



Cost reduction for exploration through technology – or driving ‘success’ Rob Hough & Discovery Program CSIRO

MINERAL RESOURCES
www.csiro.au



CSIRO Mineral Resources



2017-2022

NATIONAL MINERAL EXPLORATION STRATEGY

Vision

A sustainable economic future by unlocking Australia's hidden mineral wealth.

Goals

Drive ongoing investment in mineral exploration, generate new exploration opportunities, stimulate major new discoveries, and ensure the continuity and longevity of Australia's mineral resources industry for the benefit of all Australians.

BENEFIT OF MINERALS TO THE NATIONAL ECONOMY

The mineral resources sector plays a vital role in Australia's ongoing economic prosperity. The sector dominates the nation's export earnings, provides substantial direct and indirect employment and investment in regional and indigenous communities, supports downstream and service industries, and delivers essential revenue to governments.

In 2015-16, mining directly contributed around 6 per cent of Australia's GDP, employed more than 228 000 people and generated 50 per cent of the nation's export earnings.

Estimates produced by Deloitte Access Economics suggested that added from mining and METS activities was \$133.2 billion, contribution for the same period is estimated to have added to the economy and over 650 000 jobs.

The combined direct and indirect contribution of minerals to the economy was \$235.8 billion, which is 15 per cent of the national economy comprising 10 per cent of full-time employment.*

SCOPE OF THE STRATEGY

This *National Mineral Exploration Strategy* will address the science and technology of mineral discovery required to explore underexplored regions of Australia. This Strategy, as an Energy Council, will be delivered by the Geoscience WA, which comprises the Commonwealth, state and territory surveys. This Strategy will be delivered in partnership with the research community, and the services sector. This Strategy to attract increased investment into the Australian exploration industry and address the financial or regulatory challenges facing mineral exploration.

Roadmap for Exploration Under Cover: Unlocking Australia's Hidden Potential



Scroll down to

UNCOVER GEOSCIENCE JOBS WEALTH PROSPERITY TECHNOLOGIES



Increasing mineral discovery success

March 2018

Investment in low-impact, cost-effective technologies will assist in addressing the urgent need to increase the success rate of discovering new, internationally competitive Australian mineral deposits in increasingly challenging geological, environmental and social conditions.

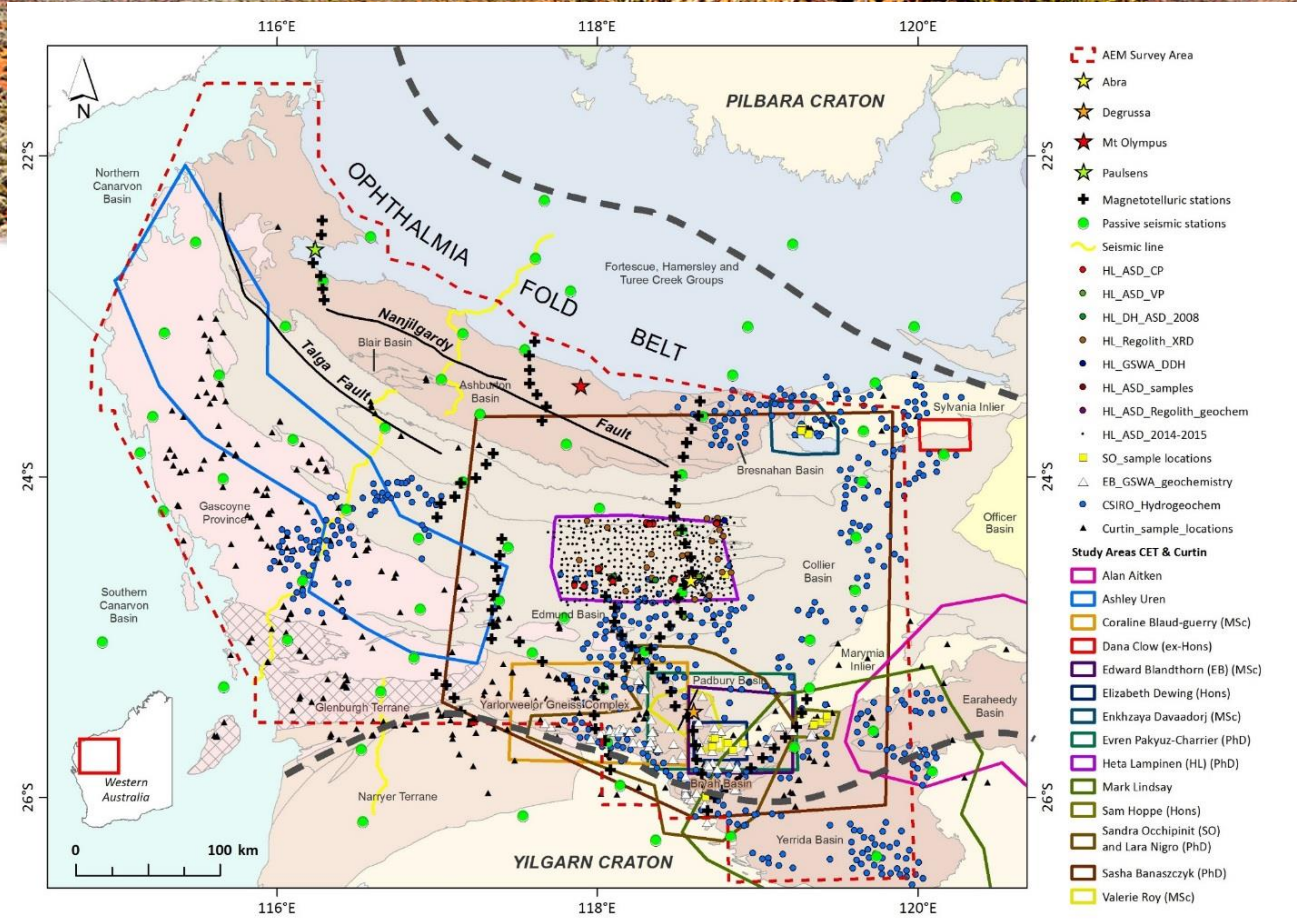


Capricorn Distal Footprints Project

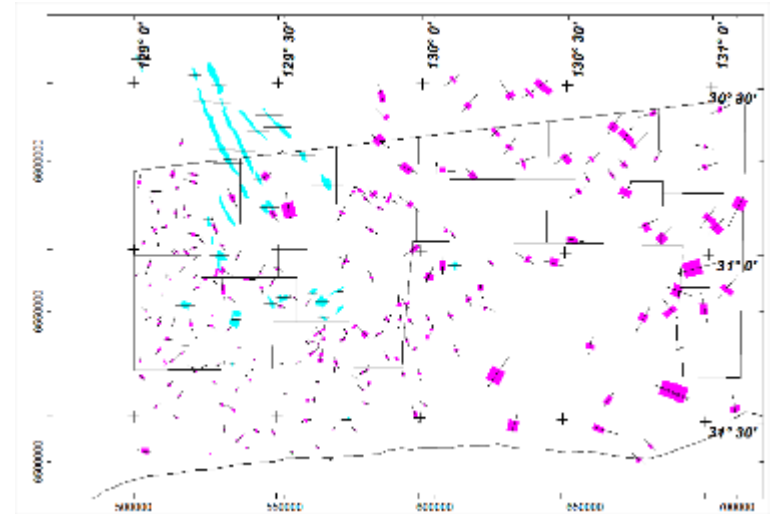
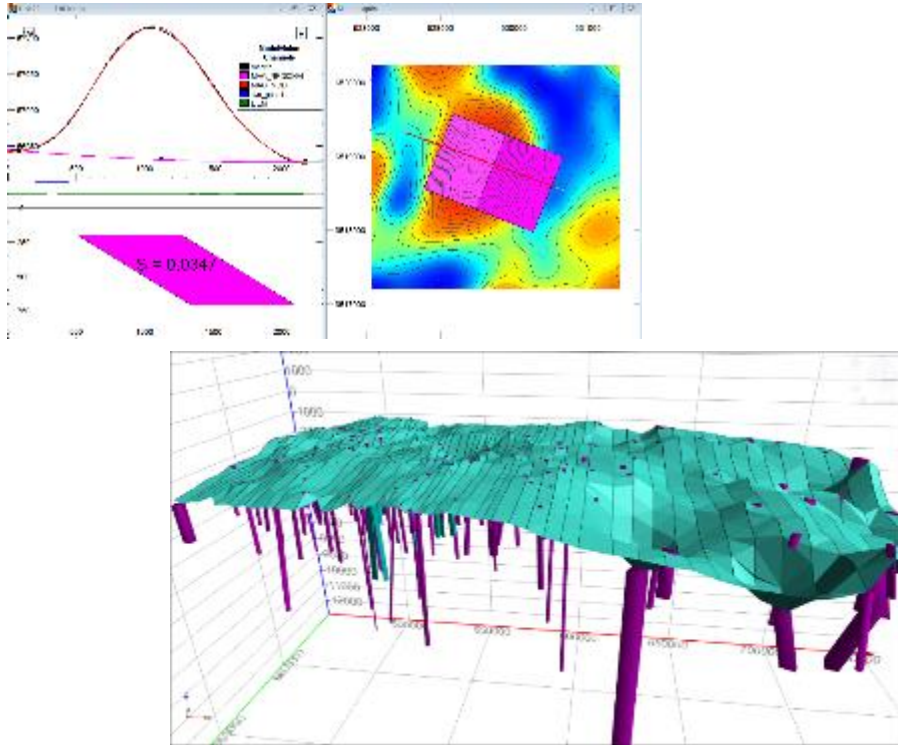
The Capricorn Research Team



THE UNIVERSITY OF WESTERN AUSTRALIA

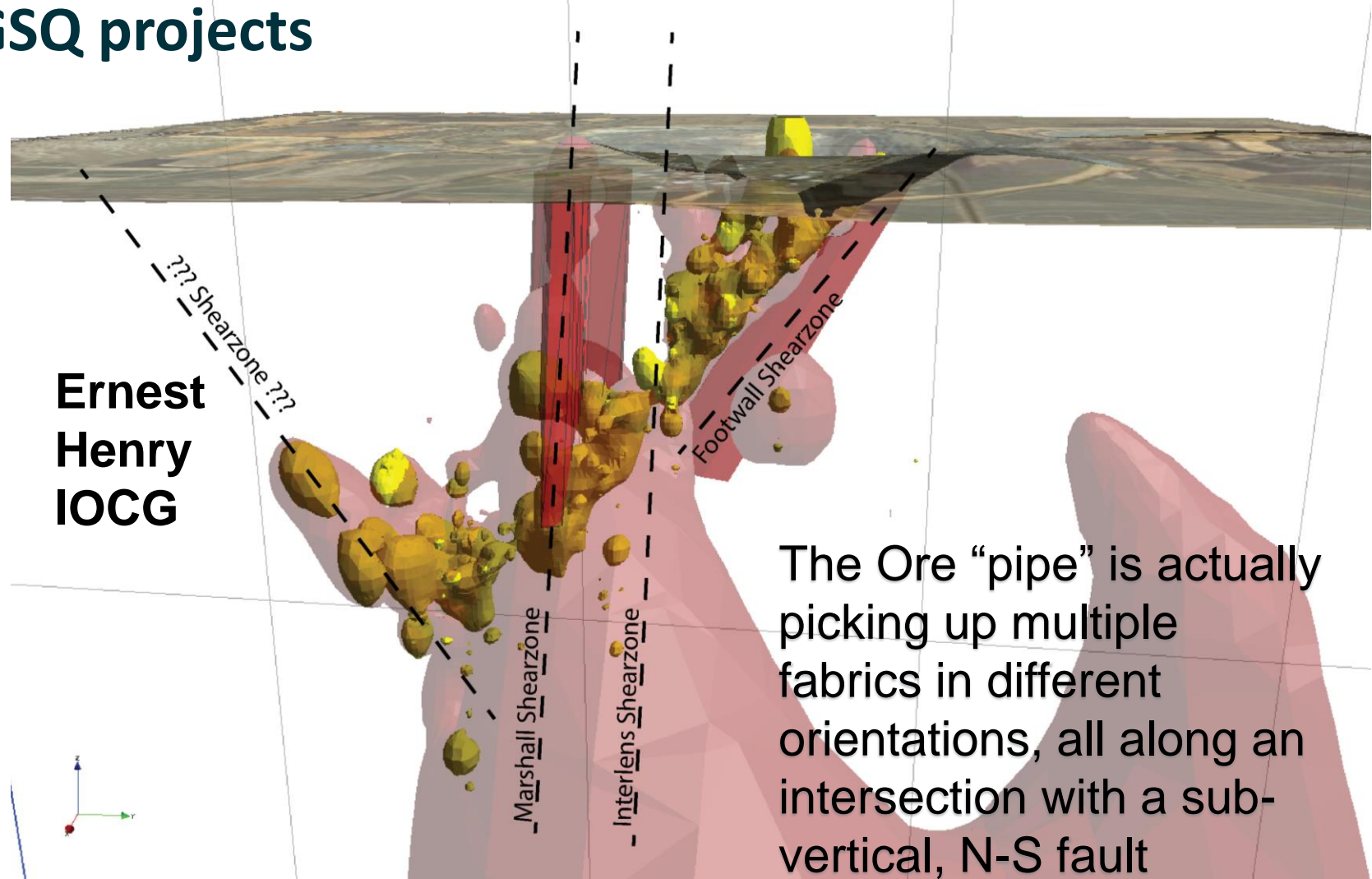


Magnetic source depth, remanence and modelling



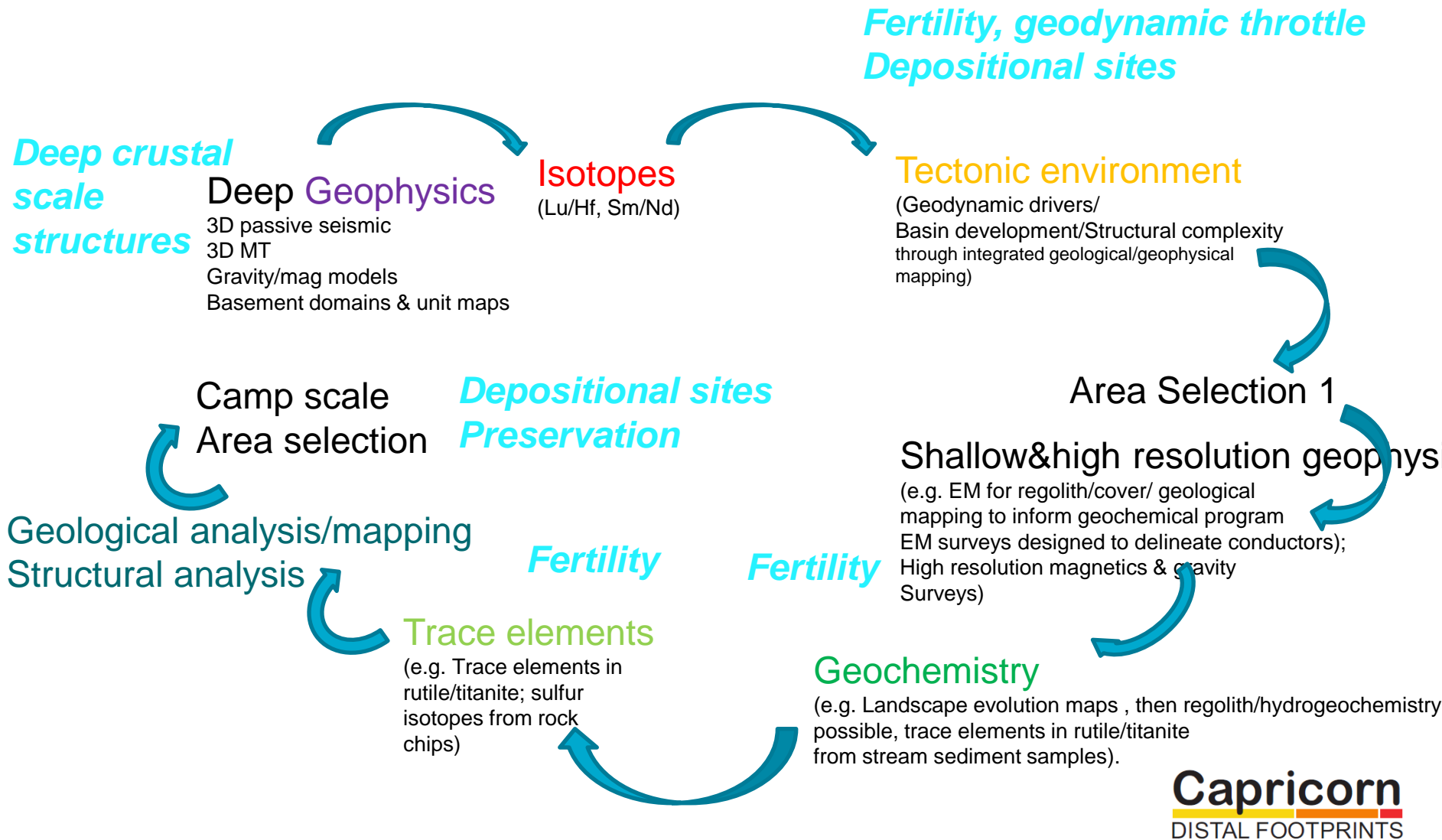
CSIRO “sweet spot” method used by GA (Exploring for the Future)
Foss & Austin.

Integrating Magnetic with Geochemical Modelling GSQ projects



Courtesy, Austin et al.

Workflow – scale reduction.....

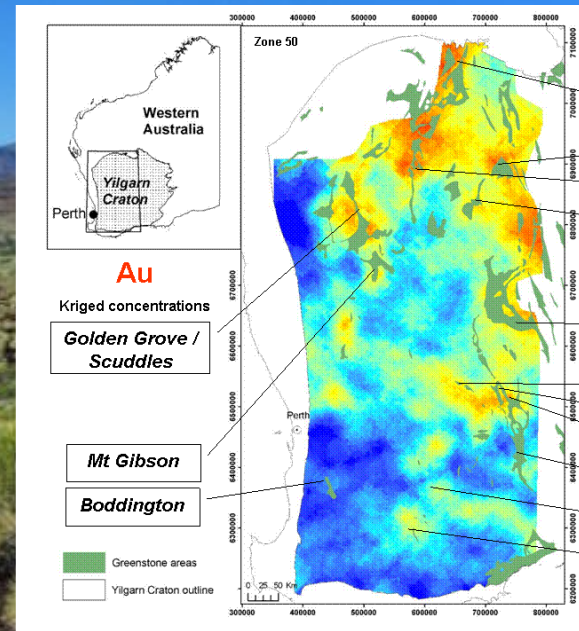
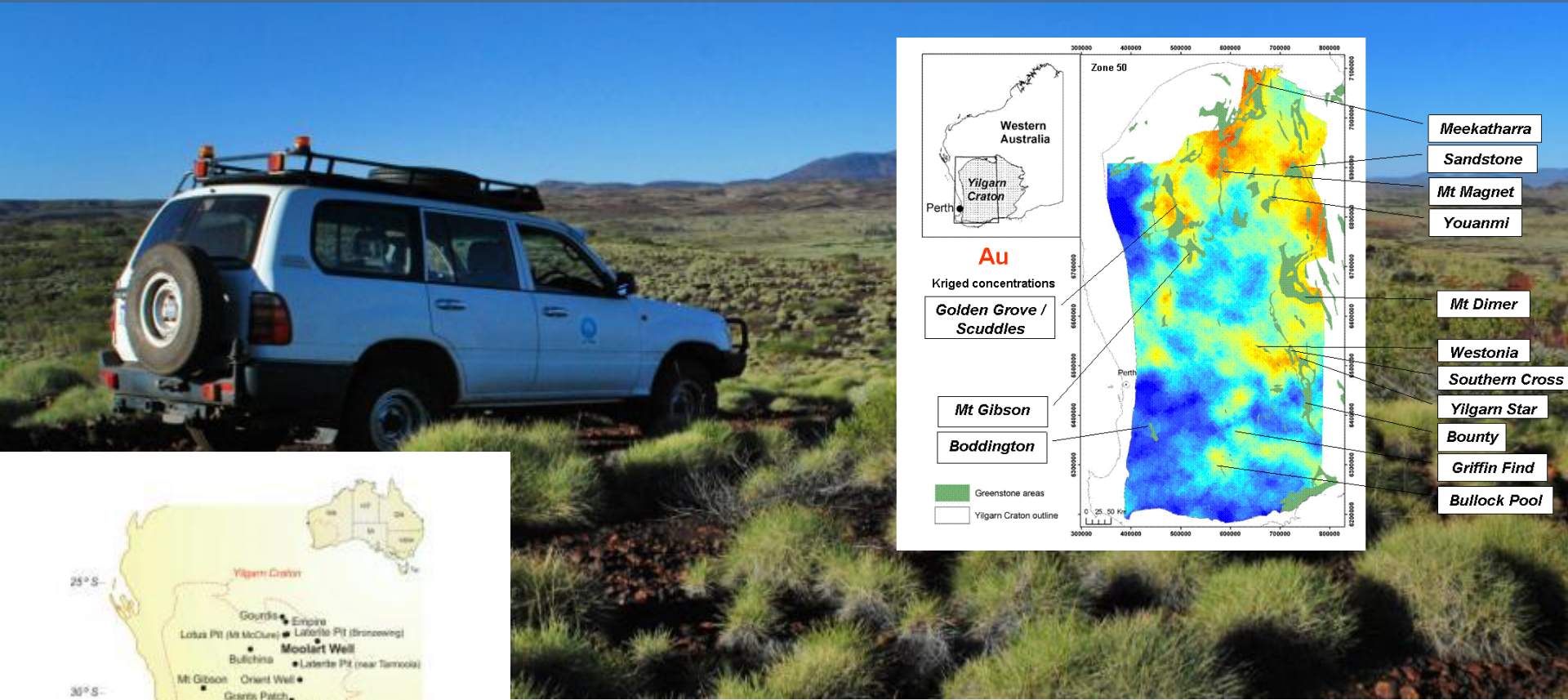


Smart sampling....

Guiding exploration using regolith. Laterite/Calcrete/Lag



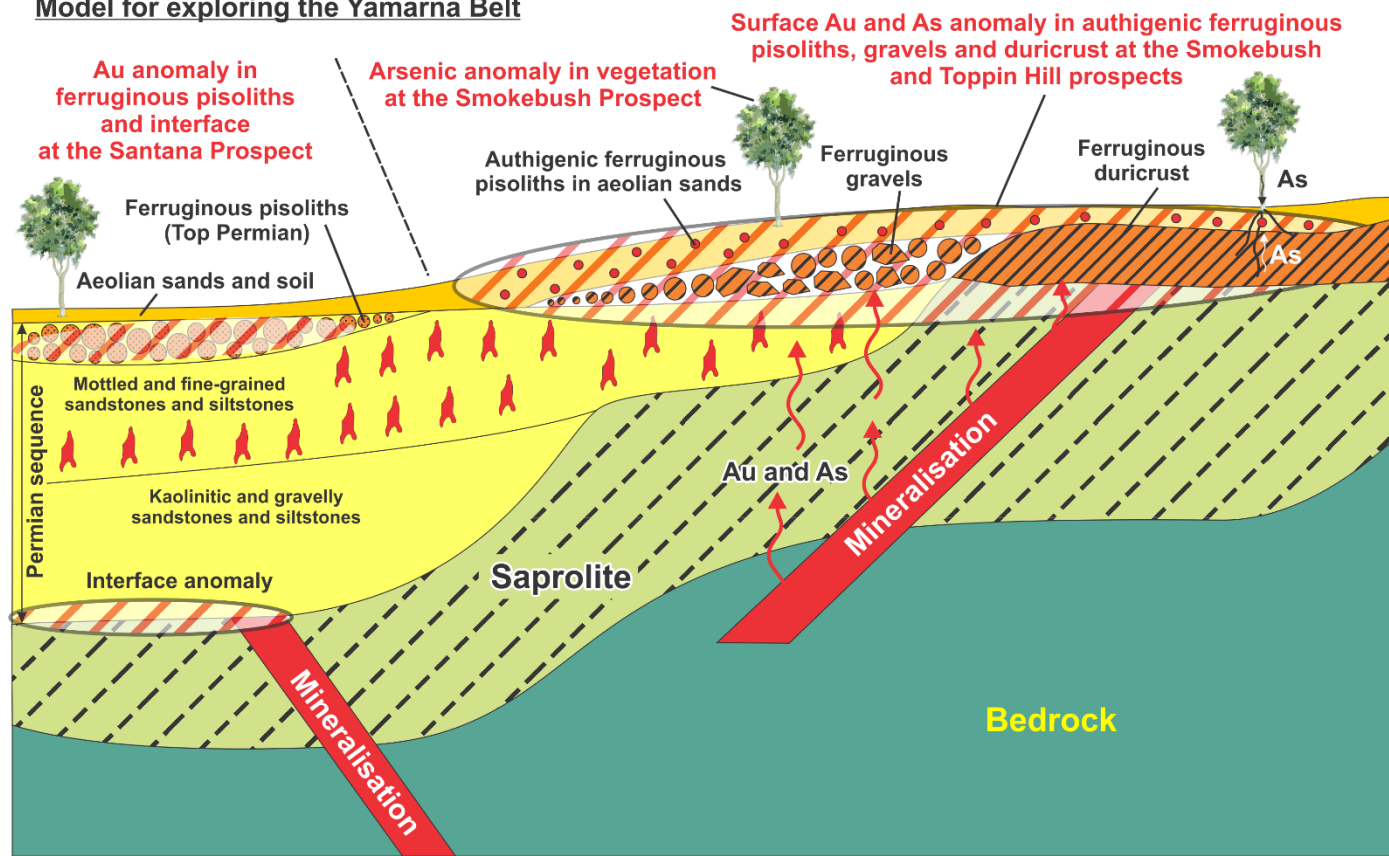
Regolith research outcomes from CSIRO used in the discovery of over 20 million ounces of gold or over \$24B “Ed Eshuys”



Exploration through cover

Transported cover of 50 m.

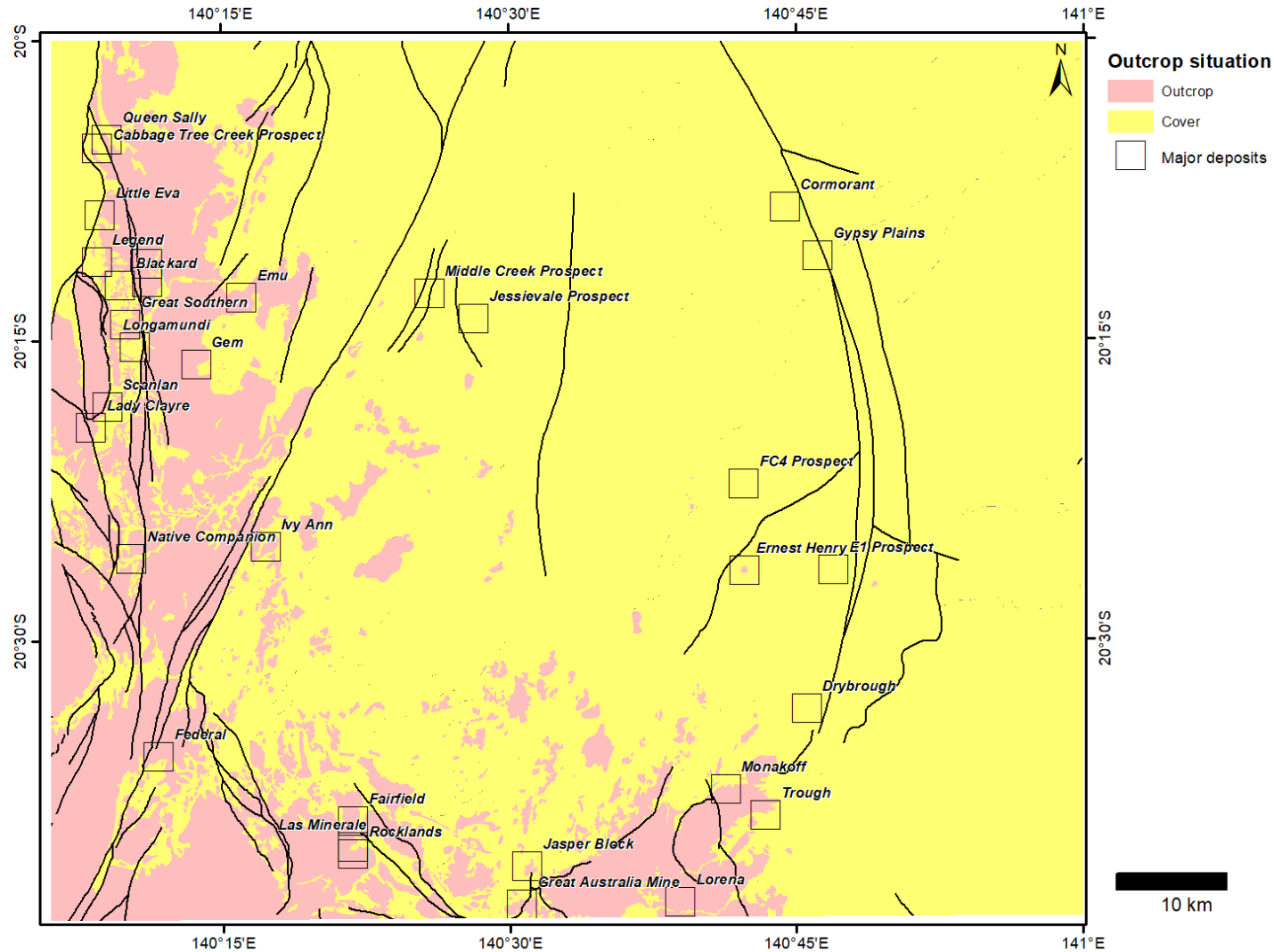
Model for exploring the Yamarna Belt



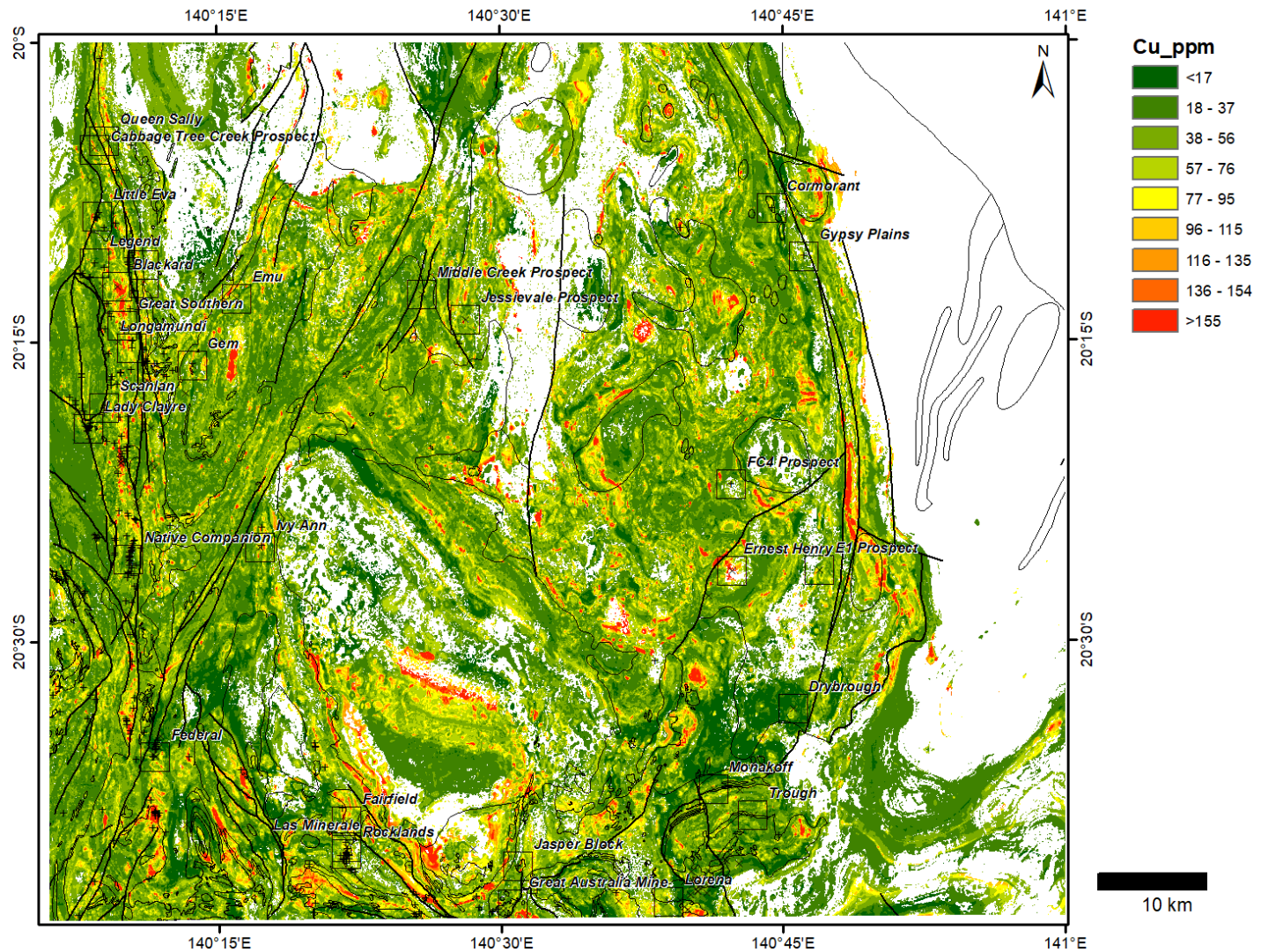
Salama, Anand et al.

Outcrop & Cover

Data supplied by GSQ and vetted with Dr Vladimir Lisitsin



Predictions of Cu (CSIRO / GSQ)

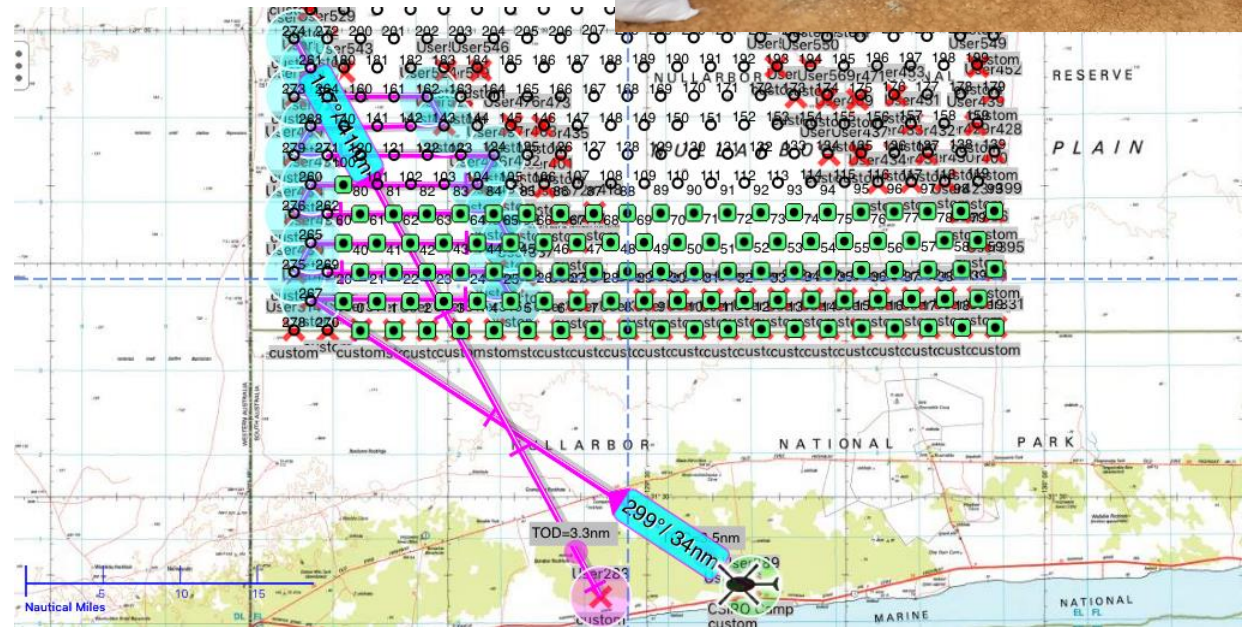


Surface geochemical mapping, 7 days, 310 sites, analysis and infill sampling on-the-fly



Optimised Sampling

- 6 mins per site (+4 mins travel/refuel)
- 280 samples on 4 km spacing 80 x50 km area
- 5 sample types (soil, rock, vegetation)
- IGSN/FAIMS – all integrated in tablets and QR code labels = Data capture and backup (FAIMS)
 - no more lost or missing sites or matching up photos/bags



Noble and team

How it's done (~10 mins into 20 seconds)



Meanwhile back at base camp

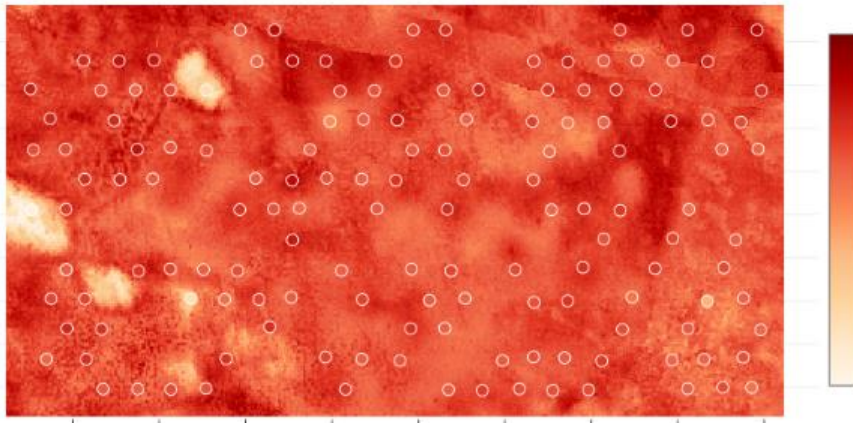
How it's done (~5 mins into 20 seconds)



Innovation in the SAMPLING approach

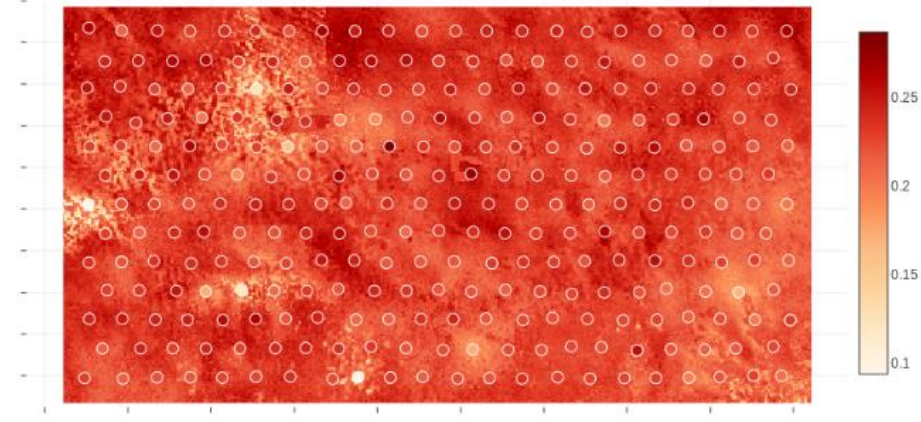
- SMART SAMPLING... how many samples are needed and where do you collect them
- In this example we could have done 50% less, big economic savings
- This is a rough example – it could be much better, we should achieve the same with 80% less samples, using the algorithm to guide next sample selection

Si estimate



50% samples removed at random

Si estimate

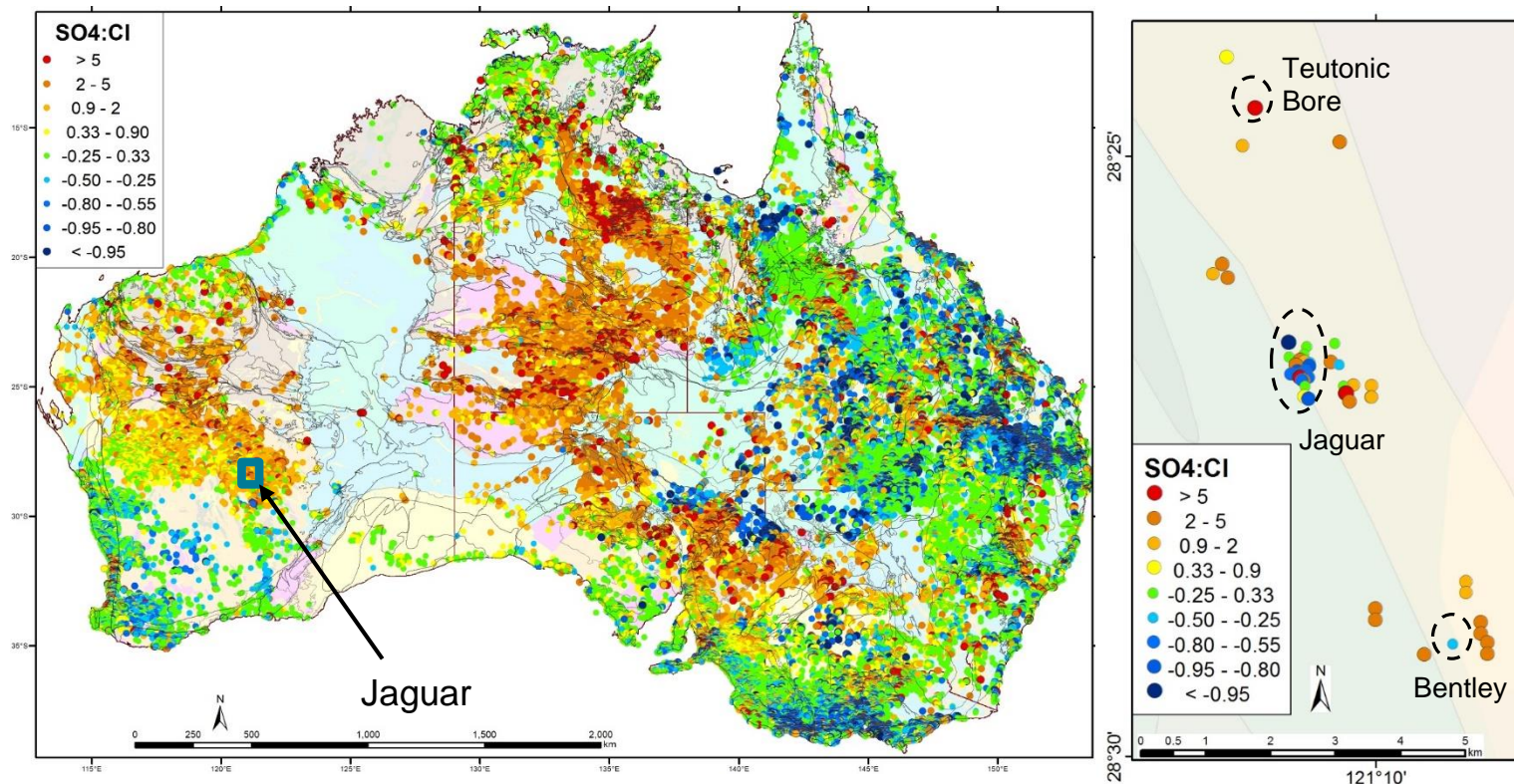


100% samples

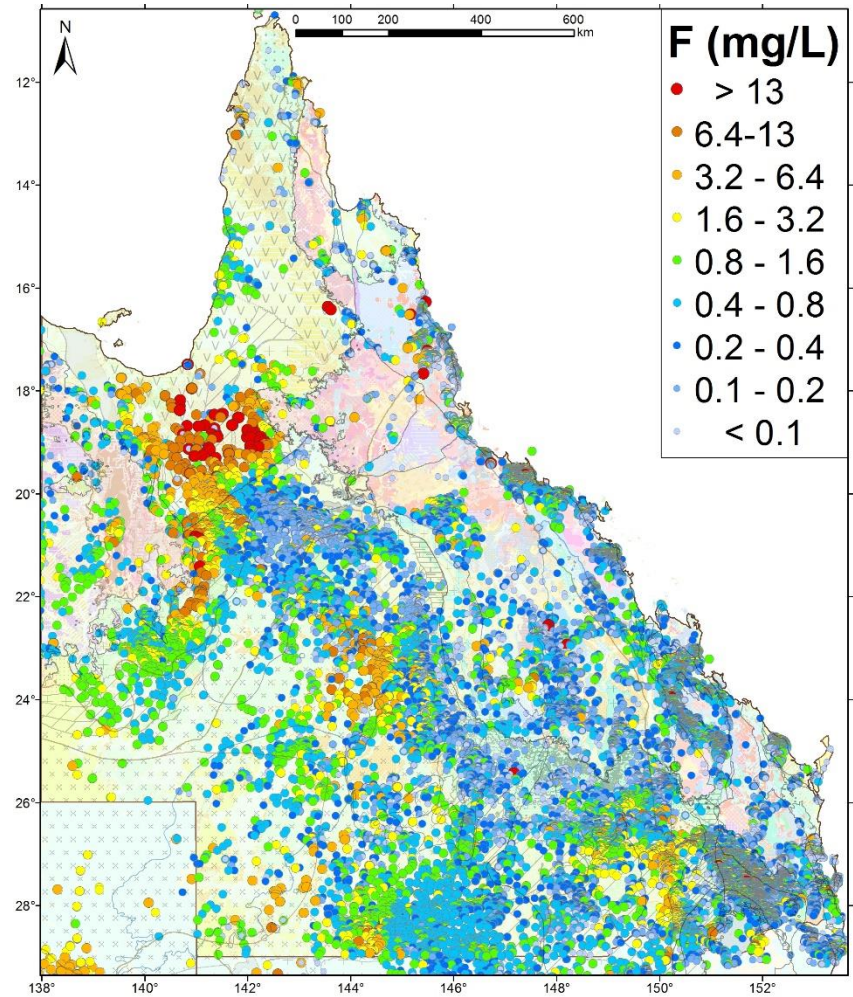
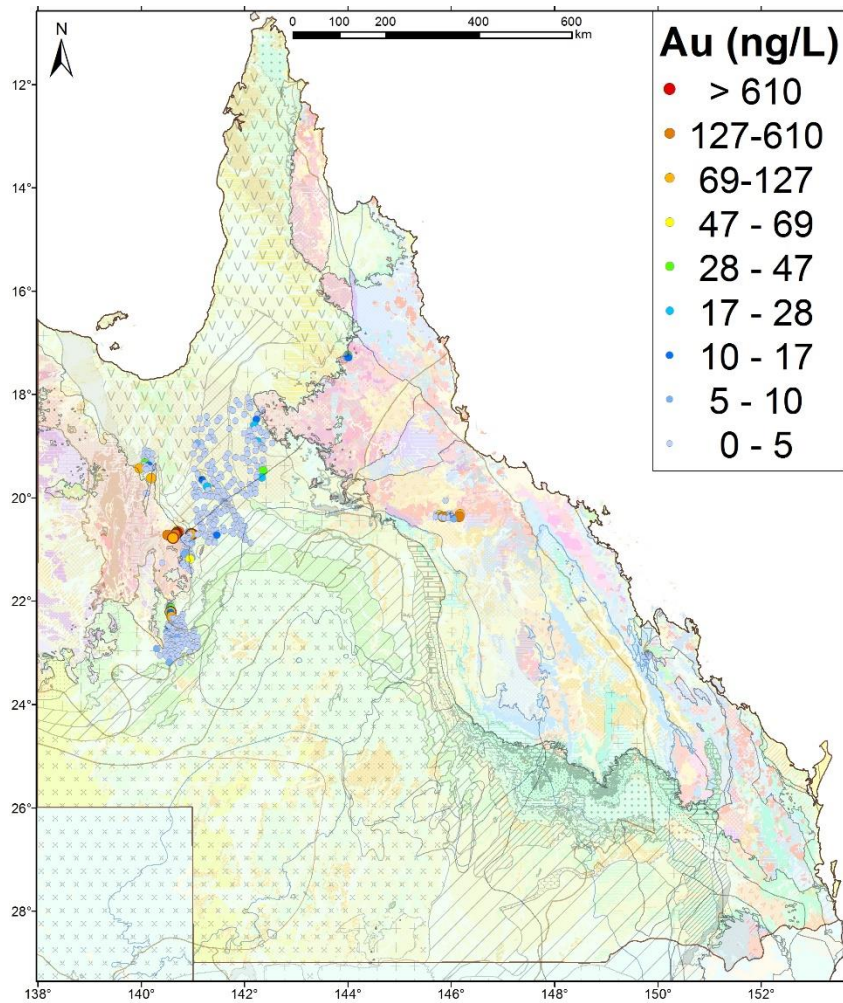
Hydrogeochemistry of scale

Continental scale can provide major lithological information

Deposit scale can identify anomalies linked to weathering sulfides

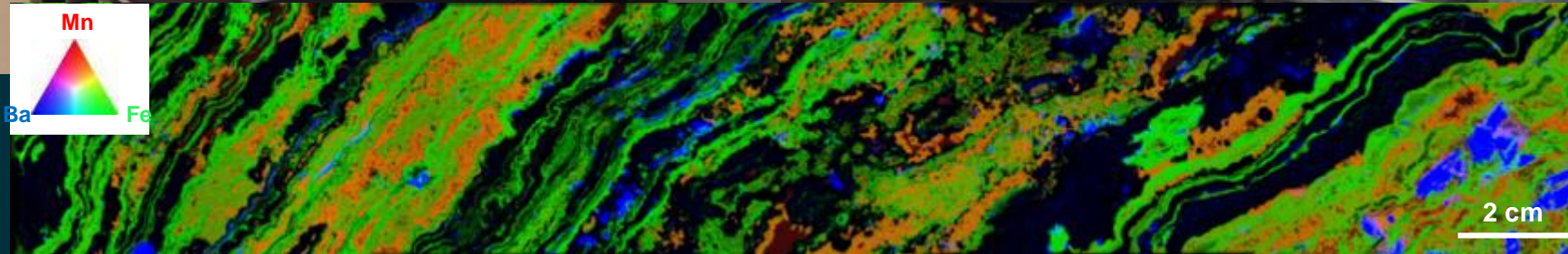
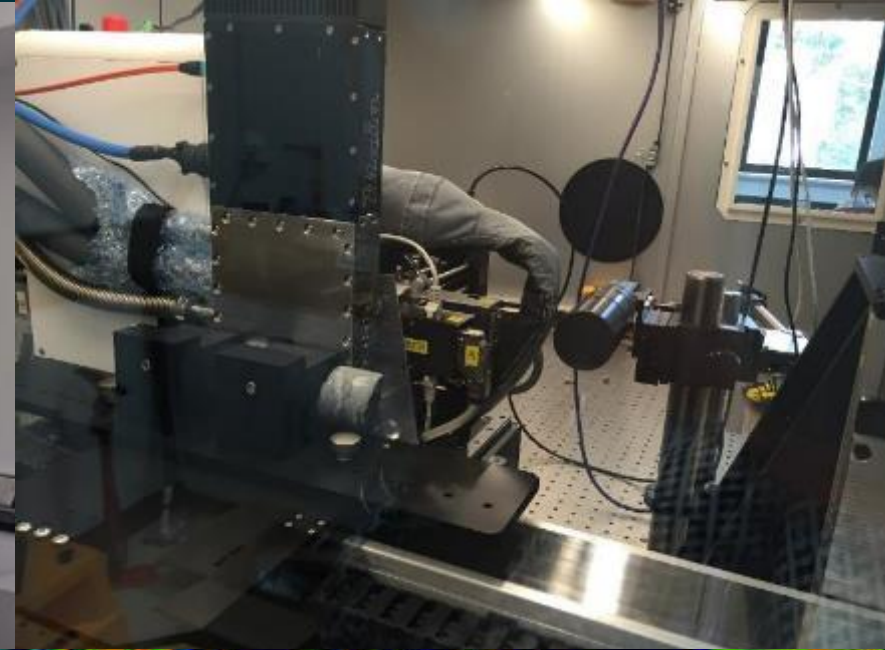


Qld data to date



Latest Technologies....

The Drill Core Lab – Whole drill core to microns – *Maia Mapper*TM

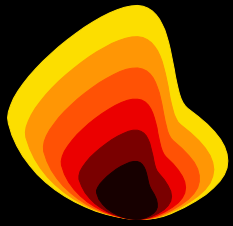


A new wave of exploration technologies.....





Lab-at-Rig



MinEx CRC

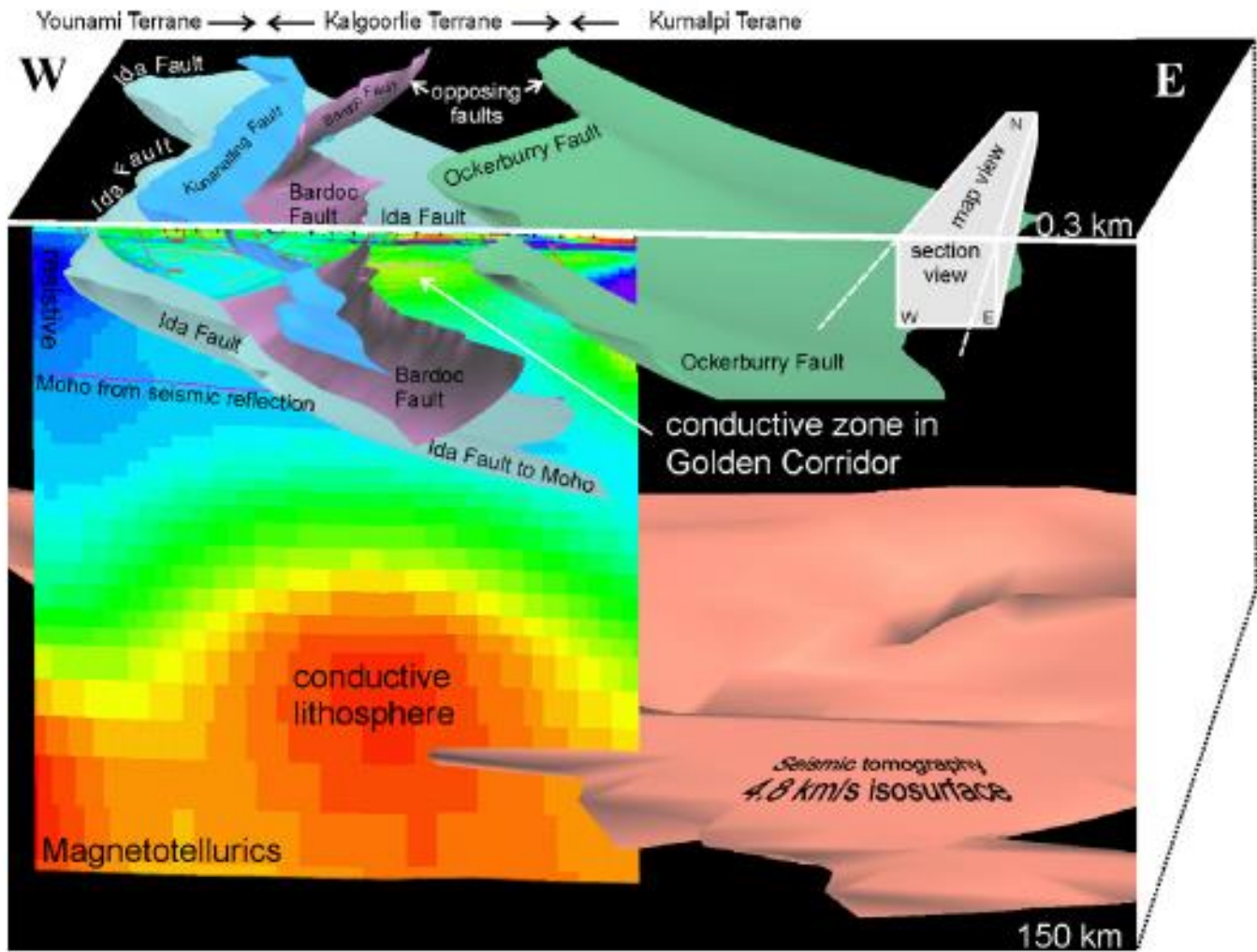
3D DRILLING



Multi-client approach to de-risking greenfields exploration

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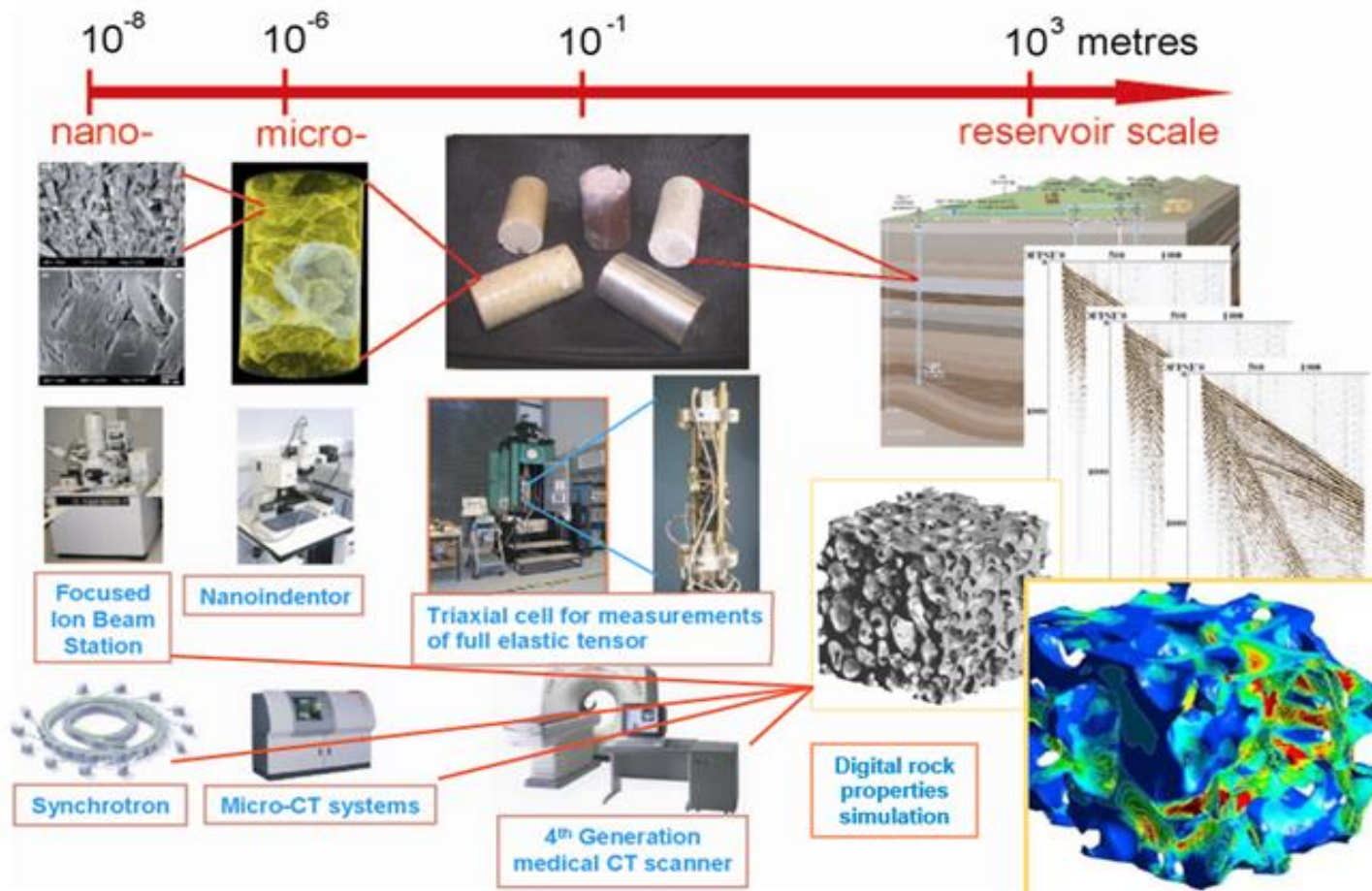
R.S. Blewett et al. / Precambrian Research 183 (2010) 230–250



Blewett et al 2010

Deep Earth Imaging – digital twins

Knowledge Integration, digital rocks and Scaling



SME Engagement and technology transfer....

INDUSTRY-RESEARCH ENGAGEMENT

20
Participating
COMPANIES



2.6 **MILLION DOLLARS**
Invested in Projects

\$30k to **\$250k**
Smallest *Largest Project*

