metamorphosed rocks. Not sure about origin of mineralization or trend. May reflect orientation of original Proterozoic rift???

Structurally complex. Blackbird District is largest. Noranda defined about 18 million ton reserve there in ~1970s before Co prices collapsed and it was never mined. Now patented district has permanent water treatment plant and old tailings reclaimed. See 2016 paper on district by Bookstrom and others in GSA Special Paper.
First Cobalt: Iron Creek

2019 Summary
- Phase 2 drilling completed Feb. 2019
- 43 drill holes, 44,000 feet
- Surface and mostly underground
- Co and Cu: Co-pyrite, chalcopyrite
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- Co-Cu resource update (NI 43-101; Q4 2019)
- Water quality monitoring
- Property exploration: Ruby Zone
- Refinery at Cobalt, Ontario

Talk by Frank Santaguida on Thursday AM

Ruby zone formerly Jackass zone?

Co is in cobaltian pyrite. Cu zone partly separate. Higher grade Co zone in east, higher Cu grad in west. For more details, see Frank's talk on Thursday.
Jervois Mining (eCobalt Solutions): Idaho Cobalt Project

- Idaho Cobalt Project
  - WAP discovery of RAM deposit by Formation Capital (renamed eCobalt)
  - Outer Blackbird District ore zones
  - Permitted UG mine
  - > $100 million spent to date
- July, 2019: eCobalt acquired by Jervois Mining, an Australian company.
- Permitted 43-101 compliant M and I resource of 3.87 Mt at 0.59% Co and 0.85% Cu; plus 1.82 Mt inferred resources at 0.46% Co and 0.81% Cu plus healthy Au credit.
- Jervois has Co and NiCu properties in Australia and Africa.
- Deal valued at $ 44 million and was agreed by shareholders in spite of protests by First Cobalt.

Jervois: Idaho Cobalt Operation

- Initiated Bankable Feasibility Study:
  - DRA Global, M3 Engineering
  - Scoping Study for Co refinery (Wood)
- Infill Drilling
- Footwall Drilling Program:
  - 2 Deep DDH - intersected previously unknown Cu-Co mineralization below main RAM zone footwall - Blacktail North zone
- Metallurgical Drill Holes (PQ)
- Dec. 2, 2019 Release: Infill drilling intercepts 4.6 m @ 1.14 % Co and 2.75 % Cu, 1 g/t Au
- Co up to 2.8 % Co
- Planning additional drilling next year.
- Hot off press – very nice assay returns from 2019 drill program. Increase confidence in economic viability of deposit. Also – no real exploration drilling for many years. Lots of potential to extend zones.

New World Cobalt: Colson Creek Project

- New World Cobalt:
  - Colson Creek Co-Cu
  - 100% Salmon Canyon Co
  - 3 other blocks in belt
- 2018
  - Soils, IP Survey
  - Drilling: 12 holes, 4,953 m
  - Extend strike of SCC zones 1.1m @ 0.18% Co, 1.43% Cu, 0.74 g/t Au
- Permitted future drilling
- Interesting targets at Long Tom and other anomalies of IP and soils

Australian Company

2019-078
Open pit resource
Updated 'Measured & Indicated' open pit resource containing 73,872 tonnes copper, 29,813 tonnes zinc, 139,000 ounces gold and 6.038 million ounces silver
- New open pit economic model to produce 7,665 tons copper equivalent annually (7,000 tons copper and 1,600 tons zinc) over the life of mine (with initial production of 8,600 tons per annum)
- Bankable Feasibility Study ("BFS") on open pit heap leach SX-EW project underway
- Land acreage increased to 5,717 acres, including 2,420 acre Navarre Creek gold zone
- Maiden 'Inferred' sulphide resource at newly discovered Red Star lead / silver zone

Maiden 'Inferred' sulphide resource at newly discovered Red Star lead / silver zone
Here's to finding the sweet spot.

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- New Plan of Operations (PoO) with USFS for 141 acres of disturbance in up to 370 drill sites and 49 km of new roads within 7.3 km² cleared boundary received February 2019
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- 5 large-diameter core holes and 6 bulk samples for metallurgy, mineralogy and structural and stratigraphic information

Leapfrog mineralization models showing modelled gold mineralization >0.2 g/t Au are for illustrative purposes and are unconstrained by a robust geologic model. A 25m buffer around drillholes limits the model from gross overestimation. The intended purpose is to illustrate the relative position of gold mineralized zones to historic mining and topography to drive drilling. Models are subject to change with ongoing study and modelling. There is no current mineral resource estimate as defined by NI 43-101 for the Black Pine Project and it is uncertain if further exploration will result in these targets being delineated as a mineral resource.

Liberty will use new understanding of structure and stratigraphy to drill more in 2020. Prior drilling by Pegasus was shallow and at time of low Au price.

Mined in multiple pits by Pegasus Gold 1991 – 1998; heap leach, Produced about 435,000 tr. ounces at historical grade of 0.7 g/t. 7 shallow pits. Tallman pit old Hg producer. Classic Carlin-style alteration and geochemistry. Old district, originally rediscovered by Noranda in late 1980s. Mined by Pegasus. Acquired from Western Pacific by Liberty in mid-2016. Liberty has since tracked down and possesses old Pegasus drill data.

Still drilling? One rig drilling since spring, but in late summer and fall, picked up pace. Added second rig. Focus Florida Mtn. Where Kinross permitted the Stone Cabin mine but only mined a small part of resource. Integra is starting with that but drilling extensions of mineralization at Florida. Also exploration drilling on claims at War Eagle Mountain to east. Third mineralized center in Silver City district. Airborne magnetics and hyperspectral survey. Extensive mapping and soil sampling. Engineering studies – Thursday AM session.
BeMetals: South Mountain
- Thunder Mountain Gold owner
- Idaho-based company
- Private land
- 2019: 20 UG holes
  - Intercept: 12.2 m at 18% Zn, 122 g/t Ag, 4.4 g/t Au, and 1.5% Pb.

BeMetals: South Mountain
- Resource (M & I): 170,000 short tons grading 17.66% Zn-eq.

IDAHO 2019: Brownfield to Minesfield

Many smaller projects and properties I did not have time to cover.

THANKS

Alberta Tunnel, 700 Level Empire mine, 1913

2019-082