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

(George 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.
Historical Legacies

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

Technical Issues vs. Legal?
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

- Silver Price
  - 14.03 USD/oz
  - 12 Nov '15

- Gold Price
  - 1,201.20 USD/oz
  - 12 Nov '15

[Graphs showing silver and gold prices over 28 years]
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

Wallace Fm.
St. Regis
Revett
Burke
Prichard Formation

Host: 1.4 to 1.47 billion year old Belt rocks. Argillites to quartzites. Intracratonic Rift.
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 UCSLZ from 3700 to 2400 level. Multiple Ag-Pb veins. Good drill results. 2400 level./Cu
- 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
Idaho Phosphate Reserve
Phosphate Processing Plants

- Itafos Conda Fertilizer Plant
- Simplot Don Plant, 2014
- Monsanto Elemental P Plant, 2014

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

Pit F1N reclamation, 2018
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.
Agrium now Nutrien.

Agrium Conda Phosphate Operation Sold to Itafos (late 2017).

Agrium/Nutrien responsible for reclamation of older South/Central Rasmussen Ridge.
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

www.idahogeology.org

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: ctate@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.
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

Some holes oxide
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.
Revival: Beartrack mine project

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.
Why Idaho? **Geology.**

5,000 NEW CLAIMS IN 2018
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 $S_2$ layering in transposed banded siltite, hinge zone of the Sunshine $F_2$ 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
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.
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

• Kinross’ DeLamar mine closed 1998.
  – Historic 1.6 million ounces Au, 100 million Ag.
  – Low sulfidation, epithermal deposit, 15 Ma.
• Integra acquired DeLamar October, 2017.
  – 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!
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
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Slide 4

Mining in Idaho: 1860-1862

Discovery:
- N. Fk. Clearwater – Feb. 20, 1860
- Pierce – Sept. 30, 1860
- Elk City – June 14, 1861
- Florence – Aug. 1861
- Warren – July 22, 1862
- Boise Basin – Aug 2, 1862

(Slide 4)

Slide 5

More Gold and Silver and Base Metals

Gold and Silver
- Rocky Fork: Aug., 1863
- Atlanta: June, 1863
- Silver City: Aug., 1863
- York Fork: Sept., 1863
- Laramie: Aug., 1864
- Leadville: July, 1889
- Caribou: Sept., 1876

Silver and Base Metals
- Yankee Fork: Aug., 1876
- Virginia: July, 1876
- Mint Creek: Apr., 1879
- White Mountain: Sept., 1880
- Cobar of Idaho: Apr., 1882
- Munsup – July, 1891
- Butte/1700: May, 1894
- Florence: Aug., 1894
- Thunder Mountain: July, 1894

(Slide 5)

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Historical Legacies

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

(Slide 6)
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.

Precious Metal Prices: 28 yr. graphs
Two World Class Mining Districts

- Coeur d'Alene District:
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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...
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.
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• 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.

Lucky Friday mine

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 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.

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.

Slide 15

**Galena mine – Americas Silver Corp.**

- Extended UCSLZ 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 at 5000 level.

- 2018 2nd quarter No. 3 hoist recons impacted production. 4-year collective bargaining agreement ratified in August.
- Agreement to combine with Pershing Gold in 2019.

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.
- 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.

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.
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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.

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.

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The Phosphate Cycle
- Mineral: Apatite Ca₅(Cl,F)(PO₄)₃
- Rock: Phosphoria Formation (265-275 million years old).
- Mining – large, open pit mines with ore assaying about 25-30 % P₂O₅.
- 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)
  - Fertilizers: 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.
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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.

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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.

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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.
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.

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.

New Phosphate Mine Plans
- 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
  (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.
  - Micaceous, 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
  - Sawtooth Stone
  - 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

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

**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
For more about IGS Data Preservation of mining files and databases, contact Reed Lewis or Christopher Tate in Moscow Office. Or myself at cstate@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.
2018:
- Uptick in Major Drilling Programs.
- Development and Advanced Projects.
- Gold and Cobalt - Priority Commodities.
- Grass Roots.
- Rediscovering Old Properties.
- More Stability on Governmental and Regulatory Environment.

BLM saw over 6,000 new mining claims filed in Idaho in 2018. 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 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.

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**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 lease.
- Nov. 2018 agreement of sale to new company to reduce lease payment in 1 year agreement.
- Working with EPA to resolve water treatment plant issues and costs.


Payments over 10 years. Trying to raise money.

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.

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 12.65 m at less than 40 meters depth.

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

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

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

Erythrite

Formation Capital Corporation, US, is wholly owned subsidiary

- 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.
- Total: 40 DDH report filed. Resource estimate of 45 million pounds Co and 175 million pounds Cu.
- Open along strike and depth.
- CoEq = % Co + (%Cu)/10. Low As.
- 2017: 40 DDH over 10,000m
- 2018: 22 DDH (ug) and 30 surface holes for 18,000 m.

- First Cobalt: Iron Creek Project (formerly US Cobalt)
- 0.11% Co Eq and 30 million tonnes at underground cutoff. Cu credit. Have permitted refinery in Ontario. CoEq = % Co + (%Cu)/10. Low As.
- 2017: 40 DDH over 10,000m
- 2018: 22 DDH (ug) and 30 surface holes for 18,000 m.
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International Cobalt, others

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

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Otis Gold: Kilgore Project

- Epithermal Au-Ag: Late Tertiary age, low sulfidation
- Clark County, eastern ID
- Sept.: filed NI 43-101
  - Indicated 29,000 tonnes Au in 44.5 million tonnes (0.58 g/t Au)
- Received exploration permit (grizzly bear issue?)

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Midas Gold: Stibnite Au-Sb Project

- NEPA – Plan of Restoration and Operations (PRO) initiated 2016
  - 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**
- Overprinted systems
  - New metasomatic phases, Au at approx. 61 Ma and 51 Ma, Sb at 43 Ma
  - Au in arsenian pyrite, stibnite
  - Pyromet-Aftonian carbonates, Stibnite is late

**IGS publication on Stibnite**
- January 2019?

**Integra Resources: DeLamar Project**

-**Kronos’s DeLamar mine closed 1998.**
  - 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 Kronos but barely mined) in Jan. 2018 for $1.6 million USD.

**Press release (11/8/18):**
- Florida Mtn. drill intercept in IPML-001A hit 5.2 g/t AuEq over 21.3 meters inc. 3 m of high grade in Trade Dollar - Black Jack vein. Surface current resource extension.
- 9 holes for 2,920 m on Florida.
- More drilling in early 2019

**Metallurgical Work**

**Geophysics and Soil Geochemistry**

DeLamar is one of 21 projects.
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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
- I-minerals clay project at Bovill
- Grass roots work
- South Mountain (Turan Mo, 94oz)
  - NI 43-101 report in May
  - Underground Zn-Pb-Ag-Cu, private property
- And many more!

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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 f(great Idaho geology).
- State’s political climate supportive, but strong concern for environment essential.
- Good data and expertise at agencies, including IGS.

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• THANK YOU!
  • www.idahogeology.org
• Virginia S. Gillerman, PhD, P.G.
  - Idaho Geological Survey, Boise
  - 208-332-4420
  - vgillem@uidaho.edu