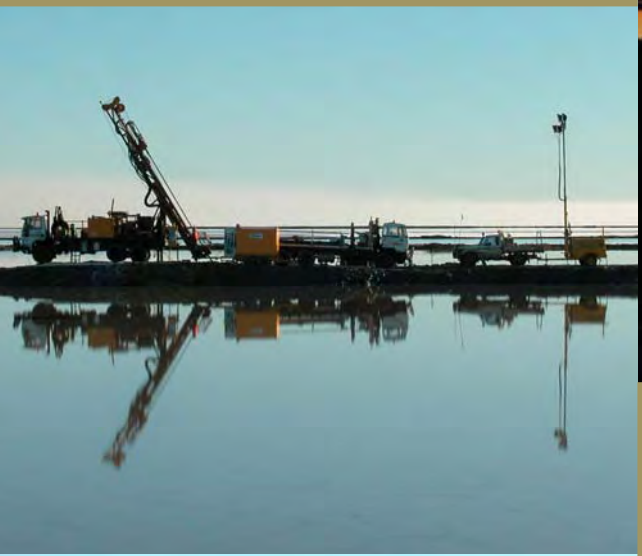


Lithogeochemistry & Gold Exploration St Ives, Kambalda, WA

Kylie Prendergast

September 2005

Lithogeochemistry & Gold Exploration
St Ives

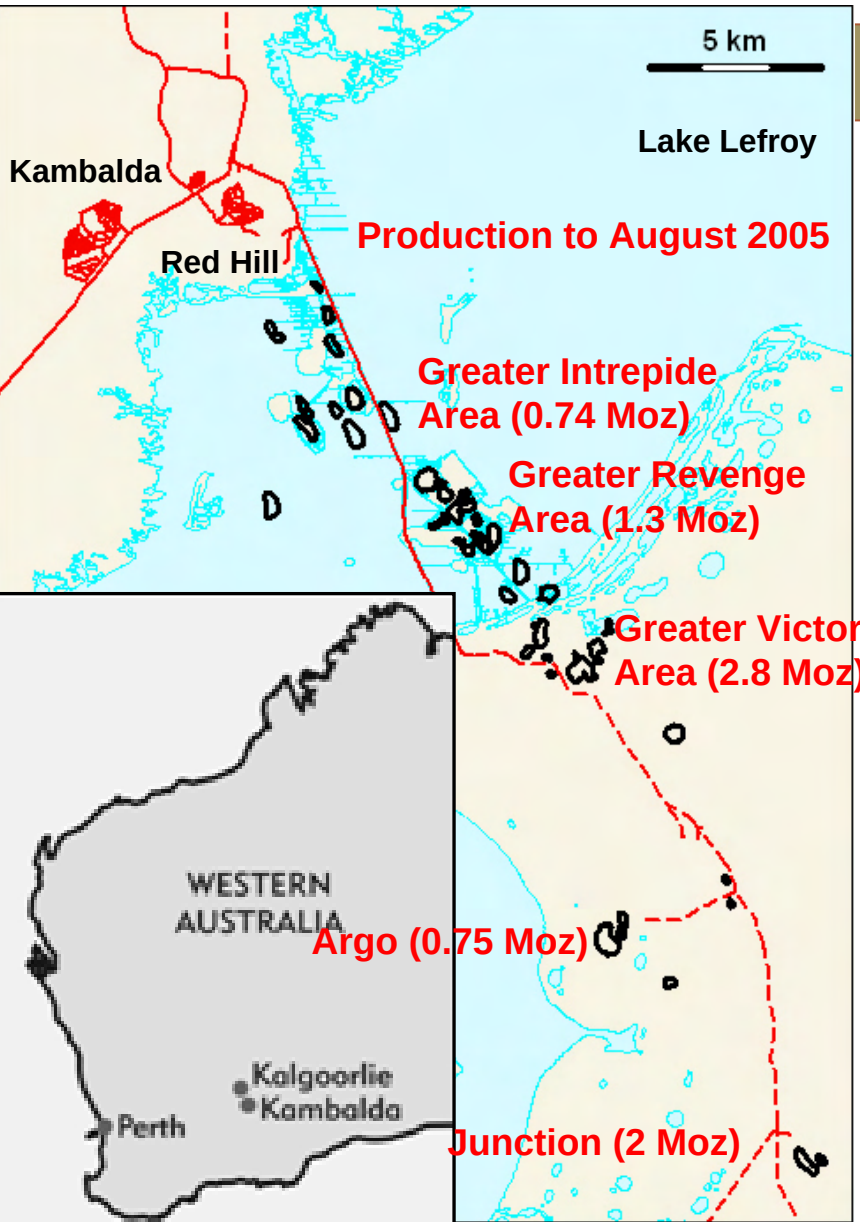
GOLD FIELDS

Outline

- Geological setting
- Classification of lithology, stratigraphy and alteration
- Chemical characterisation of existing St Ives deposits (alteration and pathfinders) - empirical exploration models
- Integration with architecture and geophysics in GoCad – testing conceptual exploration models

Lithogeochemistry & Gold Exploration St Ives

GOLD FIELDS



Location & History

- Gold first discovered at Red Hill 1897
- Mining intermittent, ceased in 1930s
- WMC discovered Ni in 1966
- Explored for gold at end 1970s
- Victory Mine discovered in 1980
- Endowment 12.5 moz Au

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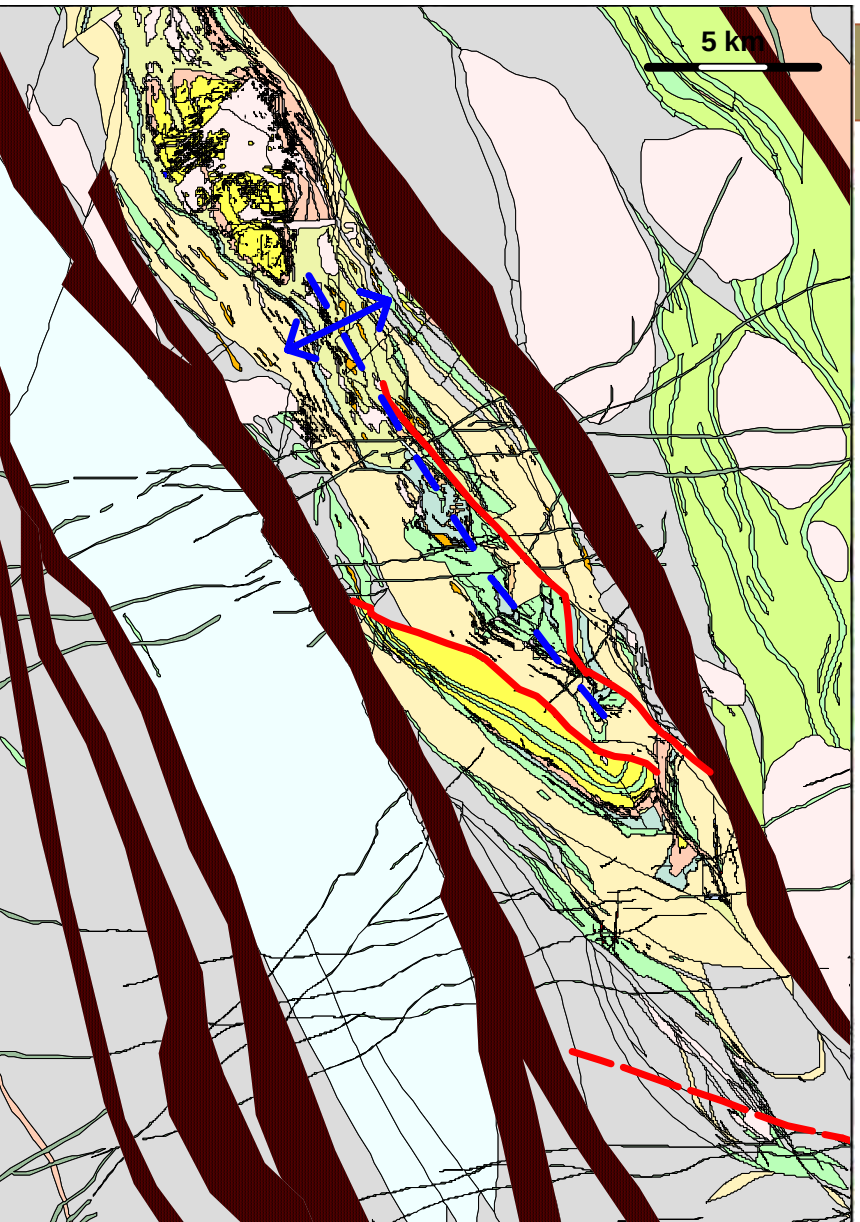
St Ives

GOLD FIELDS



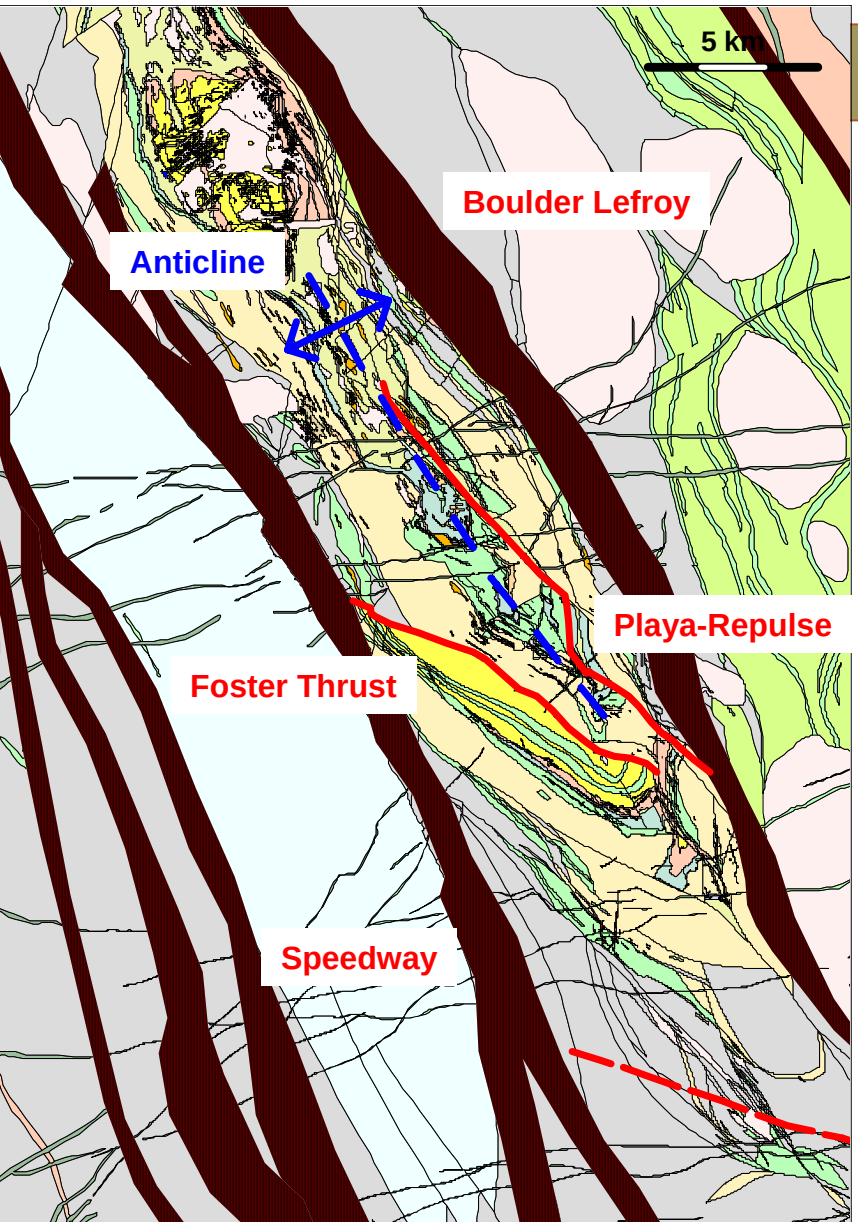
Geological Setting

- **Archaean greenstone package**
- **Gold hosted by dolerite, porphyry intrusions, interflow sediments and felsic sediments**

Felsic Sediment
Felsic Sediment
Basalt / Ultramafic
Dolerite
Basalt

Lithogeochemistry & Gold Exploration
St Ives

GOLD FIELDS



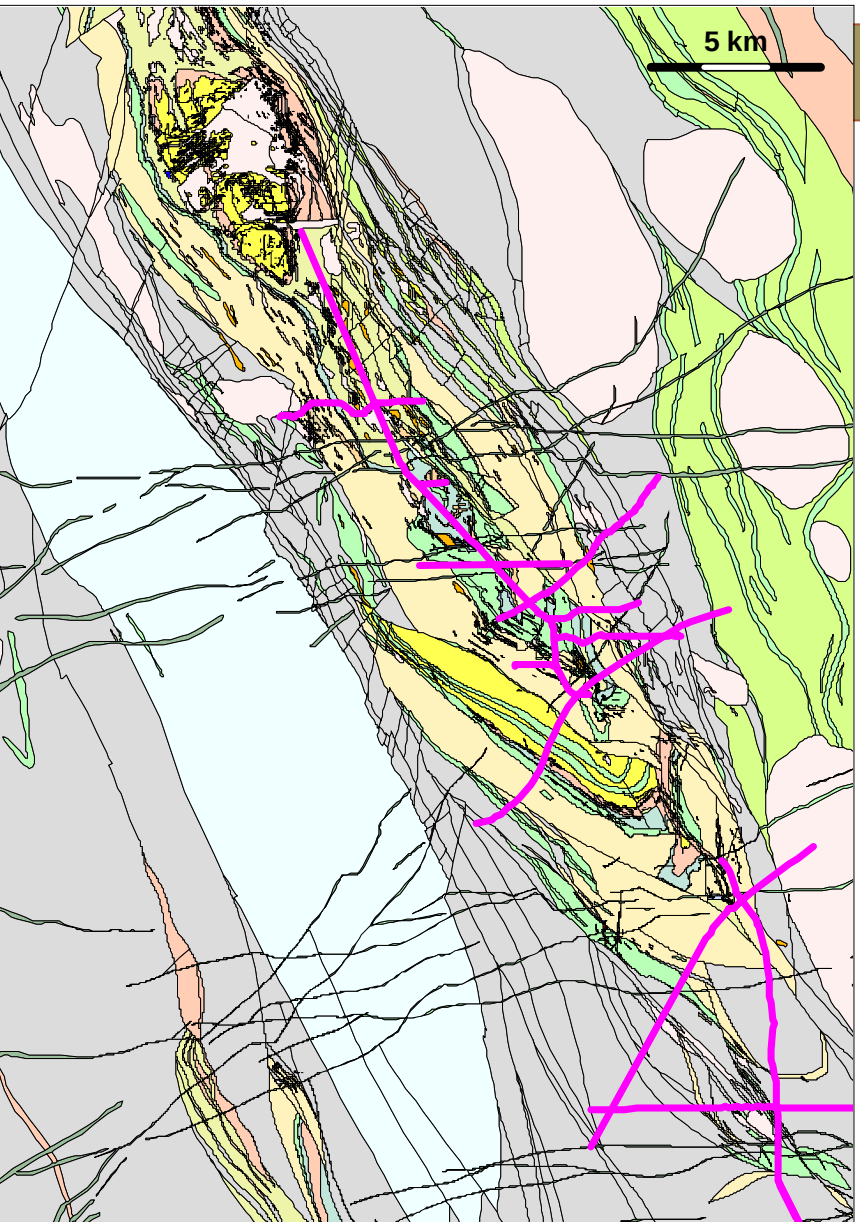
Geological Setting

- Archaean greenstone package
- Gold hosted by dolerite, porphyry intrusions, interflow sediments and felsic sediments
- Folded in south plunging anticline
- Major faults

Felsic Sediment
Felsic Sediment
Basalt / Ultramafic
Dolerite
Basalt

Lithogeochemistry & Gold Exploration St Ives

GOLD FIELDS



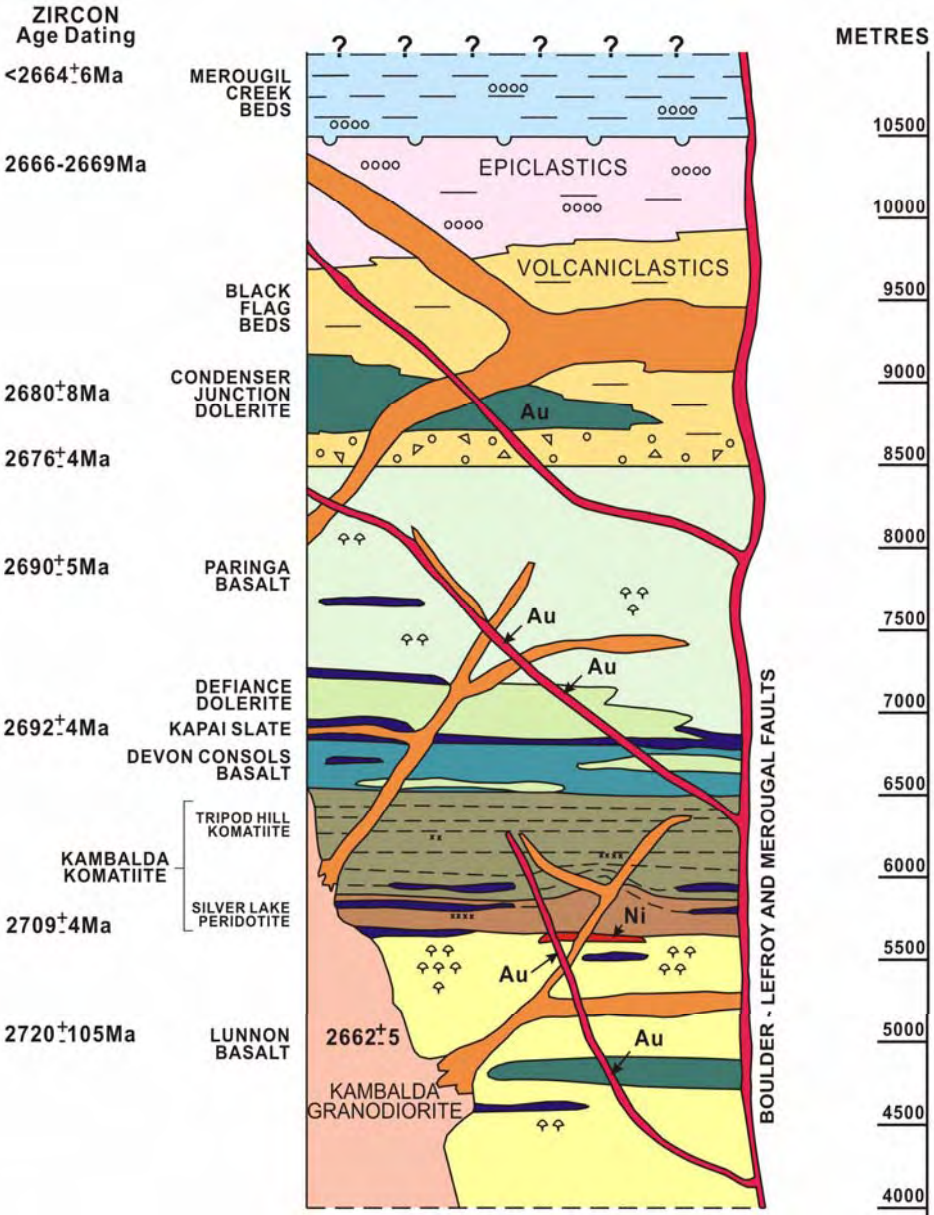
Geological Setting

- **Archaean greenstone package**
- **Gold hosted by dolerite, porphyry intrusions, interflow sediments and felsic sediments**
- **Folded in south plunging anticline**
- **Major faults**
- **Seismic constraint**

Felsic Sediment
Felsic Sediment
Basalt / Ultramafic
Dolerite
Basalt

Lithogeochemistry & Gold Exploration

St Ives Stratigraphy



Late stage basins
<2657 Ma

Black Flag Beds
2690-2660 Ma

Mafic – ultramafic sequence
2720-2690 Ma

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GOLD FIELDS

Multi element methodology – "top of fresh rock"

1. Analyse for 36 elements + Au to ppb level (Genalysis ICPMS/OES)

2. Use trace elements (less affected by alteration) to classify/domain lithology and stratigraphy

3. Use major elements to domain for alteration style

4. Check pathfinder elements for alteration style

Scott Halley pers comm.

Lithogeochemistry & Gold Exploration St Ives

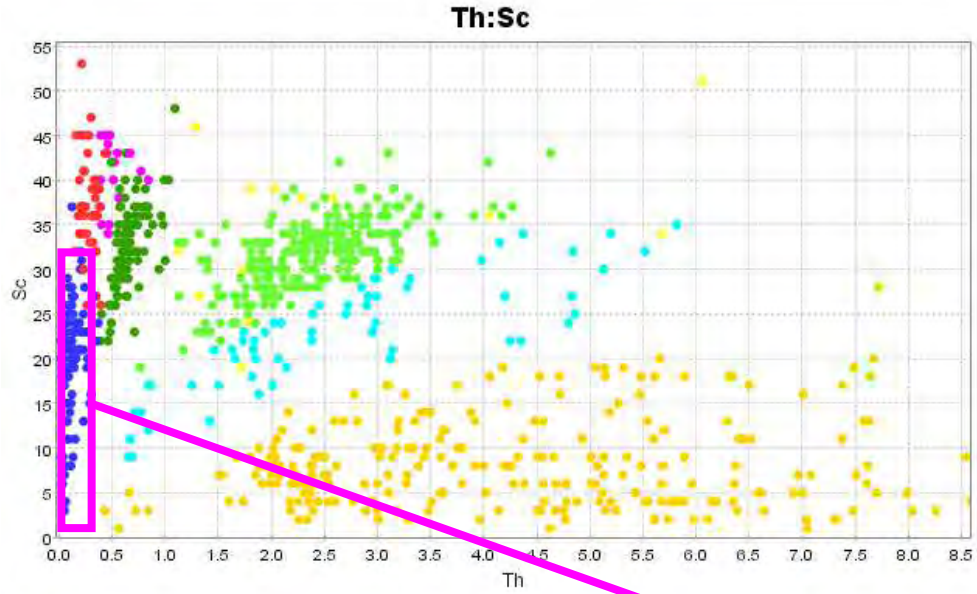
GOLD FIELDS

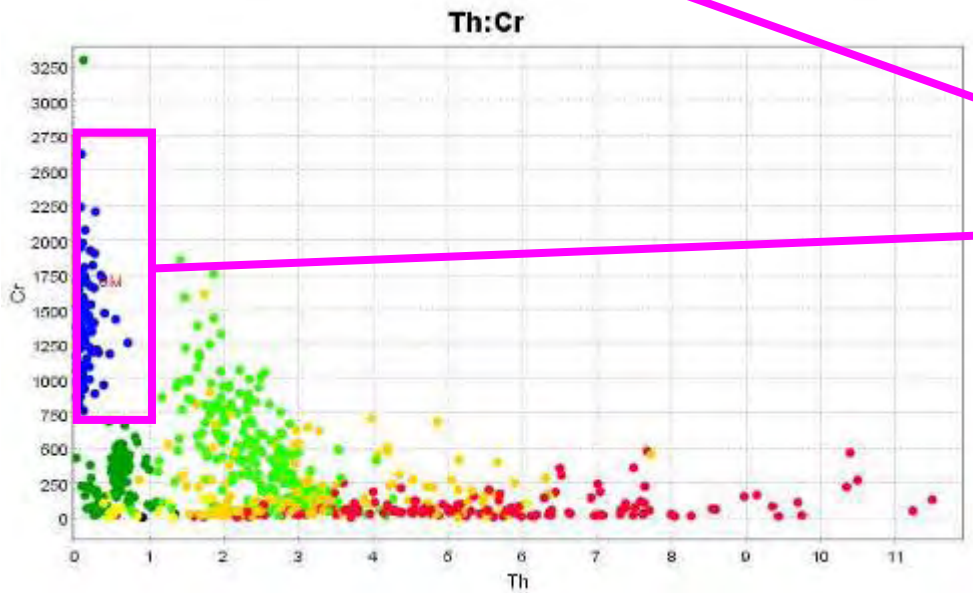
Benefits

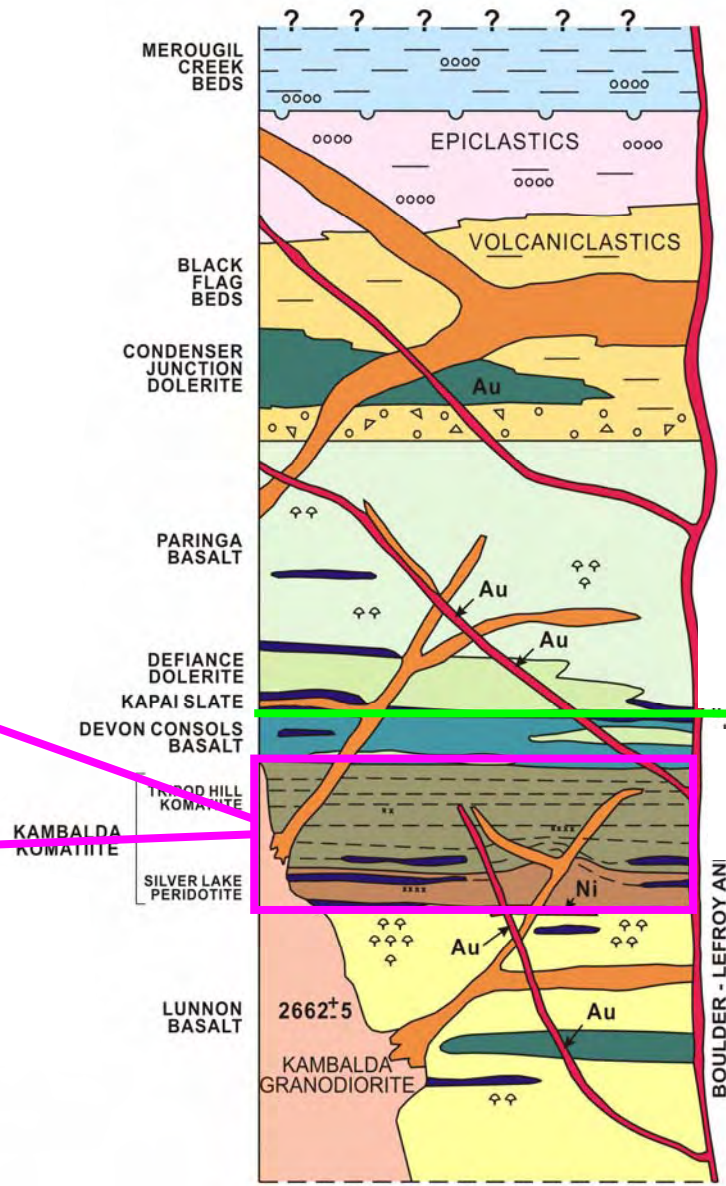
- Low cost exploration tool
- Constrain lithology and stratigraphy (strengthen geological interpretation)
- Chemically characterise existing St Ives deposits and improve empirical and conceptual exploration models
- Quantitatively compare and rank prospects on alteration and pathfinder features

Trace Elements – St Ives Stratigraphy
Ultramafic (Th: Sc, Cr)

GOLD FIELDS

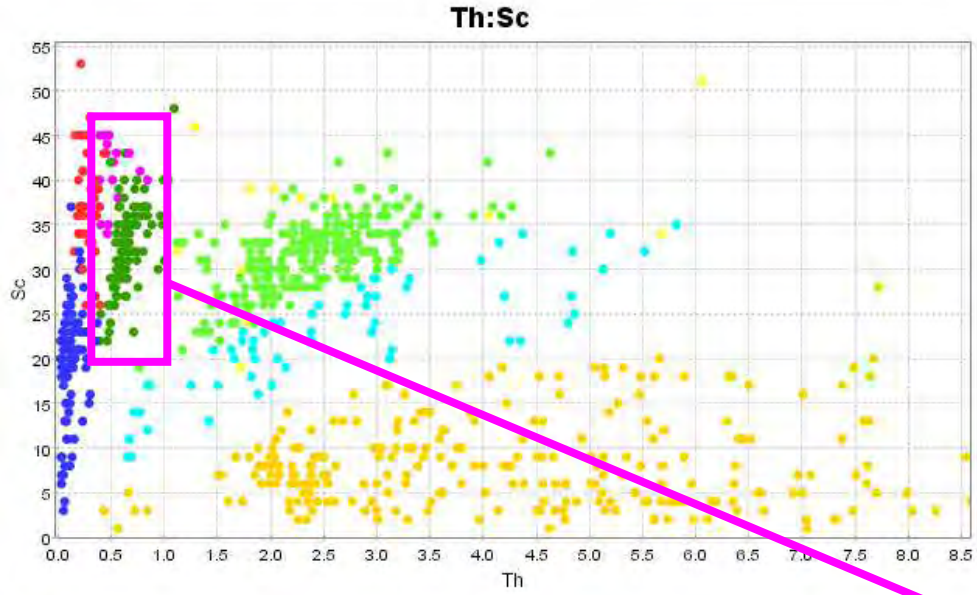


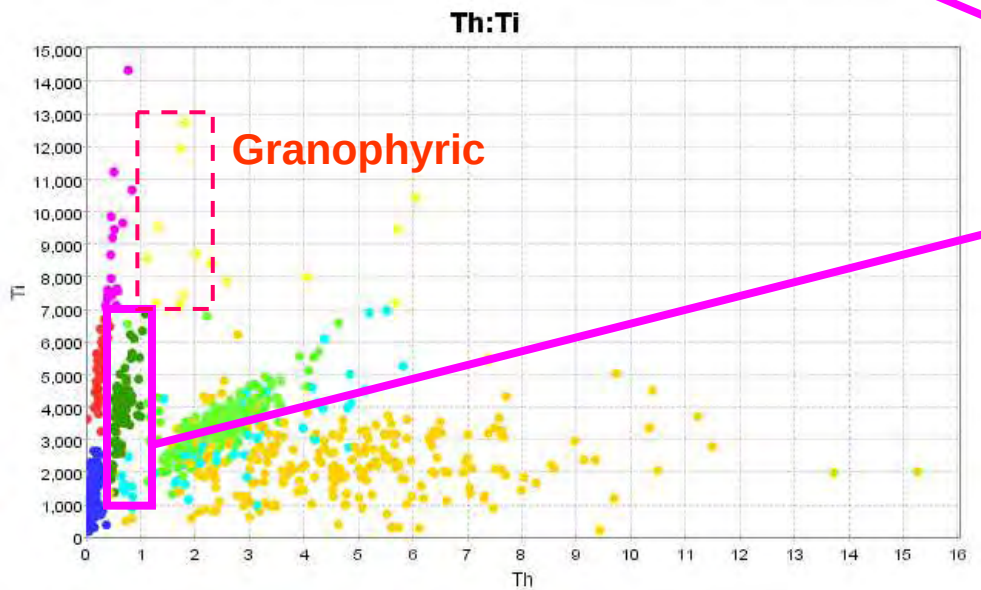


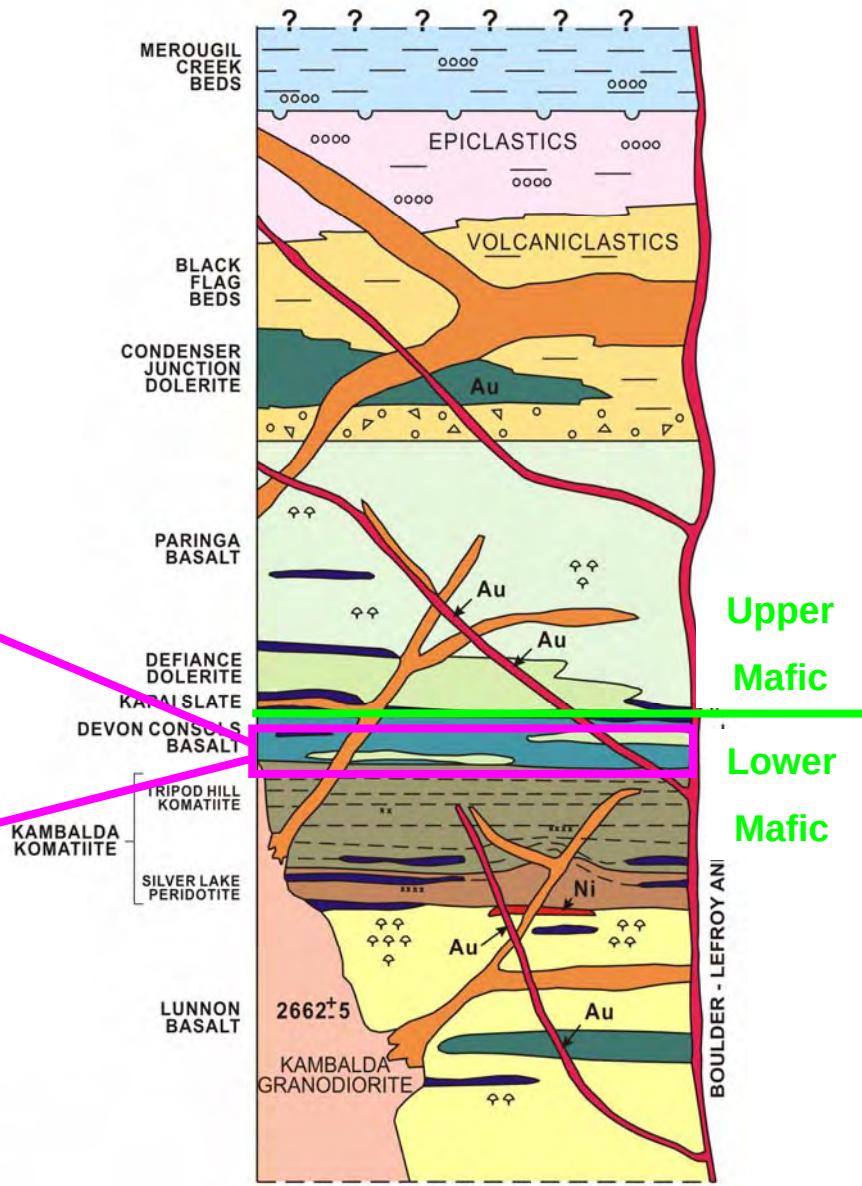


Trace Elements – St Ives Stratigraphy
Devon Consols Basalt & Victory Dolerite (Th: Sc, Ti)

GOLD FIELDS

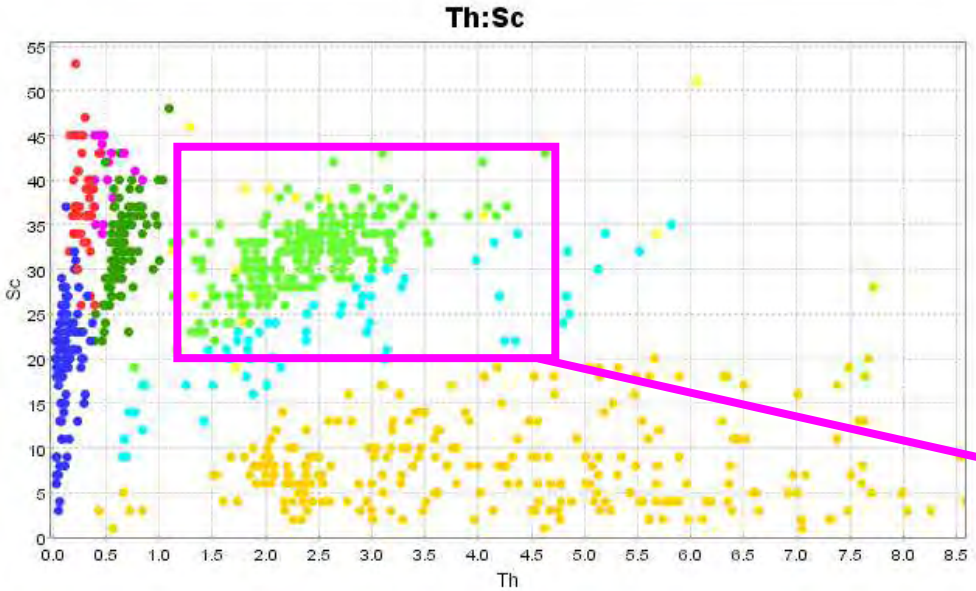


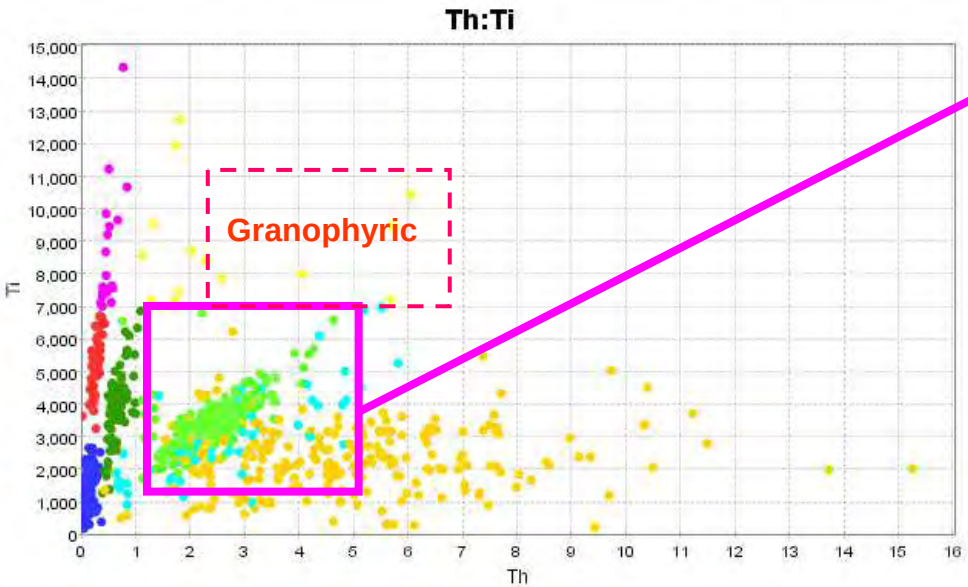


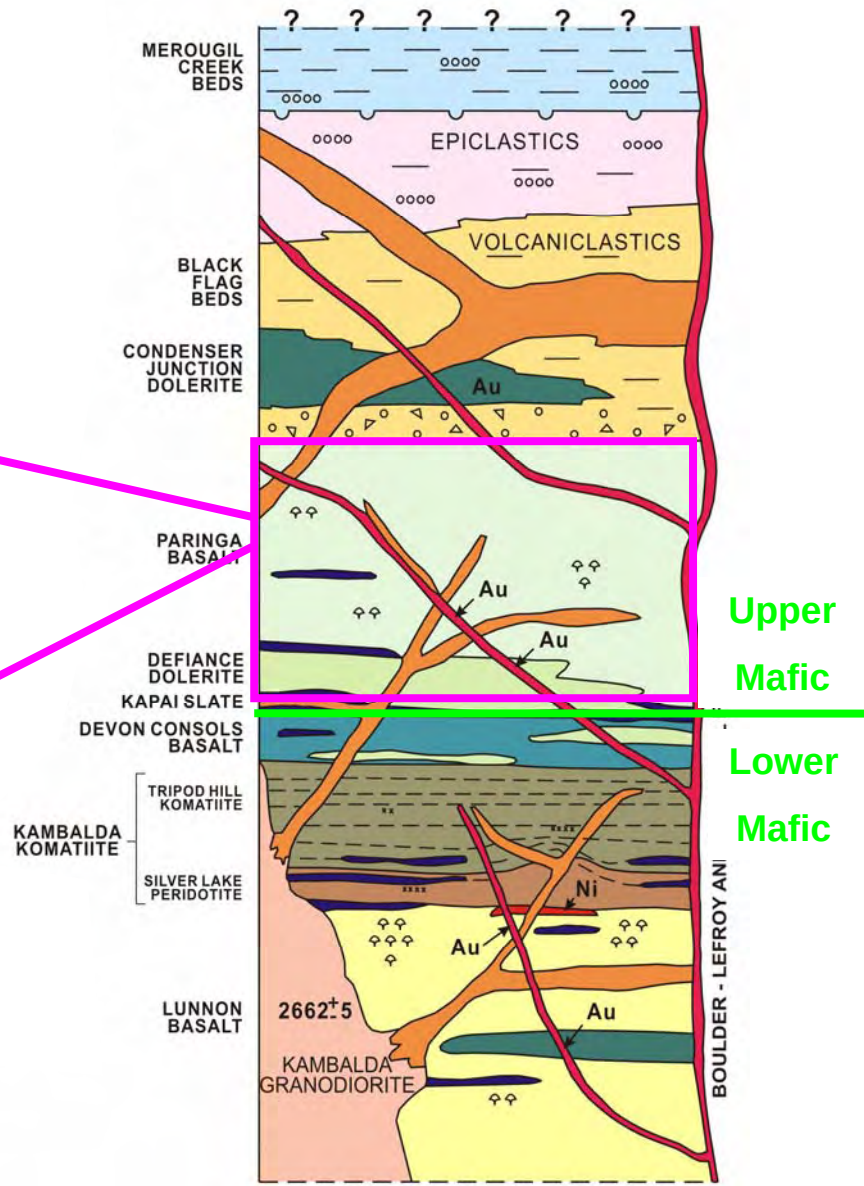


Trace Elements – St Ives Stratigraphy
Paringa Basalt & Defiance Dolerite (Th: Sc, Ti)

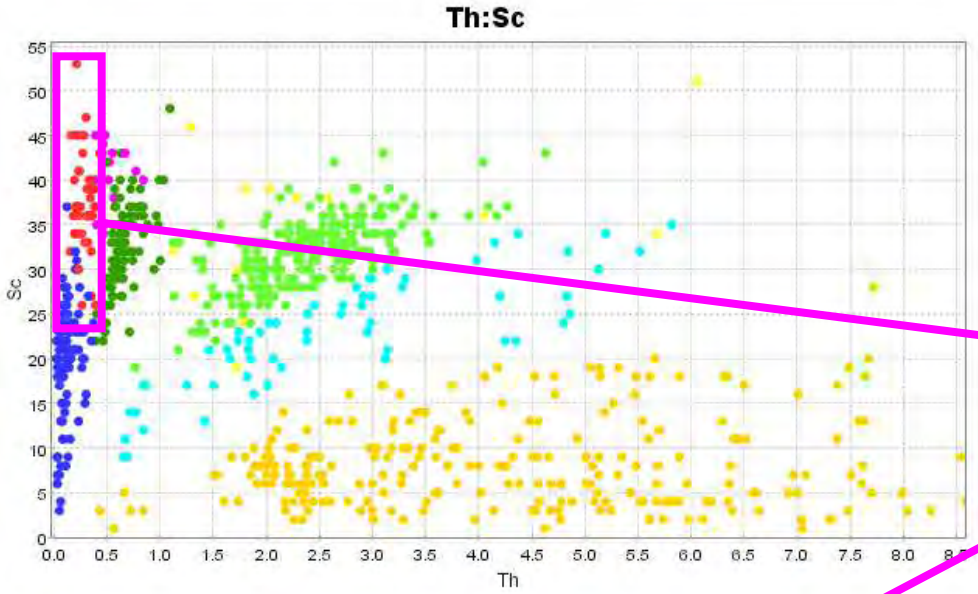
GOLD FIELDS

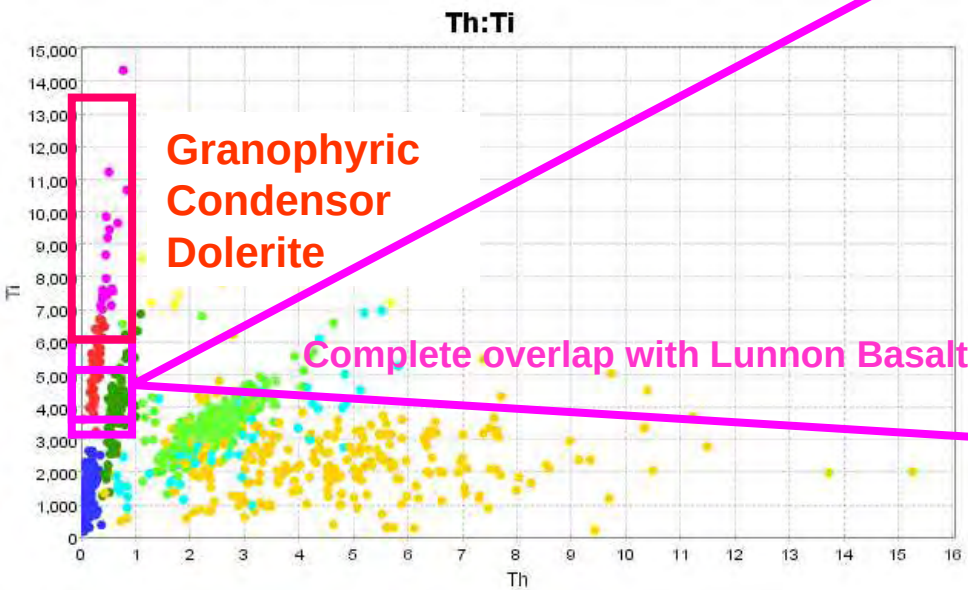


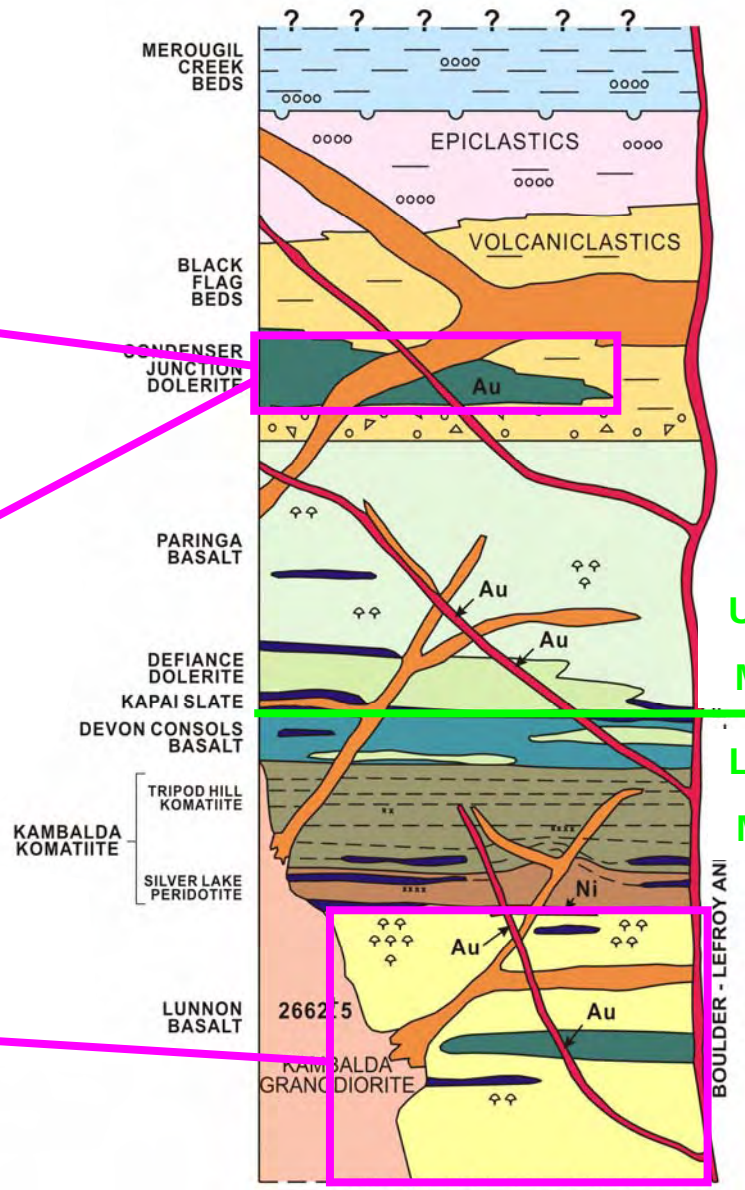




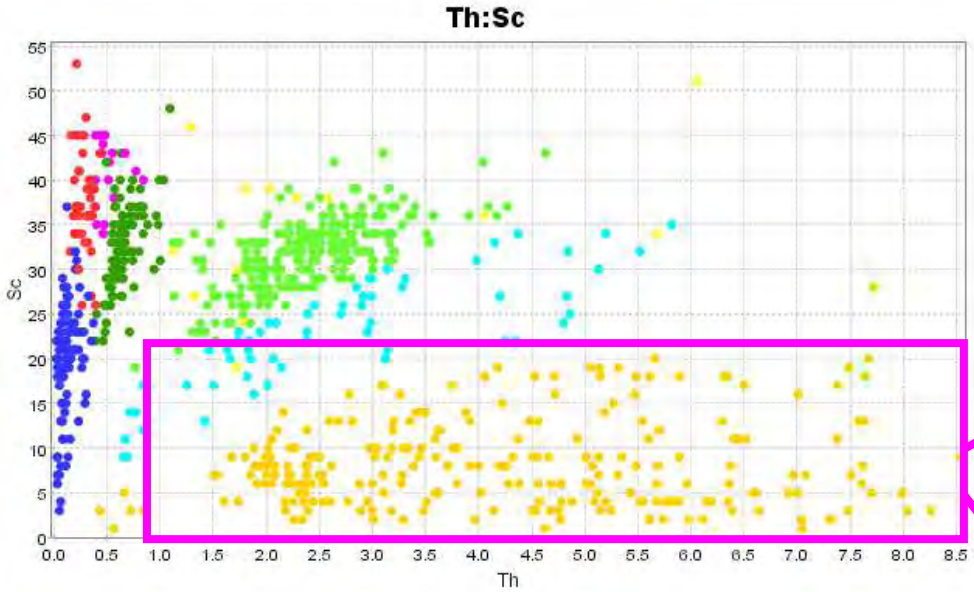
Trace Elements – St Ives Stratigraphy
Condenser Dolerite (Th: Sc, Ti)

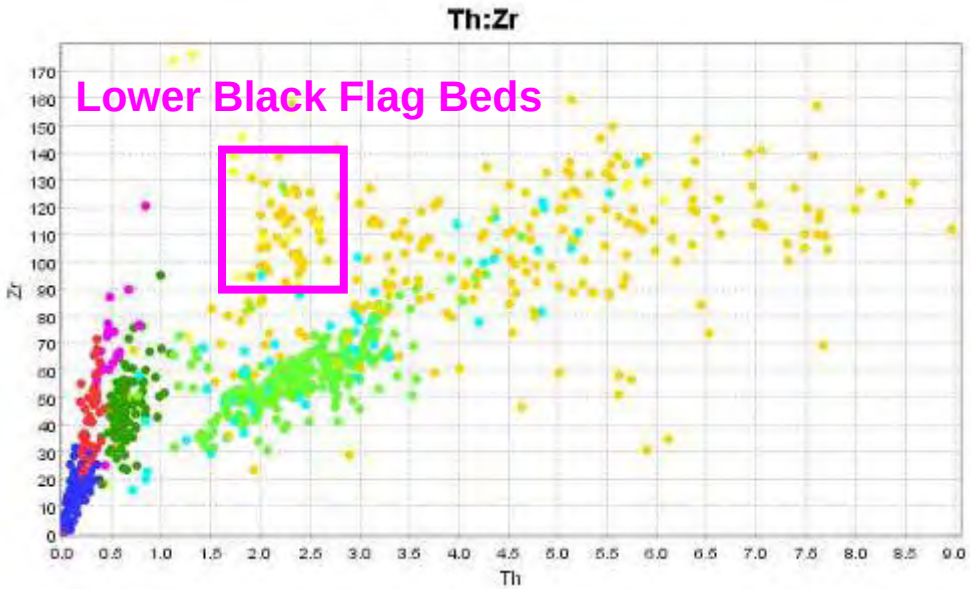


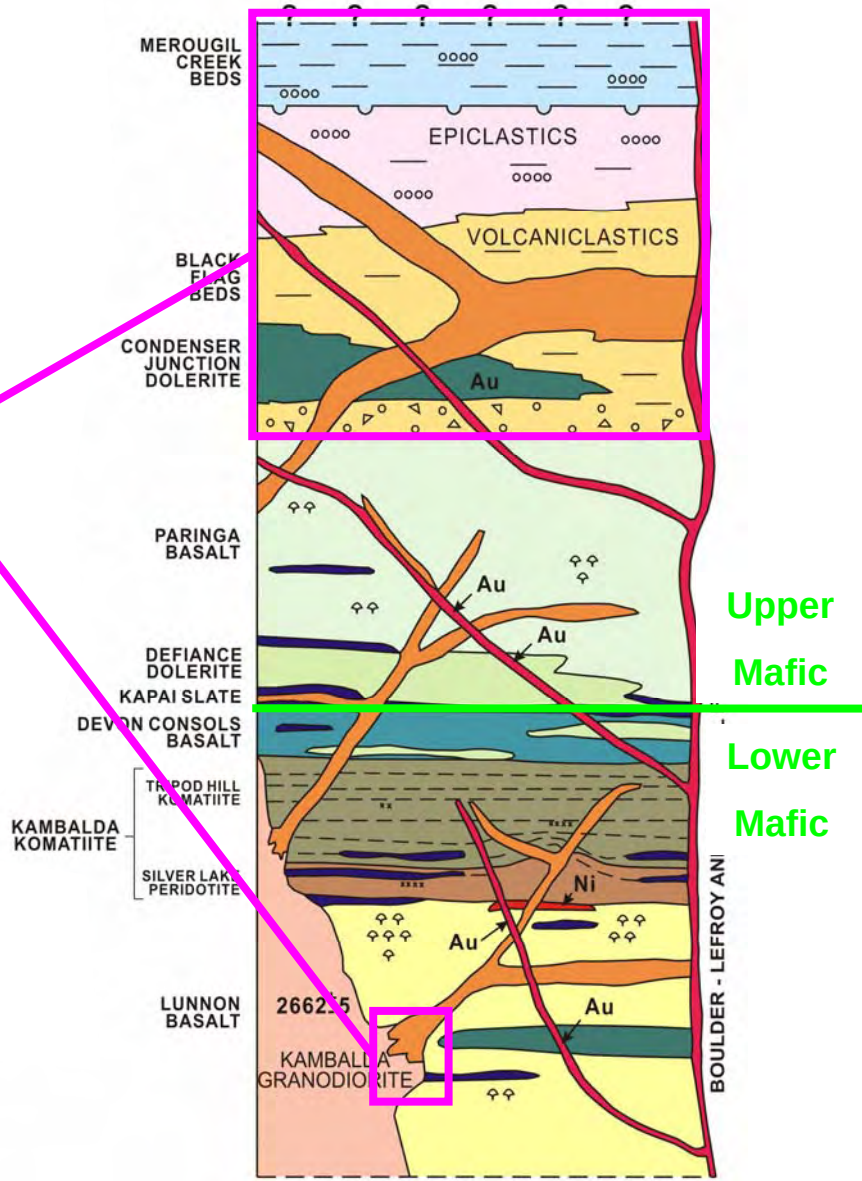




Trace Elements – St Ives Stratigraphy
Sediments and intrusions (Th: Sc, Zr)

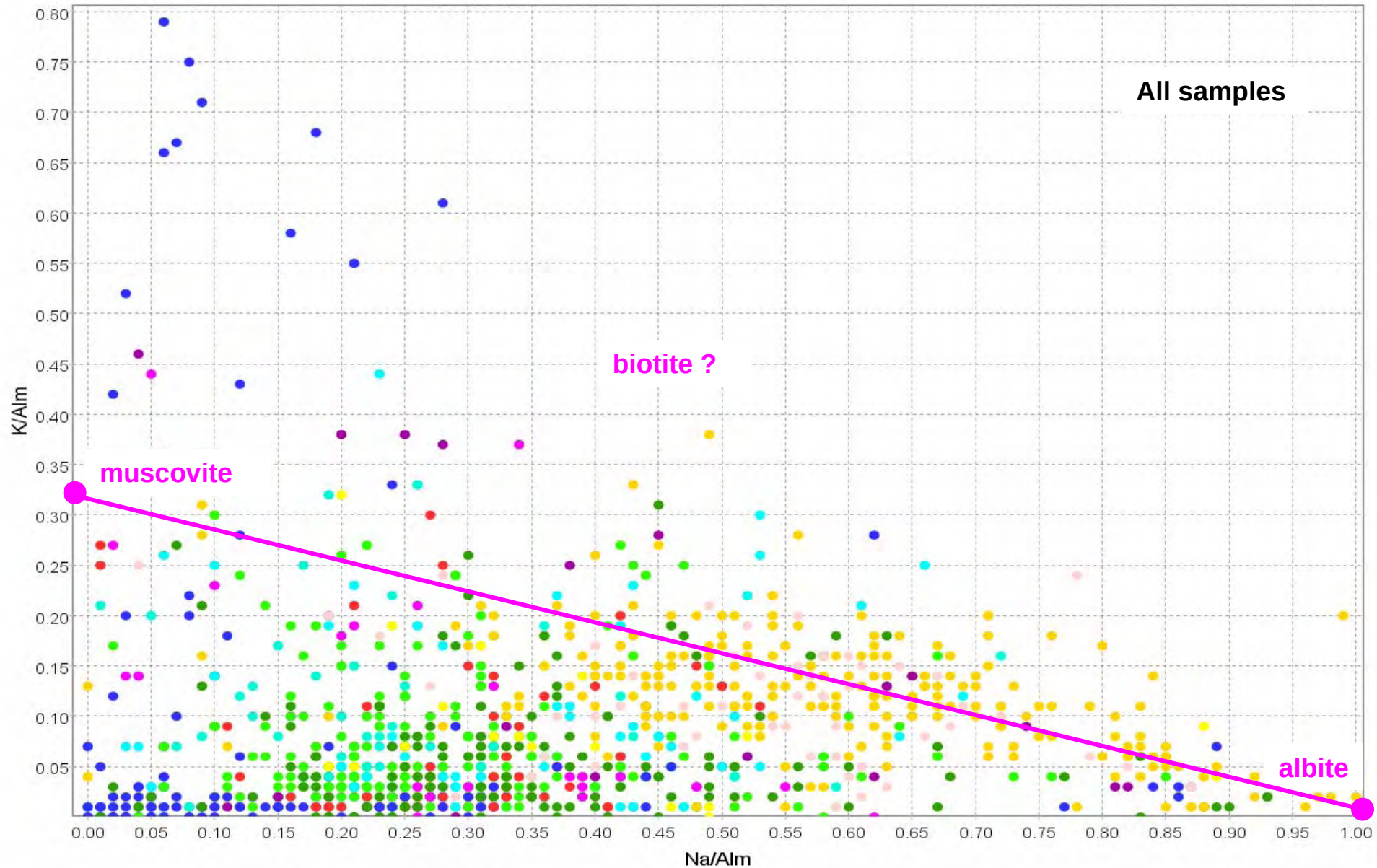






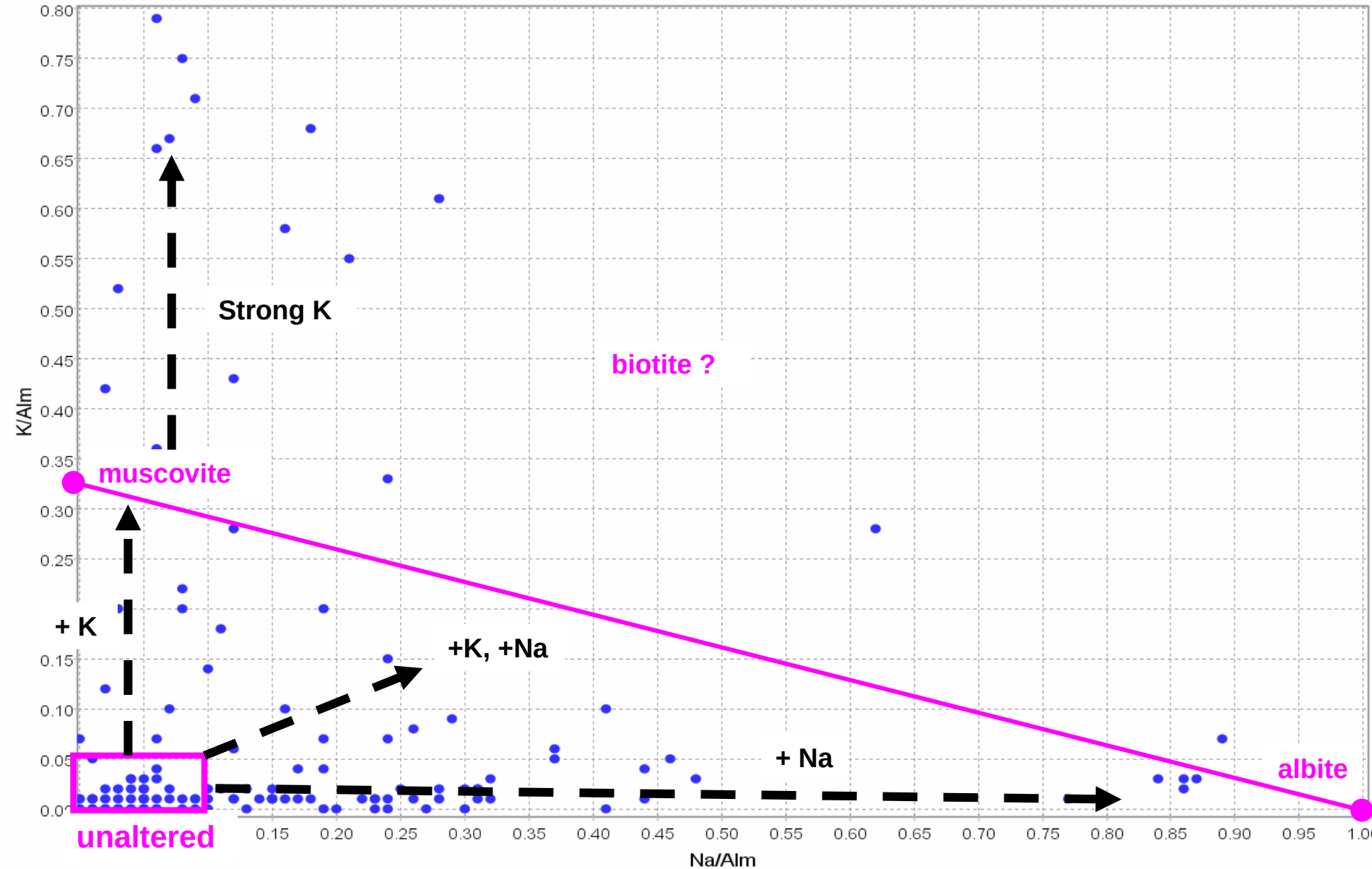
Classify Alteration - Alkali Index

molar Na/Al versus K/Al



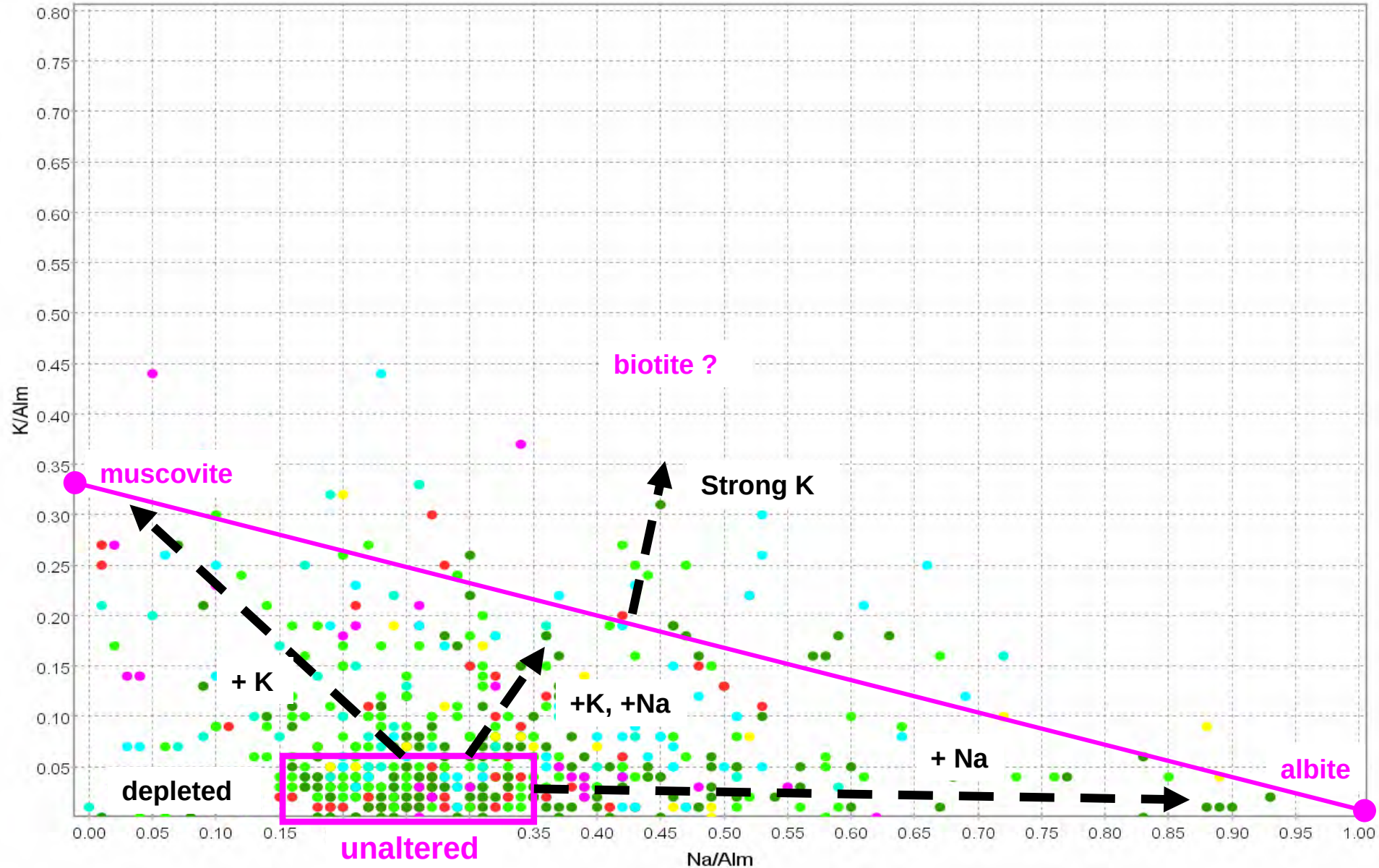
Ultramafic – Alteration fields

molar Na/Al versus K/Al



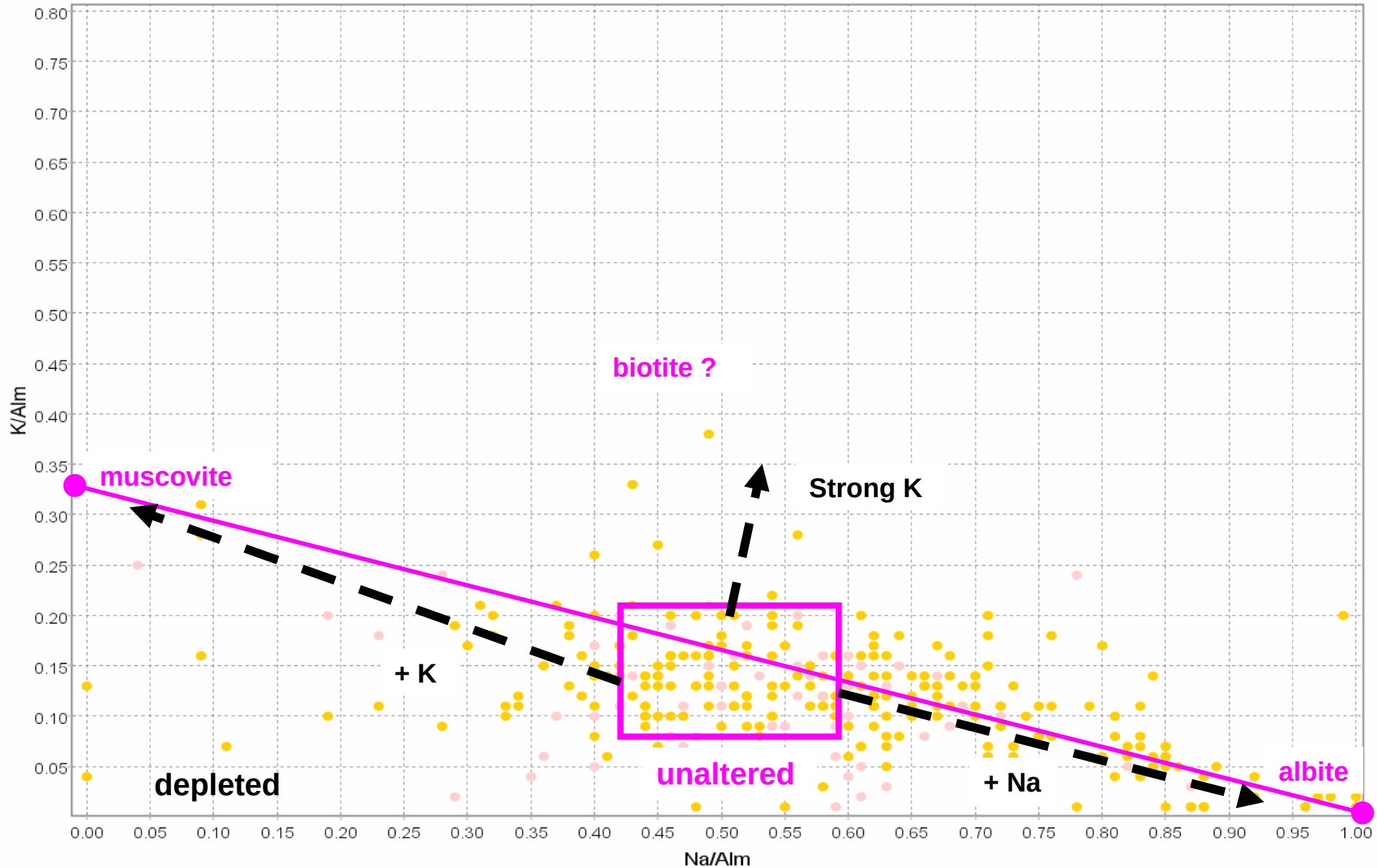
Mafic – Alteration Fields

molar Na/Al versus K/Al



Felsic-Intermediate – Alteration Fields

molar Na/Al versus K/Al



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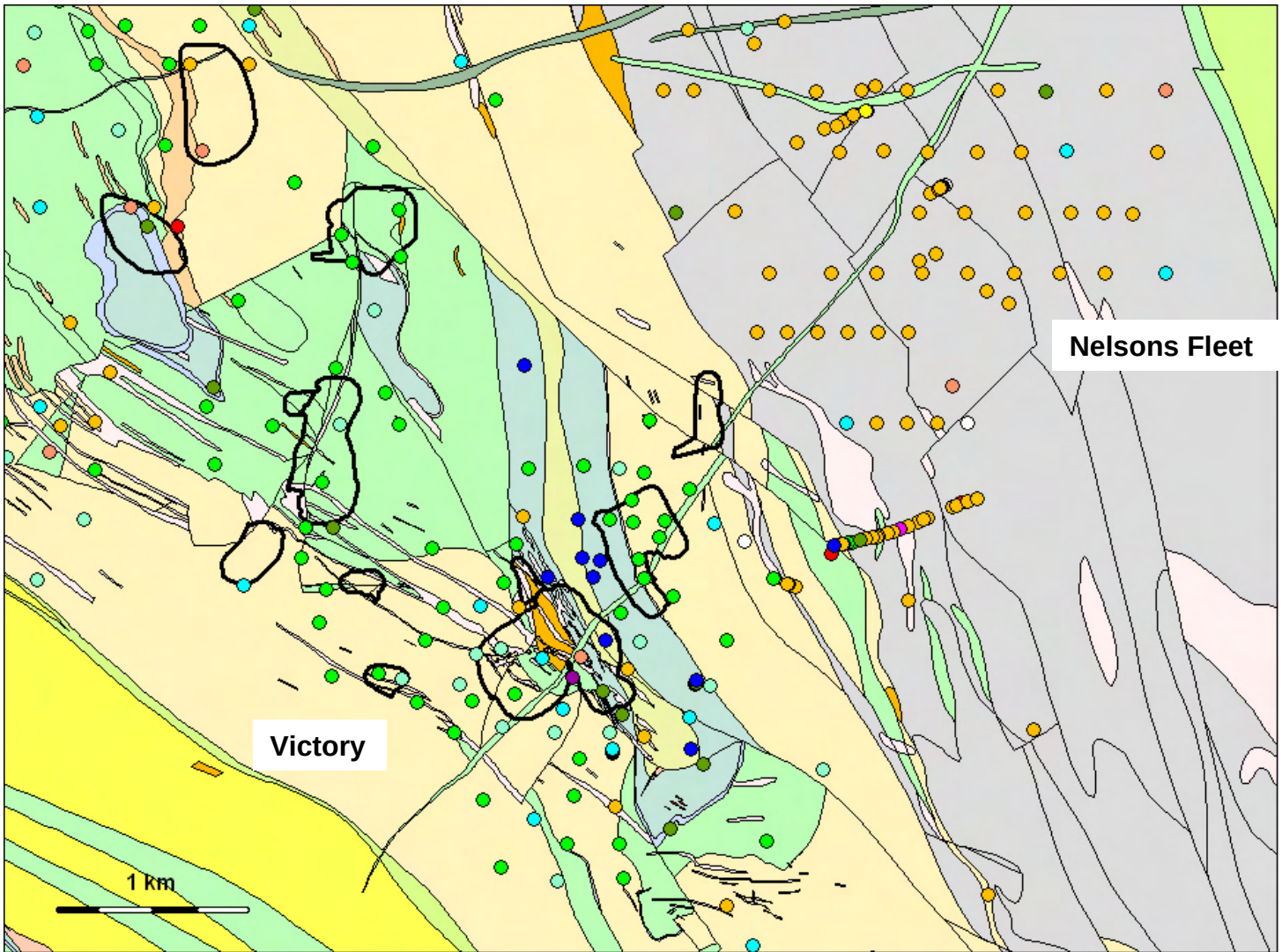
Lithology/stratigraphy at known deposits



Nelsons Fleet: (~200 koz), hematite, silica, albite, pyrite, quartz veins in Black Flag Beds

Victory: quartz vein, pyrite, albite, biotite, chlorite in dolerite and interflow sediment

Lithology

- Felsic
- Intermediate
- Upper Mafic
- Lower Mafic
- Ultramafic

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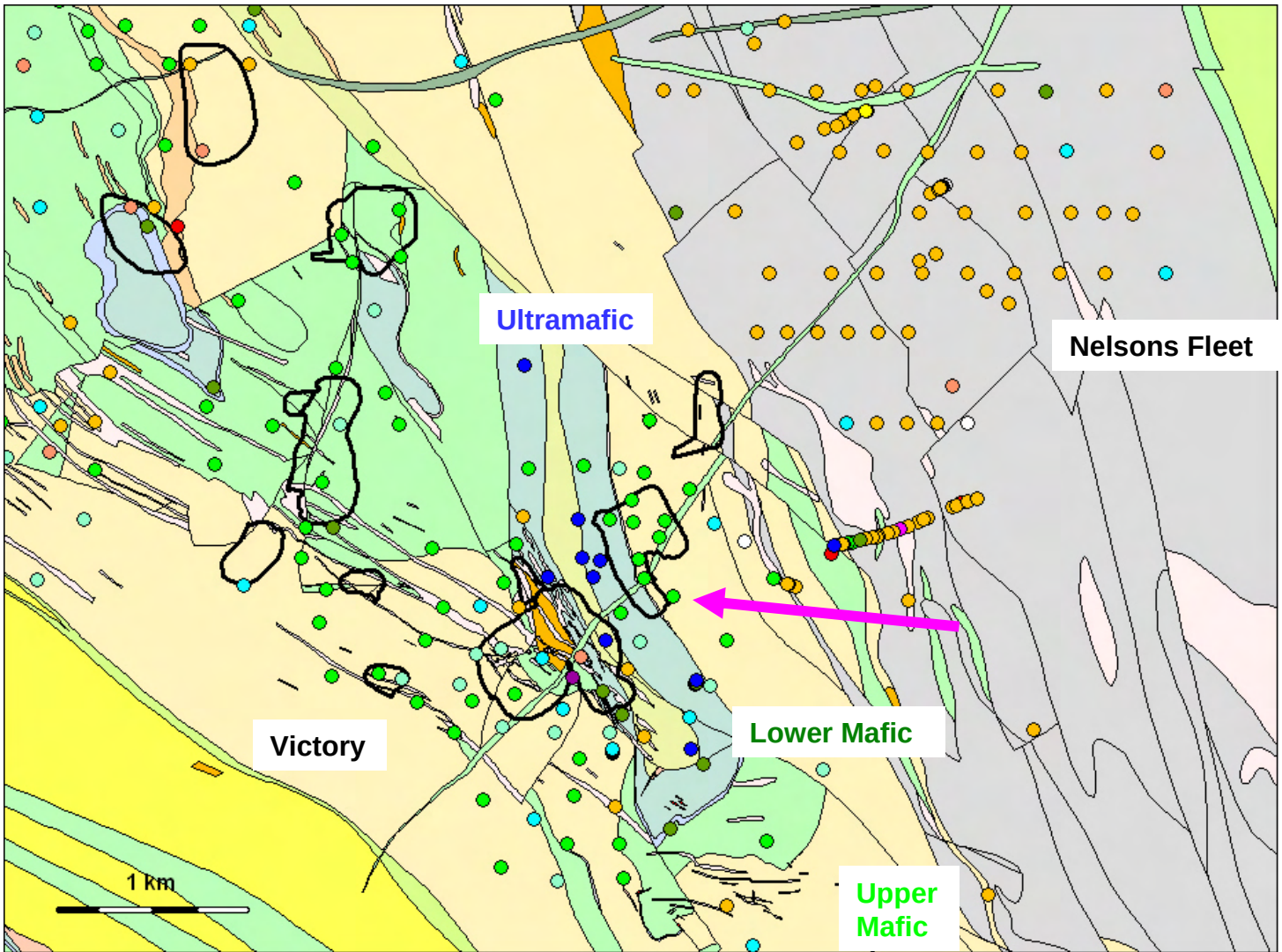
St Ives

Lithology/stratigraphy at known deposits



Multi element demonstrates Upper Mafic (Paringa Basalt) east of Victory is incorrectly mapped as Lower Mafic (Devon Consols Basalt)

Lithology

- Felsic
- Intermediate
- Upper Mafic
- Lower Mafic
- Ultramafic

Lithogeochemistry & Gold Exploration
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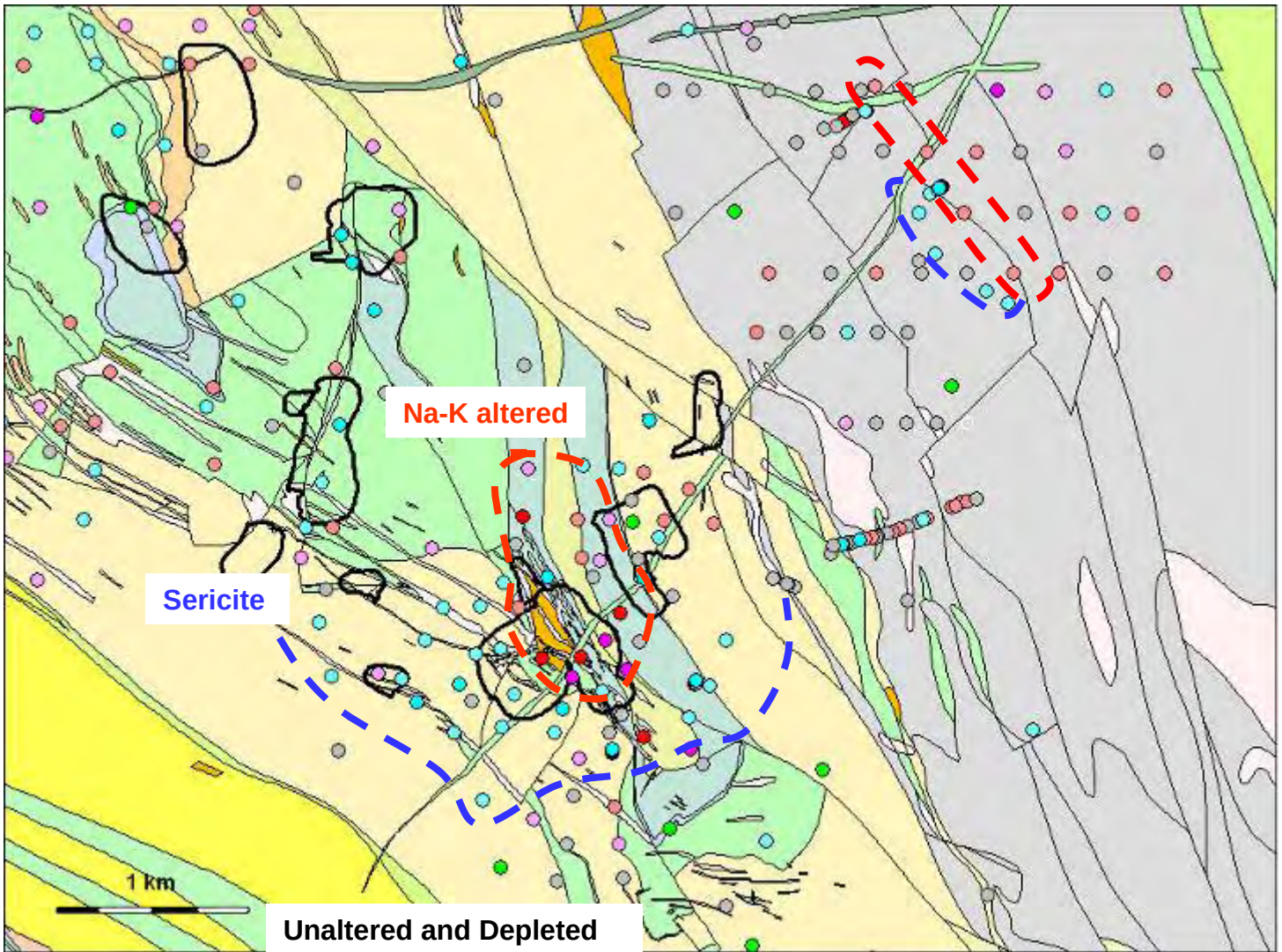
Alteration at known deposits



Proximal Na/Al &/or strong K (biotite) enrichment.

Outer sericitic alteration halo

Distal occurrence of samples with depleted Na-K

Alteration

- Na (albite)
- Strong K (biotite ?)
- K (sericite)
- Depleted
- Unaltered

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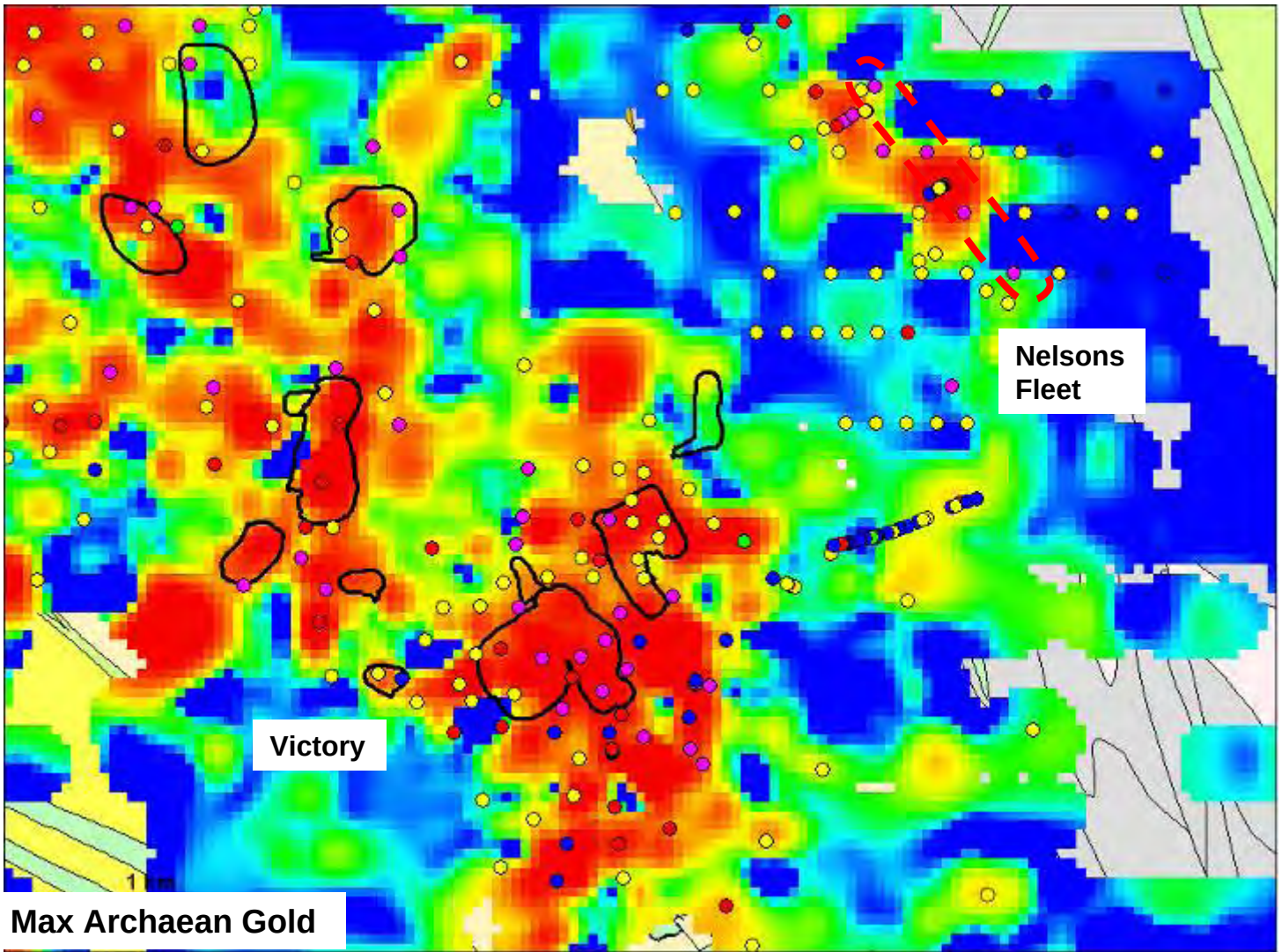
W anomalism at known deposits



W anomalism (>5 ppm) spatially correlates with gold mineralisation (10g/t top cut on image)

W (ppm)

- 10 to 1122
- 5 to 10
- 1 to 5
- 0.1 to 1
- < detection 0.1 ppm

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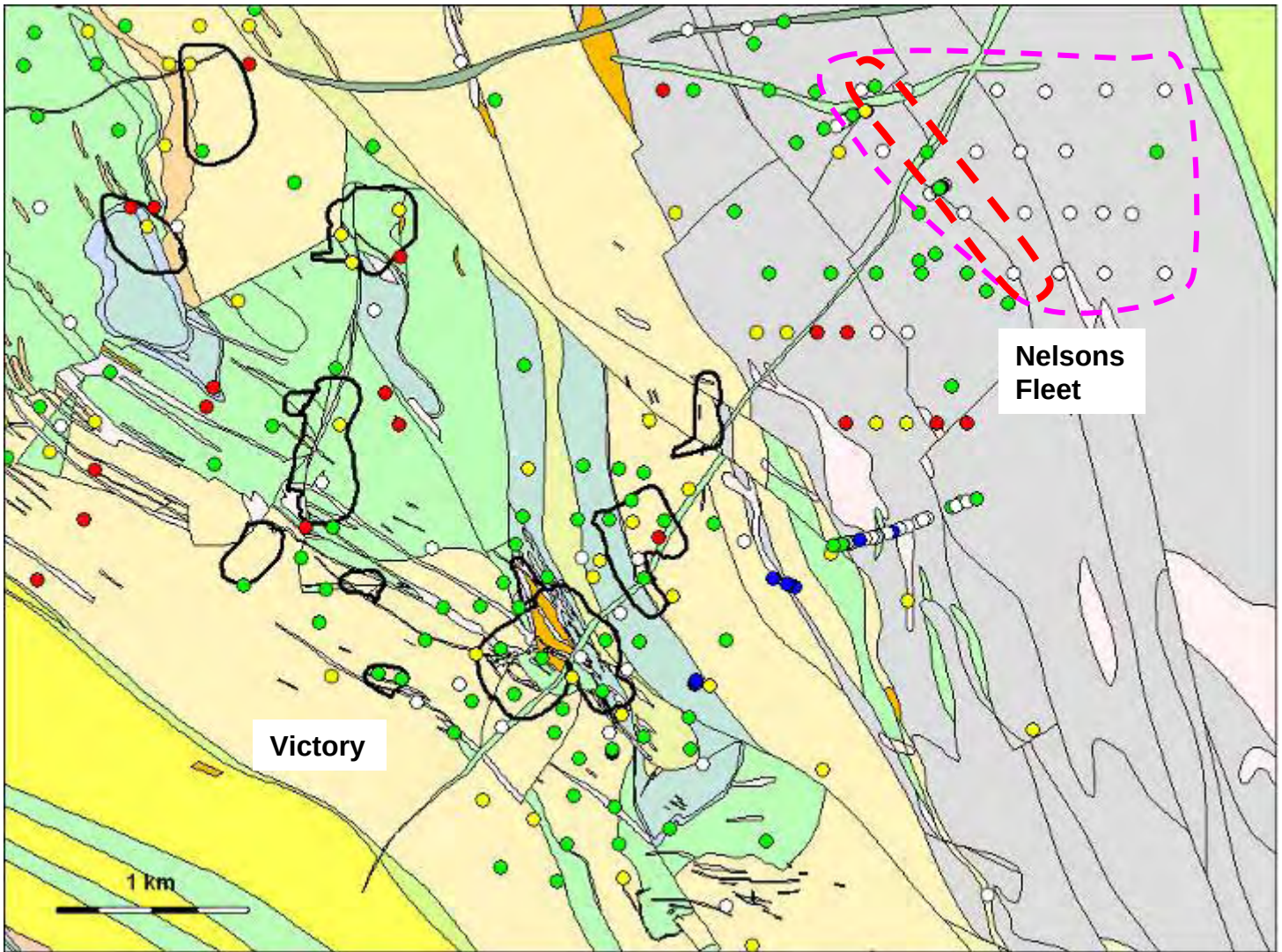
GOLD FIELDS

As gradients at known deposits



As gradient apparent at Nelsons Fleet

As-depletion (below detection level 1ppm) occurs east of Nelsons Fleet

Patchy depleted As samples occur at Victory

As (ppm)

- 10 to 23
- 5 to 10
- 1 to 5
- 0.5 to 1
- < detection 1ppm

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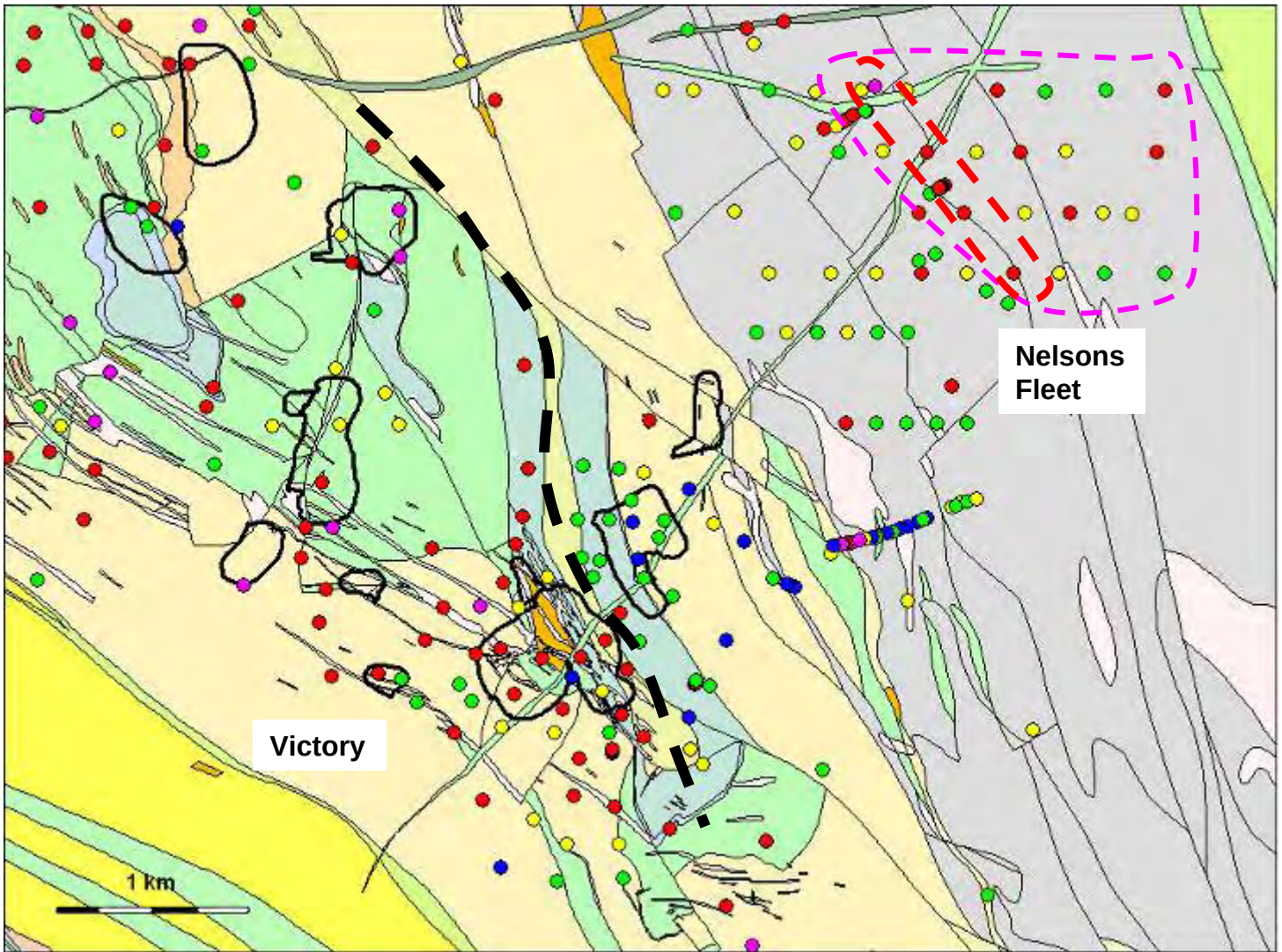
GOLD FIELDS

Bi anomalism at known deposits



Bi anomalism (>0.2 ppm) occurs east of Nelsons Fleet coincident with As-depletion

No Bi anomalism east of Victory. Not a lithological control.

Bi (ppm)

- 1 to 10
- 0.2 to 1
- 0.1 to 0.2
- 0.01 to 0.1
- < detection 0.01 ppm

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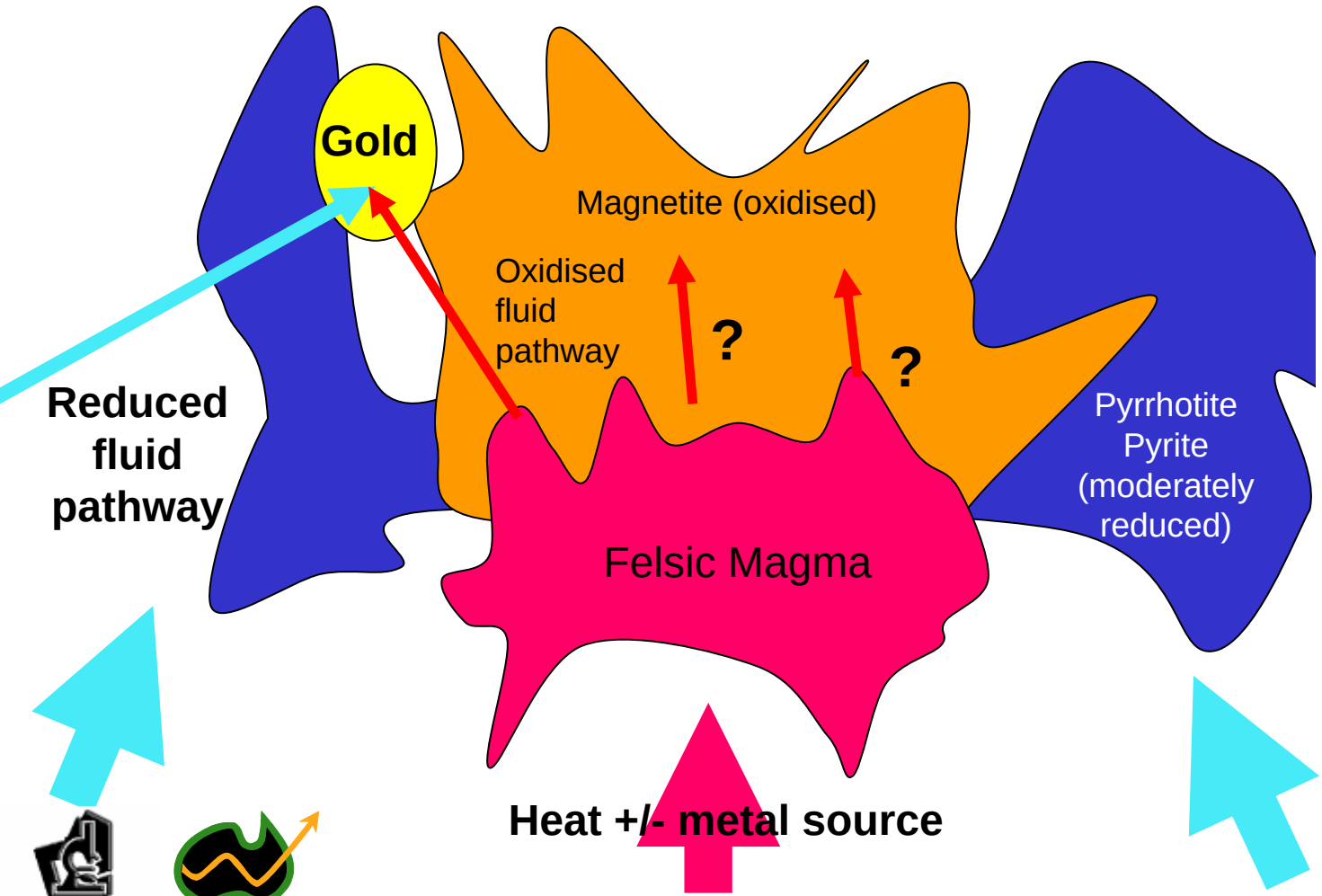
GOLD FIELDS

Conceptual REDOX Model



Gold occurs on REDOX gradients

REDOX domains derived from pyrite, pyrrhotite, magnetite, hematite distribution

MERIWA pmd*CRC

John Walshe, Peter Neumayr, Scott Halley

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GOLD FIELDS

Exploration targeting

- Identification of REDOX gradients with multi element

Oxidised Domains: gravity lows (felsic intrusions), Bi anomalism & As-depletion

Reduced Domains: As anomalism

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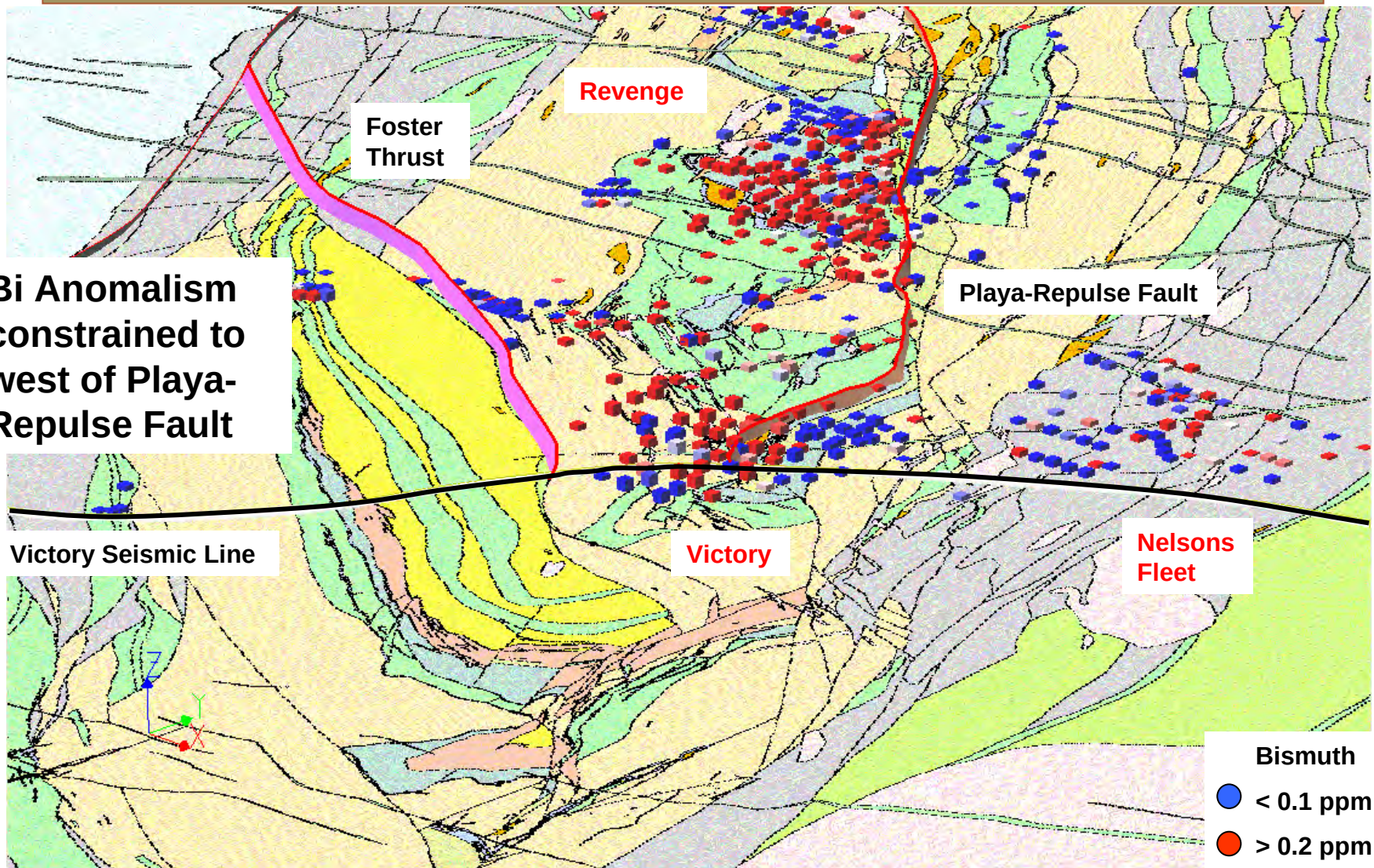
Conceptual REDOX Model

Oxidised domains (Bi) and architecture



Bi Anomalism constrained to west of Playa-Repulse Fault

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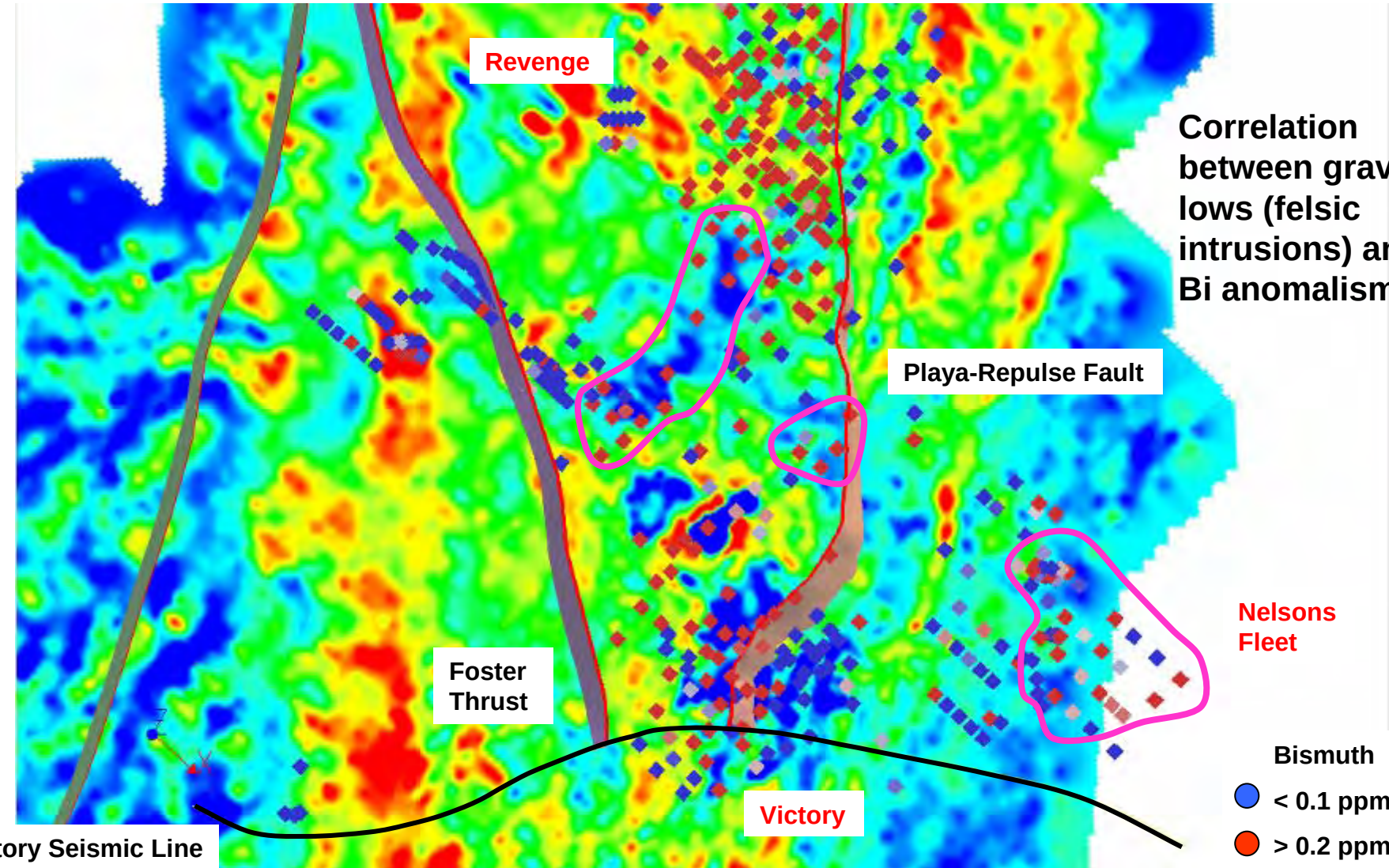
Conceptual REDOX Model

Oxidised domains, gravity and architecture



Correlation between gravity lows (felsic intrusions) and Bi anomalism

Nelsons Fleet

Bismuth
< 0.1 ppm
> 0.2 ppm

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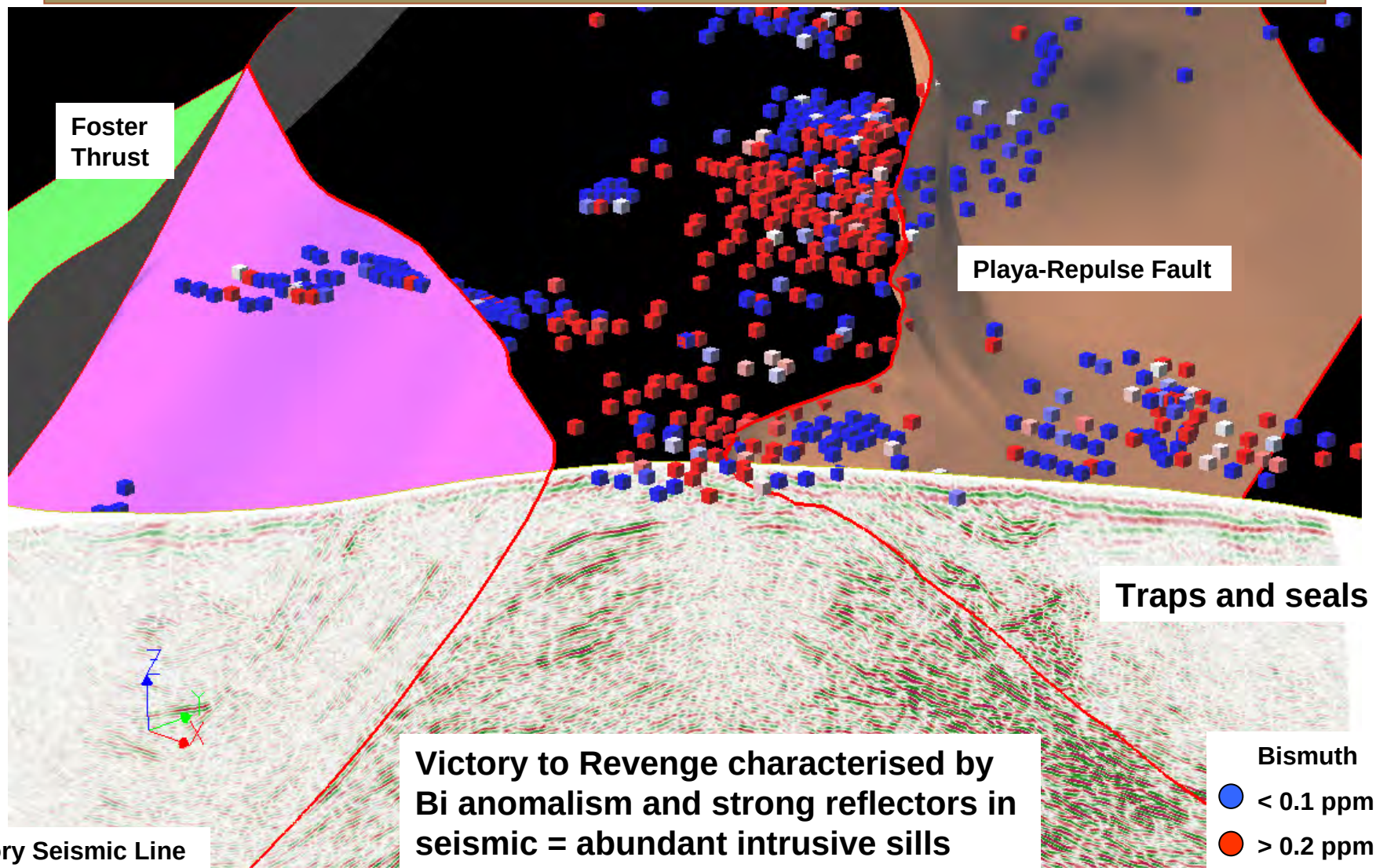
Conceptual REDOX Model

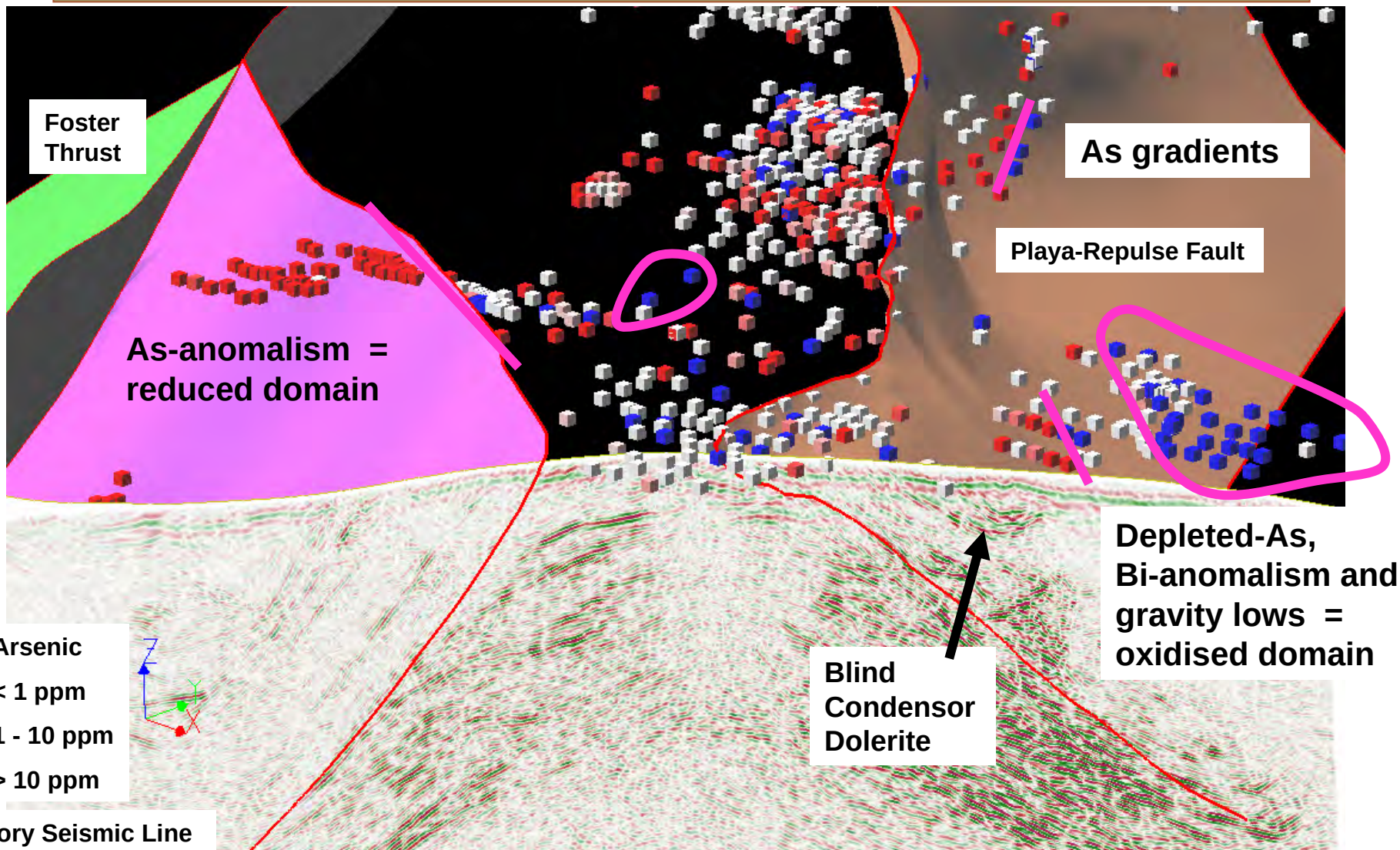
Oxidised domains (Bi) and architecture



Lithogeochemistry & Gold Exploration
Conceptual REDOX Model

GOLD FIELDS

Reduced domains, As-gradients and architecture



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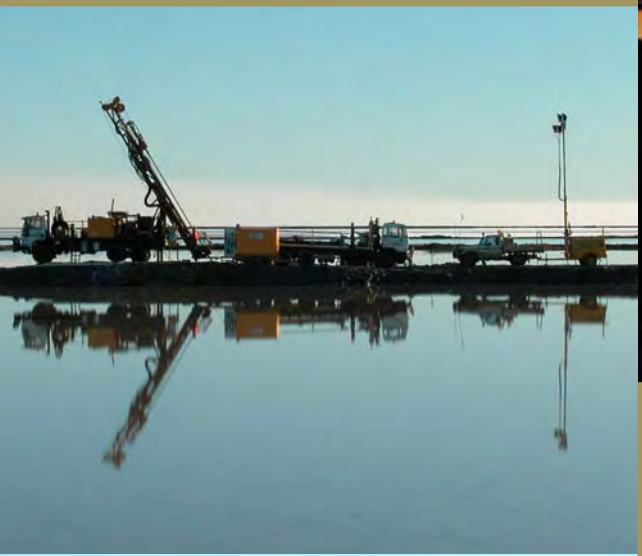
GOLD FIELDS

Conclusions

- Multi element is an effective low cost exploration tool (lithology, stratigraphy, alteration, pathfinders) - empirical exploration targets

- The next phase: conceptual exploration targeting and integration of geochemistry (e.g. alteration, chemical gradients) with geophysics and architecture in 3D GIS (GoCad)



Lithogeochemistry & Gold Exploration St Ives, Kambalda, WA

Kylie Prendergast

September 2005