Implementation of geomodels and data management at Hellas Gold for resource development

Panagiotis Zachariadis
Senior Geologist, Olympias Au-Pb-Zn-Ag U/G Mine / Hellas Gold S.A. / Eldorado Gold Corporation, Canada

Short Introduction
Integration of a commercial Database, geological and mining software streamlined the process of acquisition, management and evaluation of multidisciplinary geoscientific data and allowed the building and re-evaluation of a reliable geomodel which is crucial for the mining of an inhomogeneous orebody, thus allowing for better mine planning, better grade control, improving mining productivity, recovery rates of 3 conflicting concentrates, specifications of end products and at the end revenues.
Description of the technology/innovation

• Innovation Category
  • Process and System Innovation
    • implementation of modern software:
      • Exploration
      • Mine Planning and Production
      • Budgeting
      • Recovery Rates
      • End-Products
      • Revenues

• Application to the mining value chain
  • Exploration / safe and fast remote data evaluation
  • Extraction / safer and more efficient greater depth extraction
  • Mineral and metallurgical processing / better mill feed and recoveries
  • Data and knowledge base
Description of the technology/innovation

• Good practice criteria
  • resource security
    • better characterization of the orebody (geometry and elemental distribution within the ore, geotechnical parameters)
  • economic sustainability
    • higher productivity, better recoveries and better mill feeds allow for higher revenues / safer predictions, minimize unforeseen expenses
  • environmental sustainability
    • better recovery, better waste management / minimize unplanned waste from excavations
  • accurate budgeting of the operation and effective cost control
Implementation of geomodels and data management at Hellas Gold for resource development

Hellas Gold S.A. – Chalkidiki Projects

- Olympias Mine (Development)
- Mavres Petres Mine (Production)
- Skouries Mine (Development)
- Piavitsa (Exploration)
- Fisoka/Tsikara (Exploration)

[Map showing locations of mines and projects]
Implementation of geomodels and data management at Hellas Gold for resource development

Location of the example

Simplified map displaying the distribution of the ore deposits in the southern Balkan peninsula.

- Rhodope Metallogenic Province (RMP)
- Serbomacedonian Metallogenic Province (SMP)

The Olympias Ore is located in SMP. It is characterized as a polymetallic replacement style massive sulfide deposit. Mineralization consists of PbS, Zn(Fe)S, FeAsS and FeS₂. Polymetallic Ore Deposits are a significant source for Cu, Pb, Zn as well as Au, Ag.

(Mellos et al. 2002)
Implementation of geomodels and data management at Hellas Gold for resource development

Location of the example
Olympias Mine owned by HellasGold SA subsidiary of EldoradoGold Corporation situated in North Greece

Au-base metals mining is going to take place at Q2 2017. Previously the mine has operated as a Pb-Zn(-Ag) mine from 1970 to 1987.

Short Summary
Due to the inhomogeneous distribution of the elements and thus the grades within the orebody a 15m tight drilling followed by extensive sampling at 1m intervals was applied. Sampling covered areas around the orebody to identify possible element dispersion around it. The assays are executed in an acknowledged commercial lab. The core recovered from drilling is logged for the geological and geotechnical properties and portable XRF is used for a first-pass reconnaissance of elements. Core photo documentation is held for every borehole and is maintained in a dedicated software.

A very large amount of geological, geochemical and geotechnical data is accumulating on a daily basis. For the better evaluation, handling QA/QC and safety of the geoscientific data a commercial database (GIM database from acQuire) is used. Since 2016 the database is integrated with the geological and mining software to become a powerful and reliable system for decision making, identifying exploration trends, grade control, mine planning and budgeting.

The data have been used for creating 3D Models of the mine which are used for more accurate grade control and as an extend to that to an efficient mill feed recovery rates and improved products.

Data and report generation can be accessed online at any place using an online web-based platform.
Implementation of geomodels and data management at Hellas Gold for resource development

**Historical Data Collection**

Archive was kept with the Traditional methods and data collection and evaluation was based on the experience of the scientist/worker

Collection of old data and re-evaluation

Visualization of old mined areas and infrastructure

---

**Legend:**

- Blue = marble
- Orange = gneiss
- Brown = pegmatite-granite
- Pink = rhodochrosite ore
- Yellow = sulphide ore, with increasing stippling intensity correlating with higher base metal content
Implementation of geomodels and data management at Hellas Gold for resource development

Ore delineation and exploration

- Old drilling data
- Irregular spacing / not specific pattern
- not well documented
- lack of DH survey data / early BHs

- Plan for new drilling
- 30m indicated to measured grid
- 15m / 7.5m production grid
- DH surveys / Devico Deviflex and Reflex Gyro
Implementation of geomodels and data management at Hellas Gold for resource development

Data Collection

- Logging and re-logging
- Sampling
  - pXRF
  - ALS Lab
- Photo-documentation
  Coreprofiler / Datamine

Data Handling and QA/QC

- DataBase / (GIM acQuire)

Data Evaluation

- Leapfrog GEO / Arranz Geo
- Studio RM / Datamine
Implementation of geomodels and data management at Hellas Gold for resource development
Implementation of geomodels and data management at Hellas Gold for resource development
Implementation of geomodels and data management at Hellas Gold for resource development

Geology
Implementation of geomodels and data management at Hellas Gold for resource development

Structure and Tectonics
Implementation of geomodels and data management at Hellas Gold for resource development

Block Model

Creation of the block model

Setting Parameters for:

- Elemental distribution / Assays
- NSR
- Geometallurgical specifications / requirements for the 3 concentrates
Implementation of geomodels and data management at Hellas Gold for resource development

Au

Pb

Pb/As ratio

AU conc grade prediction
Implementation of geomodels and data management at Hellas Gold for resource development

Mine Long-term Planning

- StudioRM / Datamine
- Studio5d / Datamine
- EPS / Datamine
- MSO / Datamine
- MRO / Datamine

Mine Short-term Planning

- StudioRM / Datamine
- Studio5D / Datamine
- AutoCad Civil 3D / Autodesk
Implementation of geomodels and data management at Hellas Gold for resource development

Criteria for Success

- Mill Feed / Mine Reconciliation
  Au, Pb, Zn
  within the concentration window of the oper.par.

- Concentrate grades, i.e Au
  20-24ppm Au
  25-30ppm Au
  >30ppm Au

- Revenues

Iteration with Geomodel and Mine Planning
Policy and non-policy enabling and hindering factors

Policy enabling factors

There is no direct link to the Greek mining law/legislation or policy, therefore there are no policy enabling factors.

Legislation could updated to include best practice application of modern software to improve resource development and exploitation:

- Integration of European or International Reporting Codes as a prerequisite for the reporting of the mining activity
- Obligation for the submittal of a digital 3D Model of the orebody and a geological model of the underground in the area of mining rights
- Database of geoscientific data that could be part of the National or European Database/archive
- Definition of a minimum quantity and quality of information that has to be collected and evaluated, based on the value of the ore, before mining
Non - Policy enabling factors

Company Policy

Eldorado Gold Corporation (owner of Hellas Gold SA) instructed a minimum specification for mining only measured resources which is defined by the company as a 15m spaced grid drilling together with high quality and densely populated assay data.

Other

Technical advancement: Software Improvements and interface / mine equipment / extraction and processing technology

Competition: Optimize Mine design, Mining and Extraction / effective budgeting / minimization of unforeseen costs

Market Demands: Specification of the products and Market agreements
Hindering factors

- Upfront costs (drilling, analytics, software, people) and investments
- Permitting
- Some opposition to change ("we always did it the other way")
- Short term cost reduction
- Time / Push for production
Thank you