Integrated Exploration Platform:
Software Tools for *Multidata Visualisation* and *Integrated Interpretation*.

The Centre for Exploration Targeting (CET)

*(**Jason C. Wong,** Eun-Jung Holden, Peter Kovesi, David Nathan, Daniel Wedge)*

The Geological Survey of Western Australia (GSWA)

(Ian Tyler, Klaus Gessner, Ruth Murdie)

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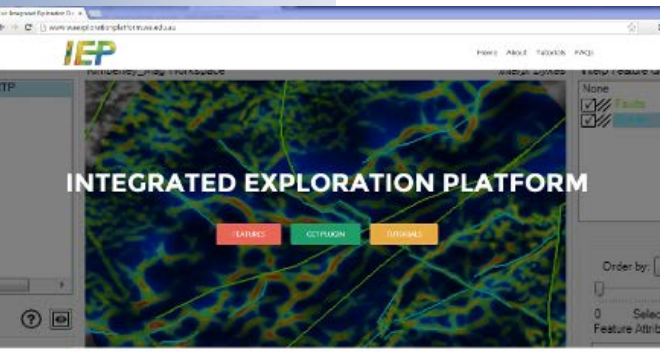
Geological Survey of Western Australia

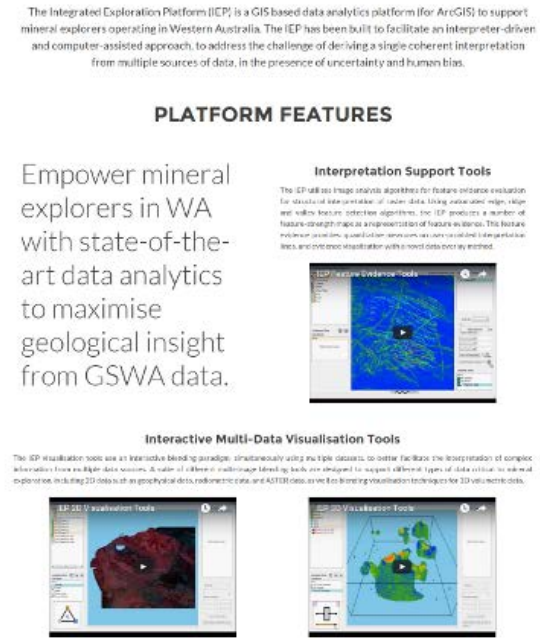
Talk Outline

i. Launch: Integrated Exploration Platform.
ii. Overview of the IEP.
    - Multidata Visualisation Tools
    - Feature Evidence Feedback Tools
iii. ArcGIS Workflow with the IEP.
iv. On-going Work.
v. Questions.

The Launch of the IEP

First Public Version - Free

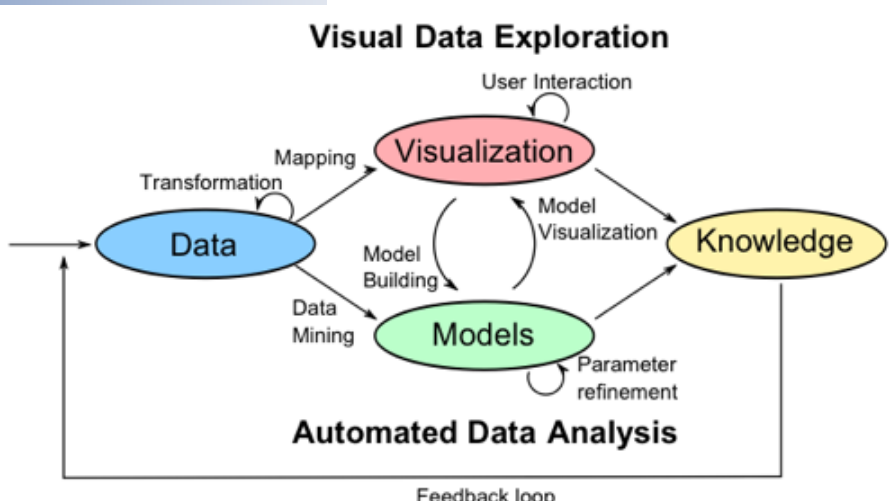




- The first public version of the *IEP* is available today http://www.WAExplorationPlatform.com (Geolocked to datasets within WA).
- Software toolset for ArcGIS with a novel **computer-assisted and interpreter-driven** approach to integrated multidata interpretation.
- Will continue to evolve based on industry feedback and suggestions, in order to continue in adapting to the needs of the industry.

Sponsored by the *Geological Survey of WA (GSWA)* in the *Exploration Incentive Scheme (EIS),* and *Australian Research Council (ARC) linkage grant (LP140100267).*

The Integrated Exploration Platform



Thomas, J., Cook, K.:
Illuminating the Path: Research and Development Agenda for Visual Analytics. IEEE-Press (2005)

1. *Visualisation tools to support multiple 2D and 3D data (A suite of blenders).*

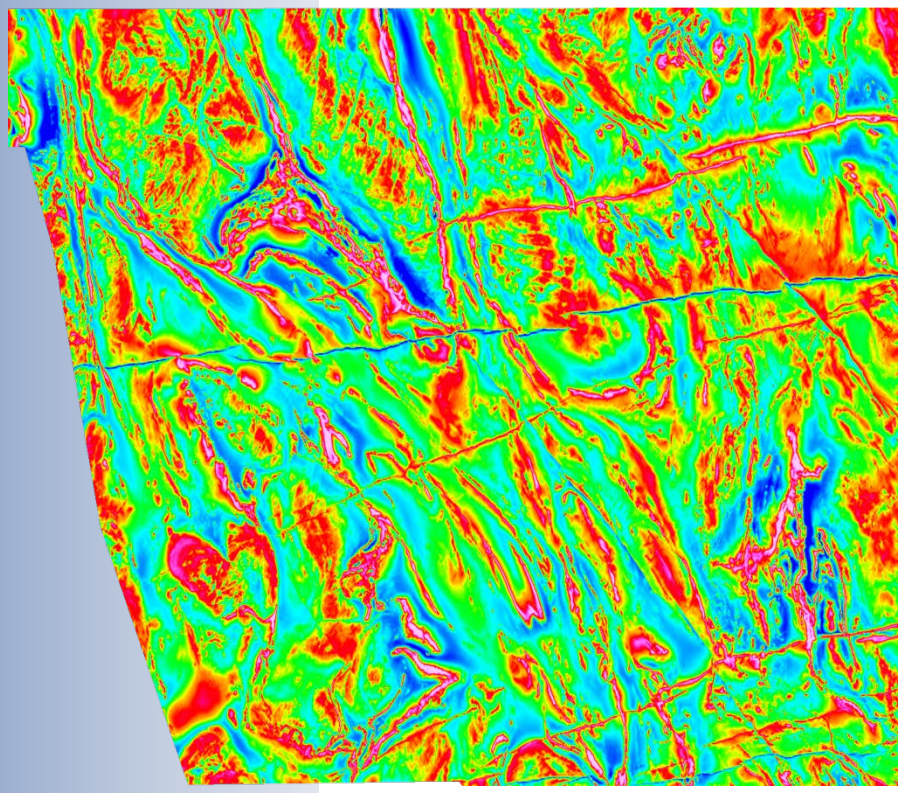
2. *Intelligent interpretation support tools (feature evidence toward quantifying confidence).*

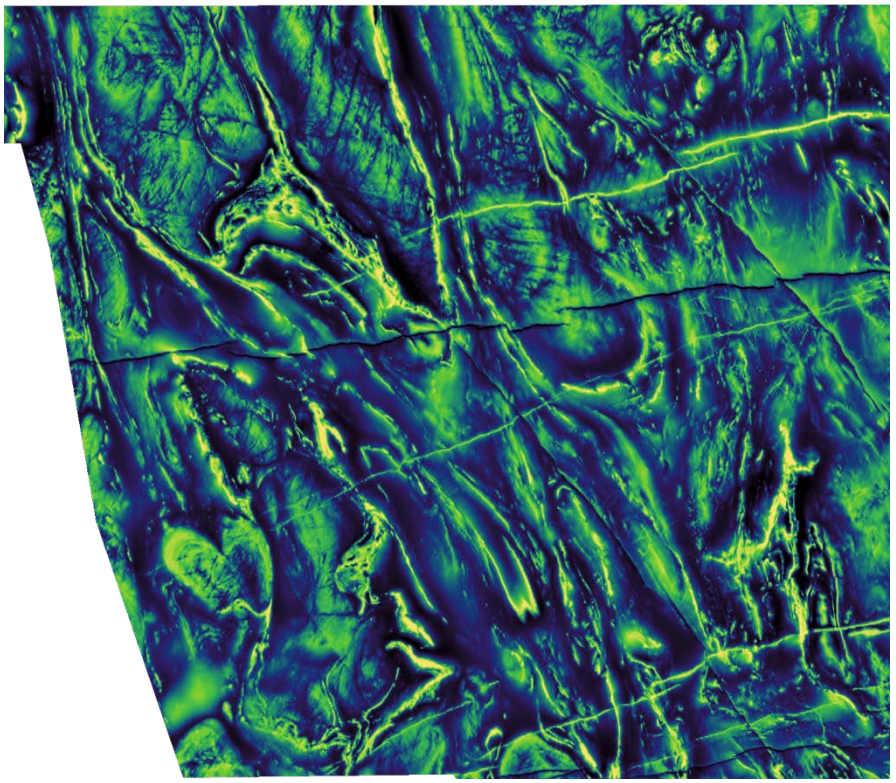
Multidata Visualisation Tools

1. Human perception sensitive **colour maps**
   - Reduce bias from the human visual system.
2. The Dynamic Range Compression **filter**
   - High pass filtering and data range compression for enhanced display of high-dynamic-range data.
3. A suite of **blending tools**
   - Interactive visualisation of multiple layers of data simultaneously.

1. Visualisation Tools in the IEP

Human Perception Sensitive Colour Maps



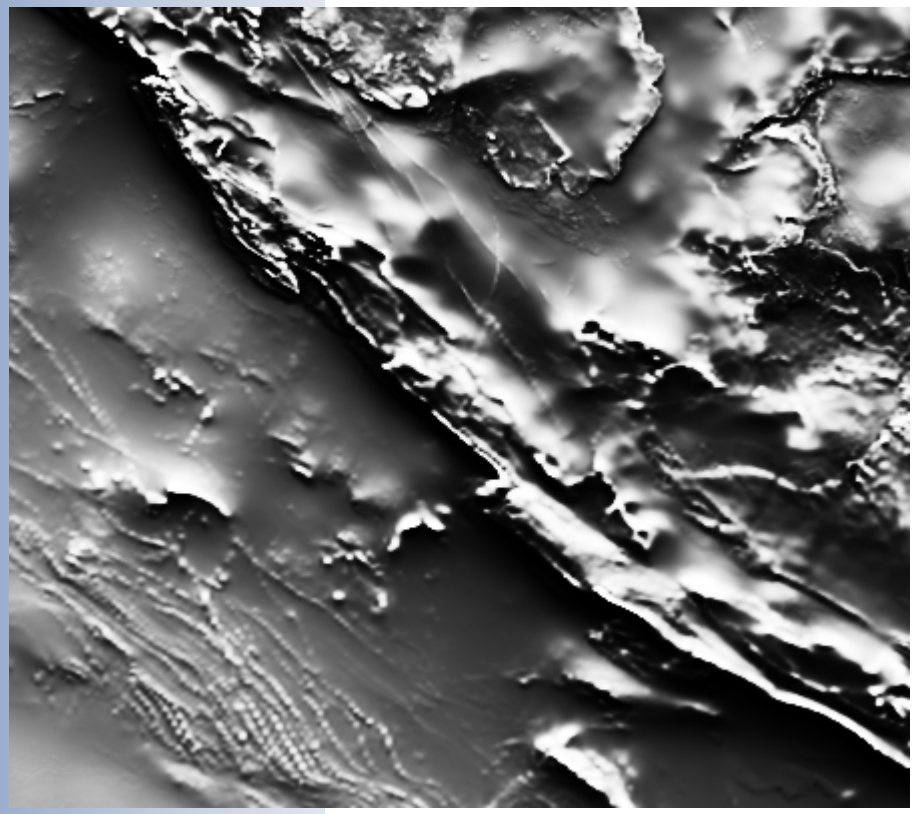


A default rainbow colour map Vs Perceptually uniform map

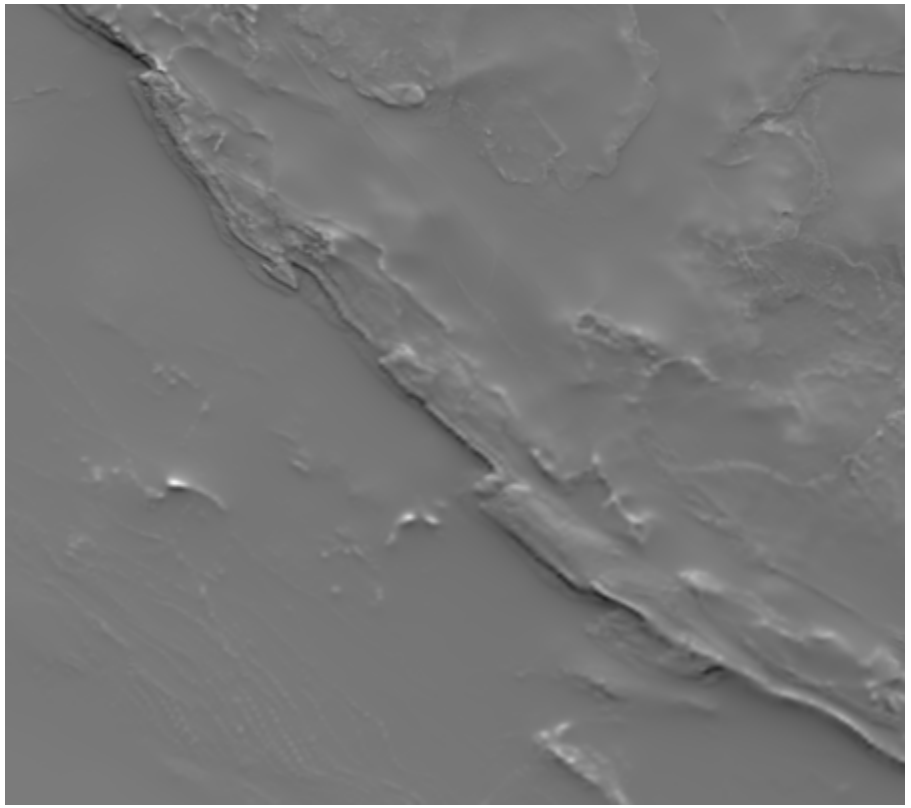
Kovesi, P. 2015. **[*Good Colour Maps: How to Design them*]**

2. Visualisation: Working with Signal Compression

- Geophysical data (e.g. magnetic data), can have a large range of values that cannot be displayed natively on computer screens – *Signal Compression*.

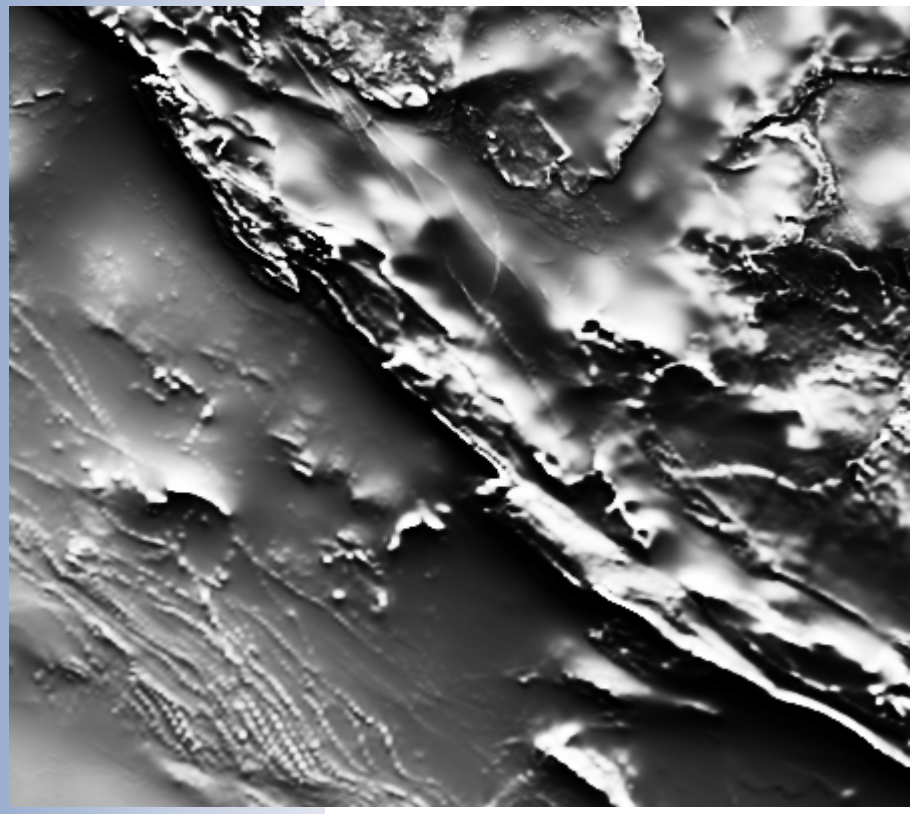


Histogram Equalisation

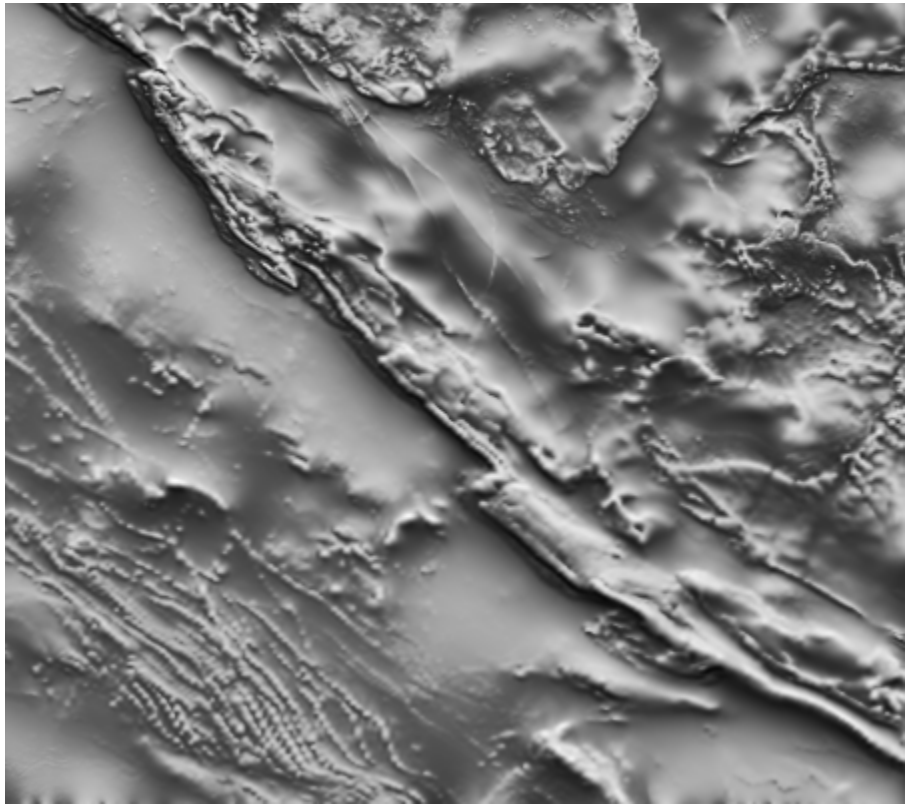


Linear Normalisation

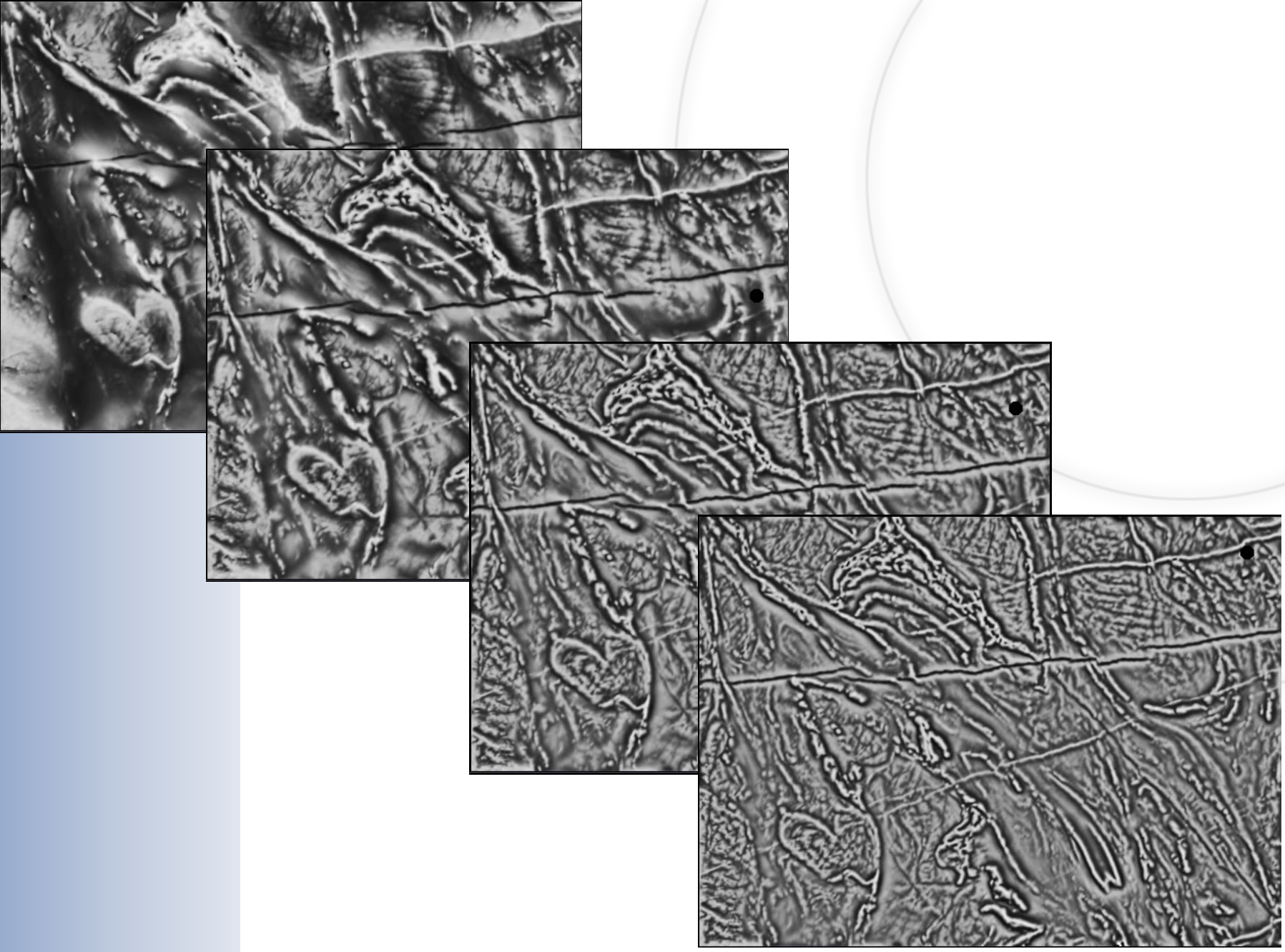
2. Visualisation: Working with Signal Compression



Histogram Equalisation



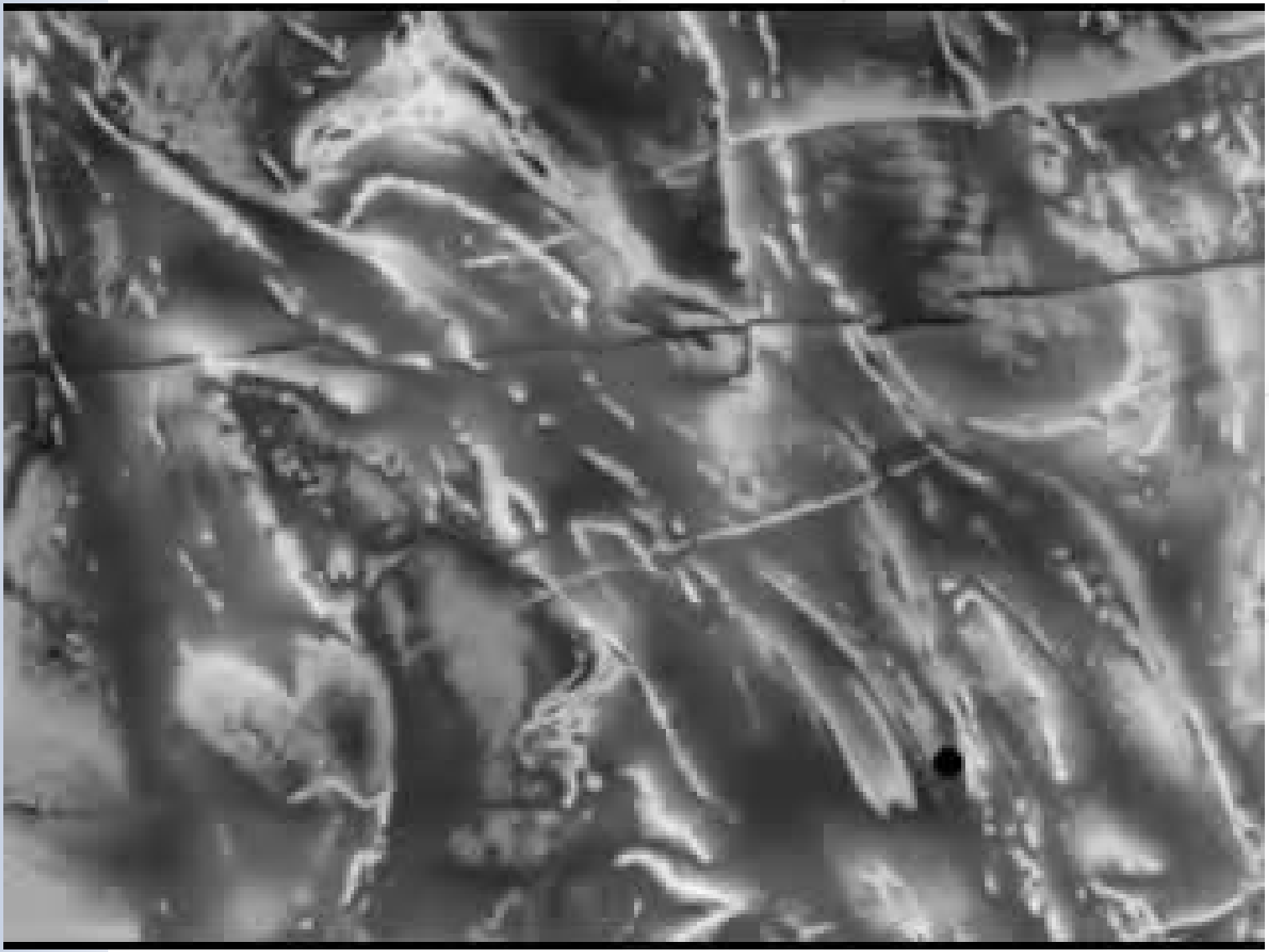
Dynamic Range Compression
(*Kovesi, P.* 2012)



Kovesi, P. 2012. **[*Phase Preserving Tone Mapping of Non-Photographic High Dynamic Range Images*]**

3. Visualisation Tools in the IEP

Blending DRC Filter Results



frequencies

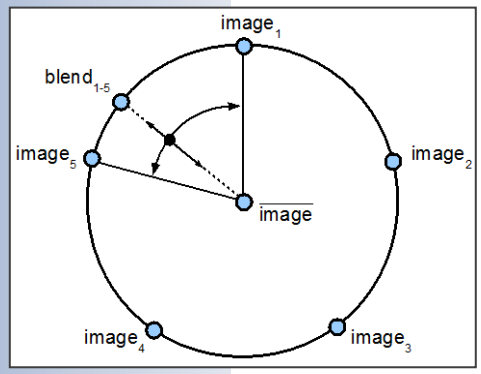
Gravity Data

Magnetic data courtesy of Fugro Airborne Surveys Pty Ltd.

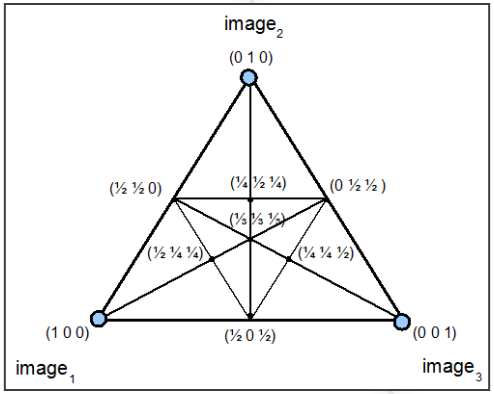
Magnetic Data

3. Visualisation Tools in the IEP

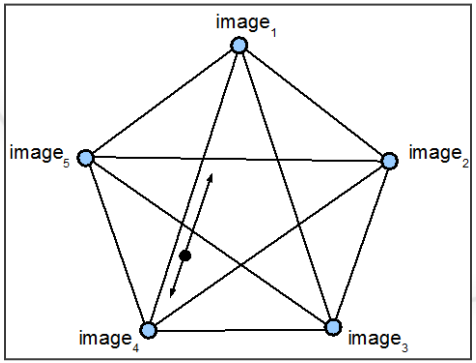
2D Data Blenders



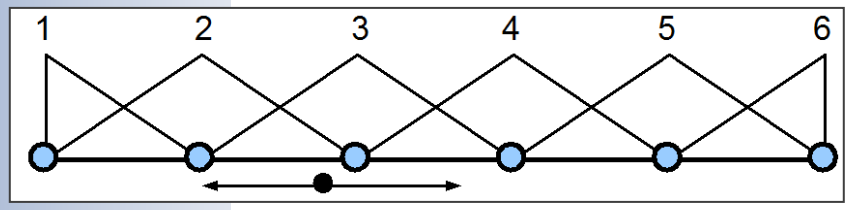
Circle Blender



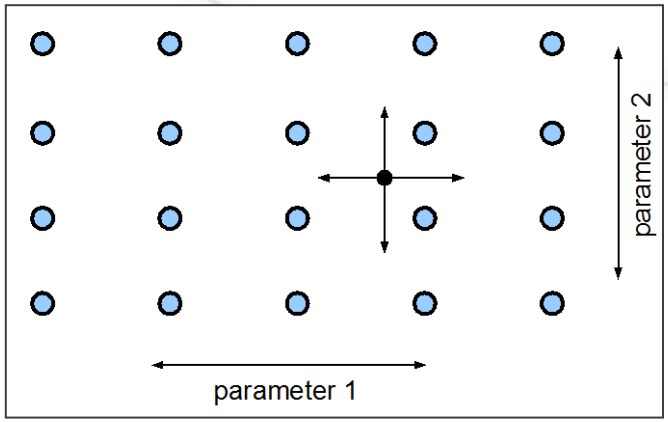
Barycentric Triangle Blender



Clique Blender



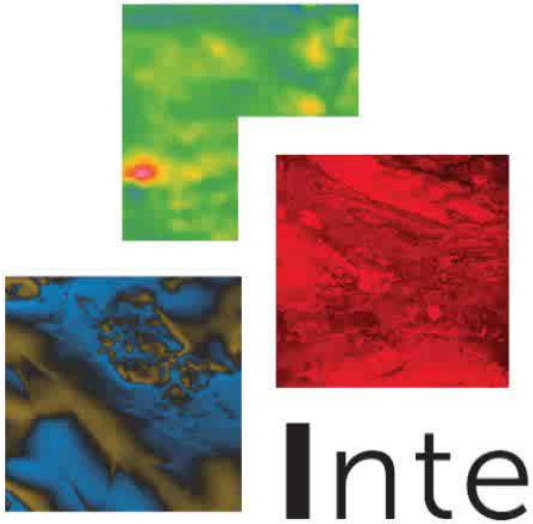
Linear Blender



Bilinear Blender

Kovesi et al. 2014. **[*Interactive Multi-Image Blending for Visualization and Interpretation*]**

3. IEP 2D Data Blenders



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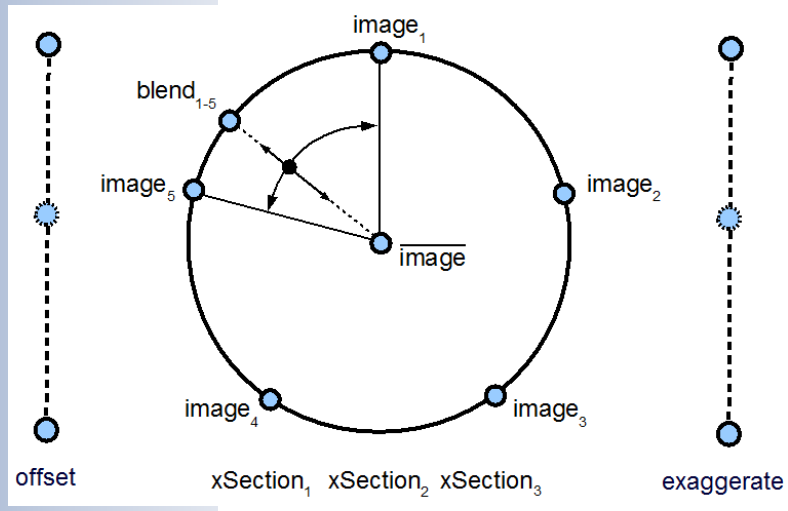
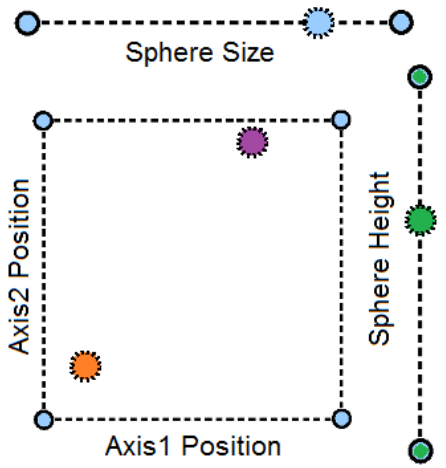
3. Visualisation Tools in the IEP

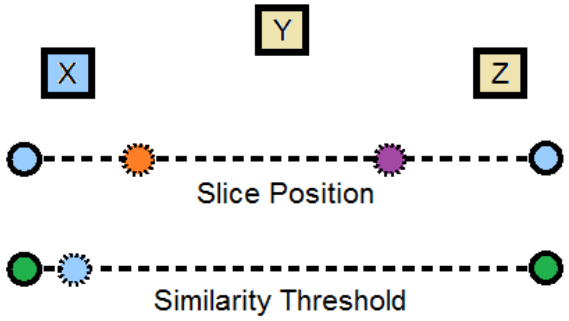
3D Data Blenders



Cross-section Data Blender

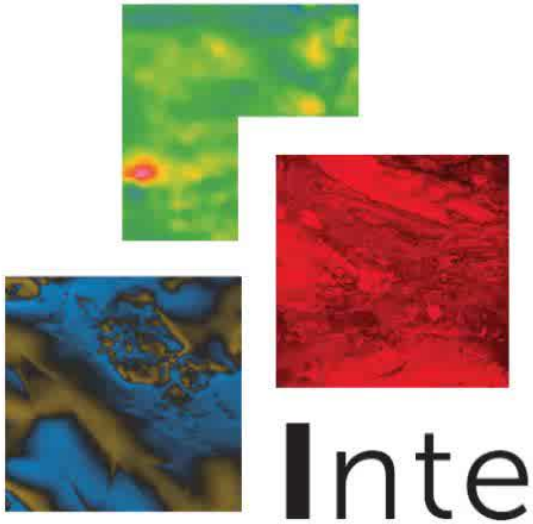


Single Volume Blender:
Sphere Data Mode



Dual Volume Blender:
Slice Similarity Mode

3. IEP 3D Data Blenders



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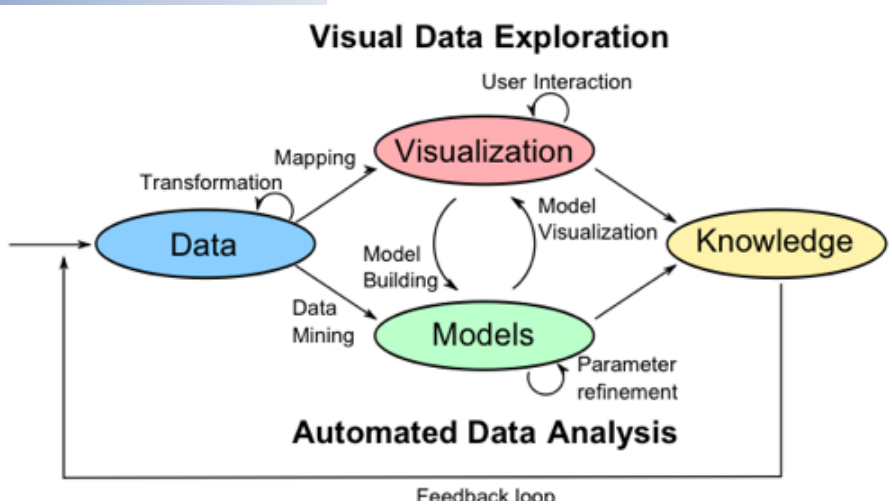
The Integrated Exploration Platform



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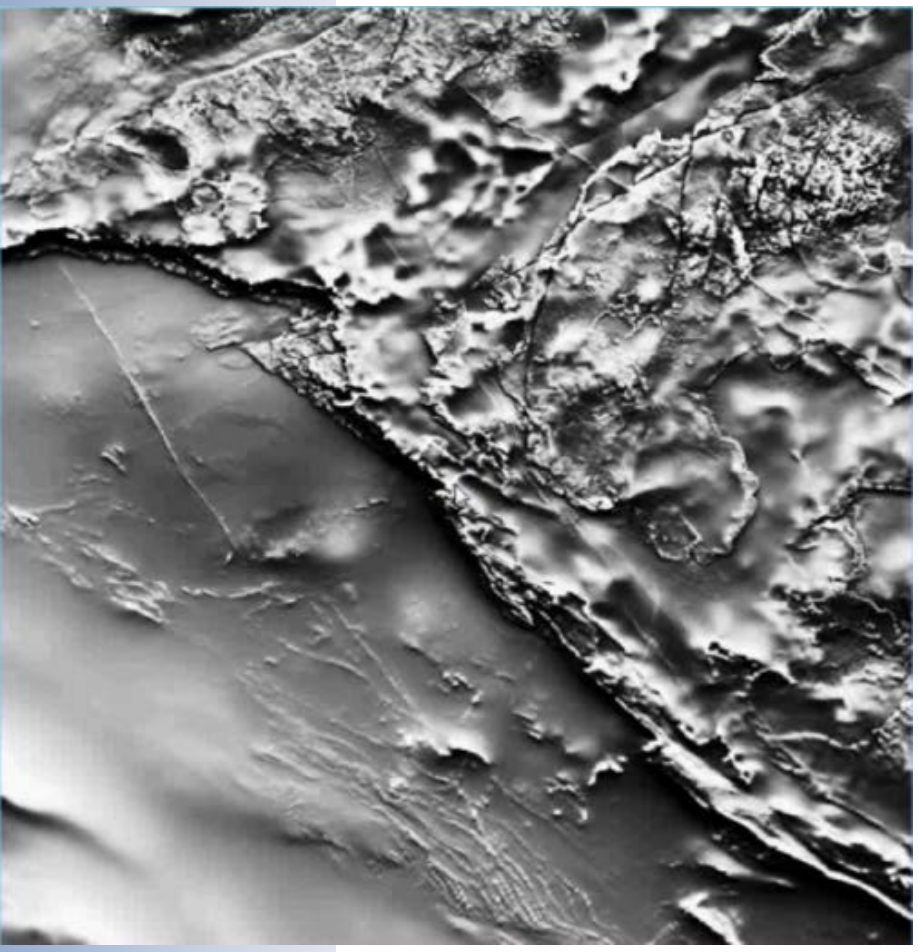
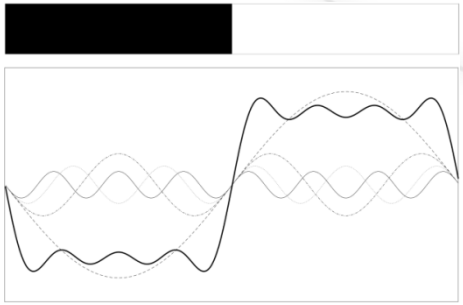
Structural Interpretation of Magnetic Data

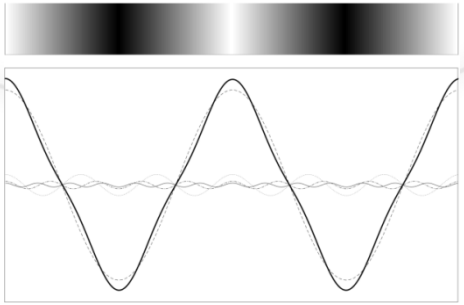


GSWA magnetic data (RTP-DRC) from West Kimberley

- For structural interpretation, interpreter seeks discontinuities (edges, ridges, valleys).



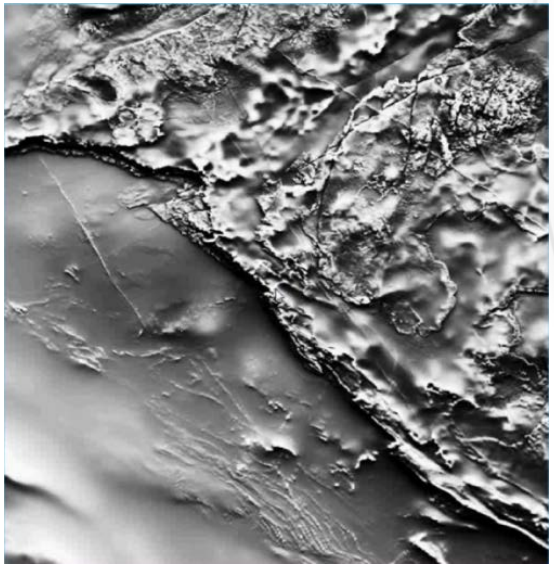
Edge Signal

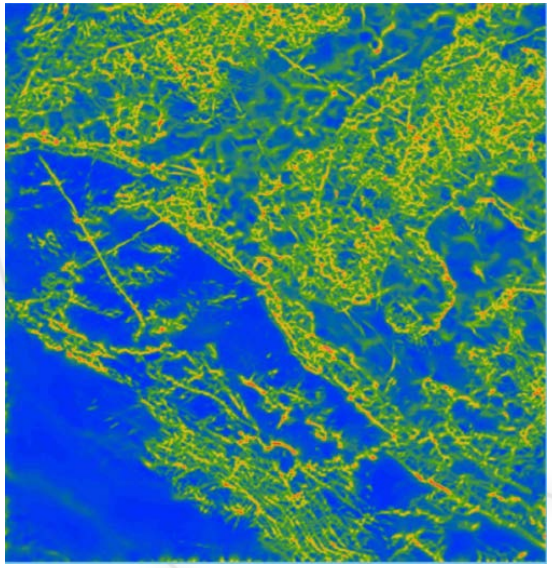


Valley/Ridge Signal

Feature Evidence Tools in the IEP

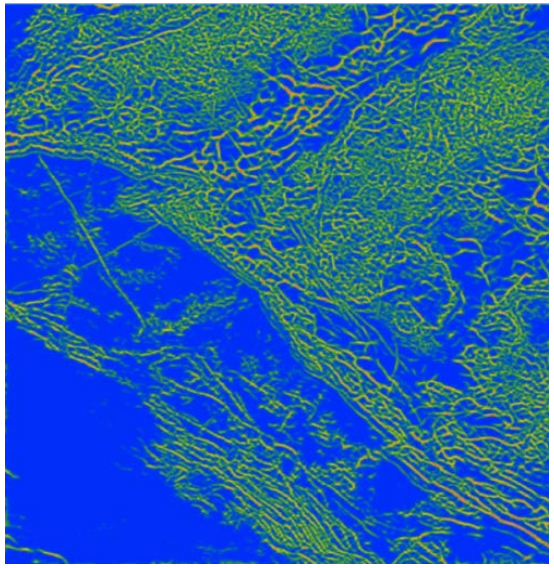
Magnetic data

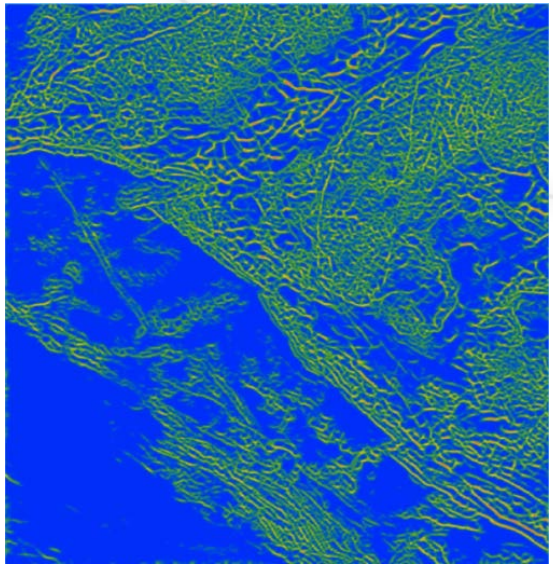




Edge strength map
(Phase Congruency)

Ridge strength map
(+ve Phase Symmetry)





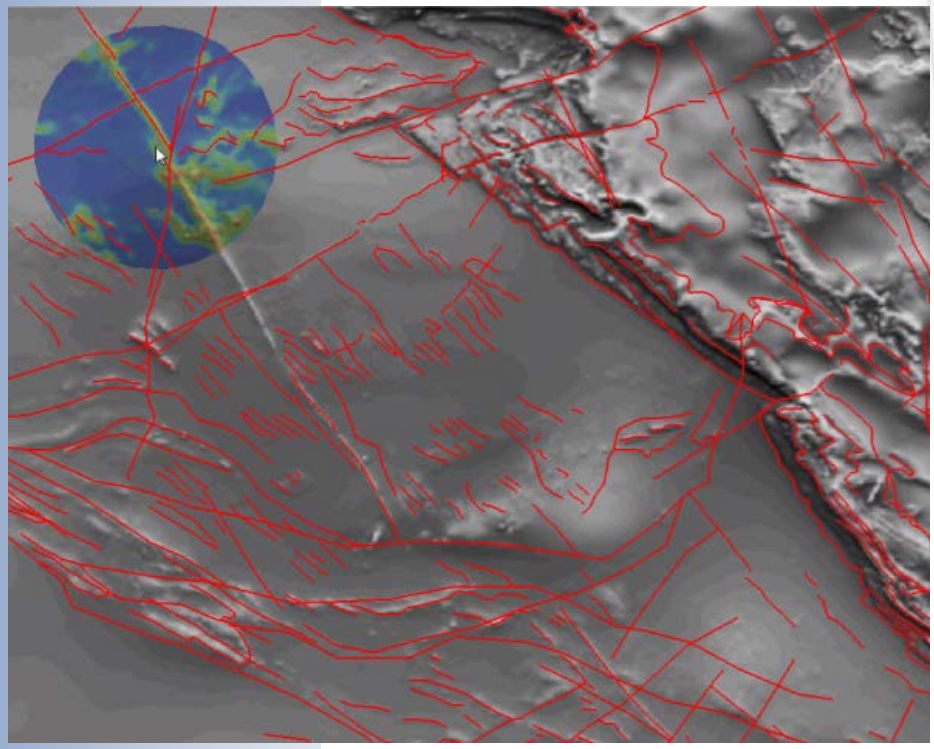
Valley strength map
(-ve Phase Symmetry)

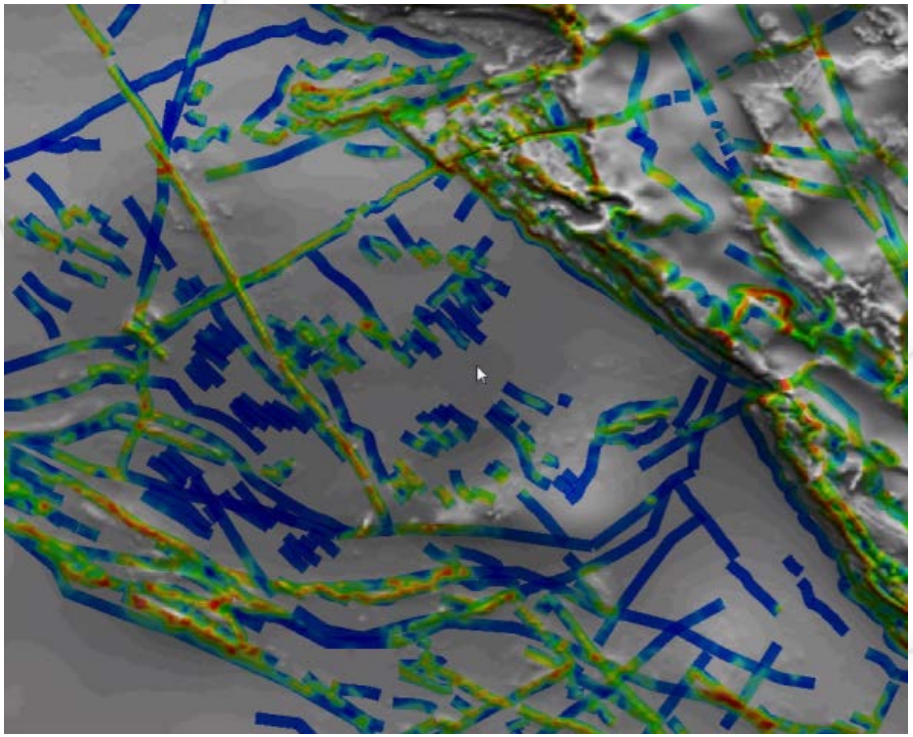
CET Grid Analysis Extension (for Geosoft Oasis Montaj)

http://www.geosoft.com/pinfo/partners/CETgridanalysis.asp

Feature Evidence Tools in the IEP

Visualising Evidence

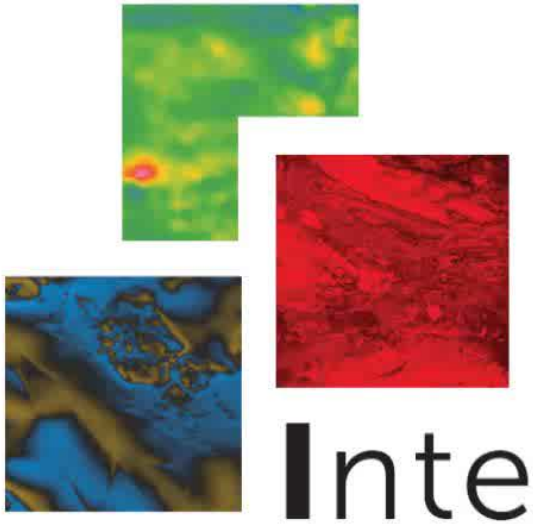




- A spell-checker equivalent for interpretation.
  - Visual feedback on data evidence.
  - Quantitative measure of feature evidence.

Holden et al. 2016.
[***Improving assessment of geological structure interpretation of magnetic data: An advanced data analytics approach***]

IEP Feature Evidence Tools



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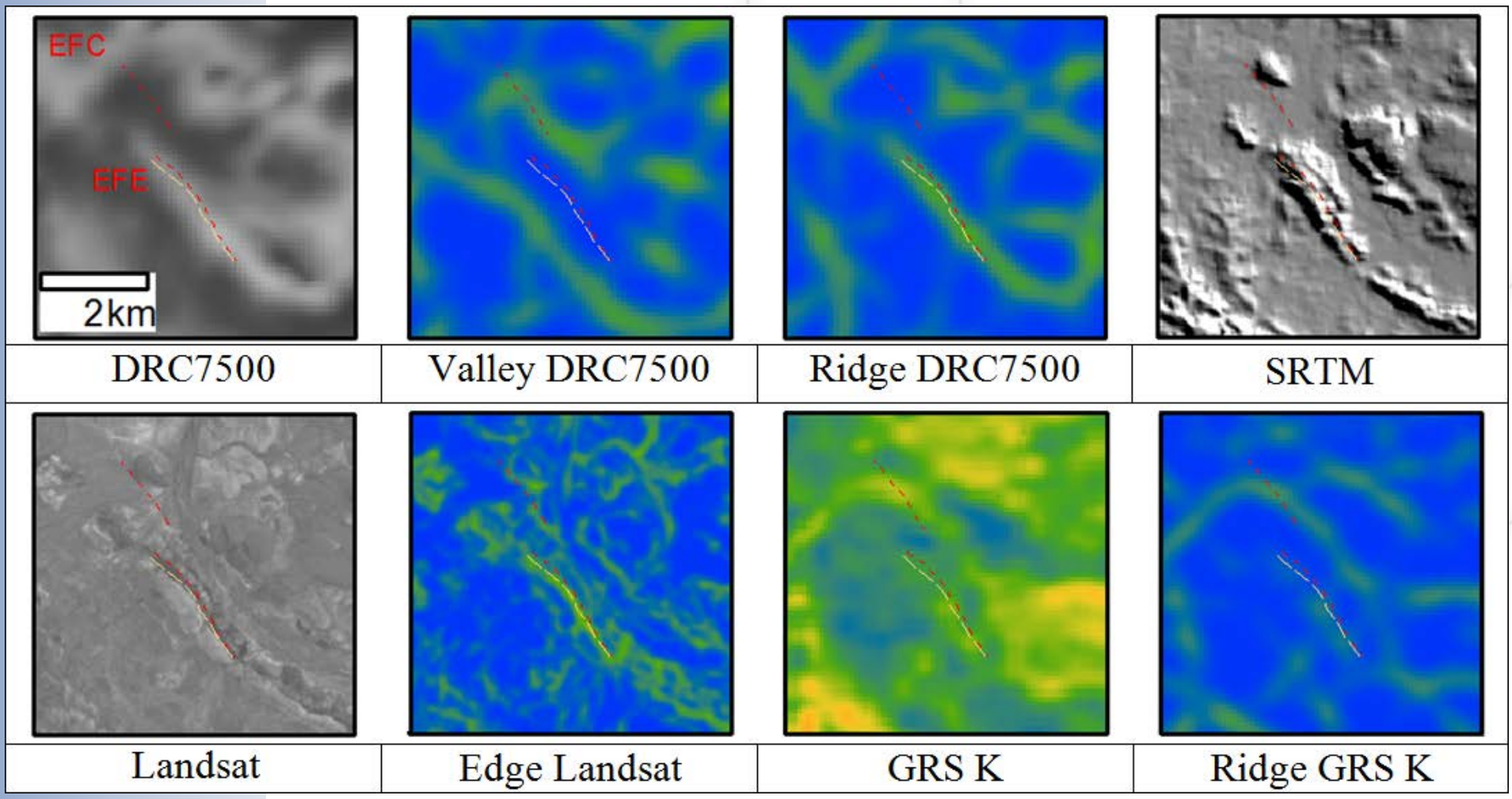
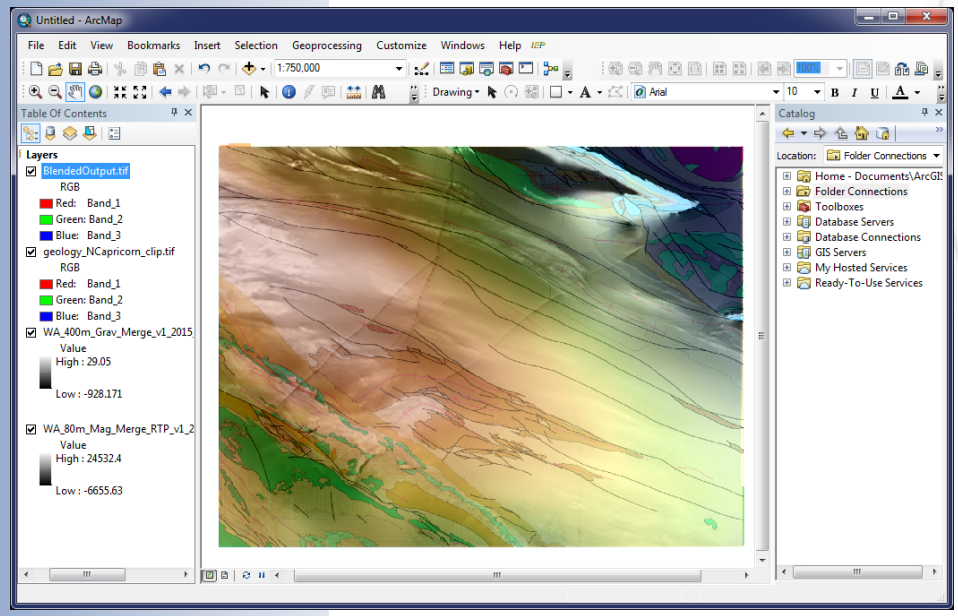
Feature Evidence Tools in the IEP

Using Evidence



An example of using multidata evidence to realign (in yellow) one of the original structural interpretation (red dashed lines).

ArcGIS Workflow with the IEP

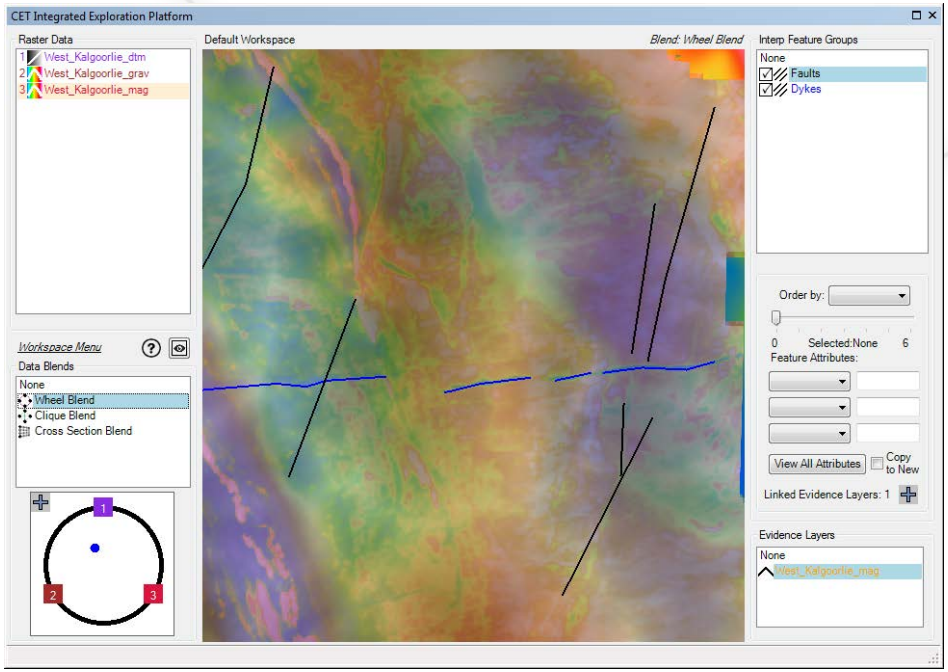


ArcMap

- Export Blends as GeoTIFFs
- Save Interpretations as Shapefiles

- Load GeoTIFF and grid datasets
- Load Interpretation Shapefiles

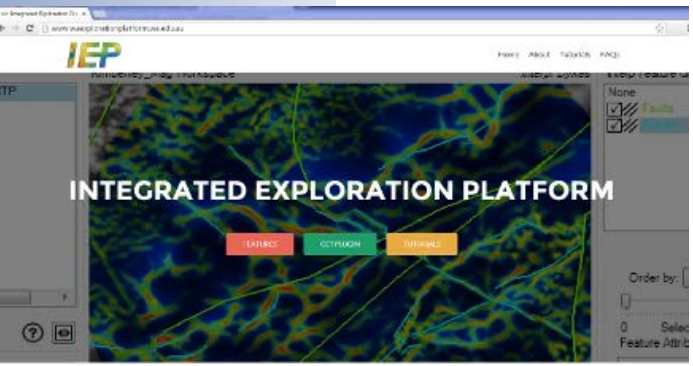
IEP

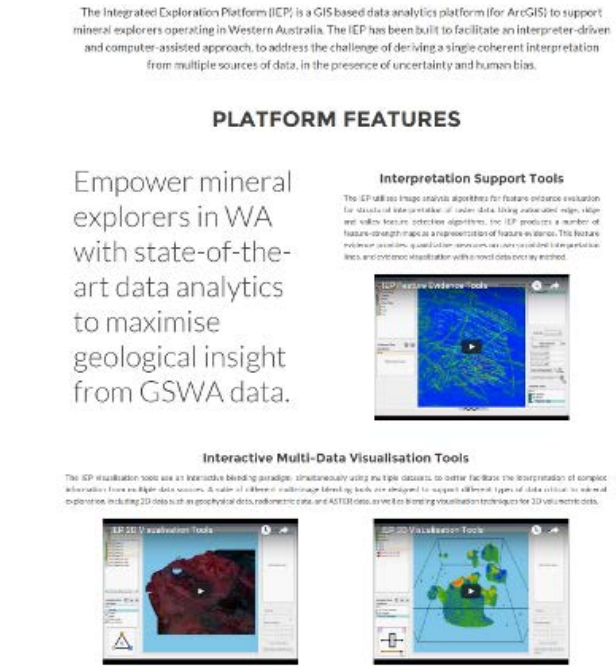


On-going Work

- Improving the interface for better useability and flexibility to different workflows.
- Next phase of interpretation support tools.
  - Lithology and texture analysis.
- More advanced tools dealing with 2D and 3D datasets (for example):
  - Exporting voxel subsets.
  - Importing 3D surfaces.
  - Custom colour maps.
  - Custom data stretches.

The Integrated Exploration Platform





- Register and download the IEP at http://www.WAExplorationPlatform.com
- Demo space with the IEP on the show floor.
- Two posters on the IEP tools for visualisation and feature evidence.

Thank you.

Questions?

Special thanks to Jon Hronsky
and to all Beta testers, especially:
Vaclav Metelka, Mark Armstrong, Mark Lindsay.
De Beers Canada. *Southern Geoscience Consultants.*
Anglo American Canada. *Rio Tinto Australia.*

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