‘Prospecting Drilling’: A Technology-Enabled Revolution in Mineral Exploration

Richard Hillis
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Technologies Will Enable ‘Prospecting Drilling’
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Cheap drilling and real-time sensing enable progressive vectoring towards covered mineral deposits by multiple holes in a single drilling campaign utilising geochemical and petrophysical haloes.
Undercover mineral potential

Surface geology
Undercover mineral potential

Major mineral deposits
Undercover mineral potential

Aeromagnetics (0.5 vert. deriv.)
DET CRC

- one of ~30 Cooperative Research Centres (CRCs) in Australia
- ~half funded by government and ~half by industry
- participants include miners, suppliers and research organisations
- incorporated entity with independent board
- $62M cash and $93M in-kind (2010-2018)
- 300 researchers for 319 person years
  - ~1/3 industry; ~2/3 research organisations
  - ~1/3 cash; ~2/3 in-kind
  - 7 research orgs and 12 industry orgs
Industry Focus

- industry-set research agenda
- 63 Participants and Affiliates
- Head Office embedded in industry
- ~30% of research funds to industry
- 110 industry-based researchers
- industry-driven Science Steering Committee and project reviews
Wireless Sub AutoSonde/AutoShuttle Lab-at-Rig® (AWD)
Coiled Tubing Drilling & Associated Sensing
Prospecting Drilling
Better Vectors
Serendipity
Wireless Sub
AutoSonde/AutoShuttle
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Coiled Tubing Drilling & Associated Sensing

Prospecting Drilling

Better Vectors

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Serendipity
Wireless Sub: Real-Time Drilling Monitoring

- traditional hydraulics-based rig gauges inaccurate
- couples drill rig to rod string and provides precise and objective measurement of:
  - feed force
  - water pressure
  - axial acceleration
  - torque
  - rotation speed
  - tangential acceleration
- remote monitoring of drillsite
- all drillers can replicate best drilling parameters across all shifts in a drilling program
- optimization enables drillers of any experience to converge rapidly on optimum drilling parameters
- involves CSIRO, Globaltech, Epslog and Boart Longyear
Why Have the Miners Joined DET CRC?

• International mining company currently spends US$300M pa on global drilling (exploration, development and production) on top of these direct drilling costs an additional 25% are incurred including rig access and transportation which takes the total annual expenditure to ~US$375M.

• Over the 8-year life of the CRC this company will have spent in excess of US$3B in direct drilling costs.

• 10% reduction in costs resulting from improved drilling technology would save this company ~US$300M or ~US$240M in direct drilling costs over 8 years. Improvements in safety and environmental performance expected.
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Coiled Tubing Drilling & Associated Sensing

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AutoSonde/AutoShuttle: Downhole Petrophysics

• routine, cheap petrophysical data from diamond drilling
• no separate wireline crew, no extra rig time, no hole collapse prior to logging
• AutoSonde: through bit, log-while-tripping
• AutoShuttle: behind core barrel, log-while-drilling
• AutoSonde: total γ, mag. susc. & resistivity
• AutoShuttle: spectral γ
• licenced to Boart Longyear
• $8M project involving Curtin University and Globaltech
AutoSonde Gamma vs. Wireline Gamma

AutoSonde: grey fill
Wireline: black line
A: Sandstone/shale sequence.
B: Metamorphosed sandstone/shale sequence
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Lab-at-Rig®: Top-of-Hole Geochemistry & Mineralogy

- geochemistry and mineralogy in near real-time from drill cuttings
- cuttings separated from drill fluids by solids removal unit (centrifuges), dried and presented for XRD and XRF analysis
- geochemical accuracy and depth-fidelity supported by extensive testing and comparison to assayed core
- Lab-At-Rig® licenced to Imdex
- $17M project involving CSIRO, Olympus & Imdex
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Coiled Tubing Drilling & Associated Sensing

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Coiled Tubing Drilling: Positives

- faster and cheaper because drill rod connections are not required (drill string is a continuous tube)
- safety: eliminates manual handling of drill pipe
- environmental: drilling fluid recycling eliminates sumps
- quicker mobilisation/de-mobilisation and less labour
- better hole stability because drilling is quicker and fluid circulation not turned on and off for connections
- tube is potential conduit for drilling and sensing data from bottom-of-hole to surface
Coiled Tubing Drilling for MinEx: Challenges 2012

- fatigue life of coil
- drill hard rocks with low weight-on-bit
- recycle and clean fluid for downhole motors
- hole deviation
- representative sample to replace core
- $AUS 50/metre target cost
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Diamond Drilling

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- 1863 blast holes in Alps
- 1890s minex Boyles wUS Longyear MN
- 1912 19 drills in Longyear catalogue
- 1930s boarts added to bits
- 1953 wireline core retrieval patent
- 1971 PDC bit patent
- 1980s synth. dia. & impreg. bits
- 2010 EDI
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CTD for MinEx

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- 2017 92m/shift MSDP 2

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“Not publish or perish. Partner and prosper.”

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“But partnership is a contact sport.”