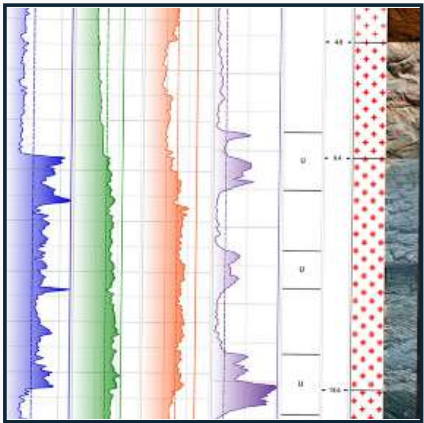


# LIM SOLUTION FOR EXPLORATION

MWD - Borehole Imaging - Borehole logging

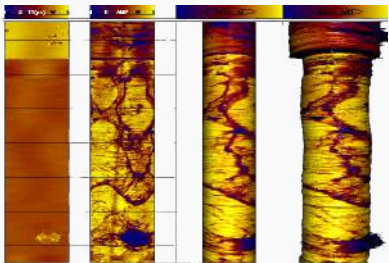
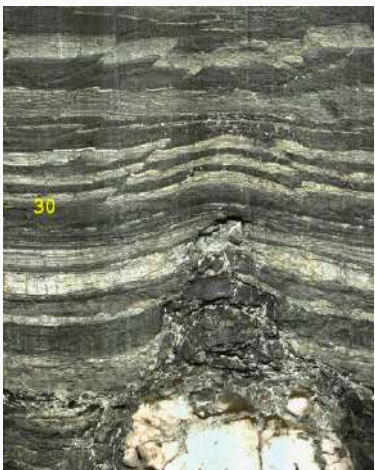


## PocketLIM-Drilling: Measurement While Drilling (MWD)



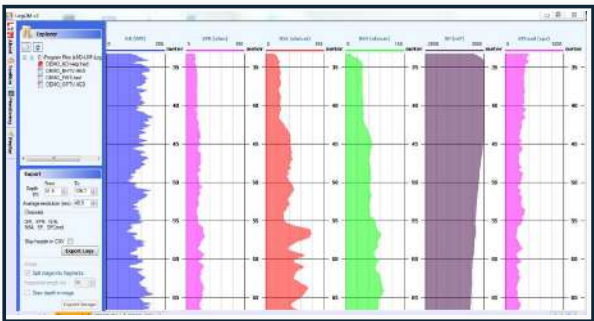
Drilling parameters recording vs depth

## Borehole Imaging probes (televiewers)

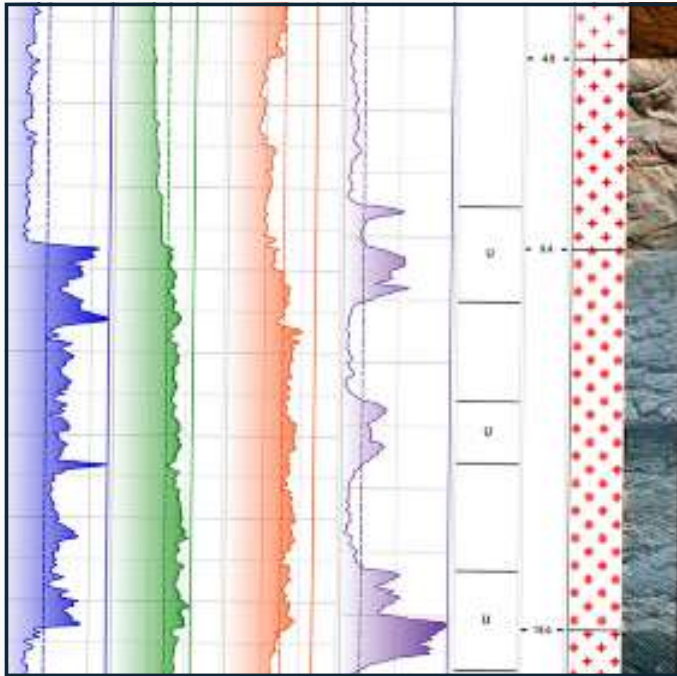


Optical (OPTV) and Acoustic (BHTV) televIEWERs

## Borehole Logging equipment

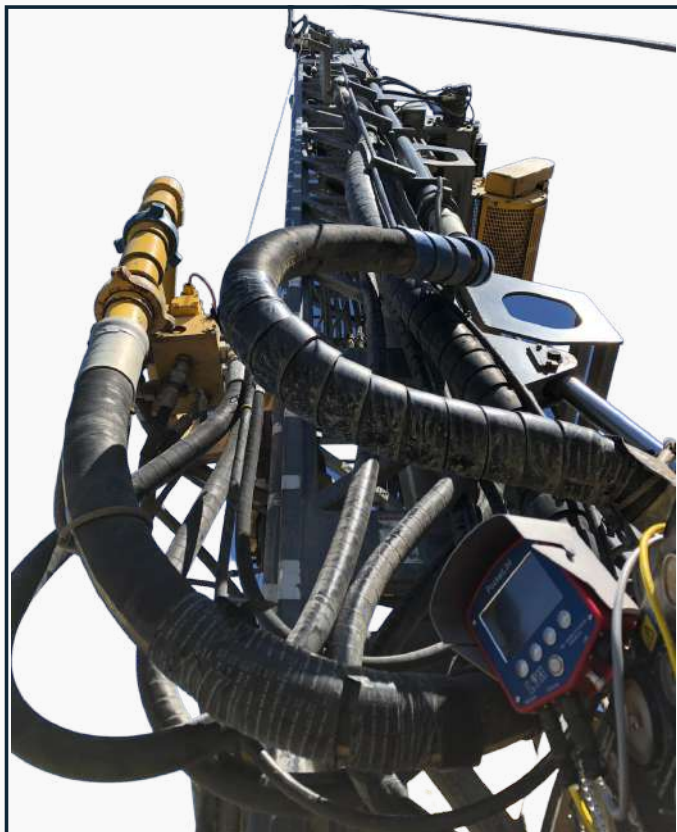


Borehole logging probes with datalogger and winches



### Example: Uranium Mine

The altered episyenite (shear zone) containing the Uranium is well highlighted by the Penetration rate (blue), water pressure (green) and rotation torque (orange), Natural Gamma for correlation is in purple.



## Mesurement While Drilling Drilling Parameters

### Drilling parameters vs depth

- ✓ Drilling Advance Speed or Penetration Rate;
- ✓ Pulldown Pressure;
- ✓ Pullback Pressure;
- ✓ Drilling fluid Pressure (Water, Mud or Air);
- ✓ Rotation Torque Pressure;
- ✓ Rotation Speed;
- ✓ Instantaneous Drilling Time;
- ✓ Drilling fluid Flowrate(s);
- ✓ Reflected Vibration of the drillstring;
- ✓ Drilling Fluid Temperature;
- ✓ Any other parameter vs depth.

### Application of the method for exploration

- ✓ Method applicable to mineral, geological, hydrogeological and geothermal exploration drilling;
- ✓ Delimitation of the different geological layers according to geomechanical criteria;
- ✓ Target geological formations detection;
- ✓ Rationalization of drilling: help the driller to manage his machine parameters in order to optimize them according to the ground variables, e.g. a significant deviation of the drill string or untimely wear of a drilling tool.

### LIM complete solution

- ✓ **PocketLIM-Drilling**: Drilling parameters recorder installed on the drill rig with all the different sensors;
- ✓ **LIM@mail**: Web application managing the data files transmission via the Internet with drilling parameters pre-processing;
- ✓ **GEO-LOG 4**: Cloud-based software that performs the layout of borehole logs.



### Mesurement after drilling Borehole Imaging Televiewers

#### Optical Imaging (OPTV)

The optical borehole imaging technique has a double advantage:

- ✓ by allowing a complete visual, in-situ appreciation of the target zone in terms of lithology, mineralisation, alteration;
- ✓ by providing the source data for a structural model of an ore body and host rocks incorporating the different types of discontinuities present (bedding, joints, fractures, veins...).

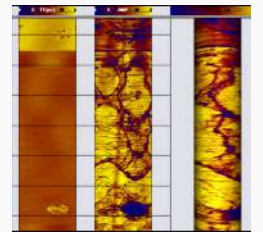
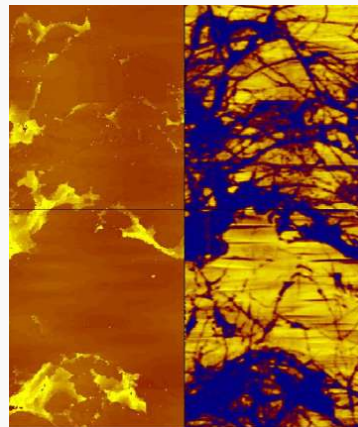


#### Acoustic imaging (BHTV)

High quality images of the borehole wall using the acoustic method. Two complementary images are obtained :

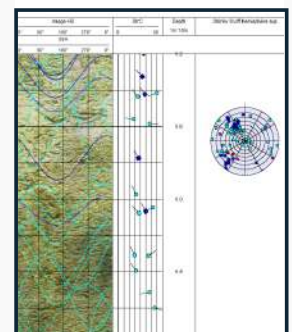
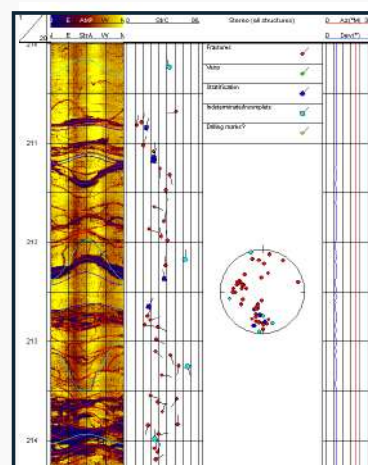
- ✓ the two-way travel time as determined by variations in the borehole cross-section;
- ✓ the acoustic reflection amplitude related to rock density/hardness.

The result is a precise, orientated acoustic reflectivity image of the formations.



#### Structural analysis

- ✓ The different structures observed on the optical or acoustic borehole image logs can be picked, orientated and classified by means of an interactive software package.
- ✓ Their true dip and azimuth values, calculated by taking into account the deviation of the borehole, are used to generate polar plots, rose diagrams, histograms etc.



# LIM SOLUTION FOR EXPLORATION

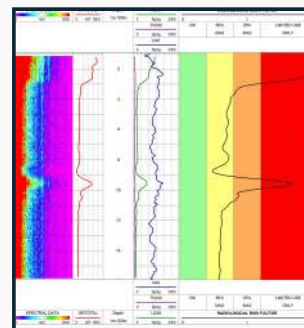
## Borehole Logging Equipment



### Measurement after drilling Borehole Logging Equipment

#### Nuclear Logging Tools

- ✓ Natural Gamma probes (GR38 & 25)
- ✓ Spectral Gamma probes (GRS42 & 60)
- ✓ Double density + Gamma Trisonde (TRS38G)
- ✓ Dual Neutron thermal probe for water content (DTN38)
- ✓ Uranium Exploration probe (UEP42)
- ✓ Densité Photo-Electric Density probe (PDGC50)

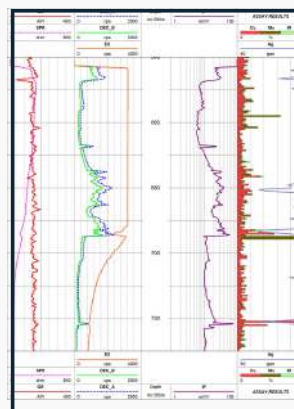
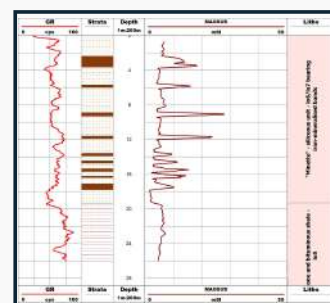


Spectral  
Gamma  
log and probe

#### Electric Logging Tools

- ✓ Electric Logging Résistivity + SP probe (ELG46)
- ✓ Single and Dual Induction probes (EM25 & DIL 38)
- ✓ Focused Electric probe (GUIP38)
- ✓ Induced Polarisation probe (IP38)
- ✓ Magnetic Susceptibility probe (MAG45)

Magnetic  
Susceptibility log



Induced  
Polarisation  
log and probe

#### Sonic Logging Tools

- ✓ Fullwave Sonic probes (FWS3RX60 & FWS4RX60)

#### Hydraulic Logging Tools

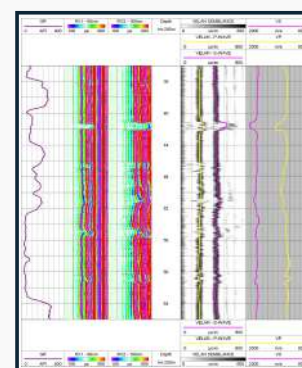
- ✓ Fluid Temperature/Conductivity/Flow probe (ETC60)
- ✓ Water Quality probe (WQP48)

#### Borehole Geometry Tools

- ✓ Borehole Deviation probe (BDV42)
- ✓ Three and Four arm calipers (3AC38 & 4AC60)



Fullwave  
Sonic

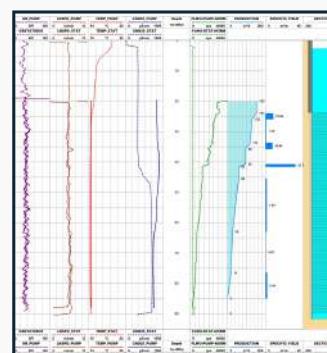


#### Surface Data Logger with acquisition software

- ✓ eMindLogger



#### Logging Winches



Temperature/  
Conductivity/  
Flow log and  
probe

