Coal Interface Detection
(Comparative study of in-seam surveying technology)
ACARP project C12024

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Participants

- CRC Mining (Scott Adam)
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- AJ Lucas
- Anglo Coal, German Creek
- DMT
- CSIRO TIP
- Auslog
What is Coal Interface Detection?

- The ability to detect proximity to roof and floor whilst drilling horizontal directional holes in coal seams

Why is it important?

- To avoid unnecessary branching in horizontal holes
  - Up to 25% increased metres drilled (cost impact to mine)
  - Avoid getting “lost” (navigational difficulties)
  - Improved gas drainage efficiencies
    - Branch points are potential cave zones
    - Reducing the amplitude of drilling (less hills and hollows)
Directional drilling - section
Objectives of project

- Review of state-of-the-art CID technologies
- Comparison of capabilities of existing commercial and R & D CID technologies including:
  - Conventional geophysical wireline tools (gamma, density)
  - Drill string radar
  - Dielectric / conductivity tools
  - Spectrometric gamma
  - Directional gamma
Outcomes

- Review of technologies has been completed, potential techniques selected
- Trial successfully completed in highwall at German Creek
- Report due out by end of September
- MWD / LWD is now within our grasp – some of this should be routine for MRD & possible for underground drilling
Inseam drilling practice

- 75kW rigs, downhole motors, NQ drill pipe and electronic survey tools
- Periodic deliberate, and unscheduled roof and floor touches
Downhole Motor and Bit
Drill rods with MECCA connection
Gas drainage drilling
What does it all mean?
Turning the sow’s ear into a silk purse ...

Problem: too intuitive, reliant on driller’s observations
Current weaknesses

- No geophysical data from underground drilling – wasted opportunity for gaining exploration information
- No real time profiling capability (CID), therefore unscheduled branching part of life
- MECCA link rules out ‘pump down’ logging

Compared to oilfield practice our way of doing things belongs in the Jurassic
Coal drilling from surface ...
MRD taps into civil & oilfield products

Rack and pinion drive

9m external upset drill pipe
Current weaknesses

- Limited geophysical & rig performance data from MRD – underutilised opportunity for gaining exploration information

Note: profiling (CID) problem largely solved
The trial …

- Lesson: Qld weather can be less than conducive to R & D

Happy researchers

Five minutes later
The aftermath ...
German Creek high wall
CID technologies trialled at German Creek:

- DMT’s Directional Gamma System
- DMT’s Borehole Shuttle (with density, gamma and acoustic calliper).
- CSIRO DEM’s spectrometric gamma system.
- CSIRO TIP’s radar and dielectric tools.
- Auslog’s density tool.
Phase 1: Directional gamma

German Creek vertical hole DD485

Gamma response (API)

Depth (m)

German Creek Seam

Gamma response (API)
Test hole section – BG & AG

Graph showing depth variations from various levels, with labels such as Hard, Seam Core, and Close to Floor and Roof.
Test hole

Structure shown in Green in Project Dykes
Structure in Brown, is "As Drilled" Dykes
Comparison of gamma readings

- Sirolog, DMT shuttle comparison
- All three gamma loggers similar
- Sirolog loses the plot near end of hole
Spectrometric gamma

- CSIRO DEM tool did not perform well, calibration problem
- Spectral work in vertical boreholes at German Ck and elsewhere suggest it should work
- K & Th present related to depositional environments, a ‘signature’ is possible!
Gamma & density

Distance down hole (m)

Natural gamma
Density

Low in seam
Mid seam band
Dyke

Floor
Roof
Acoustic caliper
Together, you have a definitive answer

“Many arrows needed in quiver” (Hiawatha)
Dielectric

Resistivity – measures current flow in strata
Dielectric (Reactivity) – capacitive properties of strata
Disappointing – wet coals poor response, great in dry lithology…
Conclusions

- Density, gamma (directional), dielectric, acoustic caliper all useful – should be part of inseam drilling
- Spectrometric gamma and radar did not perform
  - Radar appears a ‘no go’ (no more work needed)
  - Spectrometric gamma has potential – needs further development
- No excuses for not integrating at least some of these tools into everyday MRD and underground drilling
  - Mines need to think about how to utilise the new data
  - Drillers need to provide the service
  - Interpretation & flow of data needs to be streamlined
- Need mine ownership on the integration of this data with geological model
Once you have the data, then you can image it …

- Data Vs window
- Angle Vs depth

“See” the borehole wall
The ‘here and now’, ROP and gamma
Profiling using EM signal

15a Attenuation
Attenuation profiling

Vertical Seam Position - EM signal Attenuation

\[ y = 14.302x^2 - 41.723x + 61.794 \]