

## 3D Borehole Electromagnetic Reflection Probe (EMR)

# 3D Borehole Electromagnetic Reflection Probe (EMR) Application in horizontal and vertical boreholes

### Method

- Reflection of electromagnetic waves (EMR)
- Directional analysis (3D location of reflectors)

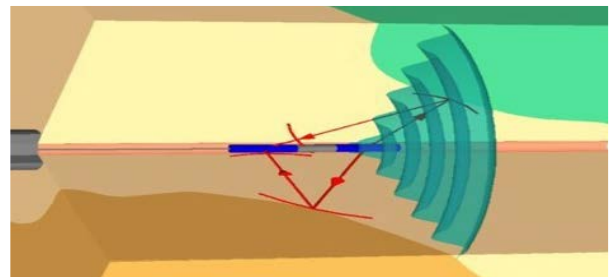
### Targets

- Saline structures (Potassic seams, Anhydrite)
- Limestone formations
- Boundary of salt deposit
- Neighbouring caverns
- Bedrock structures (faults, layers)
- Karst formation (cavities)
- Faults

### Applications

- Tunnels
- Shafts and vertical openings (ore pass)
- Cavern Structures
- Boreholes (horizontal, vertical, inclined)

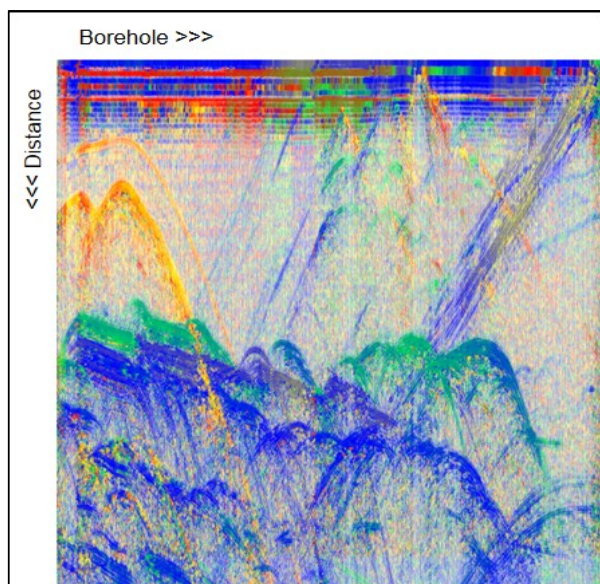
3D EMR exploration inside a horizontal borehole



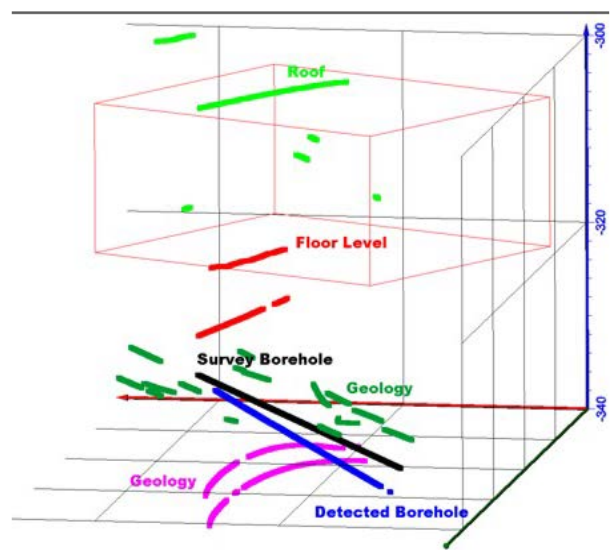
Survey operations in a horizontal borehole



Typical data section with colour coded direction information



3D view of the results for a cavern investigation



Technical Data	
Frequency	250 MHz / 50 MHz / 10 MHz
Diameter	85 - 130 mm
Probe Length	6 - 32 m
Max. Temperature	< 75°C
Max. Pressure	200 Bar / 2857 psi
Max. Operating Depths	2000 m
Azimuthal Resolution	+/- 10 Degree
Exploration Distance	up to 700 m
Weight	up to 350 kg

Subject to technical changes

References	No.	
2002 - 2013 NWKG, Germany	20	Spatial Investigation of Storage Cavern Determination of salt heterogeneities for enhancement of 3D geological model
2009, 2011, 2014 Solino (Orlen Group), Poland	8	Spatial Investigation of Storage Cavern Determination of salt heterogeneities for enhancement of 3D geological model
2009 - 2010 Gasunie, The Netherlands	3	Spatial Investigation of Storage Cavern Determination of salt heterogeneities for enhancement of 3D geological model
Since 2013 Salt Cavern Facility, Germany	5	Radioactive Waste Repository Investigation of underground caverns from several 60 m horizontal boreholes underground
2014 Limestone Quarry, Germany	1	Limestone Open Pit Mine Investigation of rock formation from a 70 m inclined borehole
2014 Salt Cavern Facility, Germany	1	Radioactive waste repository Investigation of a salt dome formation for the prospective construction of a vertical shaft
2015 Salt Cavern Facility, Germany	1	Radioactive waste repository Spatial investigation from a 350 m horizontal borehole for the prospective construction of a vertical shaft in a salt dome formation

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