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Scale-integrated Concepts to Targets of a Gold Mineral System





SCALE 3: PROSPECT ANALYSIS

How to identify the location of a specific ore deposit (5 km x 5 km area selection)

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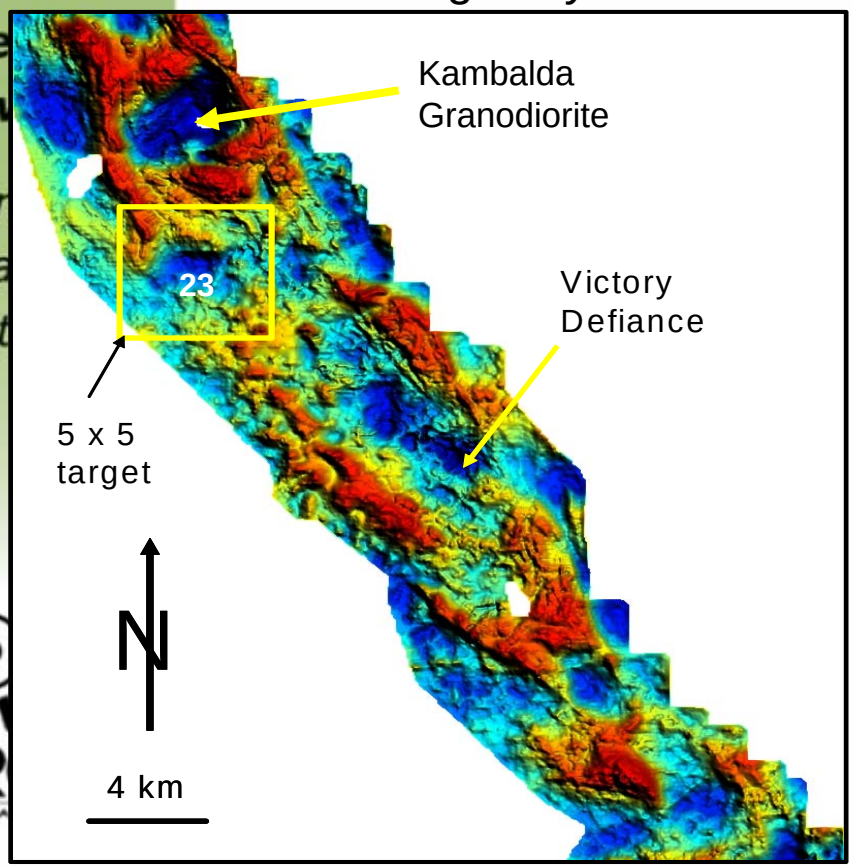
5km x 5km targeting

- probably the most valuable scale to get 'right'
- domain of the stretched Junior who may be on good ground
- danger of major walking away too early

Active hydrothermal system

- magnetic anomalies and broad haloes, demagnetised zones
- buried granites (in domes)

gravity



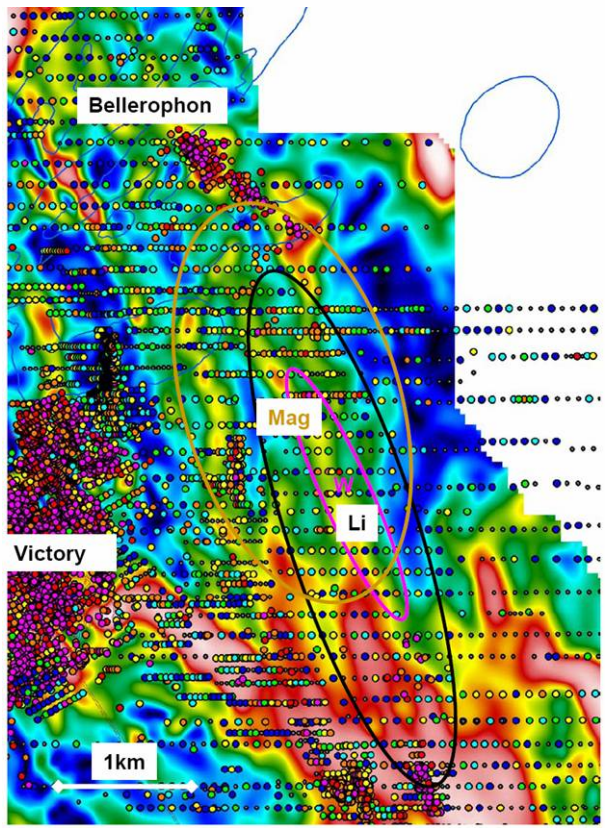
Peter Neumayr

magnetics

Paul Henson

Active hydrothermal system - Fluid-chemical complexity

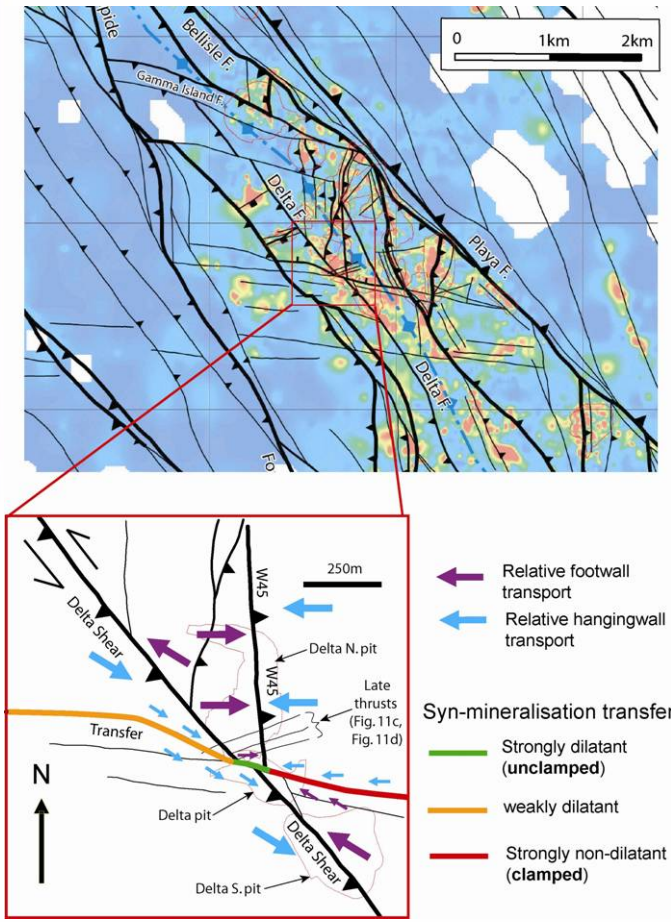
- gradients of oxidised and reduced fluid types in alteration mineralogy
- Au and pathfinders (Bi, Mo, W….) above background

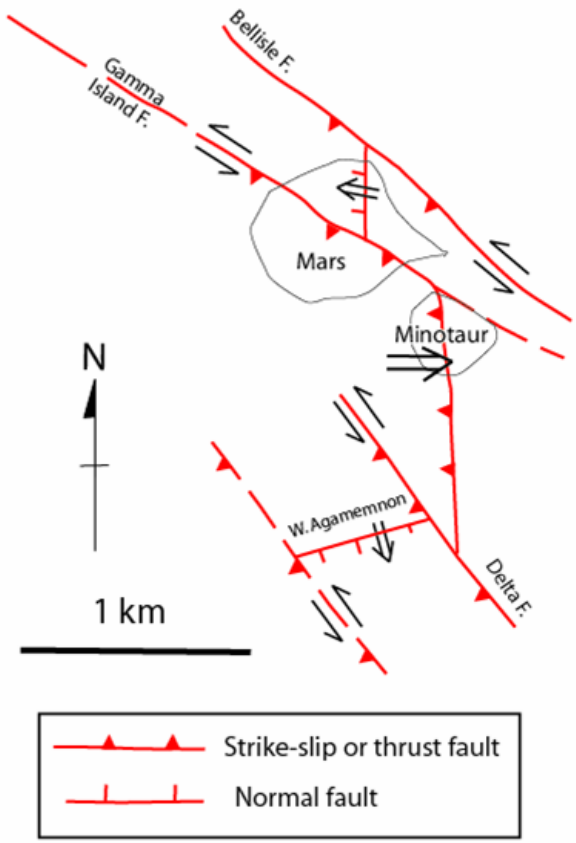


Tony Roache

Fluid Focus - Structural complexity

- reactivation of old structures
- switching tectonic mode: strike-slip and dip slip kinematics
- cross structures active with mineralisation

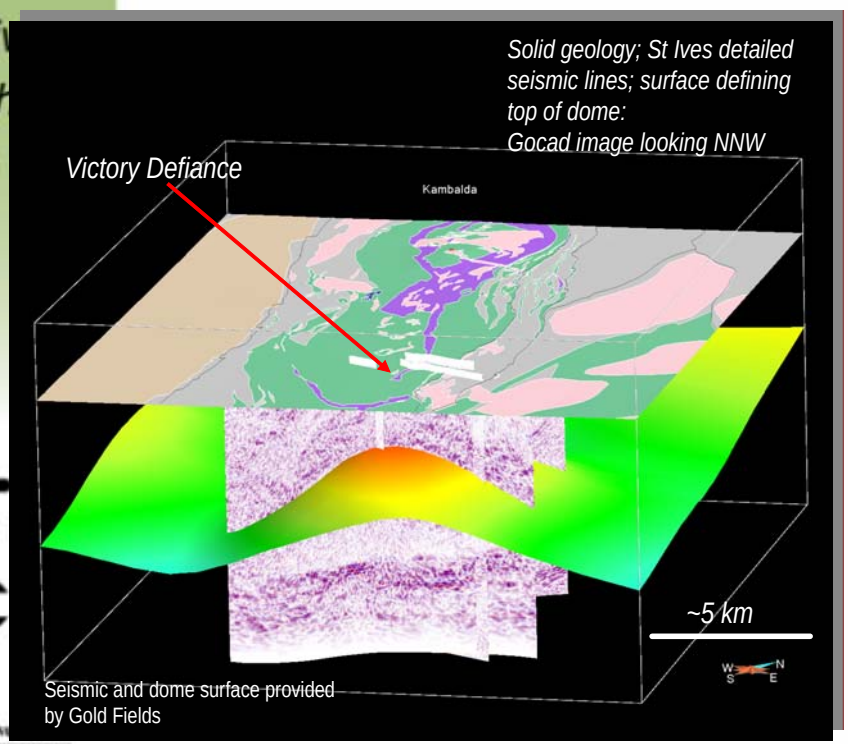


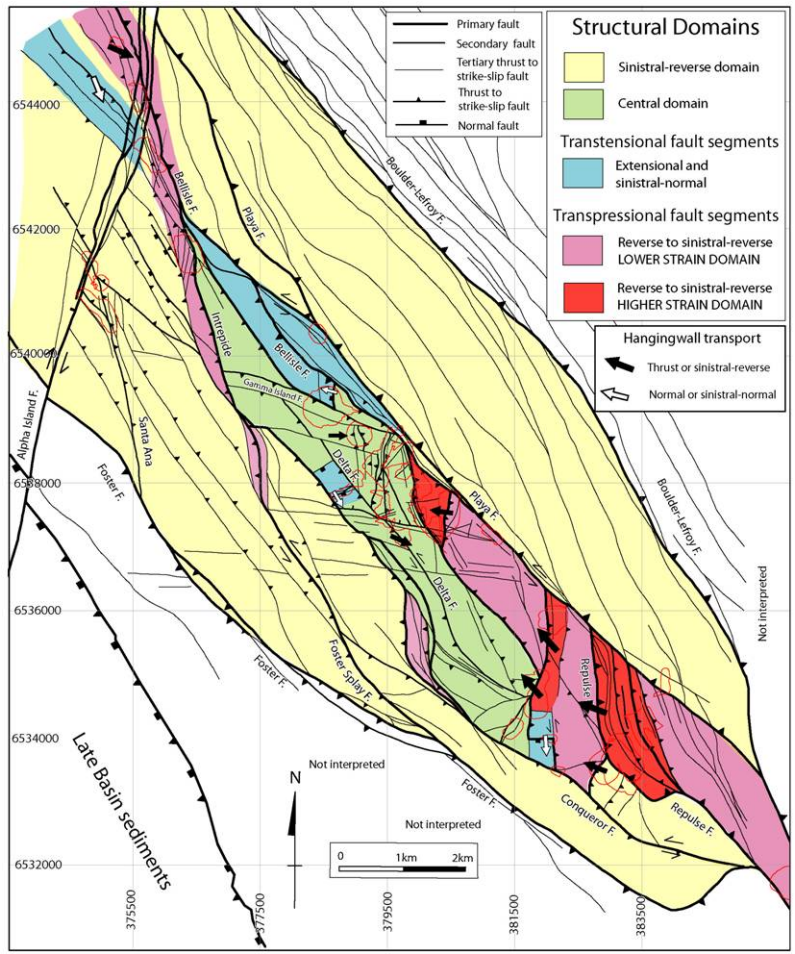


John Miller

Fluid Focus - structural architecture

- bends and deviations from mean strike on faults
- soft and hard accommodation or stress transfer or damage zones, fault tips
- domes and near dome regions
- growth faults
- seals
- 2nd-3rd order structures



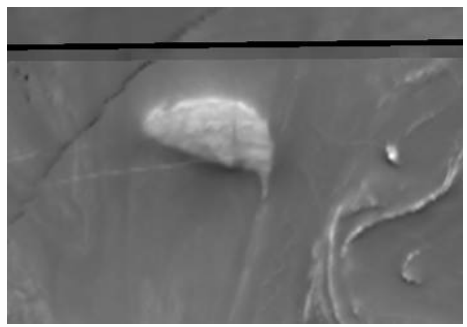


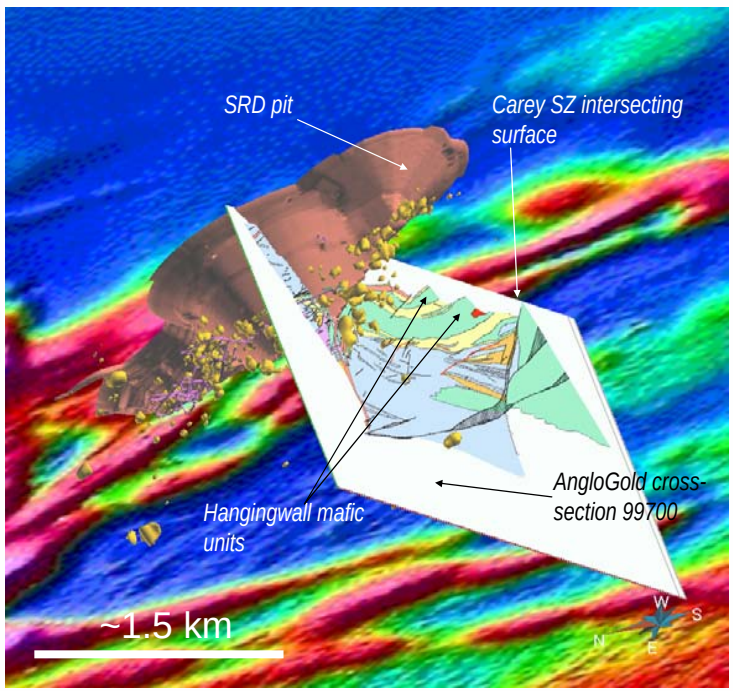
Paul Henson

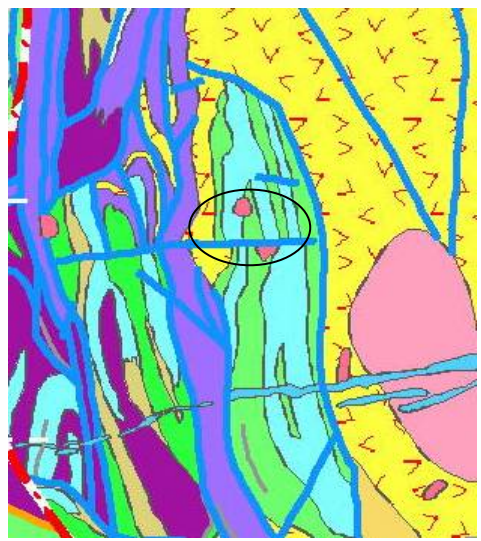
John Miller

Fluid Focus - Rheological or lithological complexity

- small stocks, plutons, porphyries, dykes, boudins
- complex stratigraphic architecture – volcanic domes/centres, sequence boundaries
- early alteration systems (silicification etc)
- Fe-rich and carbonaceous rock types



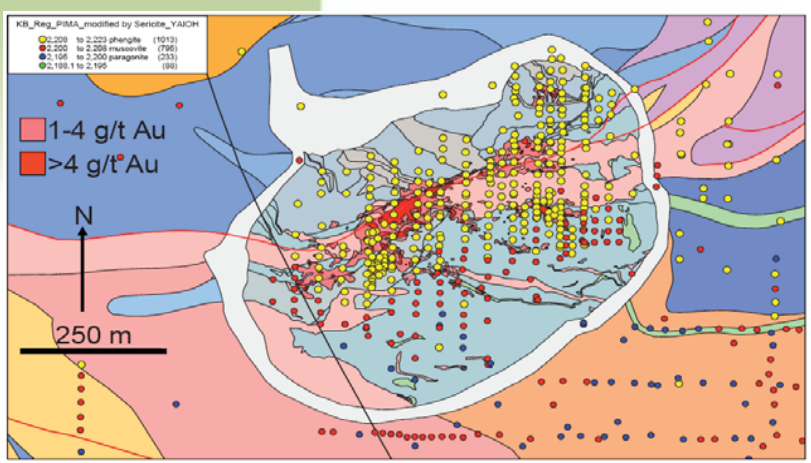


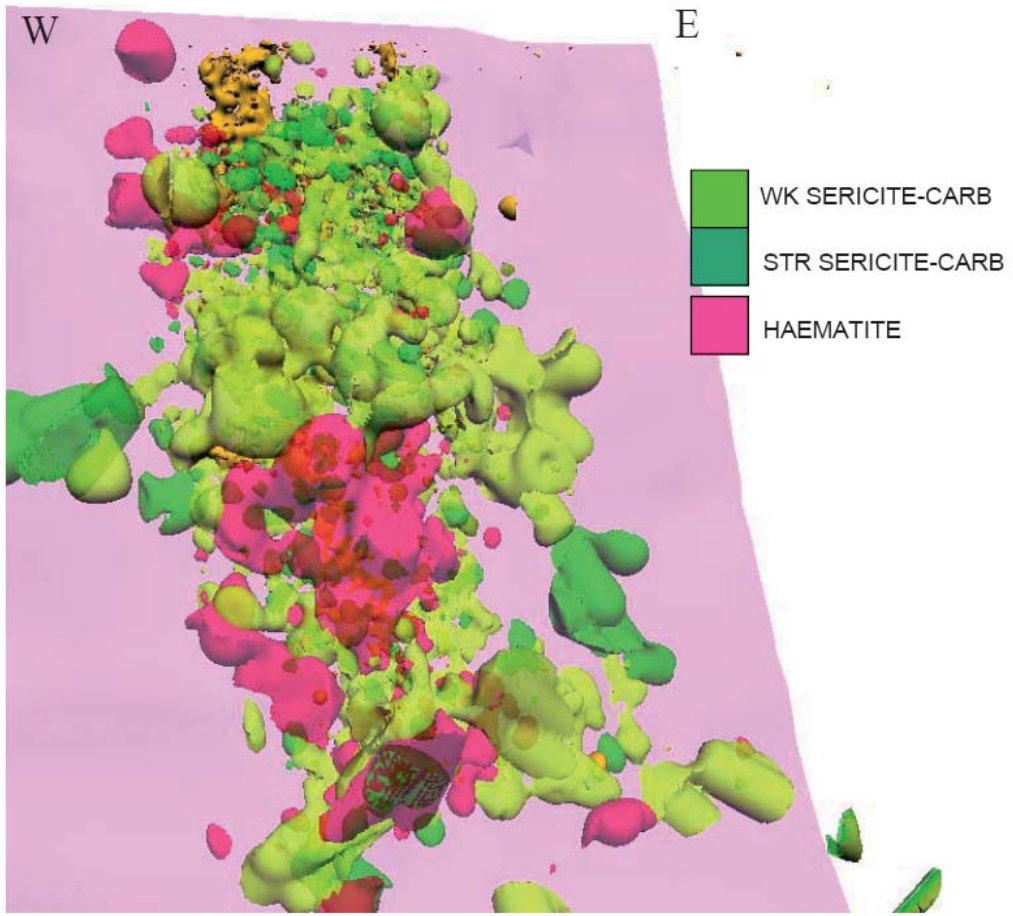


Paul Henson & Mark Doyle

Fluid-chemical complexity

- detailed gradients of oxidised and reduced fluid types in alteration mineralogy
- complex metal associations

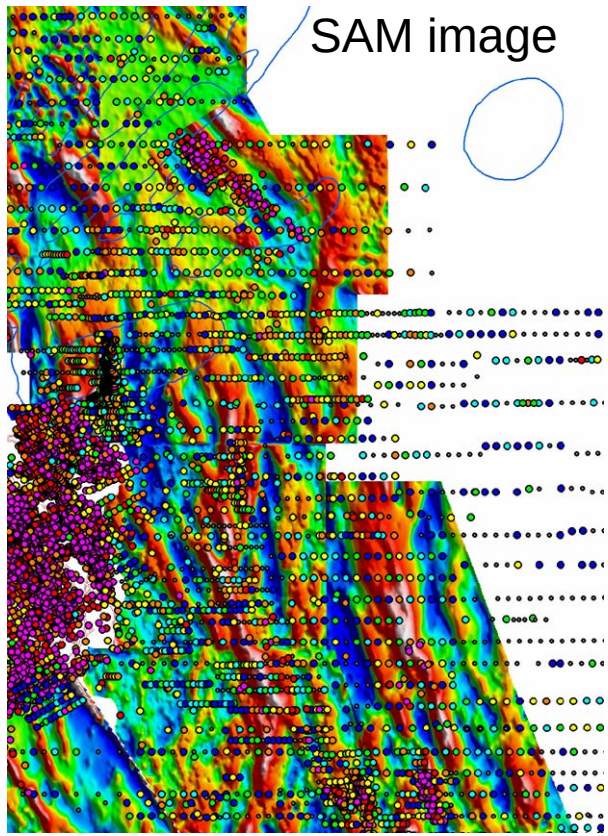




Carl Young

Cover and dispersion processes

- <<1 km to target depth
- depth of weathering
- age of weathering
- architecture of regolith (palaeochannels, conductors, ground water)
- landscape evolution



Ned Stolz

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Using patterns of hydrothermal alteration (inferred chemical gradients) to predict a 5 km x 5 km target in a mature camp (St Ives)

Peter Neumayr and John Walshe

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Targeting Concept

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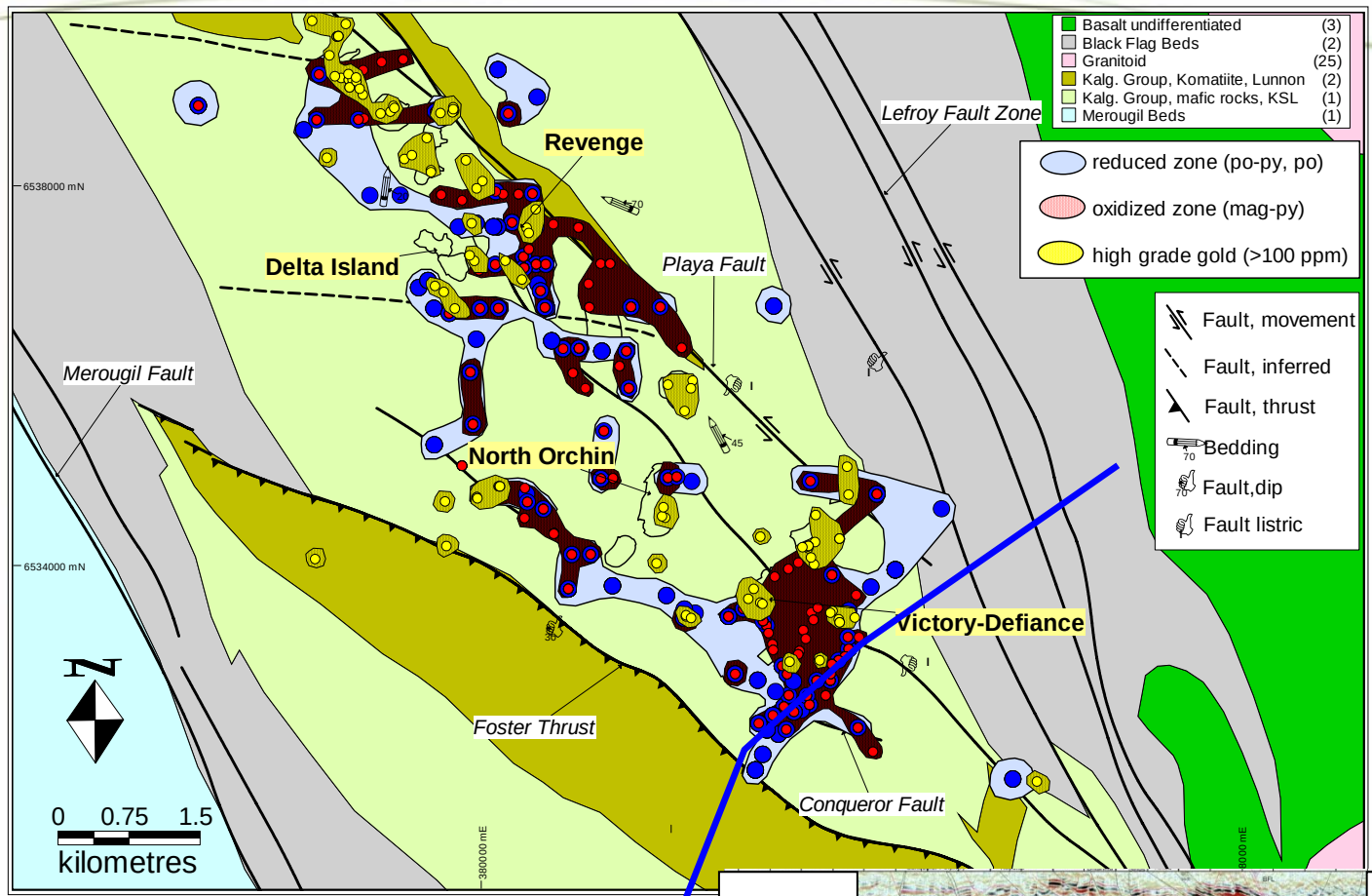

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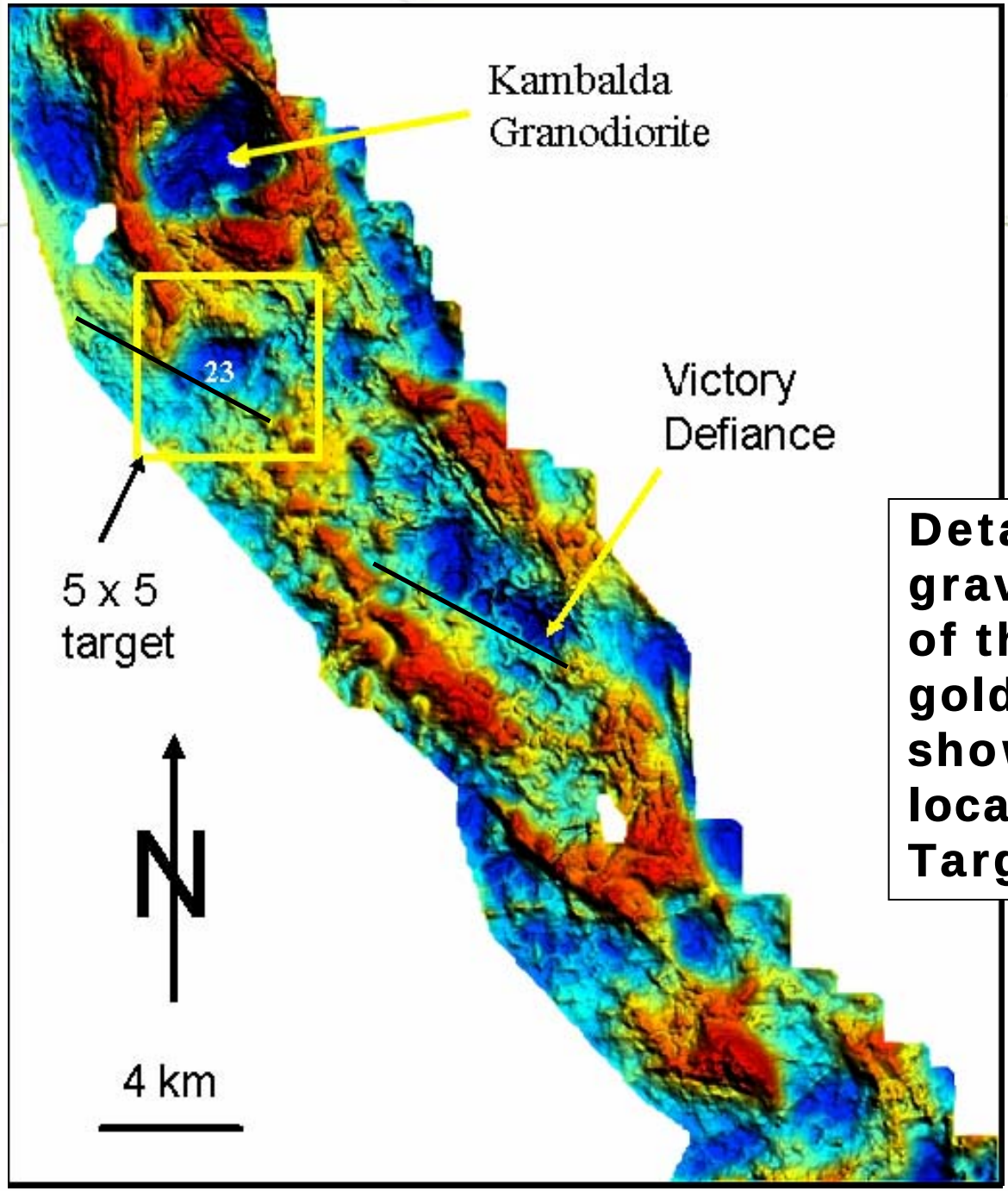

Detailed gravity image of the St. Ives gold camp showing the location of Target 23

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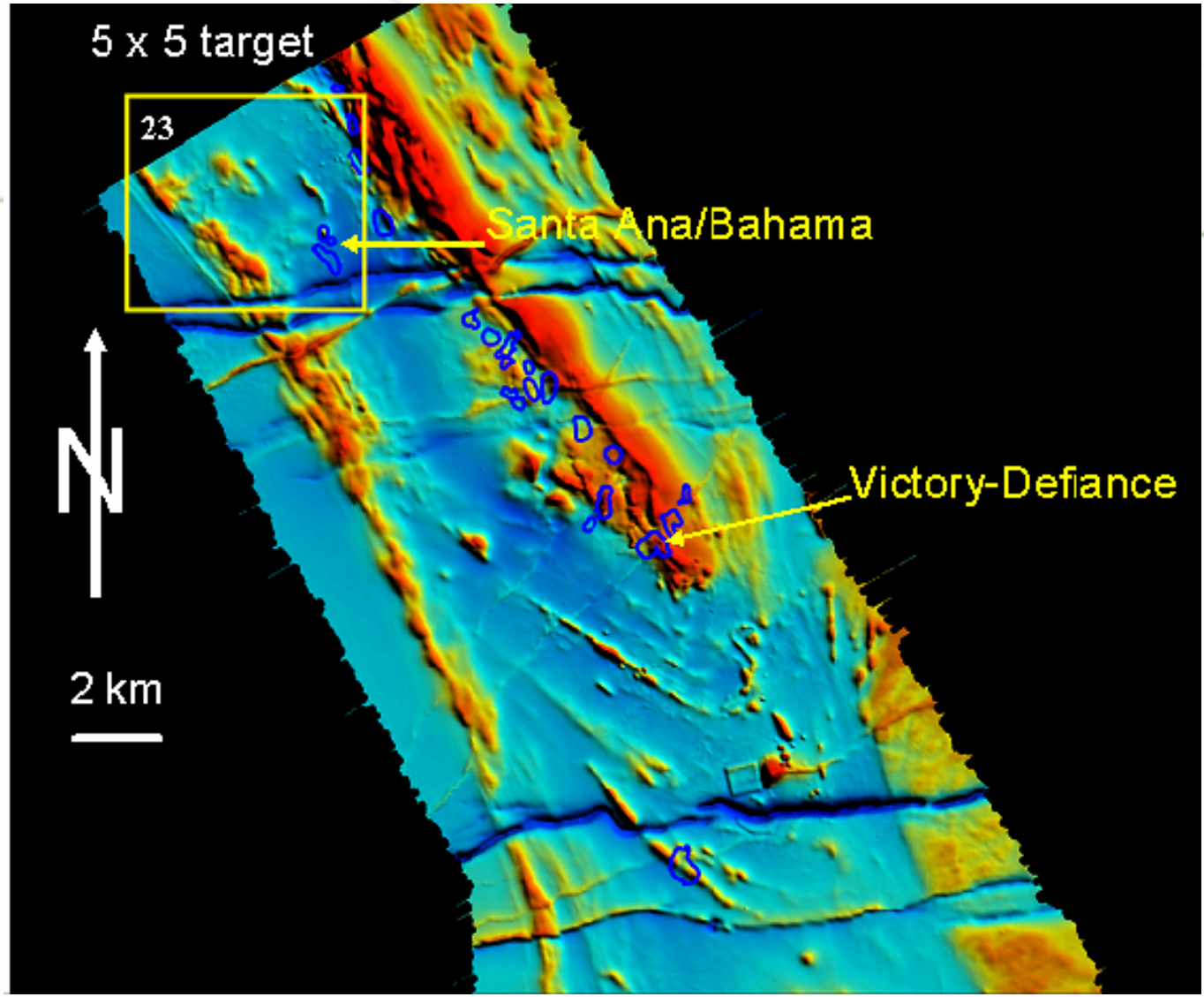

Aeromagnetic TMI image of the St. Ives gold camp showing the location of open pits (blue lines) and Target 23

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An integrated multidisciplinary approach to 5x5 km targeting gold in sedimentary basins (e.g., Bellerophon St Ives)

Tony Roache, Ned Stolz, and Rick Squire

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Bellerophon-Nelsons Fleet Area

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Multi-Element Geochemistry

- End-of hole air-core drilling sample taken in fresh bed-rock
- Some RC and diamond-core samples
- Suite of analyses for whole-rock and path-finders
- Results displayed in ArcMap as located-points and gridded-images

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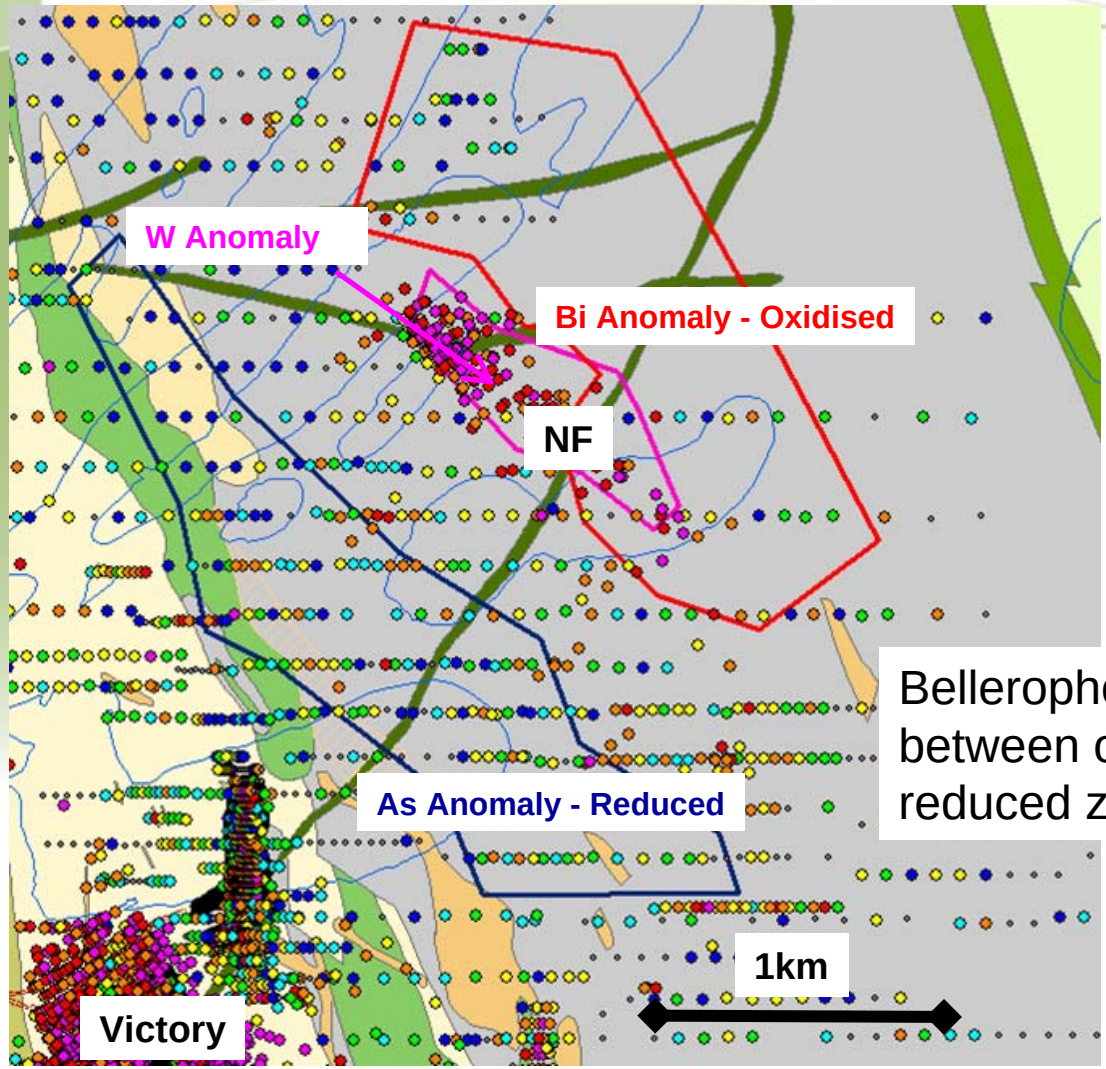
Nelsons Fleet - Victory Area

Multi-Element Geochem Anomalies



Pre-Cambrian Geology

- Black Flag Group
- Paringa Basalt
- Defiance Dolerite
- Kapai Slate
- Devon Consols Basalt
- Tripod Hill Member

Point data –
Max Au in hole

Bellerophon lies on gradient between oxidised and reduced zones

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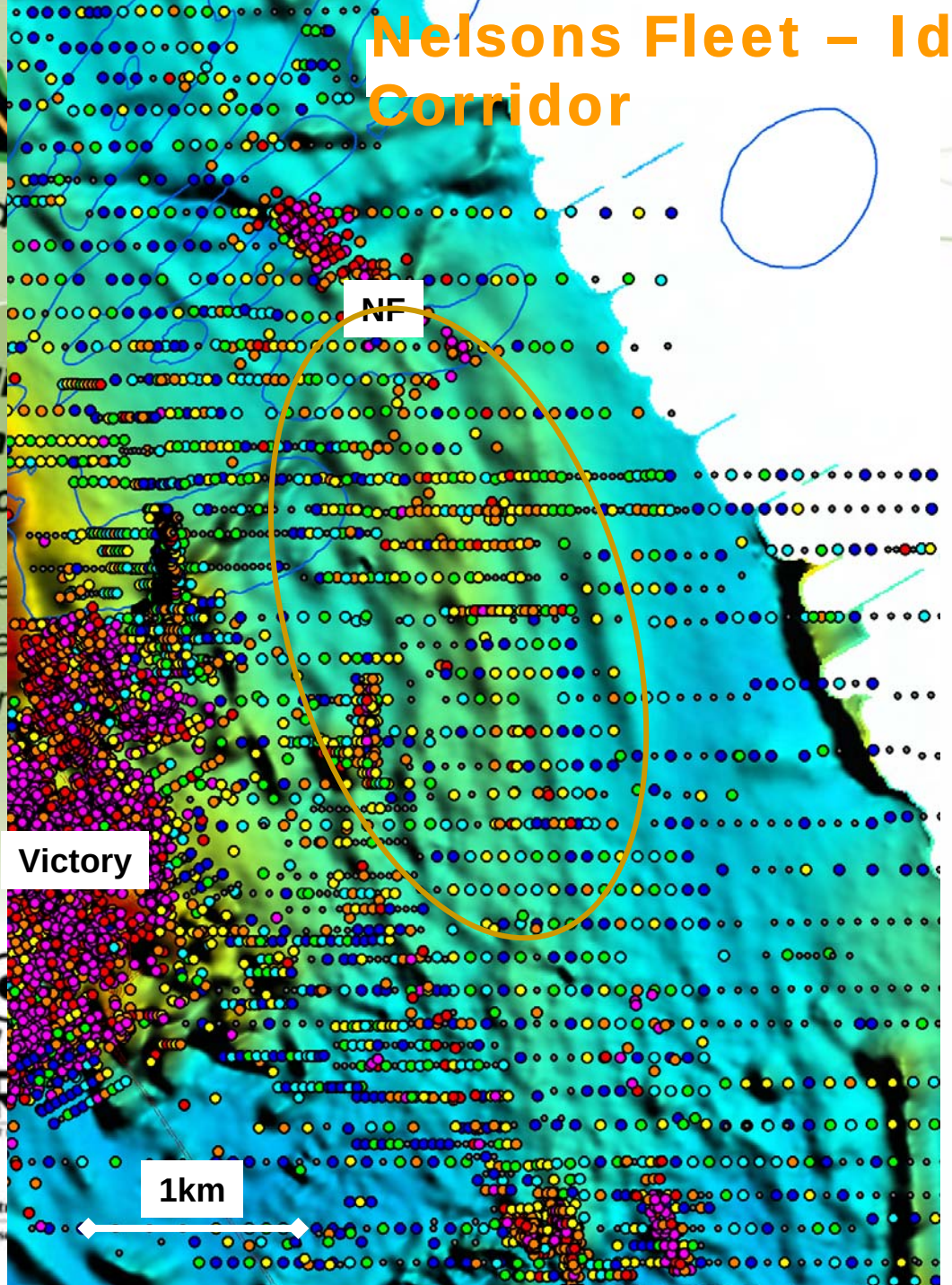
Nelsons Fleet – Idough Corridor



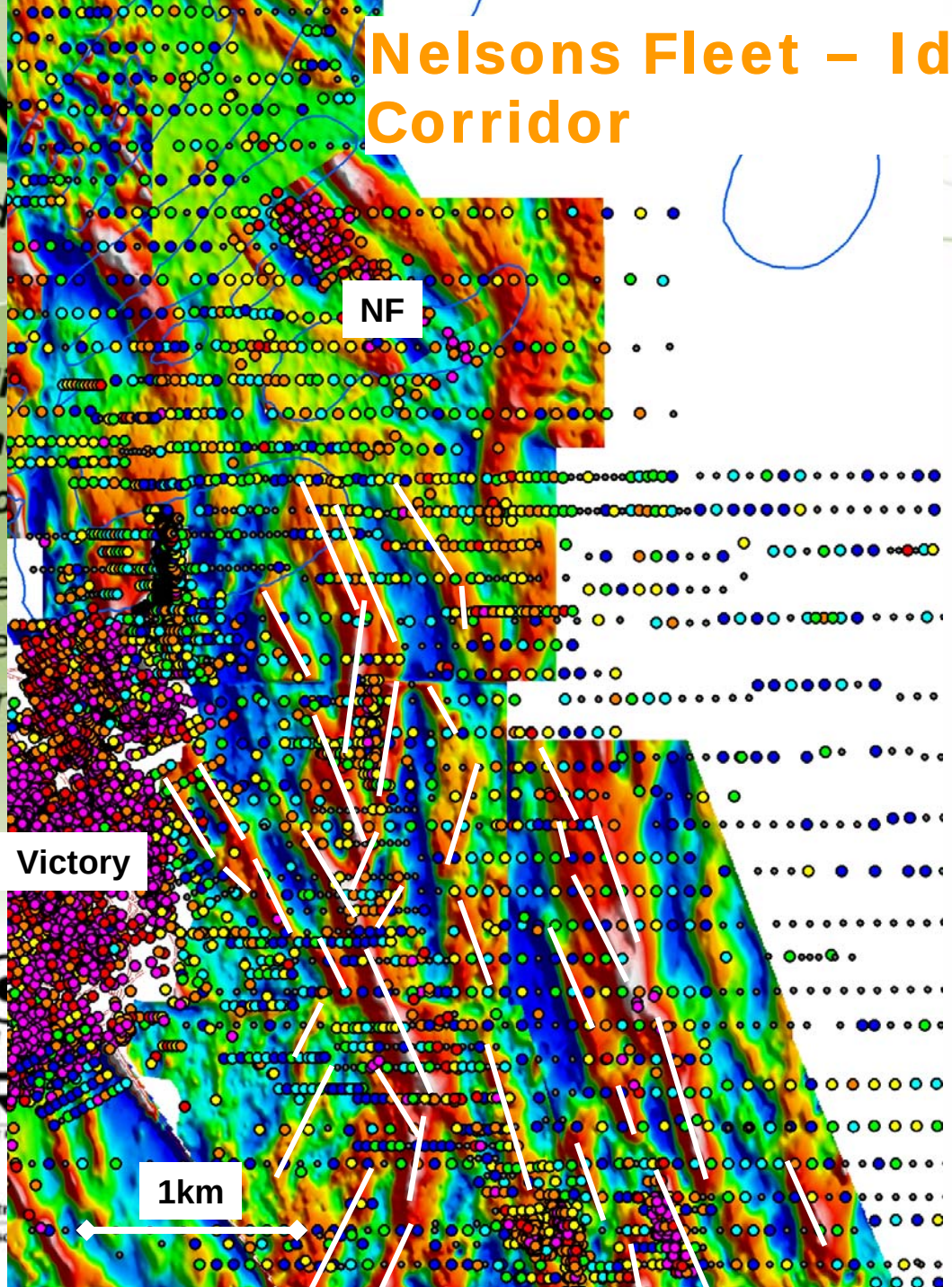
Airborne magnetics
TMI colour over 1VD

Magnetite - oxidation

Max Au in hole

Nelsons Fleet – Idough Corridor

SAM 1VD

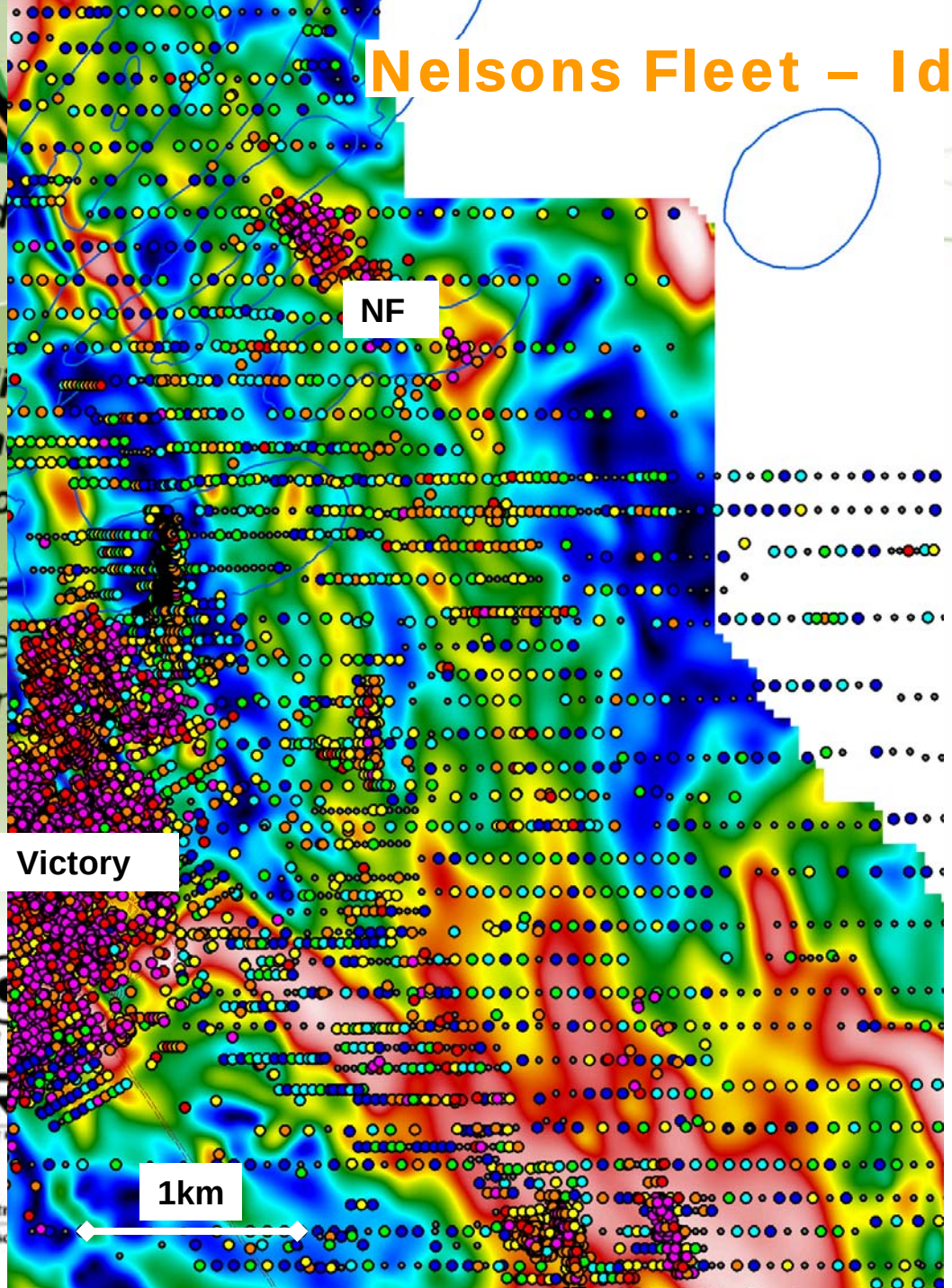


SAM MMR – 1VD

Maps structural network

Max Au in hole

Nelsons Fleet – Idough Corridor

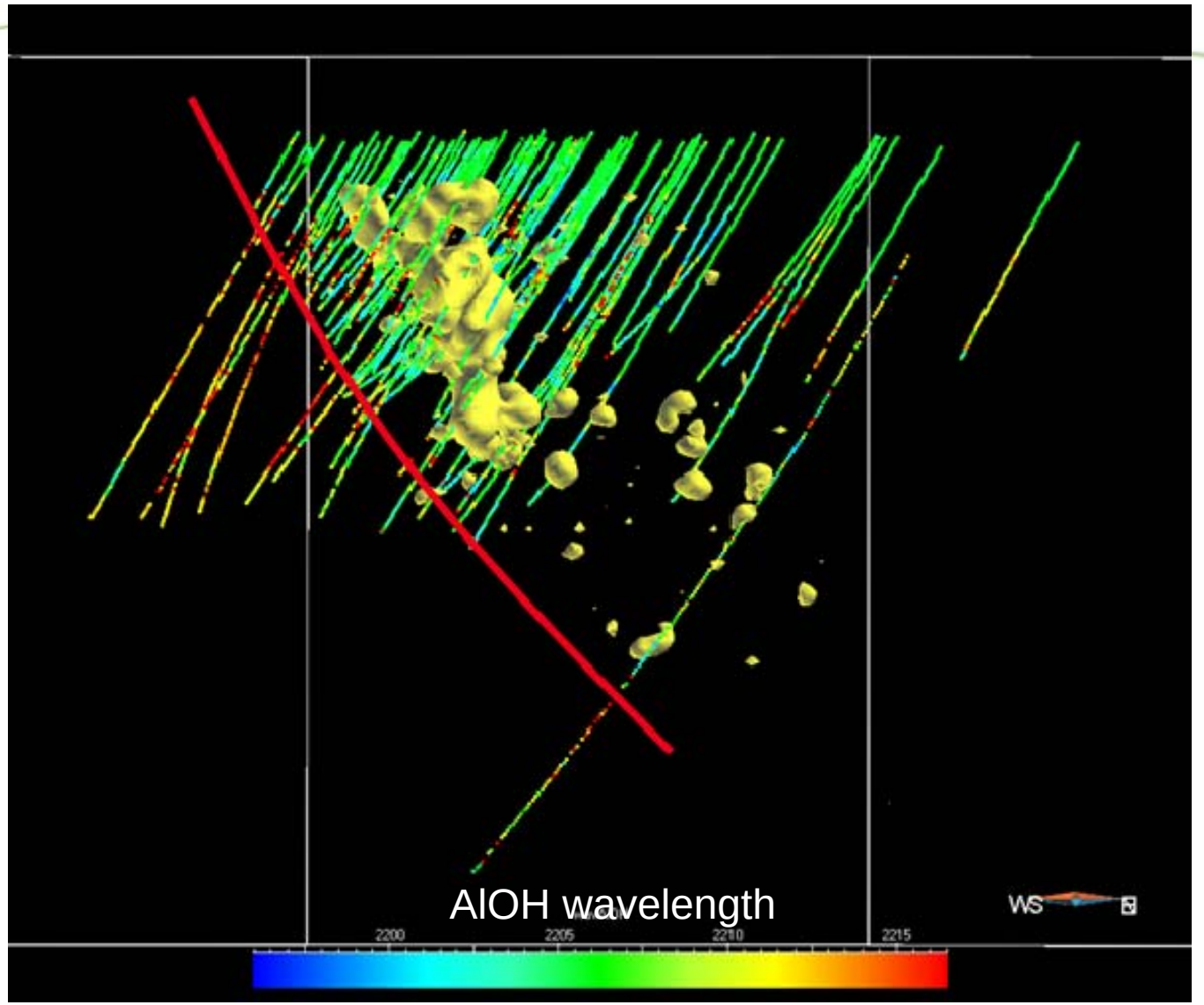


Detailed gravity –
total horizontal derivative

Large structures and
mafic-felsic contrast

Max Au in hole

Bellerophon gold and gradients: validation of the 5x5km targeting



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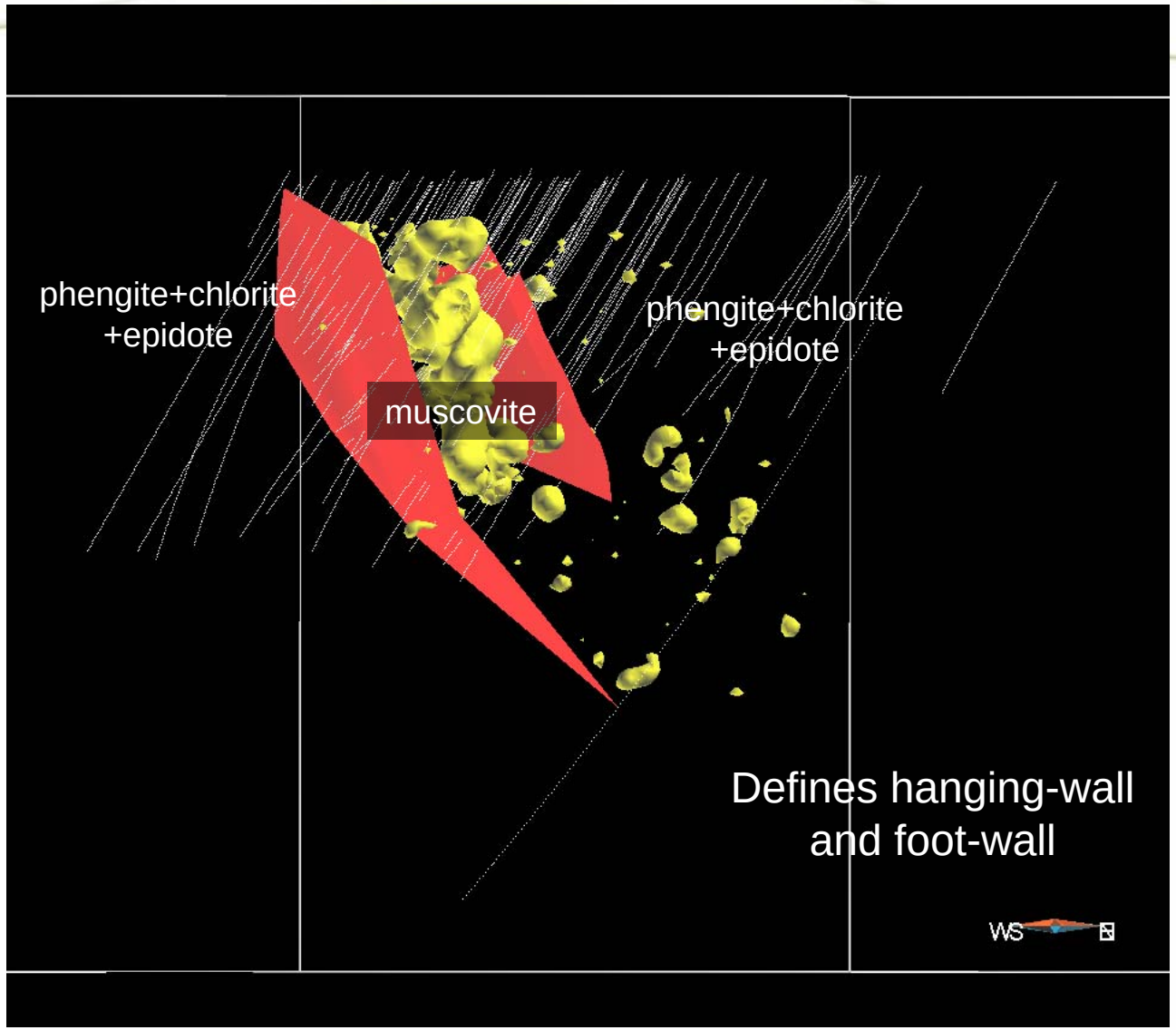
Bellerophon Section

Phengite – Muscovite Transition



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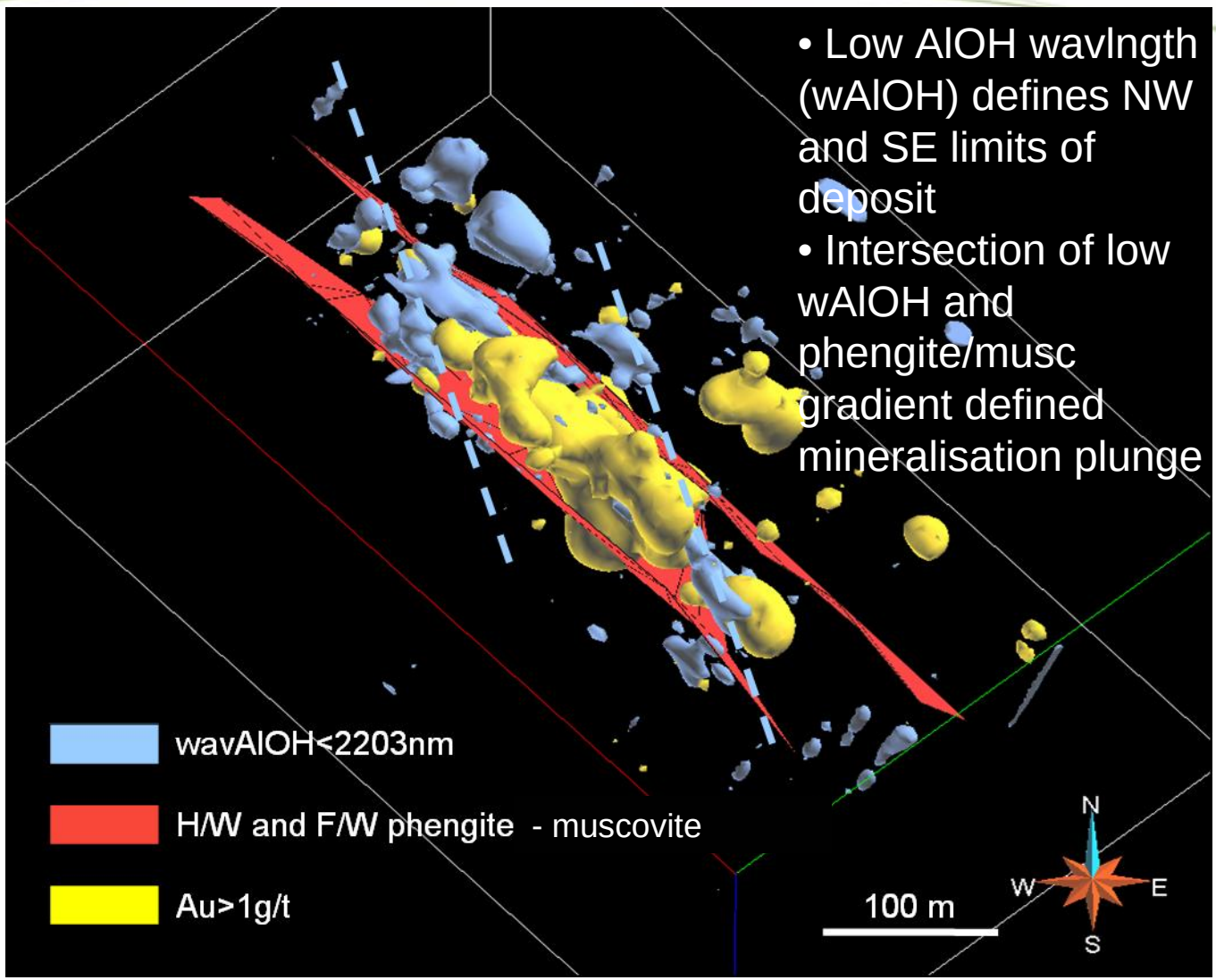
Bellerophon Perspective View

Spectral Interpretation & Au



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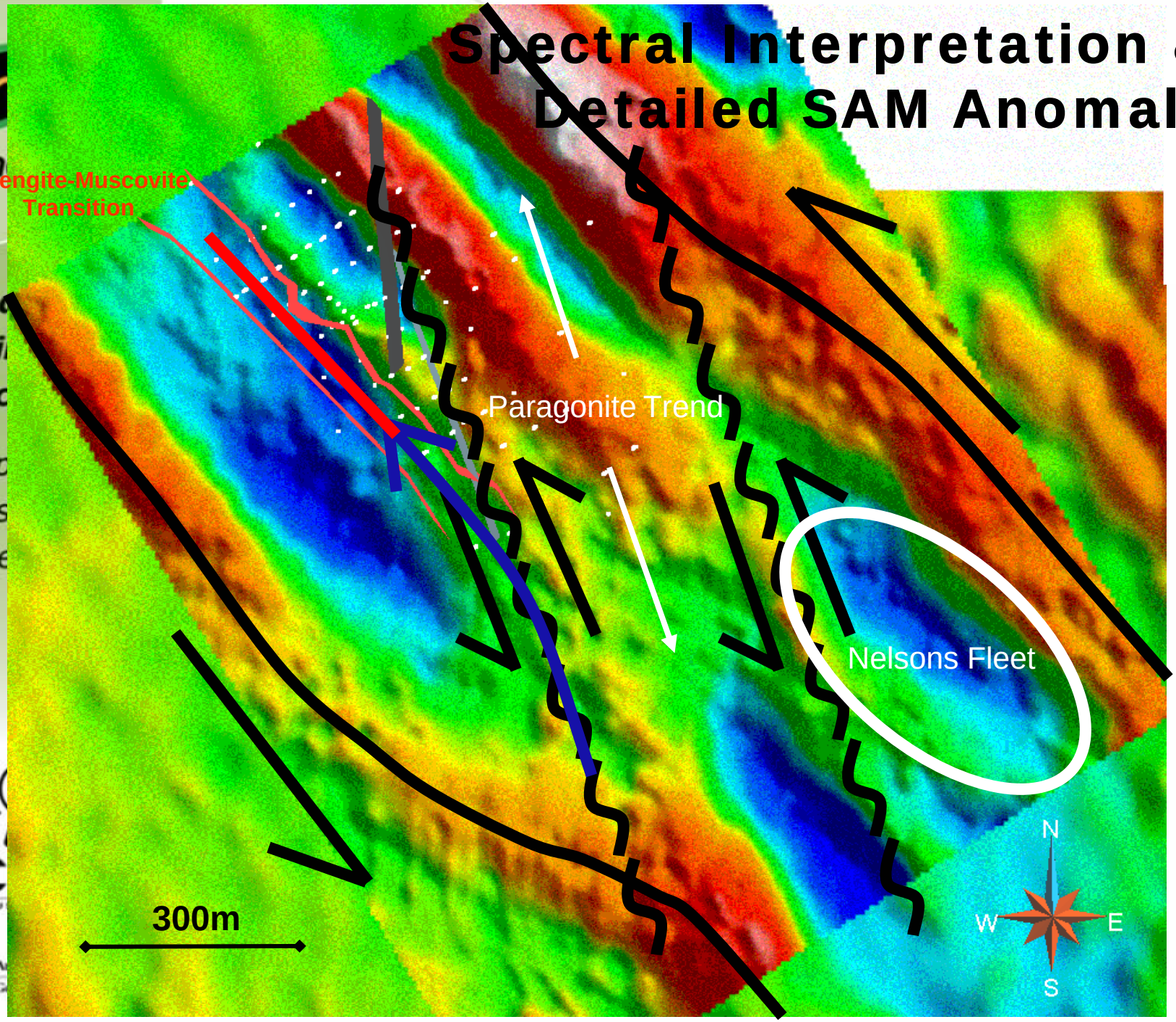
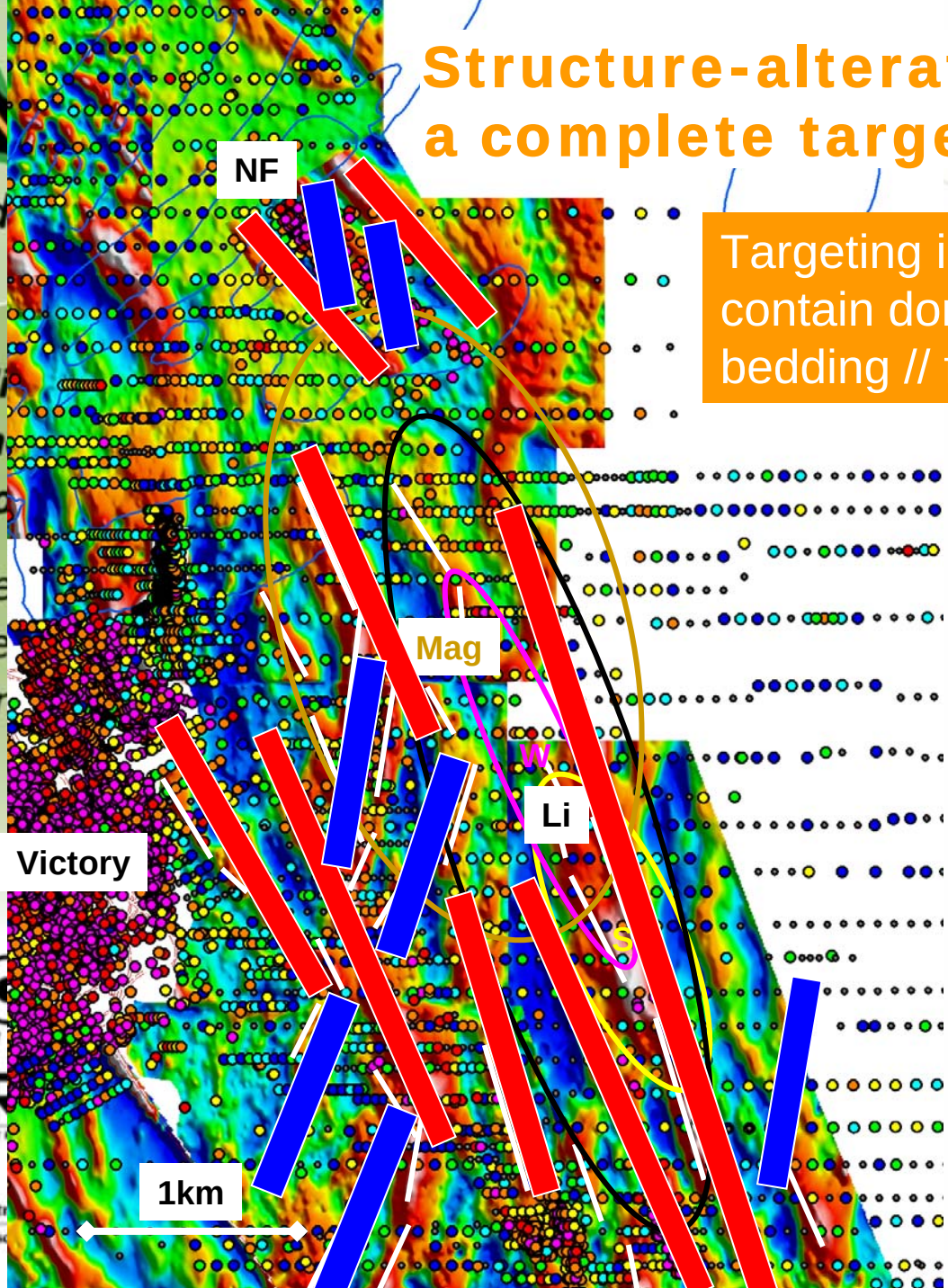
Spectral Interpretation & Detailed SAM Anomaly



Structure-alteration integration: a complete targeting formula



Targeting in the Black Flags: ie. contain dominant NW-trending bedding // foliation

Look for intersection of N- and NW-trending SAM lineaments

Lineament orientations dependent upon the orientation of the survey grid

N- and NW-trending lineaments represent reduced and oxidized structural corridors, respectively

Conclusions

- High resolution geophysical method (SAM) defined the anomaly that lead to the Bellerophon discovery
- Spectral logging of drill chips and 3D Gocad modelling facilitated a timely structural and mineralogical interpretation
- Lease-wide 'blanket coverage' geophysics and Multi-Element geochemistry allowed the learnings from Bellerophon to be applied to camp-scale exploration

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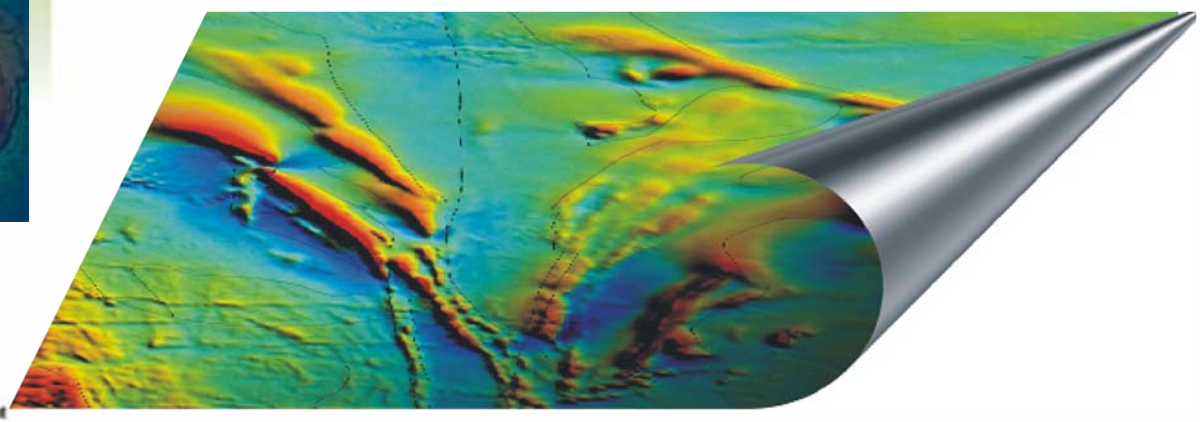
North Duketon - undercover

P. Henson & the *pmdCRC team**



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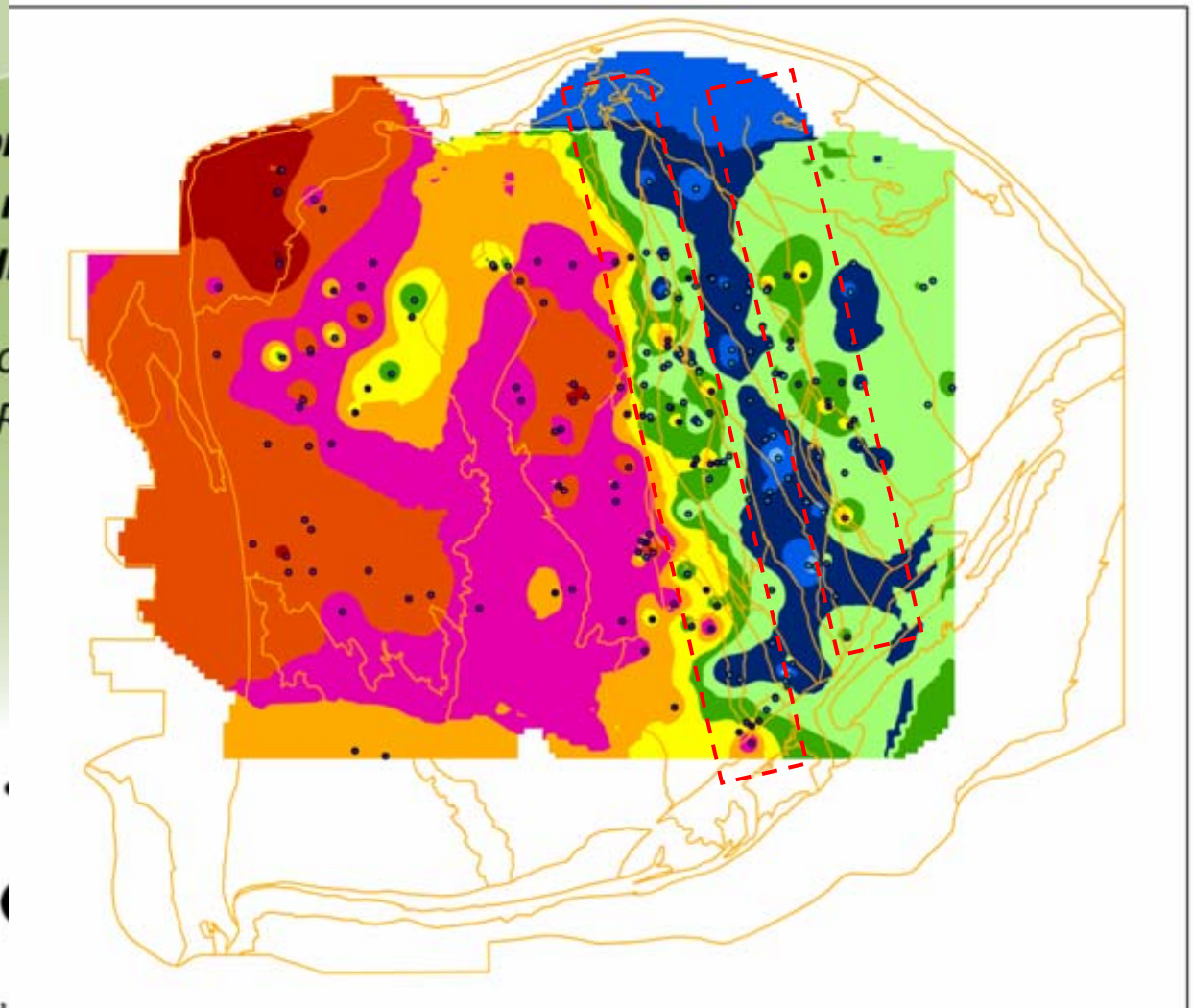
Targeting – regional

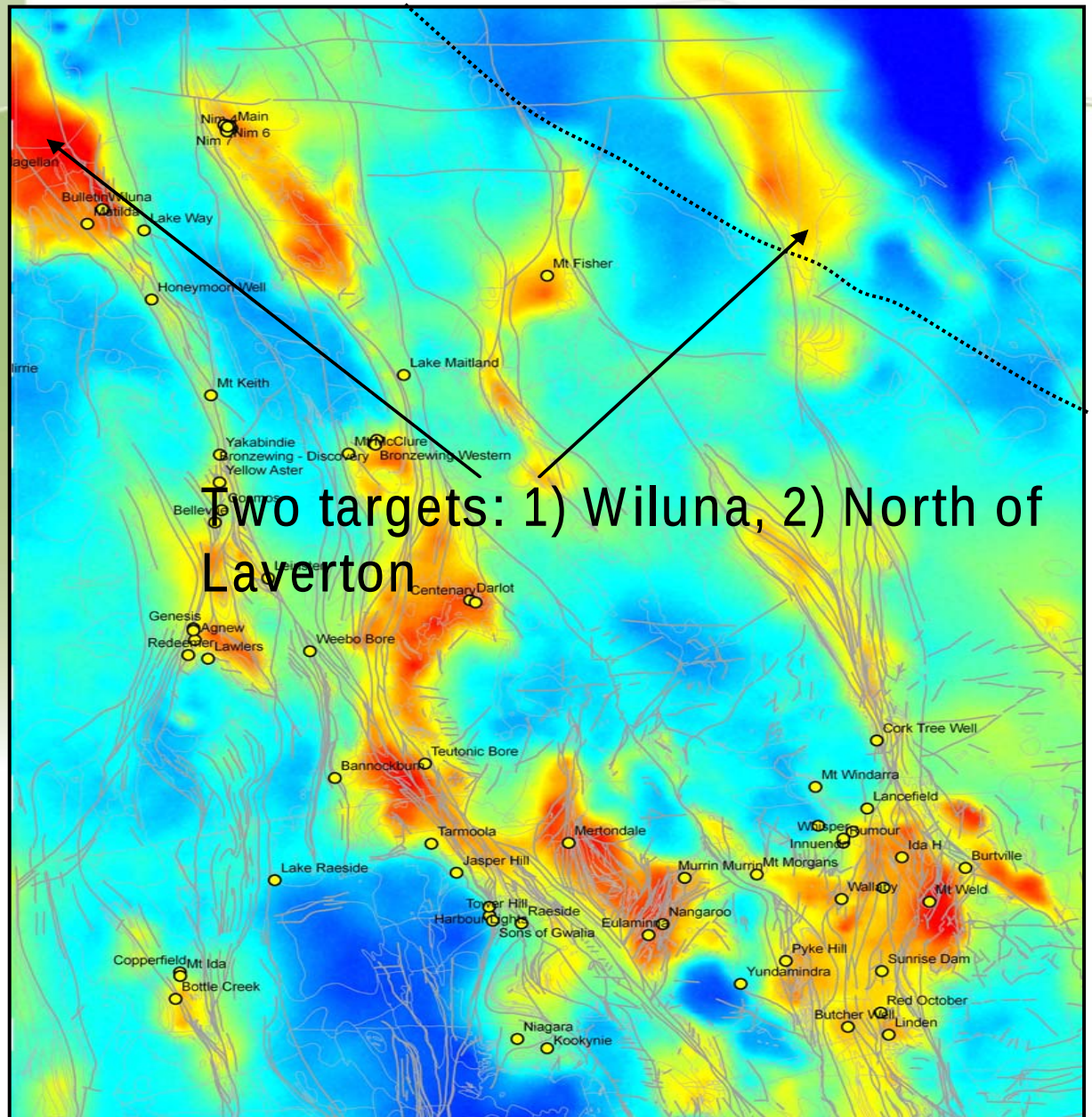
Sm-Nd isotopes



Mineralised corridors that extend undercover

Targeting – regional

Gravity



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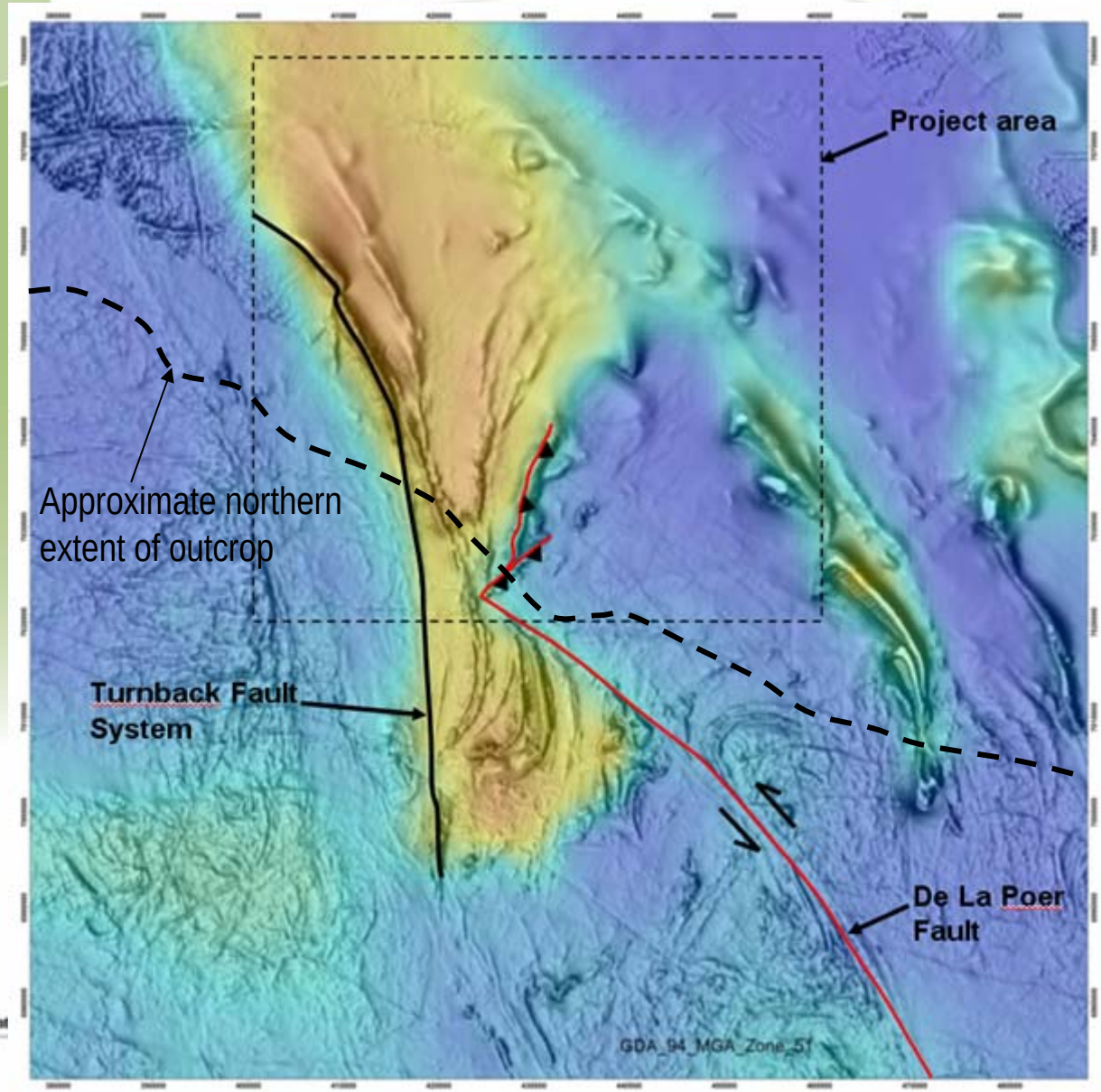
Targeting – regional

Gravity and Magnetics



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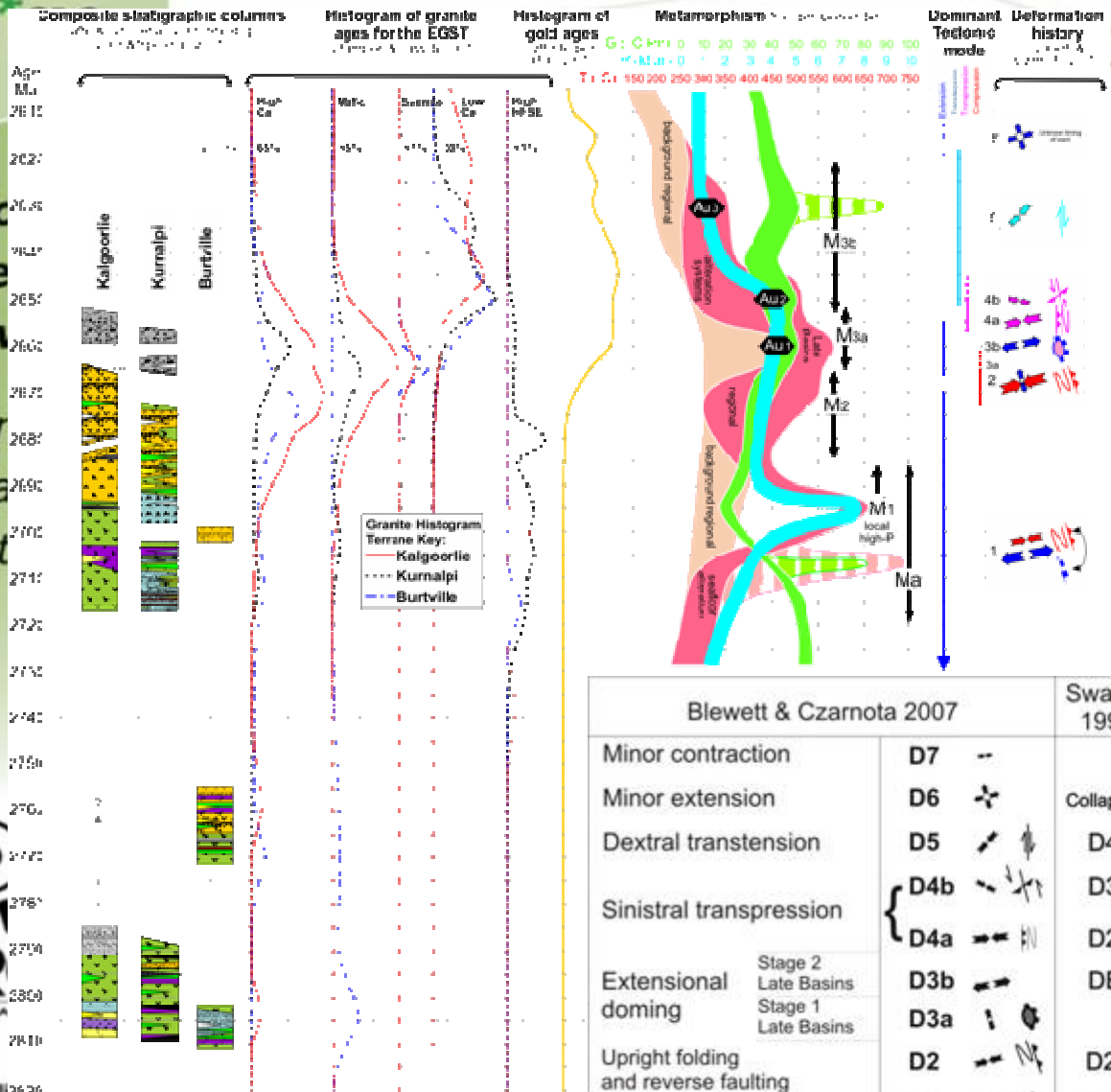
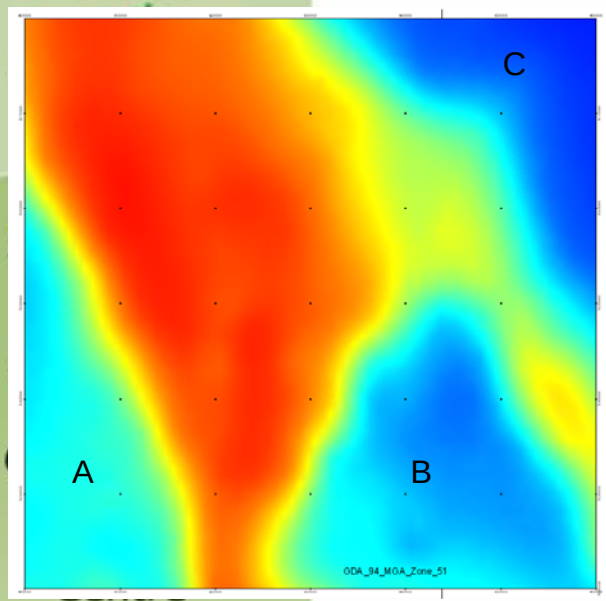
Structural & Geodynamic history

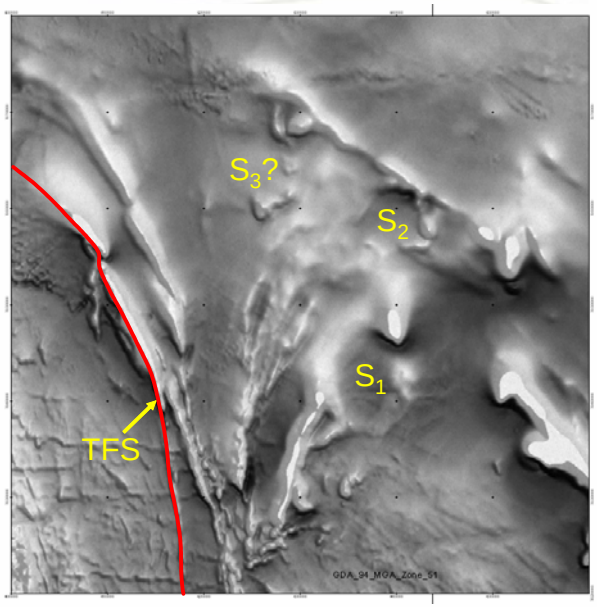
Laverton region

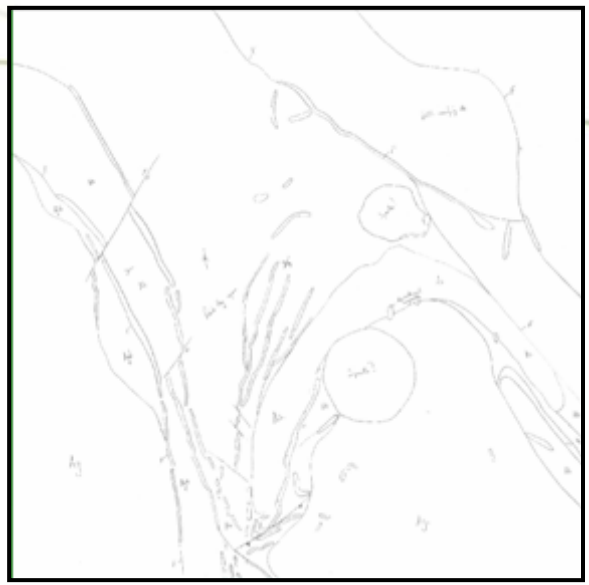


Blewett & Czarnota 2007			Swager 1997	Blewett *et al.* 2004b	Miller 2006
Minor contraction	D7	--			
Minor extension	D6		Collapse	Late De	
Dextral transtension	D5		D4	(D3 D3)	D4
Sinistral transpression	D4b		D3		D3
	D4a		D2	D2b	D2
Extensional doming (Stage 2 Late Basins)	D3b		DE	D2e	
Extensional doming (Stage 1 Late Basins)	D3a				
Upright folding and reverse faulting	D2		D2	D2a	D1
Extension with intermittent compression	D1		DE	De, D1, D1e	

Magnetic and Gravity interpretation

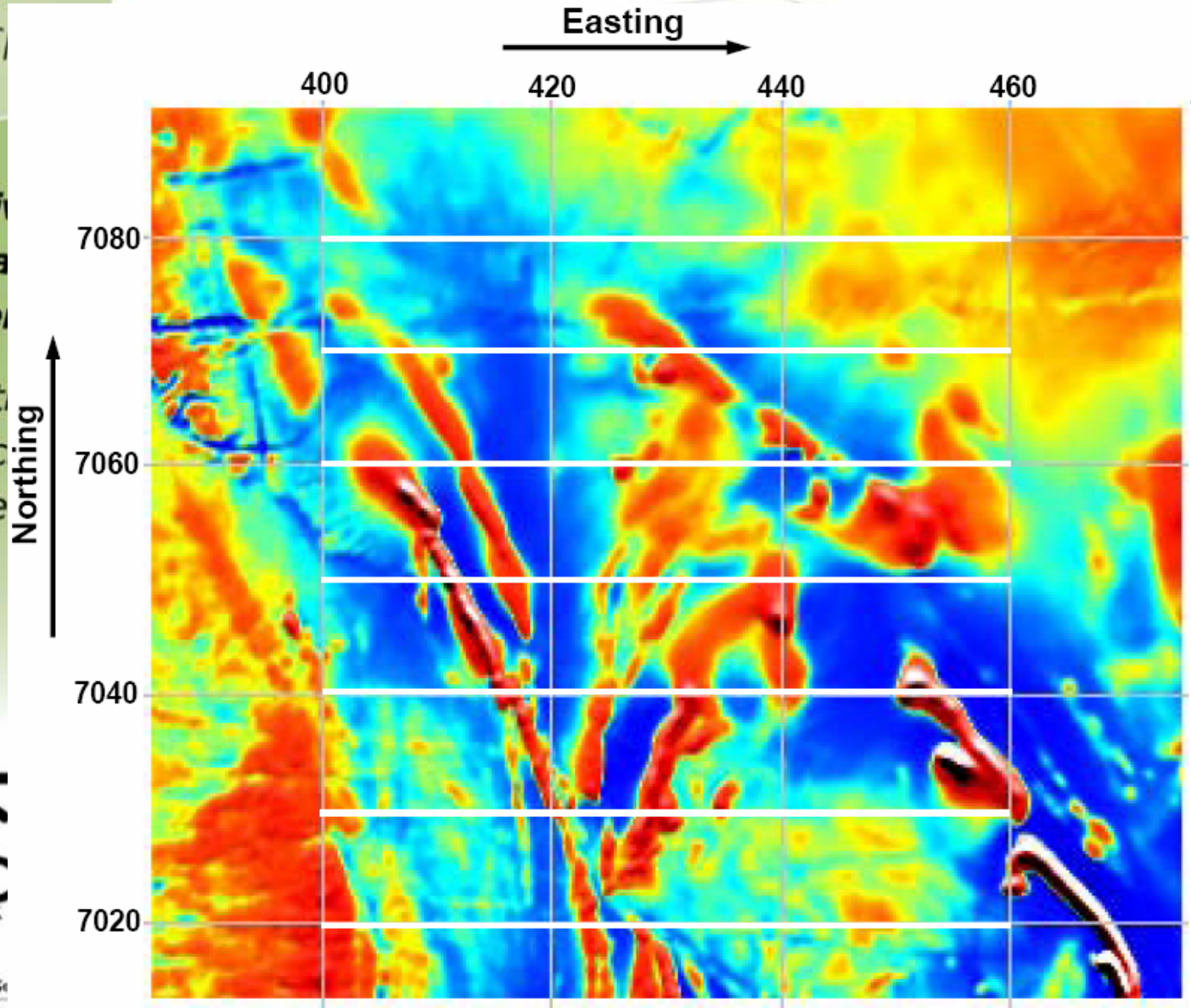






- Deposition of the mafic/ ultramafic sequence
- Deformed and folded probably during D2
- Intrusion of a large High Ca granite, truncating pre-folded mafic/ ultramafic units
- Sinistral faulting of the NW trending De La Poer Fault, imaged using magnetics, which produced a fabric orthogonal to the D4b stress vector
- Development of a NNE trending SE dipping thrust fault initiated at the tip of the De La Poer Fault during D4b
- Intrusion of syenites into to the pre-folded sequence syn to post D4b
- Development of NNE trending dextral faults associated with D5

Depth to basement



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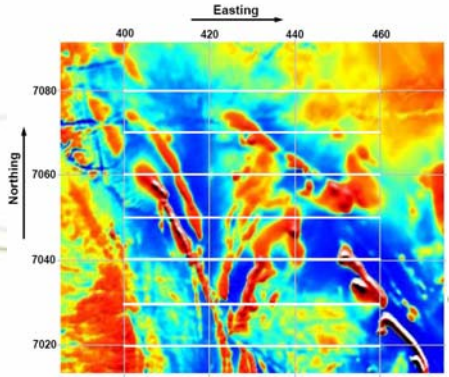
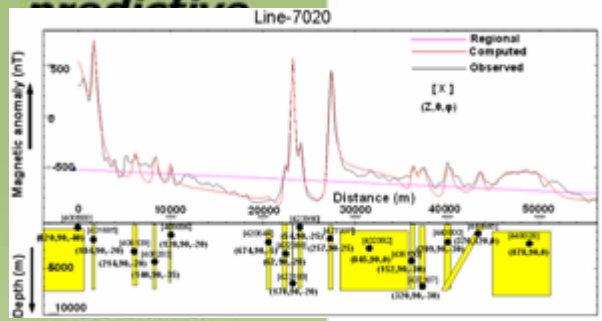
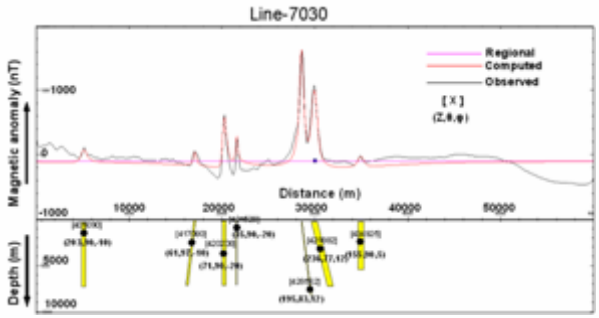
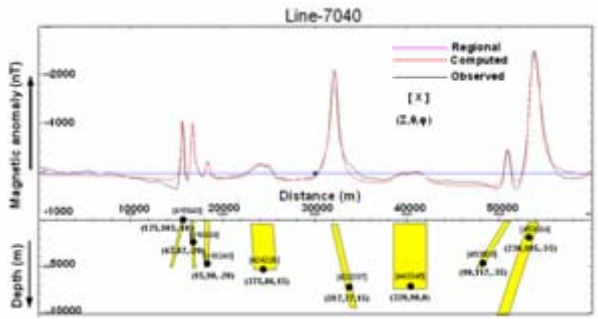
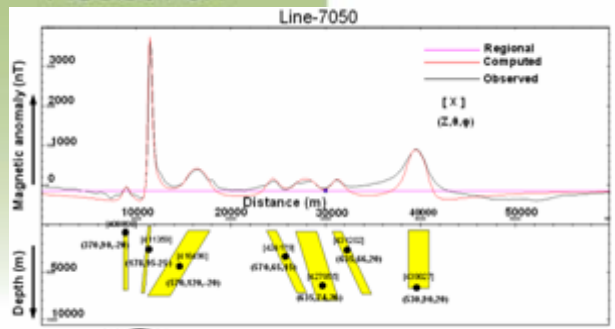
Depth to basement

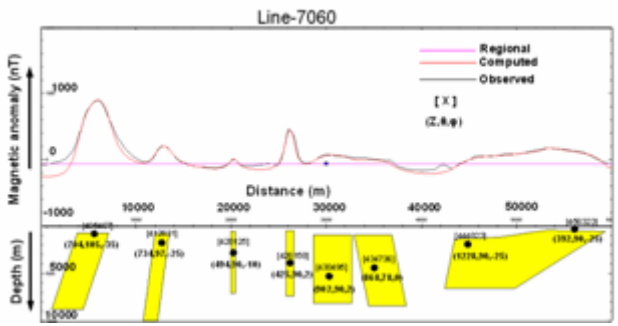


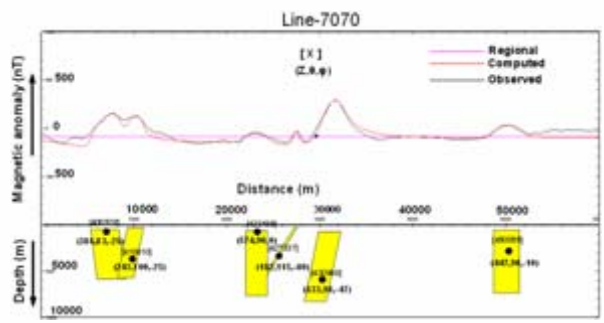


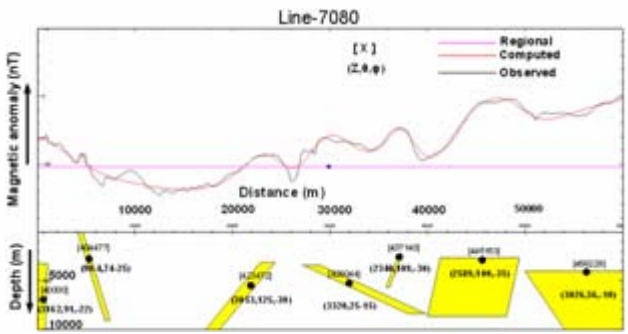




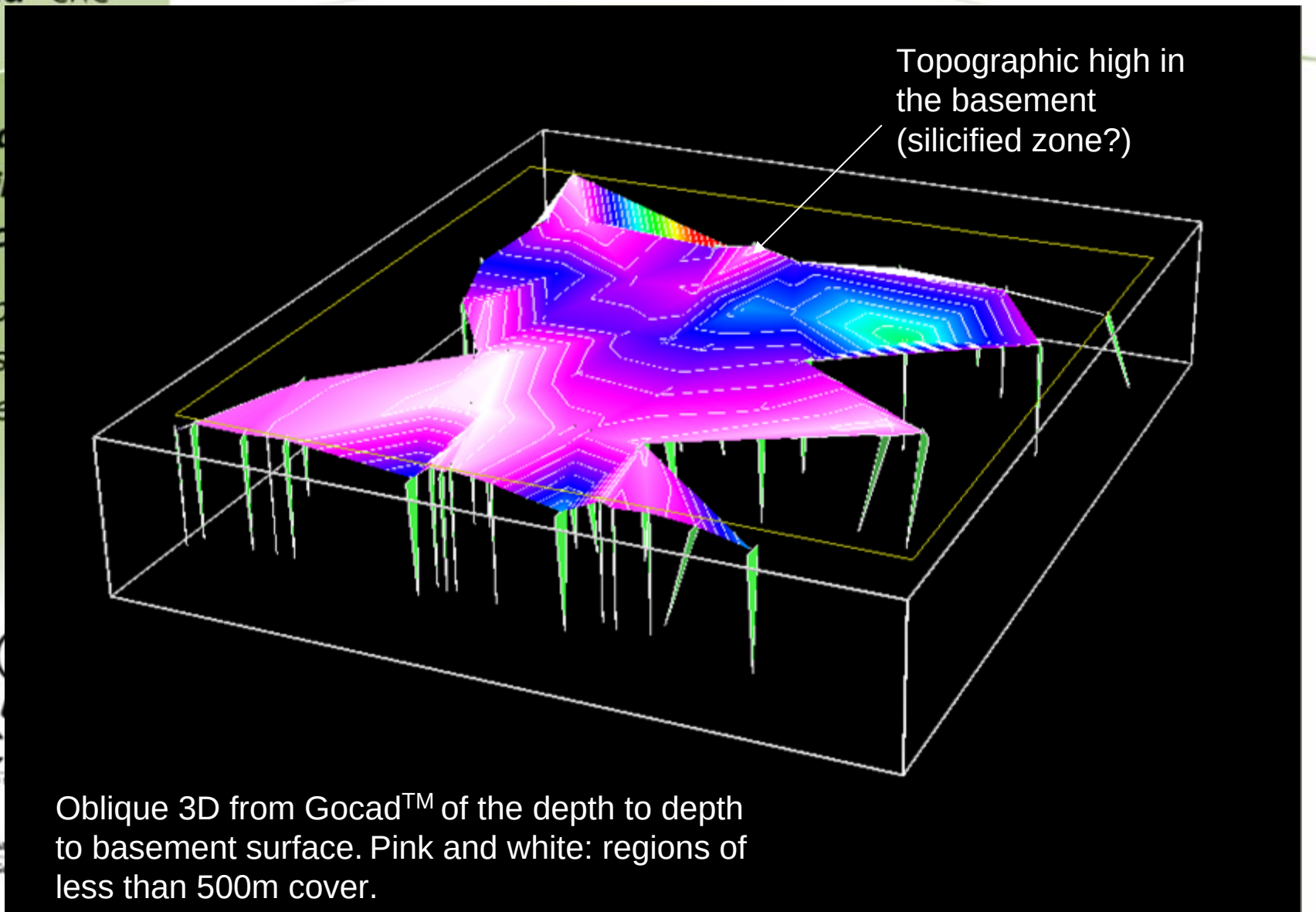






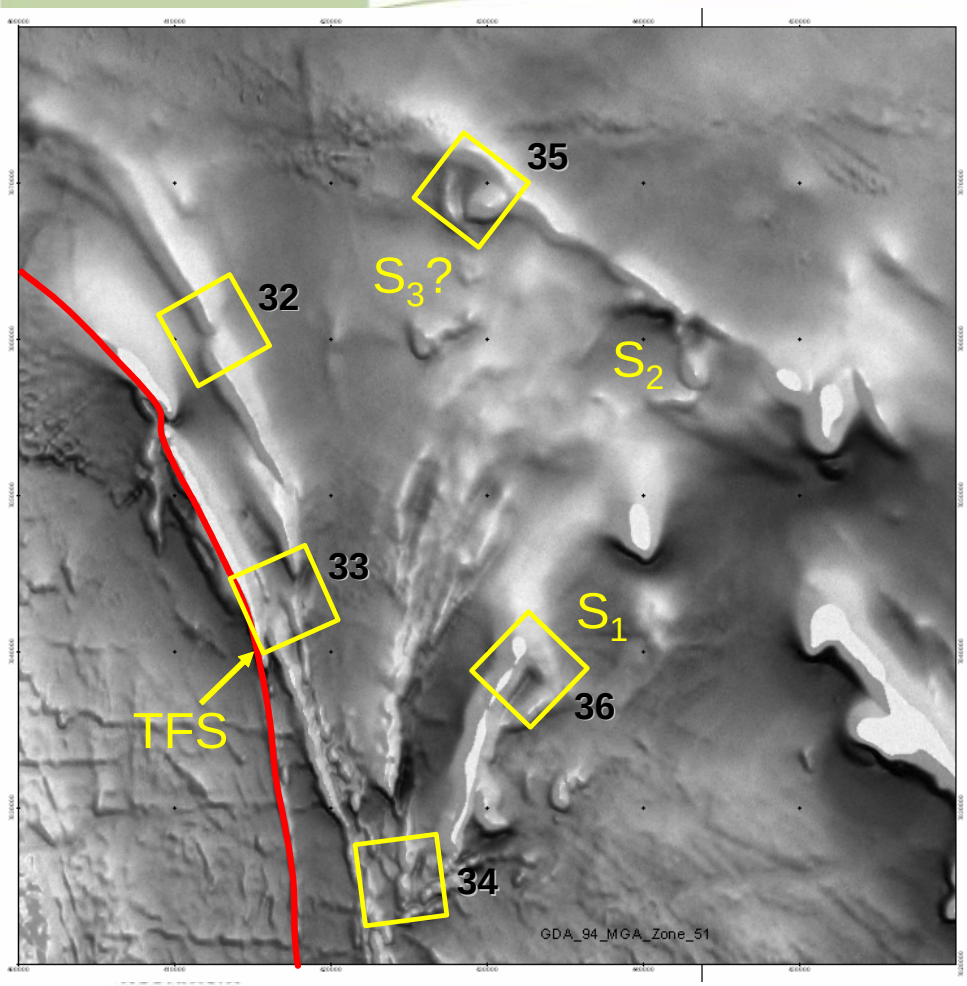


Depth to basement



Oblique 3D from Gocad™ of the depth to depth to basement surface. Pink and white: regions of less than 500m cover.

Targeting criteria



- Early formed normal faults around the granite/ gneiss boundaries
- Structural complexity
- Similar orientation of faults active during the D4b and D5 Au forming events at Laverton
- NNE trending faults active as thrusts during the D4b event
- NNE trending dextral D5 faults and their intersection with NNW trending faults
- Magnetic highs proximal to syenites indicating highly oxidised assemblages
- <500m of cover sequence

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