Could rapid XRF analysis techniques provide a step change in our ability to map geochemical dispersion patterns through cover and deliver future mineral discoveries?

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XRF (X-ray fluorescence)

Background

- Measure elemental abundances of a material
- Commonly used by exploration industry
- Key advantage = additional analyses only cost time
- Cover geochemistry rarely the focus of geochemical sampling

➤ What could it mean if geochemical data was routinely generated on all drill materials?

How does XRF work?

1 - Incident X-ray
2 - Ejected electron
3 - Characteristic X-ray

pXRF
XRF (X-ray fluorescence)

Compromises of pXRF

- No Na, high DL’s for Mg and many pathfinder elements. High sample resolution can make up for some shortcomings.
Recent developments in mineral exploration

Lab-at-Rig® and Minalyze

Lab-at-Rig®

Minalyze.com
Lab-at-Rig® - utilising a waste stream

- Deep Exploration Technologies CRC – develop transformational technologies for the minerals industry
- LAR developed by CSIRO within DET CRC. Now commercialized by Imdex.
- Analysis of drill cuttings
- Utilises SRU, XRF, XRD

1 meter composite:
8.8kg powder + 9.8kg core
Mineral Systems Drilling Program

**MSDP**

- Collaborative drill program (GSSA + DET CRC + exploration industry)

**LAR**

- Geochemical results within hours of drilling
- Analyses at 1-2 m intervals

**Vision**

- Faster, cheaper drilling using CT-rig
- LAR an important part of DET CRC vision of ‘prospecting drilling’ and may feature in the National Drilling Initiative (MinEx CRC)
- ~1 m geochemical data from surface in holes across Australia
Mineral Systems Drilling Program

MSDP
- Diamond coring with LAR from surface
- MSDP11 – margin of Gawler Ranges
Mineral Systems Drilling Program

Igneous texture obvious in drill core from ~41 m
MSDP11 – LAR results
Mineral Systems Drilling Program

MSDP02

- Benefit of high resolution sampling – enables understanding that we would rarely get the opportunity to observe
Focus – reduce cost of gaining geochemical data
• Potential to analyse drill materials stored in Government repositories
• While basement core is the focus, cover materials can quite easily be analysed – surface to EOH geochemistry
• Possibility of more dh’s with surface to EOH geochemistry
• Current limitation – broken core difficult to analyse
1600 - 1570 Ma magmatism

- Hiltaba Suite
- Gawler Range Volcanics

Prominent Hill
Olympic Dam
Emmie Bluff
Carrapateena
Hillside
Gravels at U/C are effective sample media.
CAR02 – Carrapateena discovery hole

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CAR02 – Carrapateena discovery hole

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CAR02 – Carrapateena discovery hole

Manalyze data

- Shale
- Calcareous Sandstone + siltstone
- Sandstone
- Hematite-breccia

Donington Suite
Upalina Subgroup
Whyalla Sandstone
Nuccaleena Formation
Yrelina Subgroup
Tregolana Shale
### IHAD3 – Emmie Bluff IOCG prospect

#### Minalyze data

<table>
<thead>
<tr>
<th>Layer</th>
<th>Zr ppm</th>
<th>TiO2 pct</th>
<th>CaO pct</th>
<th>Cu ppm</th>
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<tbody>
<tr>
<td>Saprolite</td>
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<tr>
<td>Tregolana Shale</td>
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<td>Tapley Hill Fm</td>
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<td>Pandurra Fm Sandstone</td>
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<td>Wallaroo Group metasediments</td>
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</tbody>
</table>

![Graph showing Zr ppm, TiO2 pct, CaO pct, and Cu ppm for different geological layers.](image)
IHAD3 – Emmie Bluff IOCG prospect

Minalyze data

- Saprolite
- Tregolana Shale
- Whyalla Sandstone
- Tapley Hill Fm
- Pandurra Fm Sandstone
- Wallaroo Group metasediments

Cu_ppm

0 50 100 200 300
Fe$_2$O$_3$ %

Cu ppm

CaO %

Copper values

- Amazing baseline dataset
Opportunities provided by semi-automated analysis

• Growing desire to collect geochemistry through cover (UNCOVER initiative)
• Emerging technologies enable these data to be collected
• As these data accumulate, provide opportunity for
  ➢ Improved logging and geochemical characterisation of basin sediments and regolith
  ➢ Detection of previously unrecognized mineralisation.
  ➢ Baseline datasets through basins that are currently lacking
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