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On-site lab technology: coupled portable sensors to deliver real-time chemistry and mineralogy (pXRF and pXRD)

Yulia Uvarova | Principal Geochemist, CSIRO
James Cleverley (Imdex), Aaron Baensch (Olympus)
26 October 2017

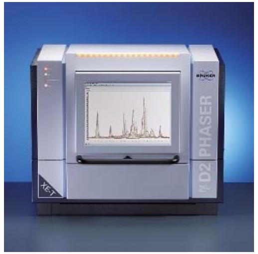
Desktop and handheld analysers

Infra red

LIBS

Raman

XRD



XRF

Coupled pXRF and pXRD

Chemistry and mineralogy on site in near real time

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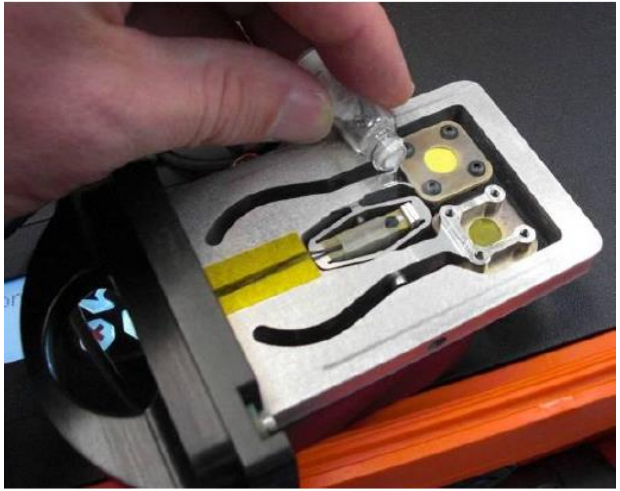
Portable X-ray Diffraction (pXRD)



- Portable and robust
- Little sample required (~ 10 mg)
- Very little sample preparation – crushing to <150 µm particle size
- Data collection time – 10 mins
- Unique piezo-harmonic vibrating cell eliminates the problem of preferred orientation

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Portable X-ray Fluorescence (pXRF)

- Little to no sample preparation
- Fast - min reading time 10s per beam
- Elements from (Mg) to U

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Example:

Application of coupled pXRF-pXRD analyses to geological materials

DEEP EXPLORATION TECHNOLOGIES CRC
Uncovering the future

Brukunga Pyrite mine, South Australia

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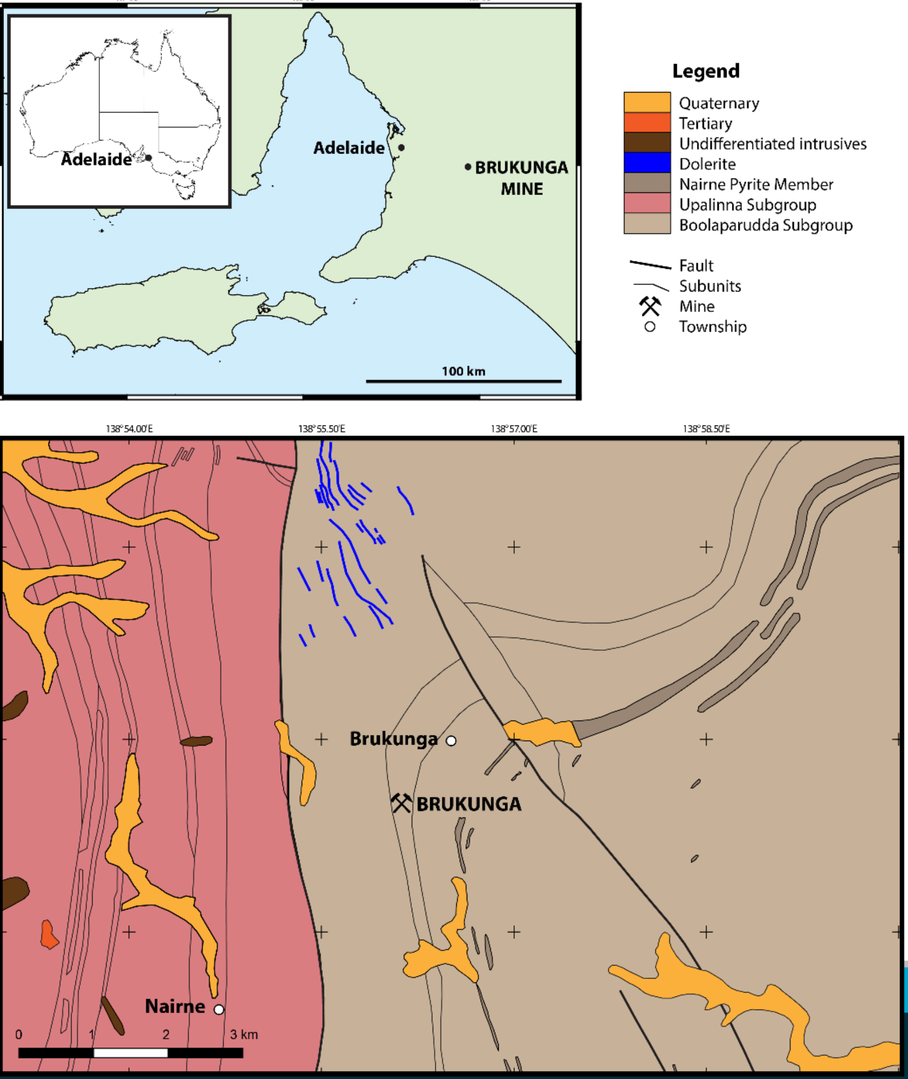
Brukunga pyrite mine



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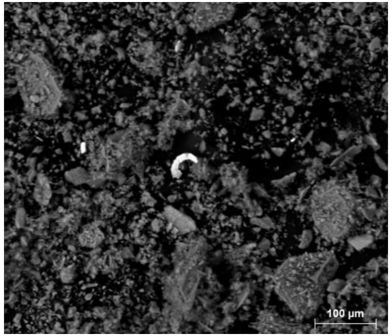
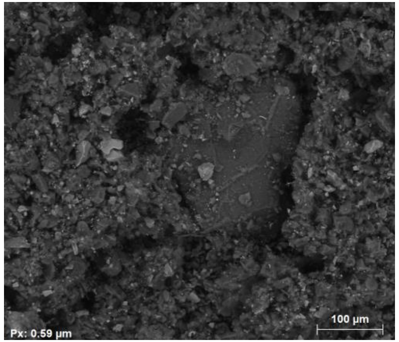
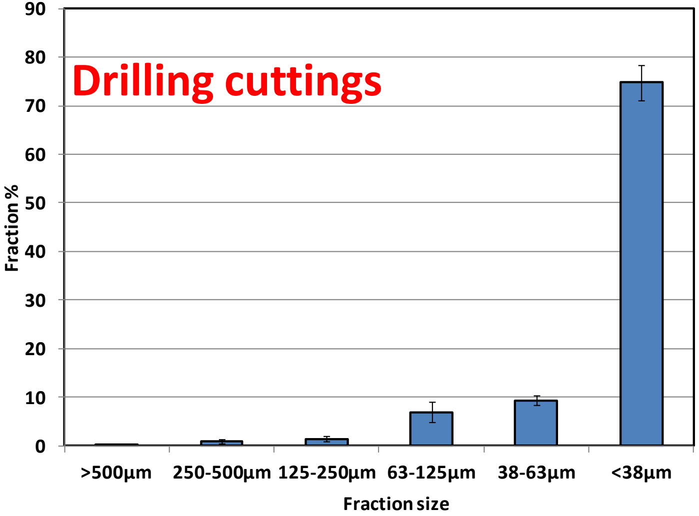
Turning a waste stream to good

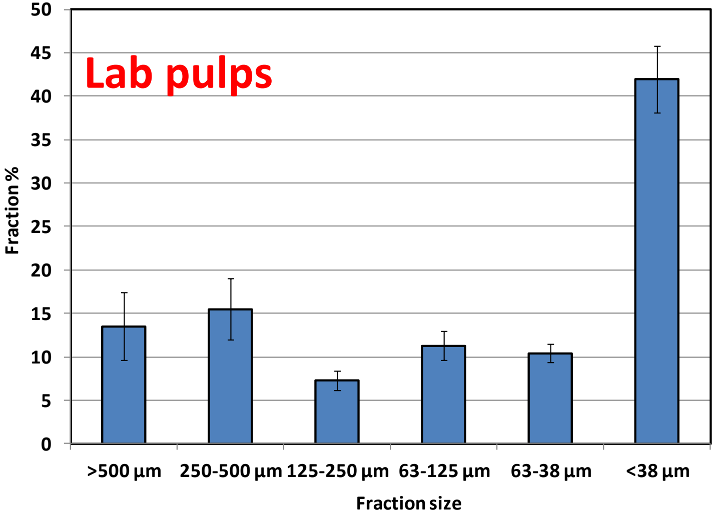
1 meter composite:
8.8 Kg powder
9.8 Kg core

Particle size distribution









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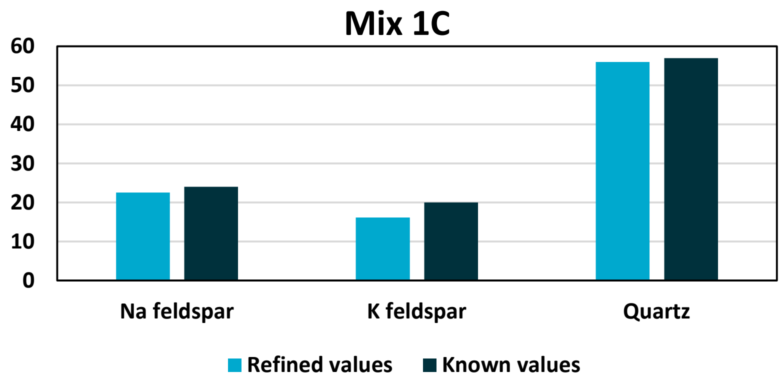
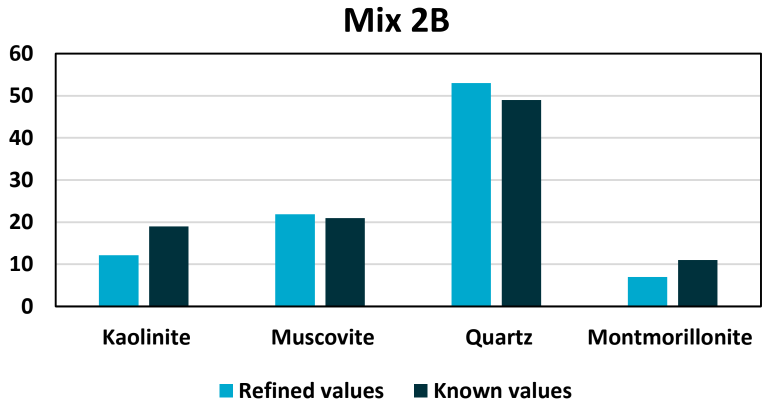
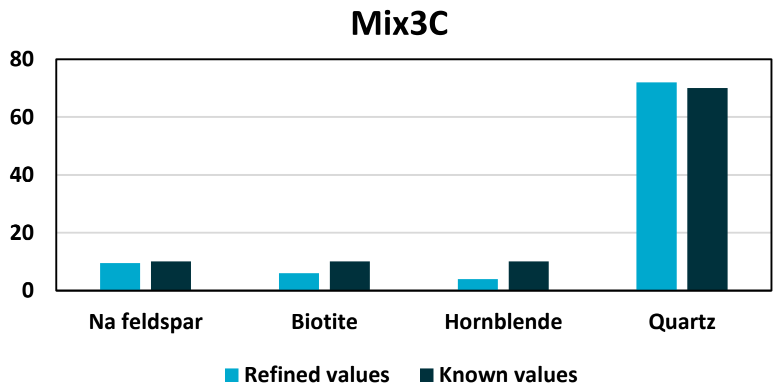
Experimental setup

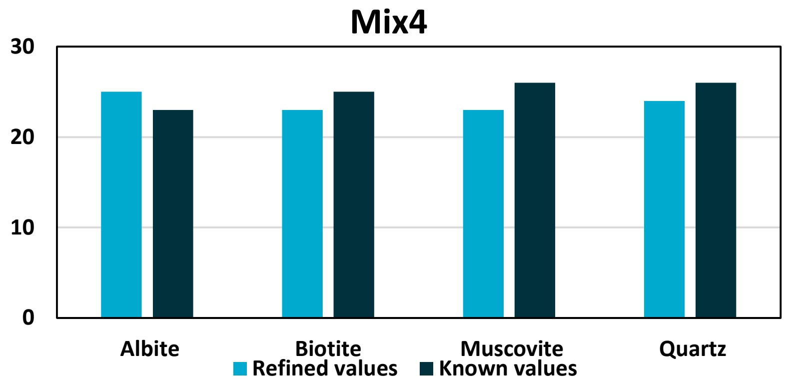
- Samples were taken from the DETBrukunga2 diamond drill hole
- The core was logged
- Composite samples of drilling cuttings were taken every 1 m
- Pulps were analysed with a portable Olympus XRD Terra instrument and a lab-based Bruker powder diffractometer
- Pulps were analysed with an Olympus Delta Premium pXRF instrument operating in Geochem Mode
- 20% of pulp samples were analysed by ICP-MS and ICP-OES by a commercial lab
- Logging, pXRF and pXRD data were compiled

Quality of pXRD data + SwiftMin®









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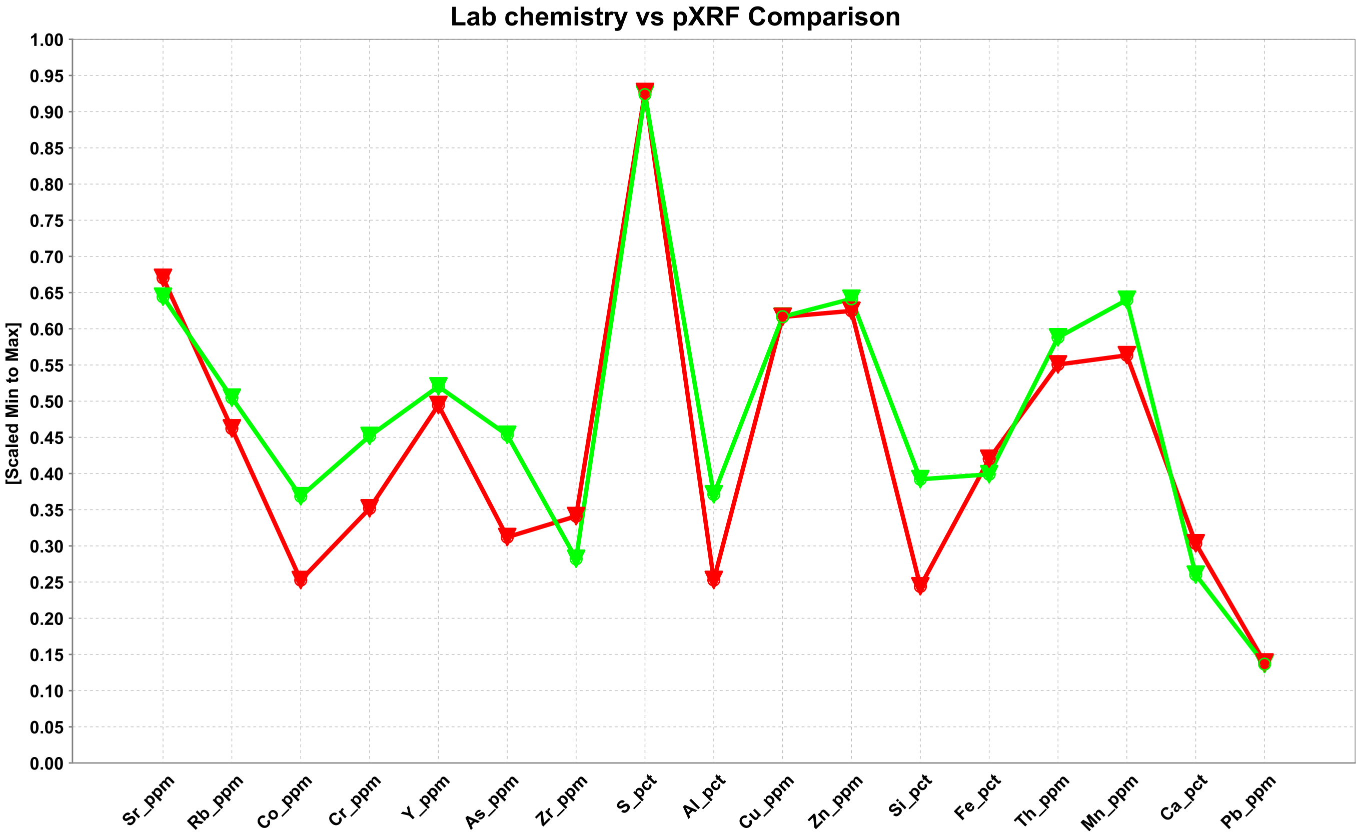
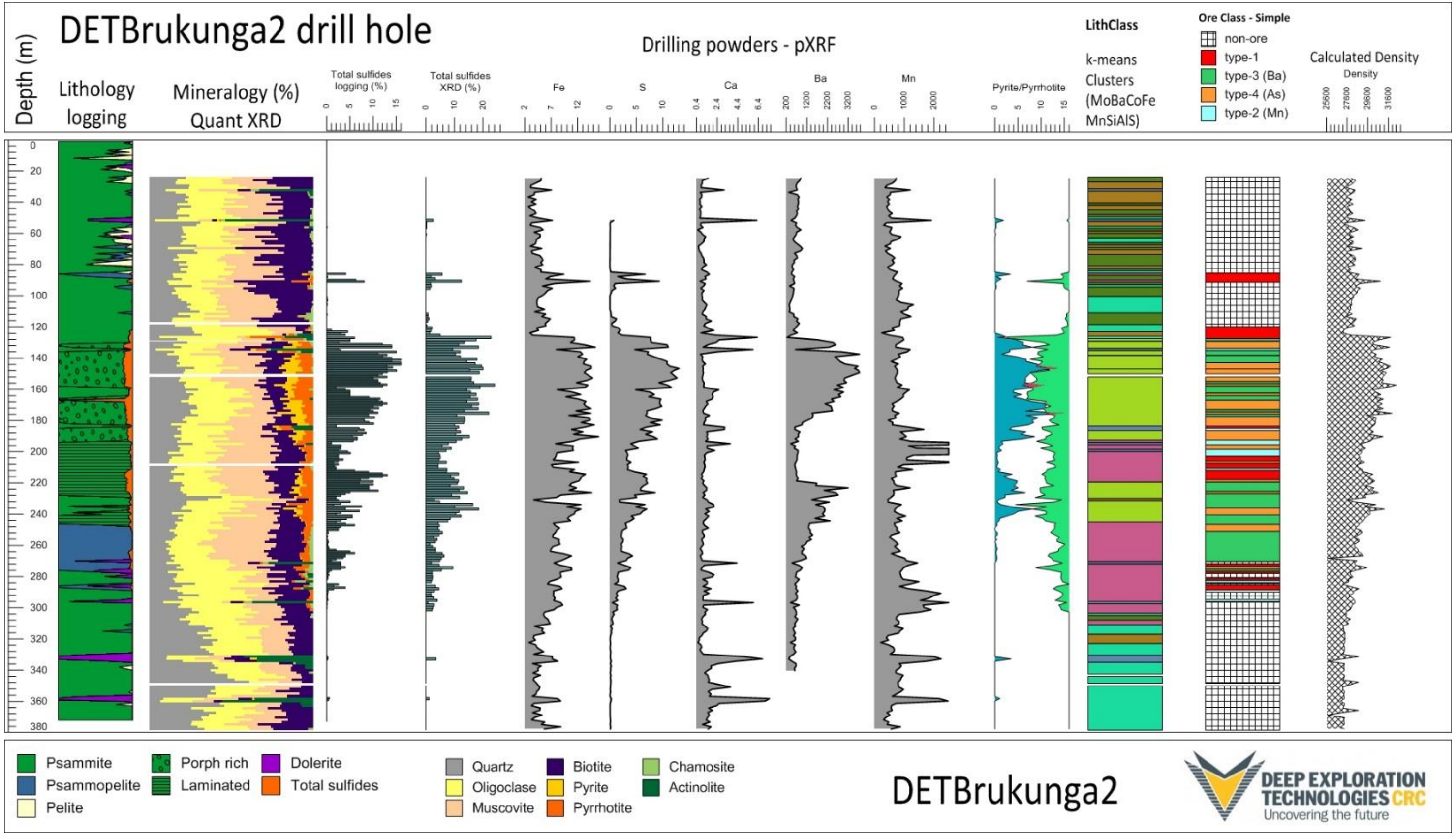
Quality of pXRF data



Lab

pXRF

Proof-of-concept at Brukunga, South Australia



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Summary

Combined XRD-XRF analyses offer rapid and low-cost characterization of geologic materials for mineral exploration and mining industry and deliver elemental and mineralogical information of high quality where appropriate QA/QC protocols are followed.

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JGE JOURNAL OF GEOCHEMICAL EXPLORATION

Representative, high-spatial resolution geochemistry from diamond drill fines (powders): An example from Brukunga, Adelaide, South Australia

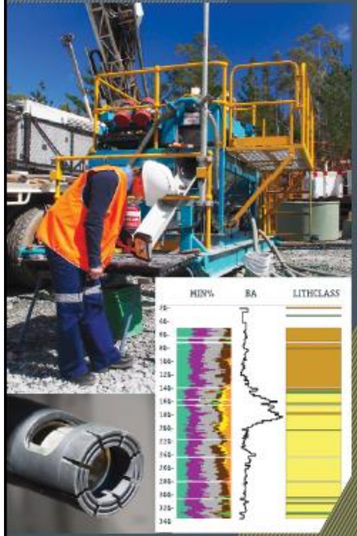
CrossMark

Yulia A. Uvarova [a,b,*], Michael F. Gazley [a,b], James S. Cleverley [a,c], Aaron Baensch [a,d], David Lawie [a,e], Monica leGras [a,b]

[a] Deep Exploration Technologies Cooperative Research Centre, P.O. Box 66, Export Park, Adelaide Airport, South Australia 5950, Australia
[b] CSIRO Mineral Resources, ARRC, PO Box 1130, Bentley 6102, Western Australia, Australia
[c] REFLEX, Imdex Limited, 216 Balcatta Road, Balcatta, Perth 6021, Western Australia, Australia
[d] Olympus OSSA, 48 Woerd Avenue, Waltham, MA 02453, USA
[e] Imdex Limited, 216 Balcatta Road, Balcatta, Perth 6021, Western Australia, Australia

Lab-at-Rig™ real-time geochemistry and mineralogy

Supporting real-time targeting



Lab-at-Rig™ will deliver a step change decrease in the time between drilling a hole and knowing what to do next.

- **Now** – Drill hole (two weeks). Log and sample hole (one week). Get core shipped to Perth (two weeks). Get core assayed (six weeks). Get data into database (two days). Export and ready to interpret. Three month cycle.
- **Lab-at-Rig™** – Drill one metre (10 minutes). Sample data (10 minutes). Assay sample (10 minutes). Into database and outputted as Level 1 products (30 minutes). One hour cycle.

WHAT DIFFERENCE DOES THIS MAKE?

Reactive drilling campaigns where the next hole can be planned on the basis of the results of the current hole, instead of incremental progress spread out across multiple field seasons. This process also enables interactive management of the "currently" drilled hole through real time target vectoring. Decrease the risk of excess drilling and put the dollars where they can get the best return.

KEY BENEFITS OF THE LAB-AT-RIG™:

- Decreased drilling costs – less holes drilled "just in case" and less metres drilled beyond targets
- Decreased mobilisation and camp costs
- Rapid turn-over of targets and tenements
- Decreased likelihood of near misses – geologists will have all the data on hand to elect to continue drilling if required
- Informed in real-time about intersecting interesting geology, whether onsite or back at base
- Drilling campaign monitored at any location
- More "mineralised" holes drilled in a typical field season due to rapid turnaround
- Ultimate fast tracking of discovery rate and rates of conversion of a prospect to a mine
- Dramatically decreased time to report the interval to the stock exchange and investors

MAXIMISE THE VALUE OF GEOLOGIST TIME AT RIGS

Geologists in the mining industry are time poor. Lab-at-Rig™ will enable geologists to monitor the chemistry and mineralogy of the hole as it is drilled – from the rig side, back at camp and from head office. As well as raw data Lab-at-Rig™ will provide the ability to automatically classify the data into lithology and alteration groups and flag when key pathfinder/ore element associations are intersected. When critical decisions need to be made the geologist can visit the rig and make the right call with Lab-at-Rig™ real-time geochemistry and mineralogy information at their finger tips.

THE POWER OF COMBINED MINERALOGY AND CHEMISTRY

Lab-at-Rig™ real-time geochemistry and mineralogy will deliver to geologists real-time chemical assays and mineralogy. The two of these in combination will provide an opportunity to quantitatively map lithologies and alteration halos for all holes drilled, in real-time. This will enable rapid identification of near and far field alteration halos which can be followed up in a dynamic manner – warmer, warmer, colder, warmer, jackpot! This also facilitates the collection of important geometallurgical & mining parameters from the time the first exploration drill hole is drilled. 3D models can be populated from the outset and not just 'after-the-fact'.

Thank you

CSIRO Mineral Resources
Yulia Uvarova
Principal Geochemist

t +61 8 6436 8728
e yulia.uvarova@csiro.au
w www.csiro.au/en/Research/MRF