

The IBERIA GEOPHYSICAL TOOL of J&C Bachmann enables Open Pit Mines to become more effective and reduce CO₂

Problem description:

Sorting of ores by type and grade at open pit mines is a significant challenge.

Mining can be summarized in two main phases: ore extraction and ore processing. Both are energy intensive, and the impact on the environment is considerable.

It is, therefore, essential to send mined/extracted material with economic value for further processing while discarding uneconomic material as efficiently as possible. However, sometimes, precisely the opposite happens:

- (a) material with no economic value is processed, and/or
- b) material with economic value is sent to the waste dump.

Incorrect processing typically occurs when geologists or mine production engineers do not have quality information at the time of decision making. The ore grade content of the mined material is fundamental for making informed decisions regarding the viability of processing or discarding material.

This is where the IBERIA Tool from J&C Bachmann provide the ability to pivot from decisions based on incomplete information to process decisions where ore grade are accounted for.



The Iberia tool

J&C Bachmann GmbH developed an **Inline Borehole Element Recognition and Identification Analysis (IBERIA)** tool to assist Open Pit Mines in improving their ore sorting abilities.

Measuring in real-time elements of interest, like Cu, Zn, Fe, etc., along the depth of the boreholes allows open pit mines to classify the bench areas according to their actual economic value. Based on the information obtained, the mine can decide whether

- to send material to the process plant,
- to a waste dump
- (or, eventually, to a stockpile).

Currently, these decisions are made "blindly" in some cases and situations. Employing the IBERIA XRF Tool inside the blast holes before blasting reduces the uncertainty of the decision. Informed decision-making could reduce the amount of valueless material sent to processing and subsequently reduce the consumption of energy, water and process consumables.

Iberia (Inline Borehole Element Recognition and Identification Analysis) is a borehole logging tool for qualitative and quantitative measurement of desirable and undesirable ore forming elements along a borehole. Data is recorded in real time and continuously along a borehole. No sampling, **no laboratory analysis** are needed.

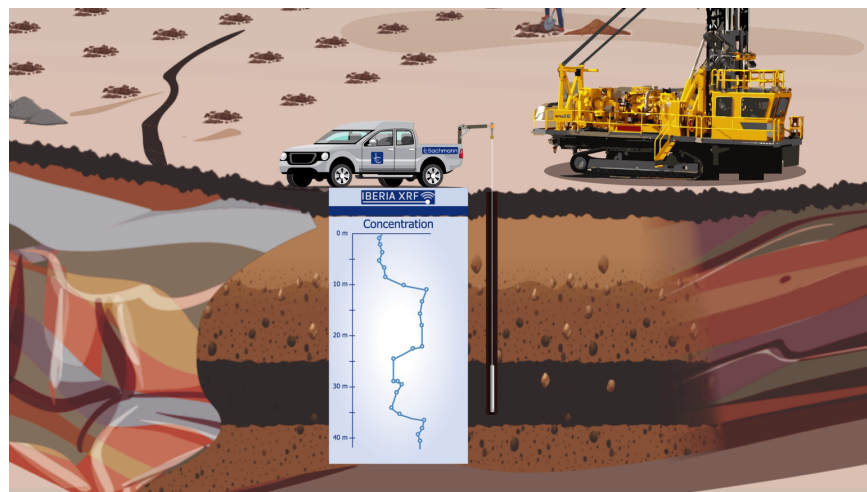


Fig. 1: Schematic representation of the IBERIA logging tool

Iberia is significantly faster and more representative than current conventional methods.

Positive environmental impact by using the IBERIA Geophysical Tool

The European Institute of Innovation and Technology supported NGO "Climate-KIC" Program approached J&C Bachmann to participate in a study to evaluate the environmental impact of a tool such as IBERIA.

After training and mentoring, the J&C Bachmann team could use the <https://impact-forecast.com> online platform in a case study to calculate the IBERIA Climate Impact Forecast.

There are several consequences associated with processing mineral ores without economic value. From an environmental point of view, the following are the most important:

- a) Waste of energy.- derived from crushing, milling and processing "bad/poor" material
- b) Waste of water (and consequently of the energy associated with its extraction or recirculation)

Estimation of the energy reduction using IBERIA

The study considers an open pit copper porphyry mine, with an average annual production of 5 MT and a copper concentration of nearly 1%.

Typically there is a transition area in the ore body between waste-rock and mineral-rich ore body. This area generates uncertainty regarding its value to process; it is why early ore grade characterization is needed. Generally, the "transition area" is limited to a fraction of the ore body that is not quantitatively defined and can vary during the mine cycles.

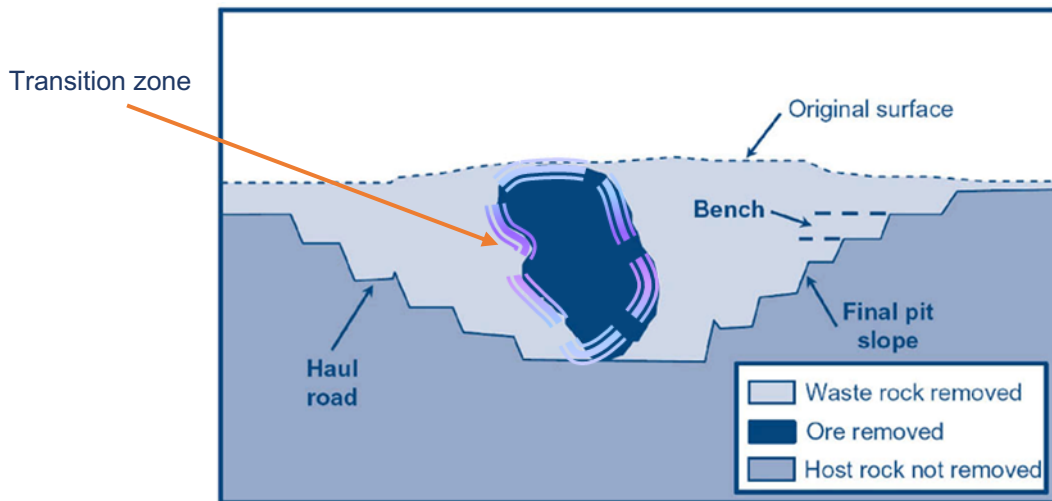


Fig. 2: Schematic representation of the area of uncertainty to be logged with IBERIA

For this case study, the following assumptions apply

1. The area of uncertainty represents 30% of the total area to be mined,
2. 50% of the material in the area of uncertainty is not suitable for processing.
3. IBERIA will have a positive impact of 20% i.e. 20% of the material will be correctly assigned to be processed or shipped to waste

These percentages are entirely arbitrary as both the "transition area" fraction and the relation "good material" v/s "bad material" inside the transition area constantly changes. On the other hand, they are realistic and helpful in illustrating the impact of using the IBERIA tool for material classification and energy-saving purposes.

The "transition area" represents **1,500,000 tons/a** of which **750.000 tons/a** is "material without economic value".

Timely use of IBERIA may result in correctly assigning as waste 20 % of the 750.000 tons/a resulting in the ability to prevent the processing of **150.000 tons/a of waste material.**

As the energy needed to process 1 ton of copper is nearly 12.000 MJ /ton Cu (1) the energy saving by adopting the IBERIA tool will be **18.000.000 MJ/a.**

The saving in energy equates to a climate impact reduction of 2,3 KtCo2Eq/year, or the equivalent of burning 4446 barrels of oil annually.

Description	Quantity	Calculation
Total Mine resource	5 MTA 1% Cu grade	
30% Area of Uncertainly	1,500,000 tons/a	5 MTA x 30% = 1,500,000 tons/a
Uneconomic (waste) ore in Area of Uncertainly	750.000 tons/a	1,500,000.000 tons/a x 50% = 750.000 tons/a
20% IBERIA saving by prevention to process	150.000 tons/a	750.000 tons/a x 20 % = 150.000 tons/a
The energy needed to need to process 1 ton copper is nearly	12.000 MJ /ton Cu ⁽¹⁾	
Energy Saving	18.000.000 MJ/a	150.000 tons/a x 1% Cu grade x 12.000 MJ/ton Cu = 18.000.000 MJ/a
CLimate Impact Reduction	2,3 KtCo2Eq/year,	
= 4446 barrels of oil burnt annually		