Selected Mining Applications of Borehole Geophysics

- General considerations
- Borehole Geophysics in the mining lifecycle
Borehole Geophysics – Why spend money on it?

- **Valuable, targeted information**
  In many cases drilling / cuttings / coring do not supply all information required.

- **In-Situ data**
  The methods provide data of the undisturbed subsurface.

- **High sampling rate**
  One gets profiles with high vertical sampling rate (“continuous”).

- **Exact depth reference**
  Logging data have exact depth reference, can be used for calibration of drilling data.

- **Objectiveness**
  Data are widely independent from the “human factor”.

- **Low costs**
  In most cases costs are significantly less than 5% of the drilling costs.

- **Reliability**
  The methods are state-of-the-art, oil & gas standard for nearly 100 years.
- **Mineral exploration**
  Mineral identification and quantification.

- **Structural geology**
  Evaluation of geological discontinuity planes (borehole imaging).

- **Lithology**
  Lithological profiles and crosshole correlation.

- **Petrophysical parameters**
  Density, porosity, velocity of elastic waves.
  Young's Modulus, Shear Modulus, Poisson's Ratio.

- **Cavity investigation**
  Oriented survey of subsurface cavities.

- **Rock stress analysis**
  Measurement of direction of primary rock stress.

- **Hydraulic logging**
  Vertical and horizontal groundwater flow, aquifer evaluation,
  calculation of hydraulic parameters (Transmissivity, etc.),
  groundwater quality logging, technical check of existing water wells
Borehole Geophysics in the mining lifecycle

- Desk Study
- Reconnaissance
- Exploration
- (Pre)Feasibility
- Construction
- Operation
- Closure
- Remediation
Jadar Lithium deposit, Serbia

The project
- Location = 100km SW of Belgrade
- Lithium-Borates (Jadarite) in Miocene lake sediments
- Detected in 2004
- One of the largest Li-deposits worldwide (inferred resources after JORC)
- Owner = Rio Sava d.o.o. (100% Rio Tinto)

Courtesy of Rio Tinto plc
Jadar Lithium deposit, Serbia

The questions
- Pre-feasibility study 2011/12
- >100 investigation boreholes down to 650m
- Structural investigation of the deposit
- Evaluation of geotechnical parameters
- Hydrogeological investigation

The methods
- Acoustic Borehole Imager
- Full Wave Sonic
- Gamma Gamma Density
- Natural Gamma Ray
- Dual Focused Electric Log
- Borehole Deviation
- Caliper
- Flowmeter Logging
- Fluid Temperature and Conductivity

Courtesy of Rio Tinto plc

Desk Study  Reconnaissance  Exploration  (Pre)-Feasibility  Construction  Operation  Closure  Remediation
Jadar Lithium deposit, Serbia

The results

- Acoustic Borehole Imager
- Structural analysis
- Caliper
- Natural Gamma Ray
- Fluid Temperature
- Formation Resistivity
- Velocity & elastic rock parameters

Desk Study  Reconnaissance  Exploration  (Pre)-Feasibility  Construction  Operation  Closure  Remediation
MIBRAG lignite coal mine, Germany

The project
- 2 open pit mines south of Leipzig/Germany
- Production >20 mio t lignite coal per year
- 85% of production supplied to local power stations
- Approx. 2000 staff
- Mine expected to be active until 2040
The questions

- Coal extraction planning
- Field crew at call
- On-site interpretation

The methods

- Natural Gamma Ray
- Gamma-Gamma Density
- Neutron-Neutron
- Focused Electric Log
- Caliper
- Fluid Temperature
- Fluid Conductivity
MIBRAG lignite coal mine, Germany

The results

- Caliper
- Focussed Electric Log
- Neutron
- Natural Gamma Ray
- Formation Density
- Composite interpretation

Desk Study  Reconnaisance  Exploration  (Pre)-Feasibility  Construction  Operation  Closure  Remediation
Abandoned gypsum mine, Austria

The project

- Location: SW of Vienna / Austria
- Collapsing surface above mining caverns and gypsum karst in densely populated area
Abandoned gypsum mine, Austria

The question
- Oriented 3D survey of subsurface caverns.

The methods
- Borehole Camera (CCTV)
- Cavity Laser Scanner (CLS)
- Cavity Sonar Scanner (CSS)
Abandoned gypsum mine, Austria

The results

- Oriented sections and plan views
- 3D images
- X-, Y-, Z-data for further processing
- Volume calculation
- Overlay on land register plans
Thank you very much for your attention!

Большое спасибо за Ваше внимание!

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