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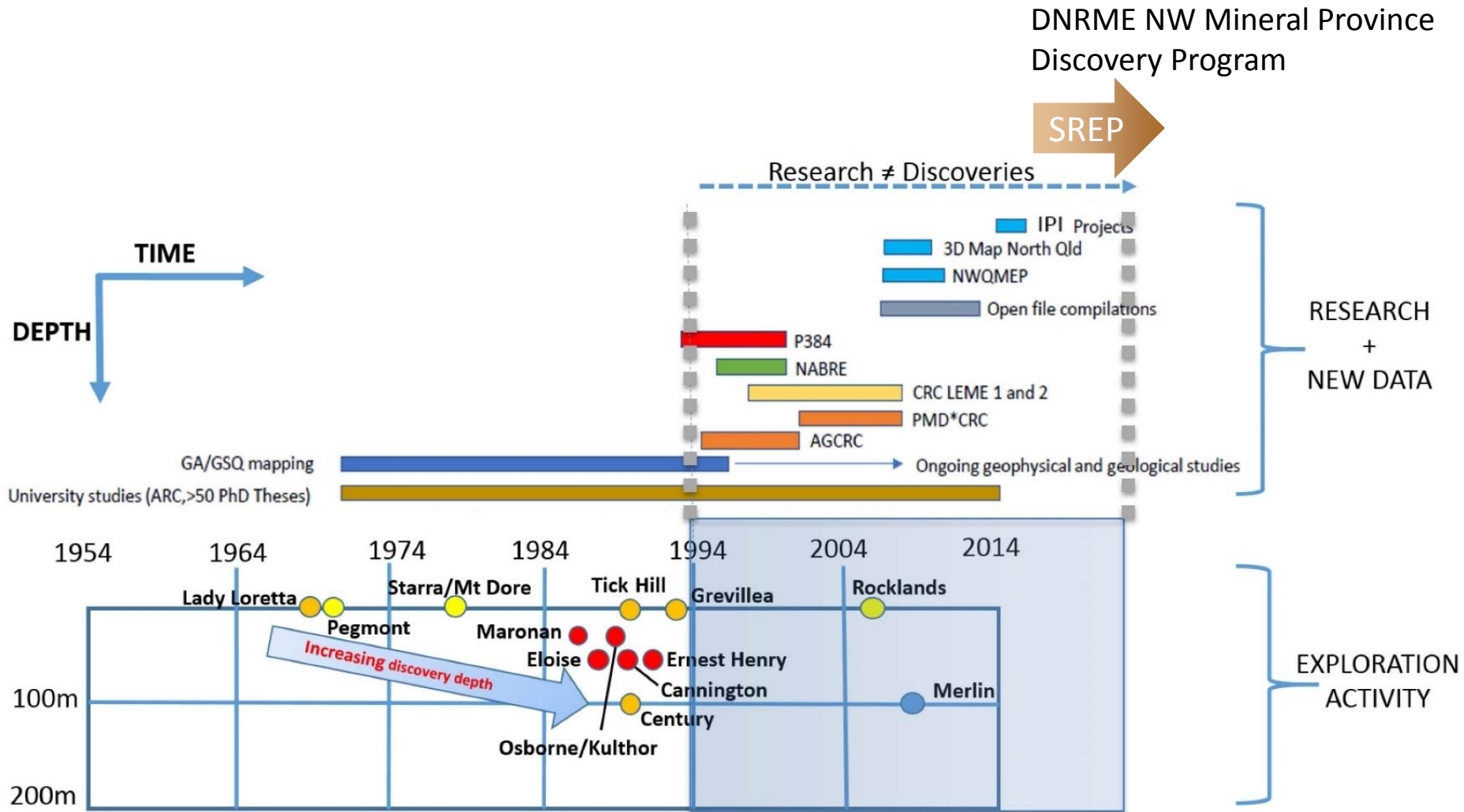
NW Mineral Province Discovery Program



Discovery Success in the NW Mineral Province

R Valenta – March 2018

Recent history – discoveries and studies



Current state

NWMP mines are maturing

- Short time frame to closures
- Declining economics of remaining

Lack of exploration success – need for a “step change”

- Multiple research projects and compilations over decades
- Strong base of data and knowledge
- Potential to improve industry focus of precompetitive products
- Untried approaches required

Decline in technical resources for exploration companies

- Declining exploration expenditure
- Decreasing resources for technical support

Increased role of junior companies

- Shorter time frames
- Need to reach drill stage quickly
- Need to maintain investor interest

New discoveries will not be easy

- Subtle
- Blind
- Buried under younger cover



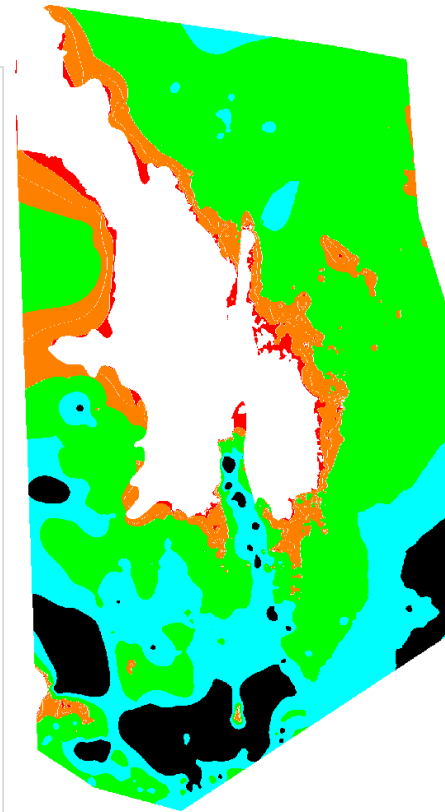
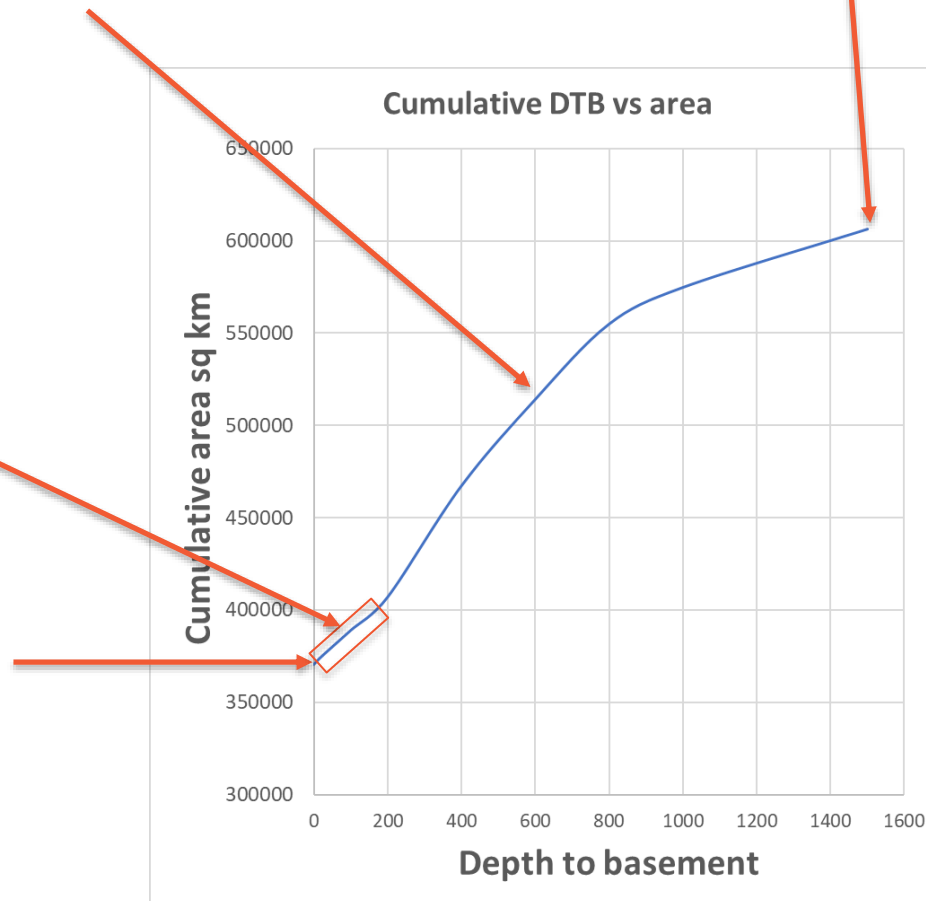
Success Scenarios

Deeply covered areas (217,400 sq km)

Areas under relatively thin cover (36,492 sq km)

Exposed and data-rich areas of the Mount Isa region (370,690 sq km)

Approx limit of mass underground mining



Success Scenarios

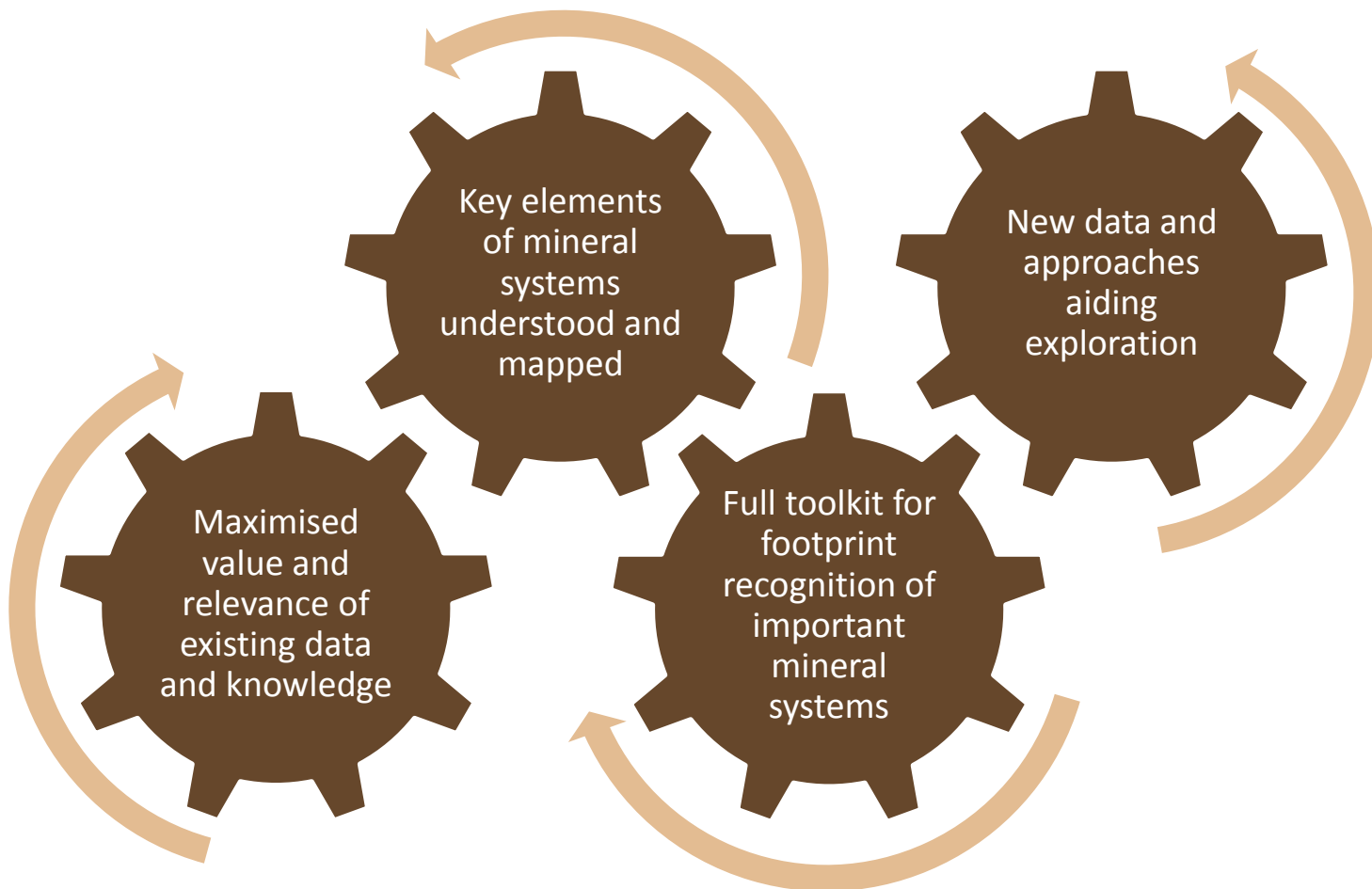
1. In exposed and data-rich areas of the Mount Isa region: Value-added interpretation of geoscientific datasets, combined with state-of-the-art data analytics, uncovers a previously unrecognised or under-appreciated target which turns into a major discovery

2. In areas under relatively thin cover: New insights into key controlling features and halos related to known deposits, combined with new geophysical and deep-looking geochemical data, result in a new major discovery

3. In deeply covered areas: New interpretations and 4D models allow mapping of high priority target regions, and a new major discovery is made with the aid of these interpretations and new datasets

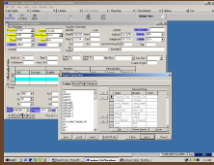


Future state



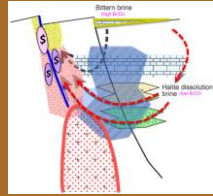
NWMP Discovery Program Components

Comprehensive compilation



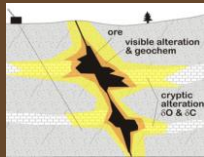
- updating the existing open file data compilations (to extent possible)
- distilling the results of geoscientific studies
- ensuring that this information is comprehensive, spatially consistent, well-explained
- delivered in a form which can be easily used by explorers and other projects

Mineral systems insight



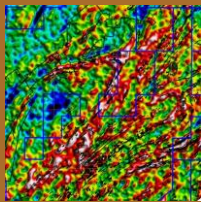
- Regional structural/stratigraphic targeting frameworks
- Mineral systems and footprints
- Studies of Igneous fertility
- New insights from data analytics

Exploration toolkits



- Atlas of Northwest Mineral Province mineral deposits
- Geochemistry over post-mineralisation cover sequences
- Halo models for recognition of blind or covered systems

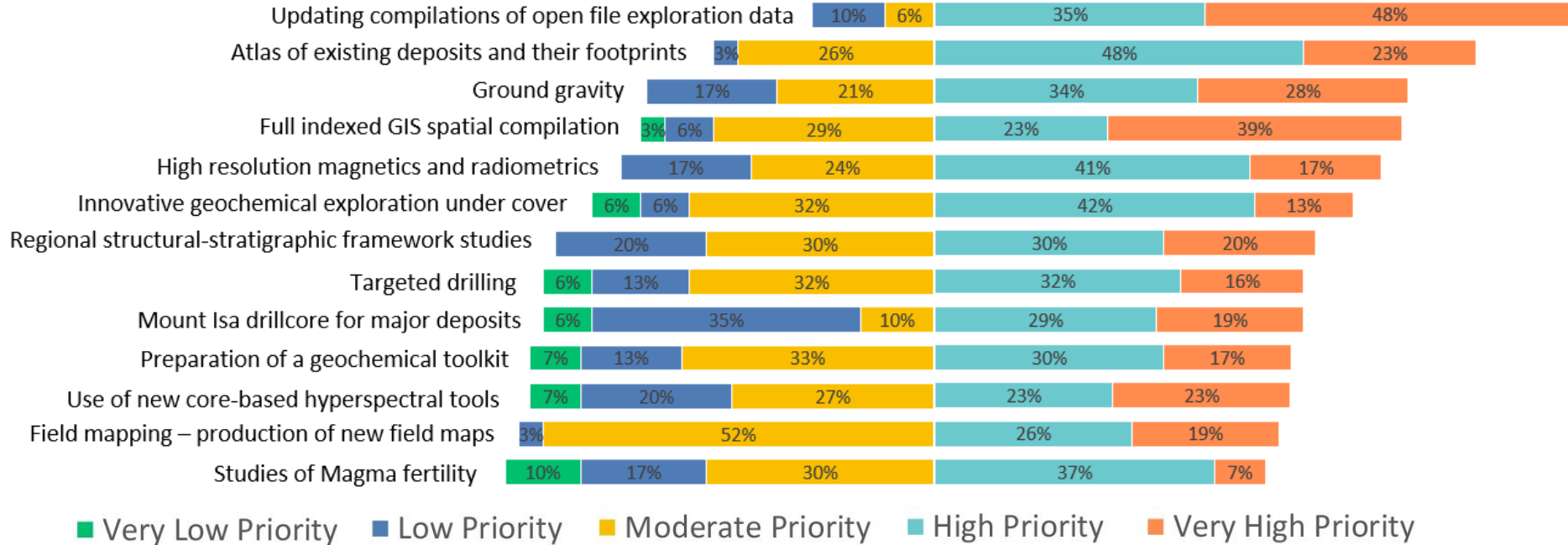
Transformative new data and interpretations



- New regional airborne gravity gradiometry
- Cover geochemical surveys
- Targeted drilling
- New interpretations of existing precompetitive datasets



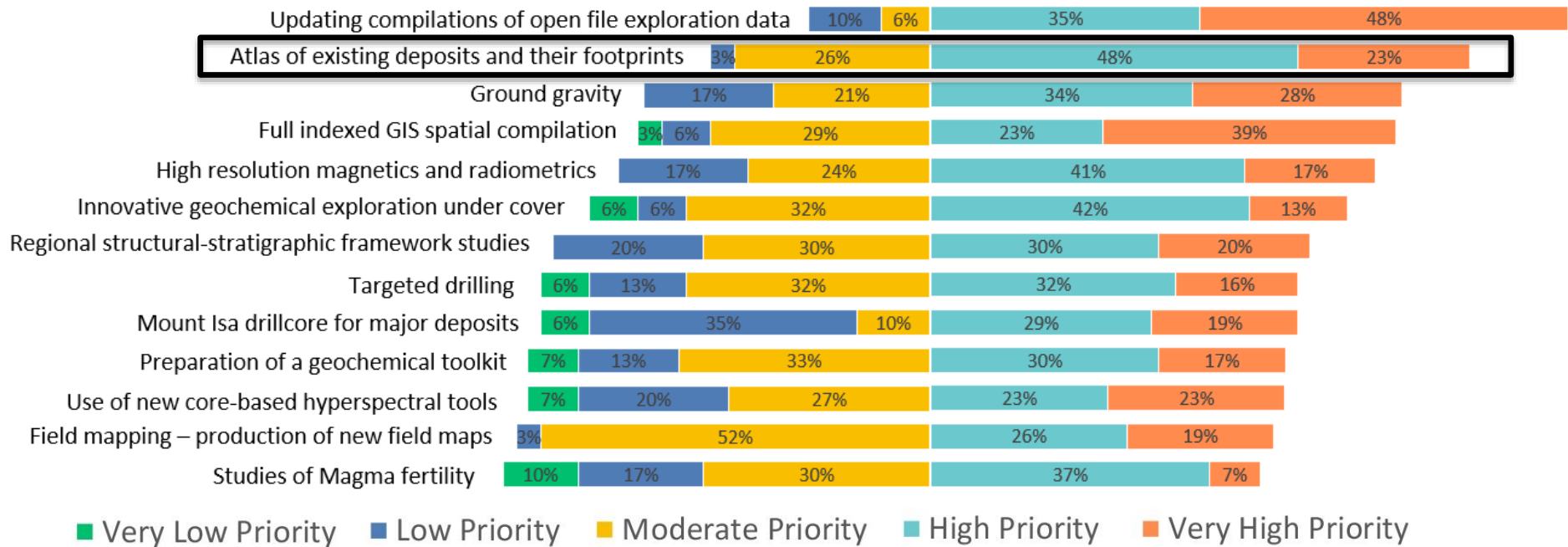
Survey of Industry – top half priorities




- Open file exploration data (1/26)
- Atlas of existing deposits and footprints (2/26)
- Full indexed GIS spatial compilation (4/26)
- Mount Isa drillcore repository (9/26)



Atlas of existing deposits and footprints




Atlas of existing deposits and footprints



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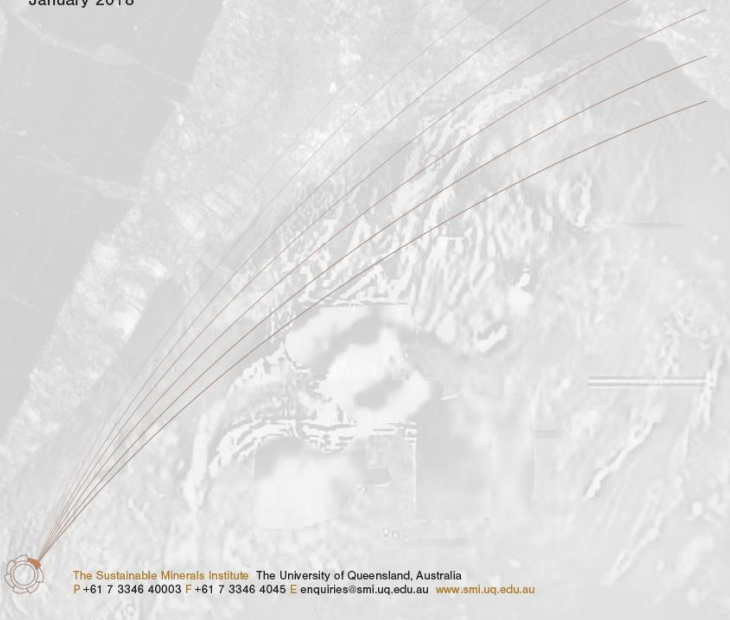


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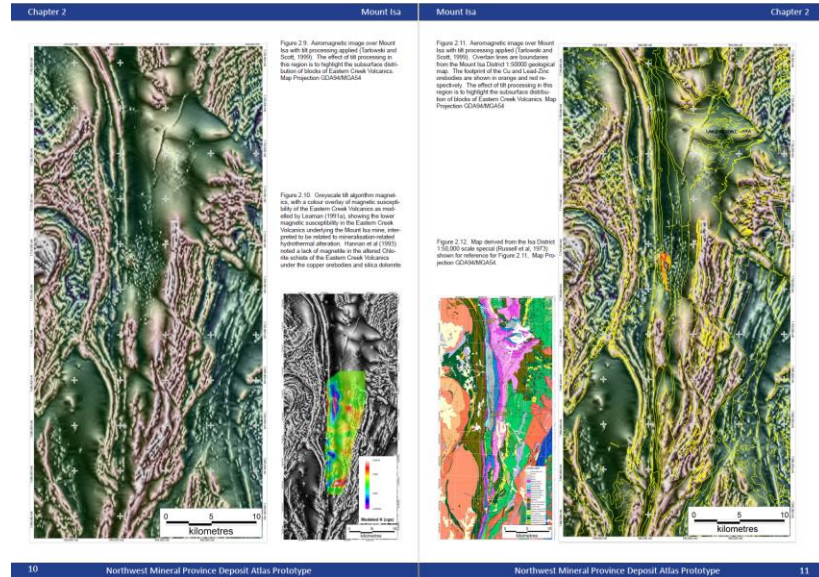
Northwest Mineral Province Deposit Atlas Prototype

Mount Isa Cu-Pb-Zn-Ag and Ernest Henry Cu-Au

January 2018




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Basic geology and geophysics




Atlas of existing deposits and footprints



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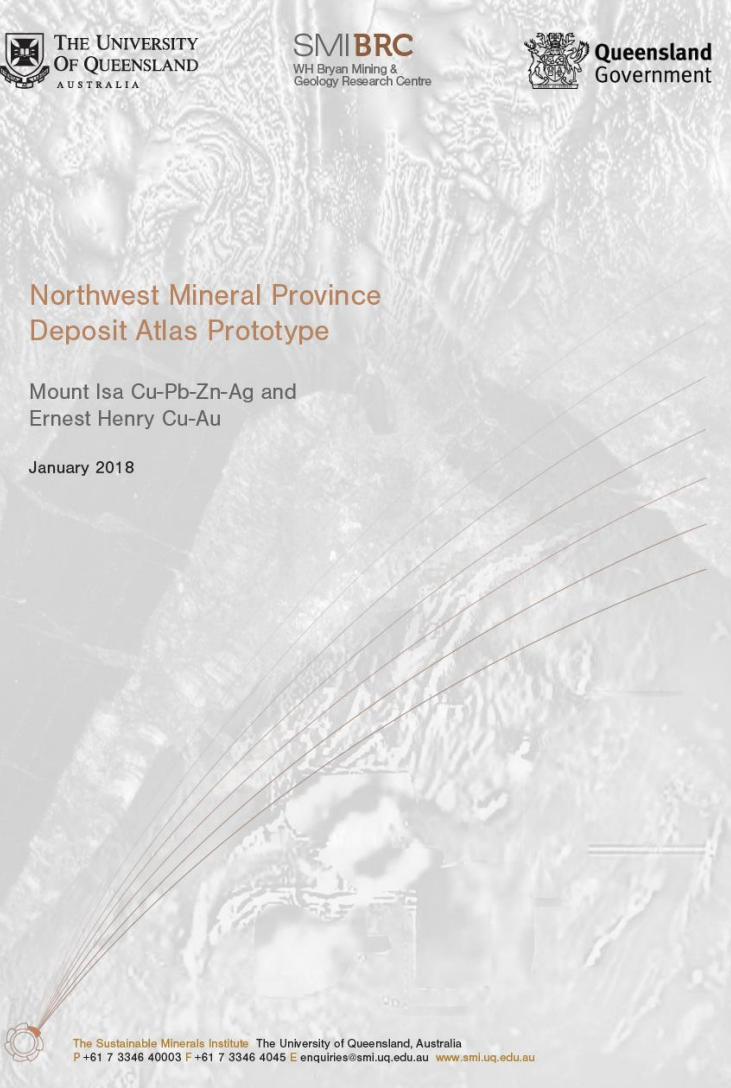


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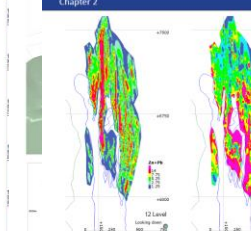
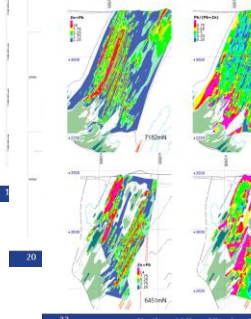
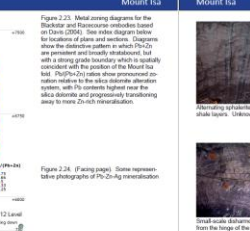
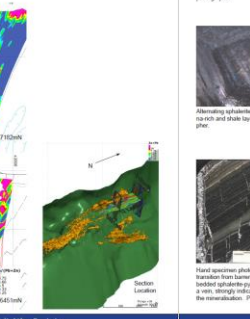
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Chapter 2 Mount Isa	Chapter 2 Mount Isa
<p>Figure 2.19 Aerial photograph of Mount Isa with 40 processing units (Turbowest and South 1995). The effect of air processing in this region is to highlight the subsurface drain-belt of blocks of Eastern Creek Volcanics.</p> 	<p>Figure 2.11 Aerial photograph near Mount Isa with 40 processing units (Turbowest and South 1995). The effect of air processing in this region is to highlight the subsurface drain-belt of blocks of Eastern Creek Volcanics.</p> 
<p>Figure 2.22 (this page and facing page) Set of aerobically dipping fault locations in the geometry of Cu mineralisation, silica alteration and host zone mineralisation, and the relationship to bedding and faults. From the 1995 MSA/AMM presentation.</p> 	<p>Figure 2.23 Metal zoning diagrams for the Blockade and Franciscan volcanics based on Davis (2004). See index diagrams below for location of data and sections. Diagrams show the distribution of elements in the Blockade and Franciscan volcanics in general. The diagrams are presented and locally stratified, but with a zoning grade boundary which is mostly consistent with the position of the Mount Isa belt. Pb/Zn/Cu ratios show pronounced zonation relative to the silica-sulfate alteration system, with the greatest highest near the silica alteration and progressively transitioning away to more Zn-rich mineralisation.</p> 
<p>Figure 2.24 (Facing page). Some representative photographs of Pb-Zn-Ag mineralisation.</p> 	<p>Figure 2.22 (this page and facing page) Set of aerobically dipping fault locations in the geometry of Cu mineralisation, silica alteration and host zone mineralisation, and the relationship to bedding and faults. From the 1995 MSA/AMM presentation.</p>  <p>Figure 2.23 Metal zoning diagrams for the Blockade and Franciscan volcanics based on Davis (2004). See index diagrams below for location of data and sections. Diagrams show the distribution of elements in the Blockade and Franciscan volcanics in general. The diagrams are presented and locally stratified, but with a zoning grade boundary which is mostly consistent with the position of the Mount Isa belt. Pb/Zn/Cu ratios show pronounced zonation relative to the silica-sulfate alteration system, with the greatest highest near the silica alteration and progressively transitioning away to more Zn-rich mineralisation.</p> 
22	23

Metal zoning and ore examples




Atlas of existing deposits and footprints



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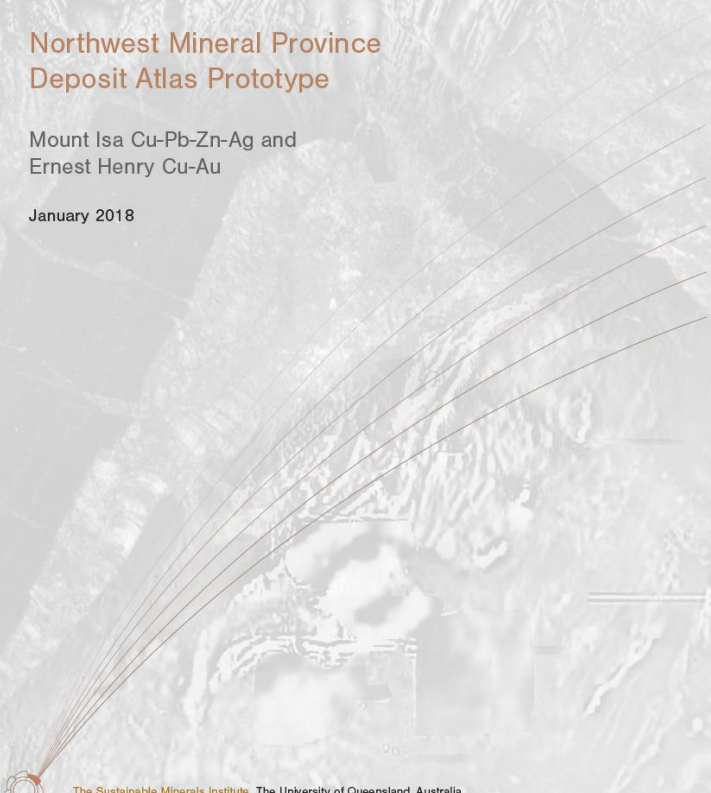



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Northwest Mineral Province Deposit Atlas Prototype

Mount Isa Cu-Pb-Zn-Ag and Ernest Henry Cu-Au

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Chapter 2 Mount Isa Mount Isa Chapter 2

Figure 2.19. Aerial photograph of Mount Isa with 3D processing applied (Lambert and Scott 1998). The effect of 3D processing in this region is to highlight the subsurface distribution of the Mt Isa Cu-Pb-Zn-Ag deposit.

Figure 2.20. Aerial photograph of Mount Isa with 3D processing applied (Lambert and Scott 1998). The effect of 3D processing in this region is to highlight the subsurface distribution of the Mt Isa Cu-Pb-Zn-Ag deposit.

Figure 2.21. Aerial photograph of Mount Isa with 3D processing applied (Lambert and Scott 1998). The effect of 3D processing in this region is to highlight the subsurface distribution of the Mt Isa Cu-Pb-Zn-Ag deposit.

Figure 2.22. (This page and facing page) Set of vertical cross-sections for the Mount Isa deposit, showing the geometry of Cu mineralisation, siliceous alteration, and high-sulphide concentrations, and the relationship to bedding and faults. From the Mount Isa Geology (Lambert and Scott 1998).

Figure 2.23. Metal zoning diagrams for the Mount Isa deposit, showing the distribution of Cu, Pb, Zn, and Ag. Diagrams are presented and locally shaded, but with a strong grid overlay which is mostly consistent with the position of the Mount Isa deposit.

Mineralogical and chemical summary zoning from Painter (2003) PhD Thesis - Figure 2.27

Chapter 2 Ernest Henry Ernest Henry Chapter 3

Figure 3.3. (Facing page) Geological interpretation map based on merged open file data, showing the distribution of mineralisation, siliceous alteration, and high-sulphide concentrations. The map is based on the Ernest Henry Geology (Lambert and Scott 1998) and the Ernest Henry Geology (Lambert and Scott 1998).


Figure 3.4. Composite aeromagnetic image showing 200m spaced and 50m spaced contours over the area surrounding Ernest Henry, colour shaded to the 10m magnetic intensity scale. The map is based on the Ernest Henry Geology (Lambert and Scott 1998) and the Ernest Henry Geology (Lambert and Scott 1998).

Figure 3.5. Composite aeromagnetic image showing 200m spaced and 50m spaced contours over the area surrounding Ernest Henry, colour shaded to the 10m magnetic intensity scale. The map is based on the Ernest Henry Geology (Lambert and Scott 1998) and the Ernest Henry Geology (Lambert and Scott 1998).

Updated solid geology




Atlas of existing deposits and footprints



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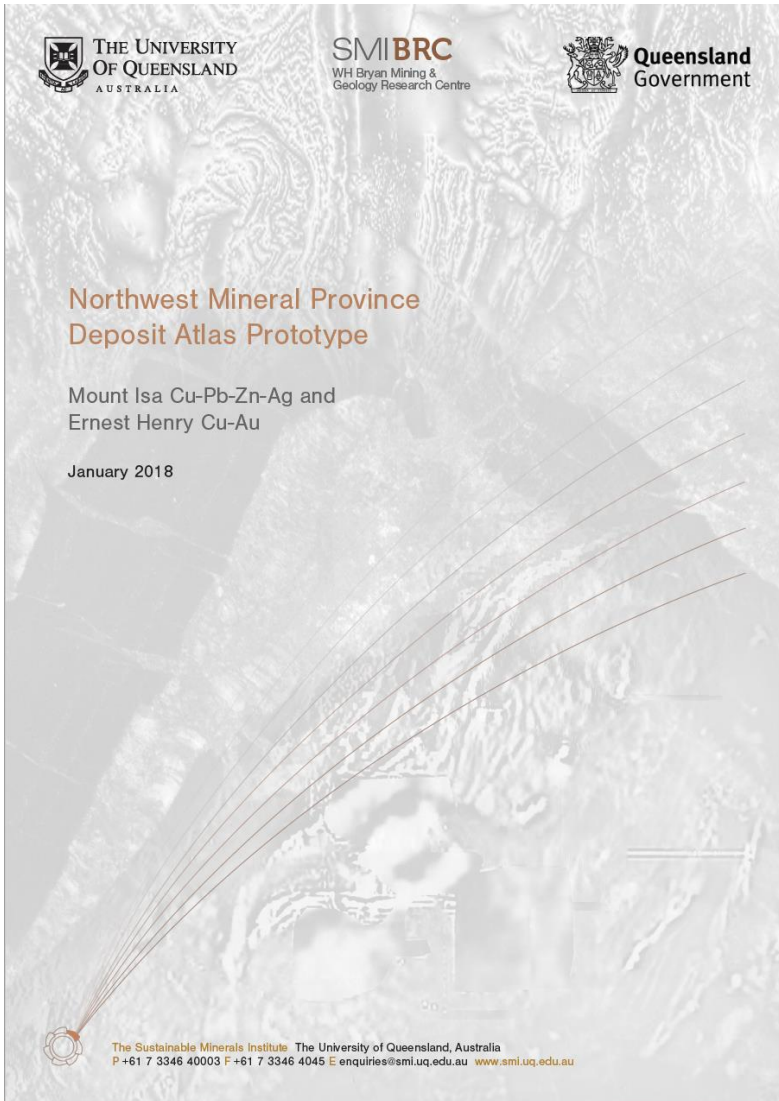



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Northwest Mineral Province Deposit Atlas Prototype

Mount Isa Cu-Pb-Zn-Ag and Ernest Henry Cu-Au

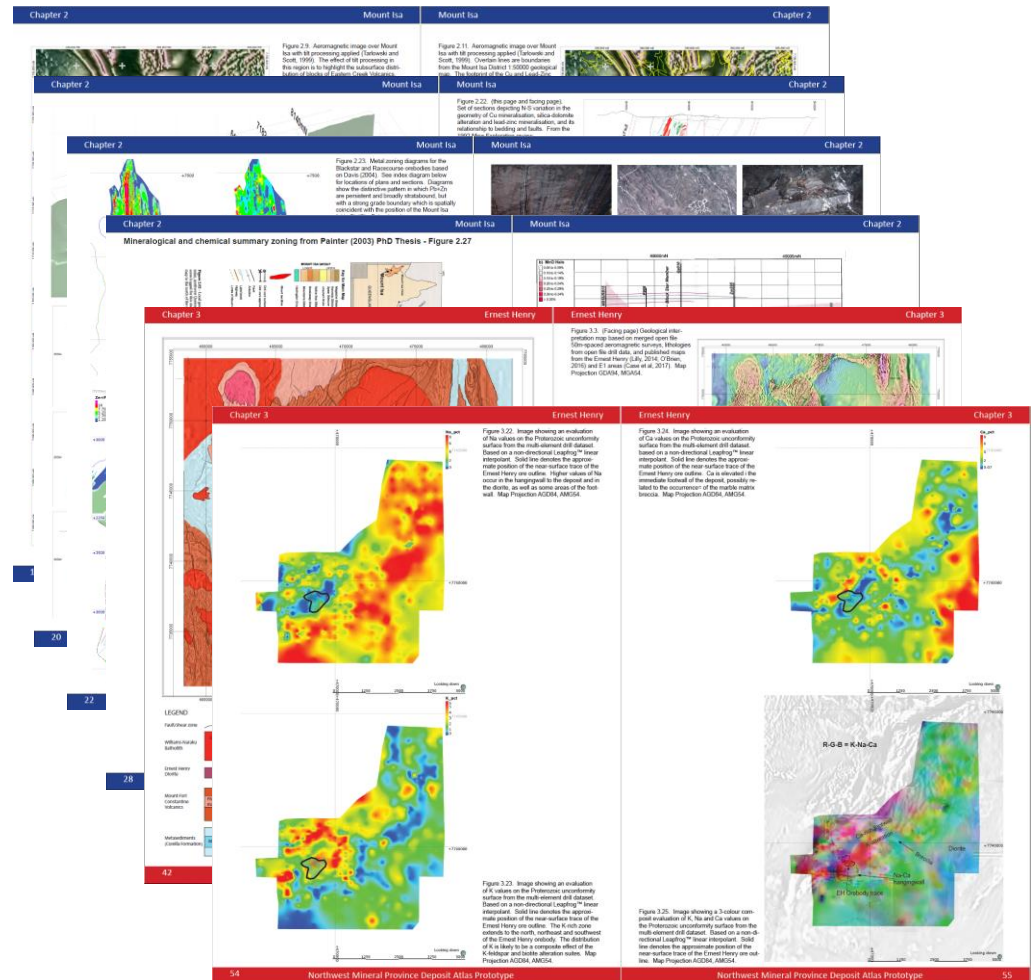
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Trace element zoning - plan




Atlas of existing deposits and footprints



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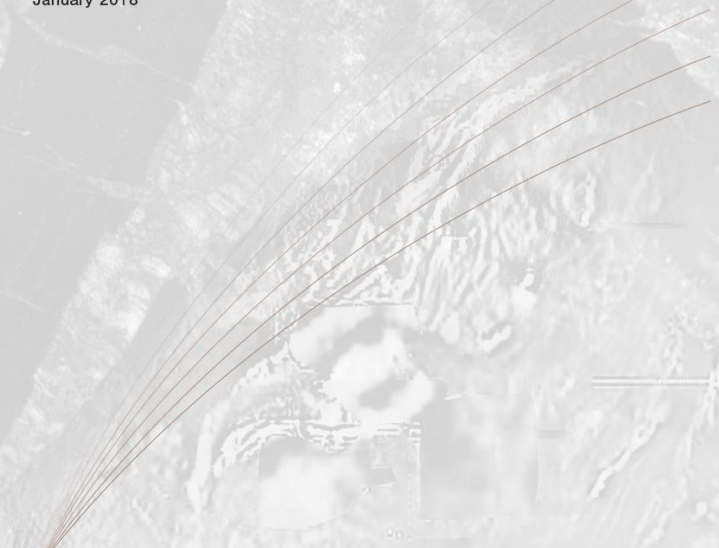


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Northwest Mineral Province Deposit Atlas Prototype

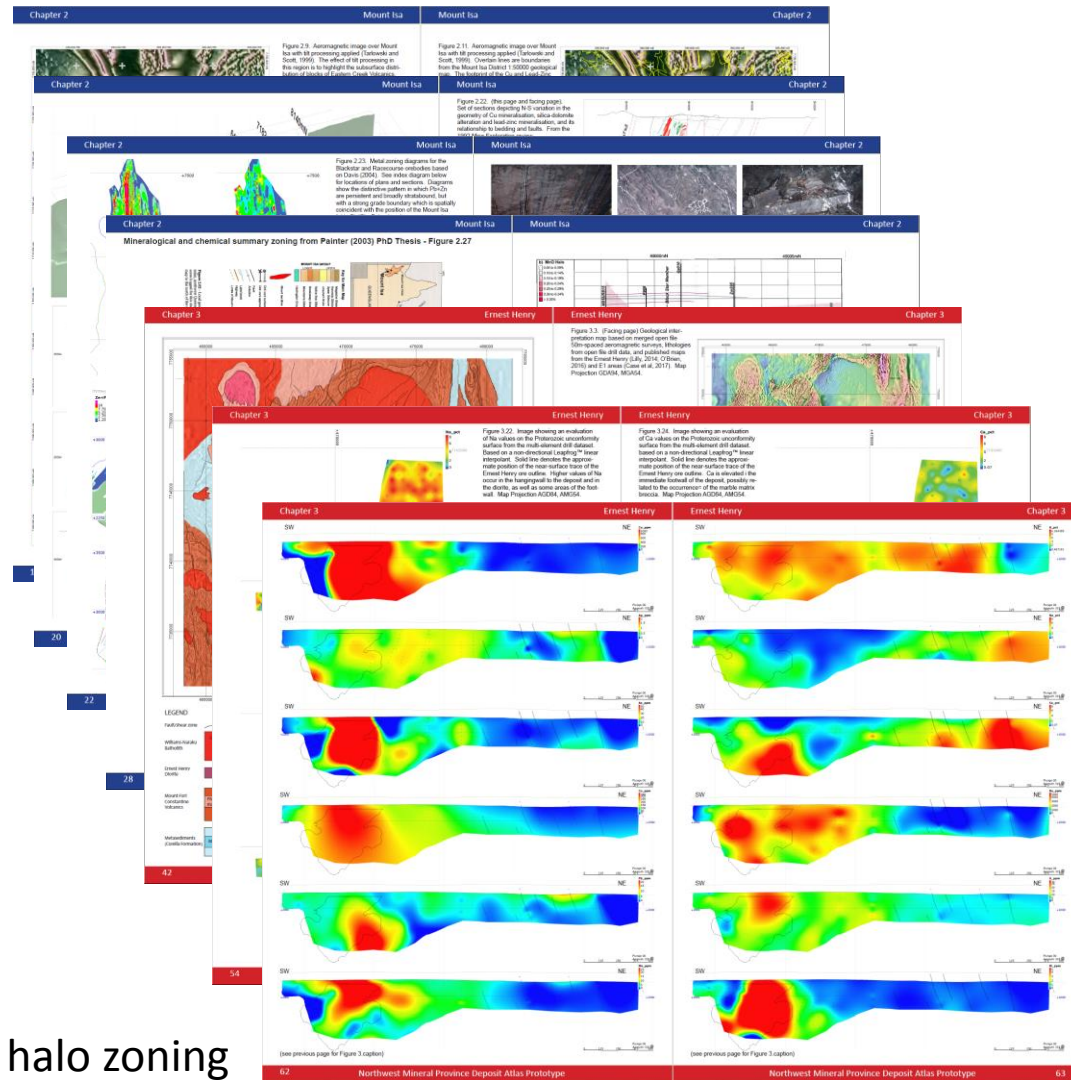
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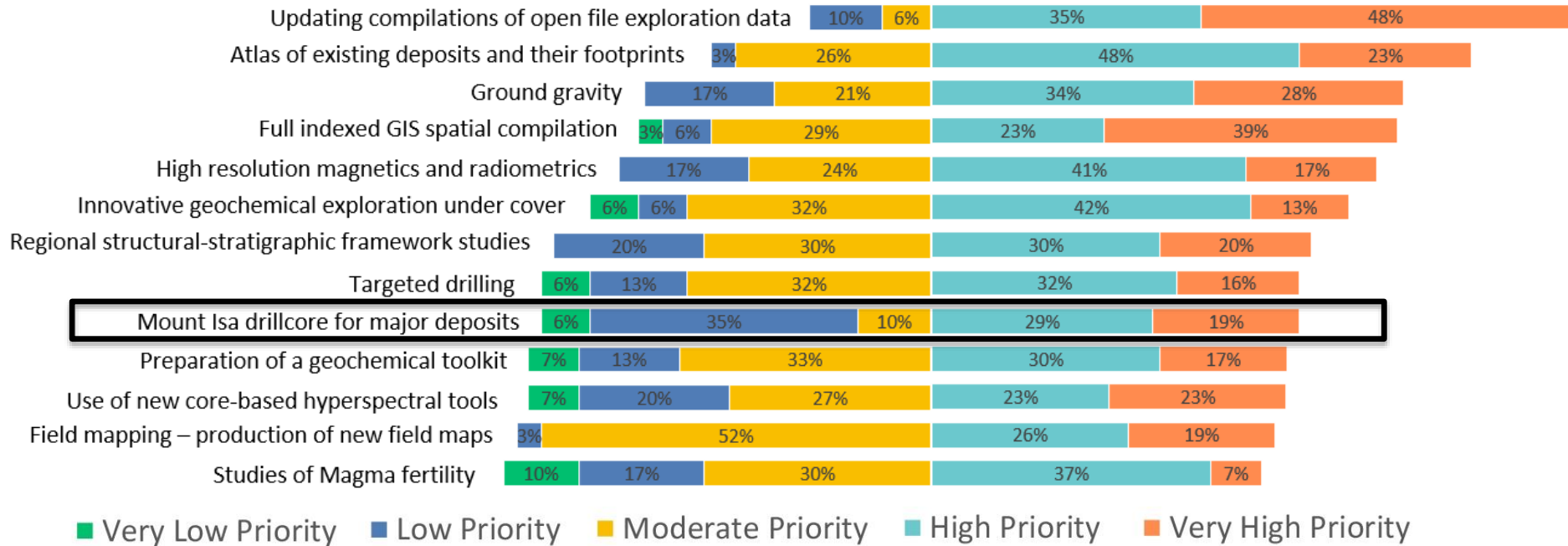


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Inner halo zoning



Mount Isa Region Drillcore Collection

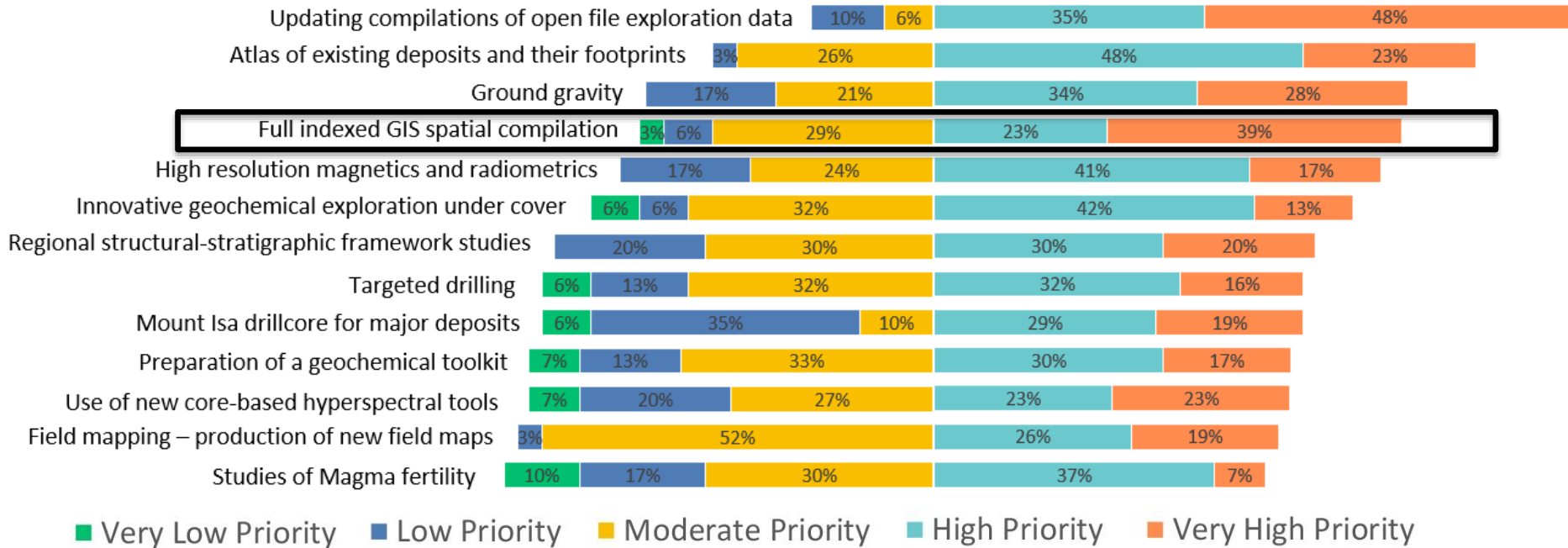


Mount Isa drillcore repository

- Key resource for explorers in the region
- Representative core and accompanying information all major deposits
- Collection under way



Full indexed spatial data compilation



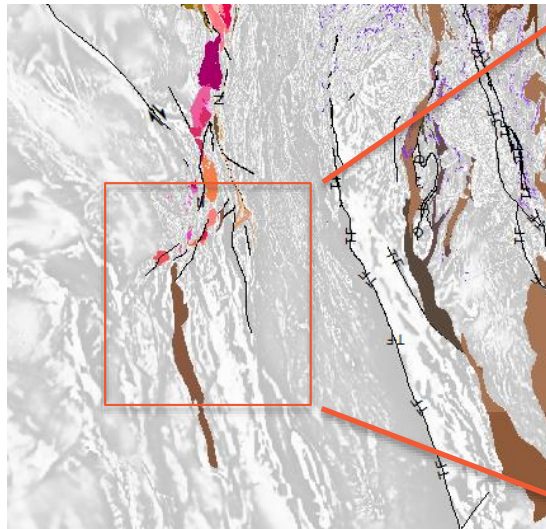
Full indexed GIS spatial compilation

- Faceted spatial data index
- Updated time-space chart
- GIS time-sliced stratigraphy, structure, igneous events
- 2D isopachs/depths from existing 3D models
- Exploration target compilation
- Compilation of miscellaneous legacy datasets
 - Metamorphic map
 - NABRE sections
 - CRC LEME regolith maps
 - Others as available
- Update of solid geology interpretation where justified



Faceted spatial data index

- Full compilation of reports, theses, publications, etc
- Categorised by study focus, data type, mineralisation style,...
- Spatially indexed
- Faceted search by theme



Data type	
GIS	5
Raster	3
Report	8
Thesis	2
Article	7
Map	2
3D Model	1
Study focus general	
Stratigraphy	2
Structure	3
Geochemistry	4
Geophysics	6
Prospectivity	1



✕ GIS

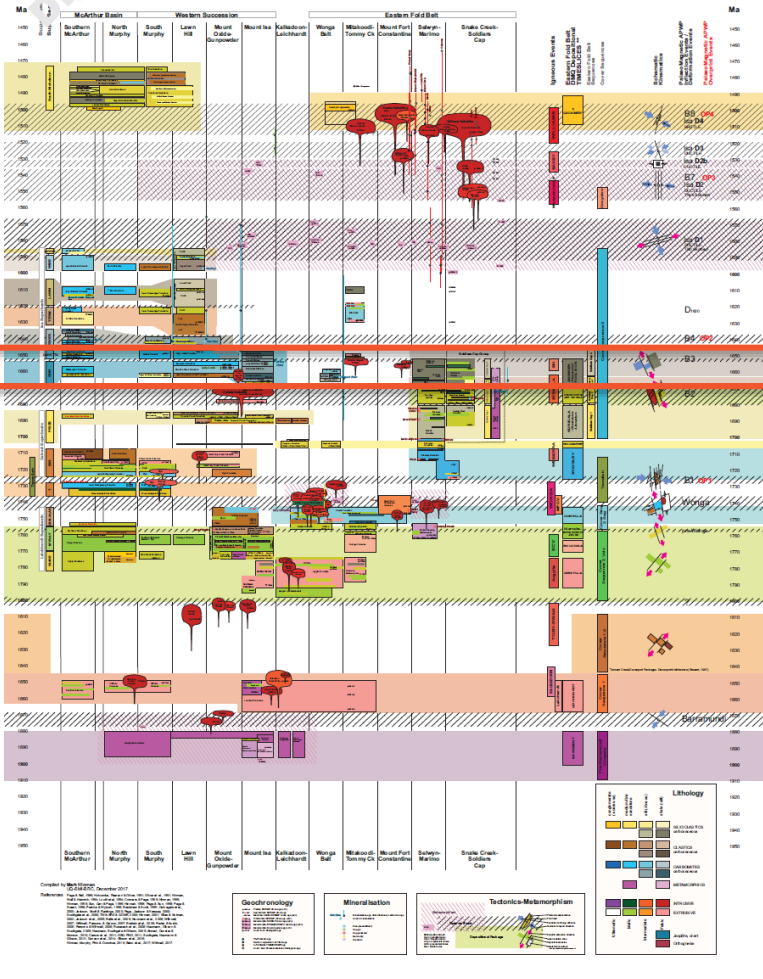
✕ Prospectivity



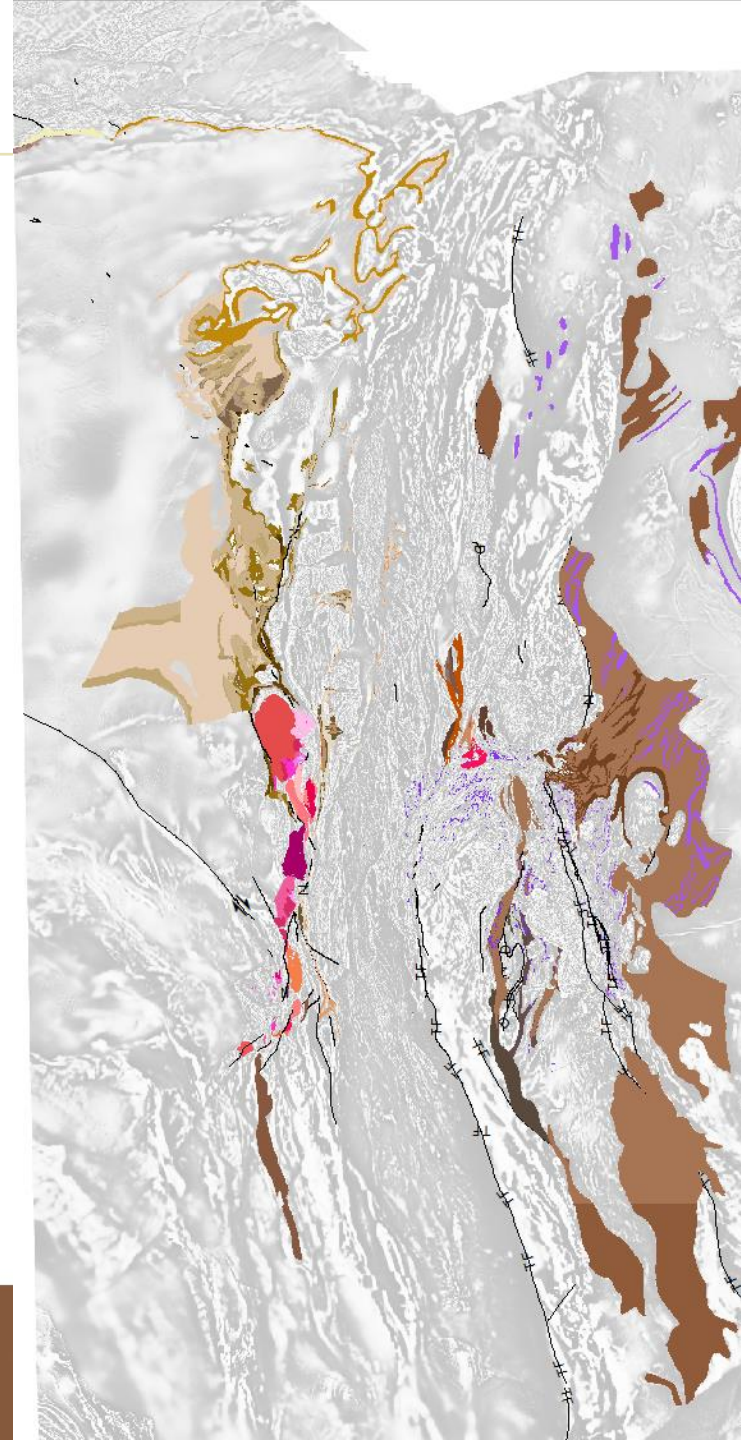
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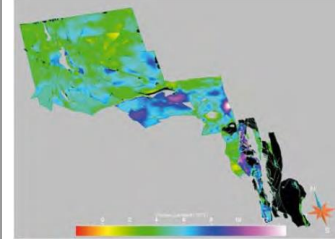
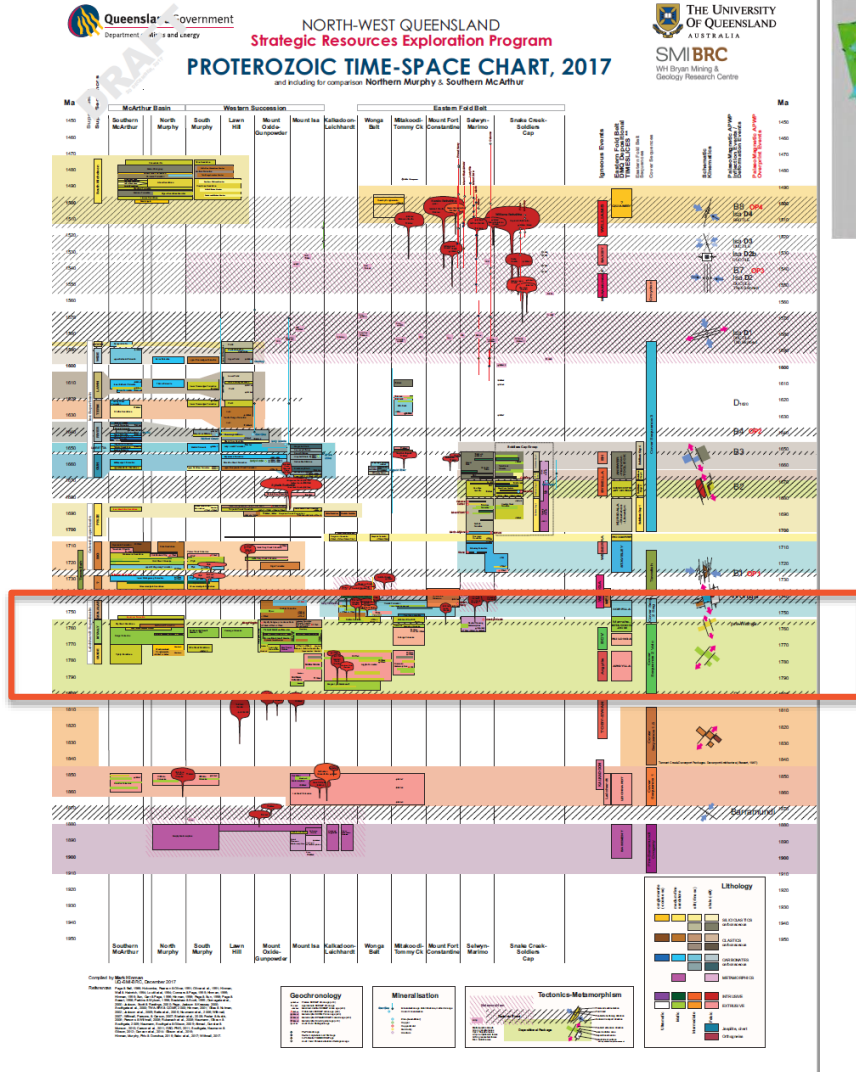
Updated time-space chart



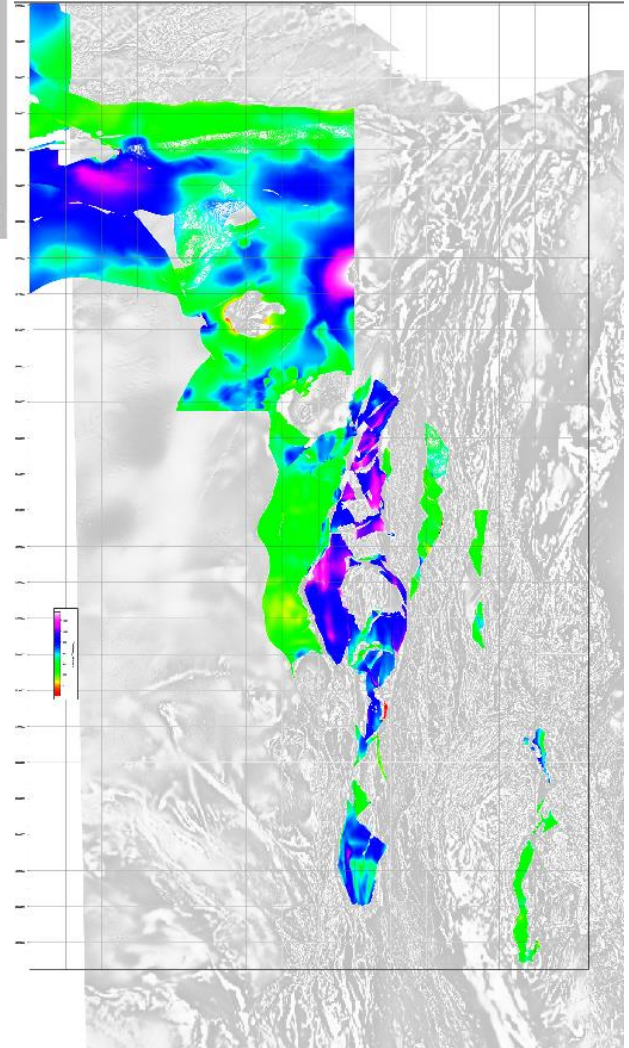
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2D isopachs/depths from existing 3D models



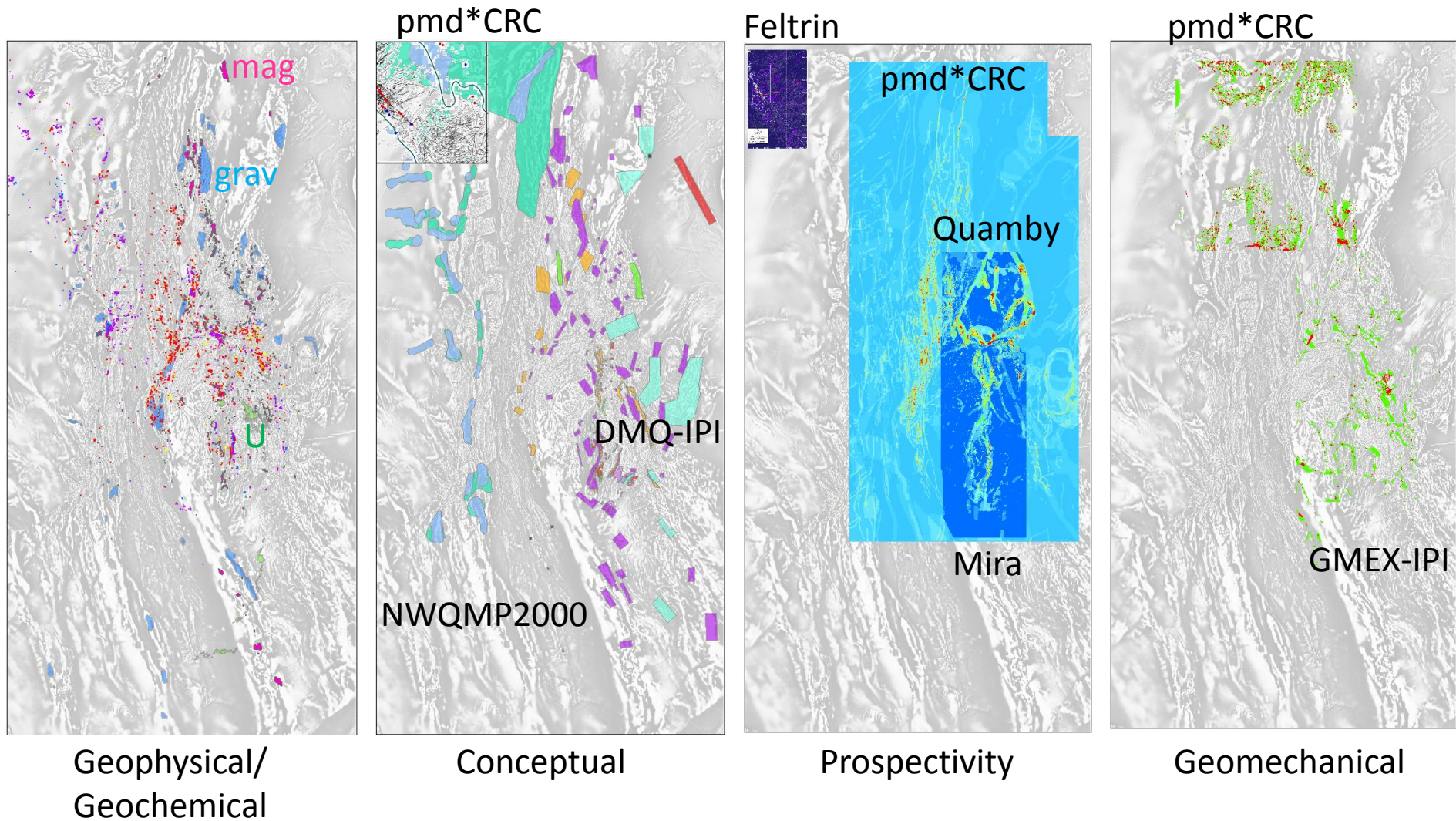
*pmd*CRC I7 report*



Pmd*CRC – Thickness Leichhardt Superbasin



Exploration target compilation



Current Status and Next Steps

- **Current Status**
 - Time-space compilation complete
 - Atlas Prototype complete
 - Target compilation complete
 - Spatial data index well progressed
 - Core collection under way
 - Legacy datasets near completion
 - Solid geology updates under way
- **Next Steps**
 - Expand Atlas Prototype (Mt Isa/EH) to full atlas of all deposits
 - Full core collection
 - Additional studies based on gap analysis

