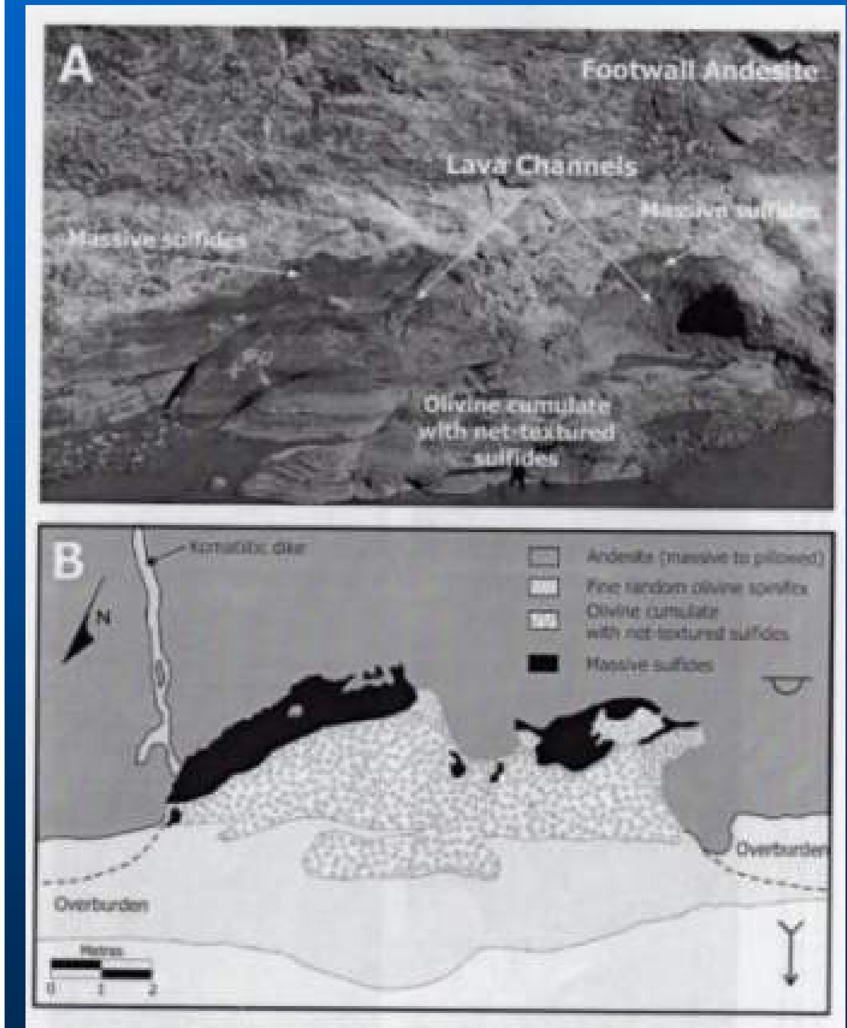
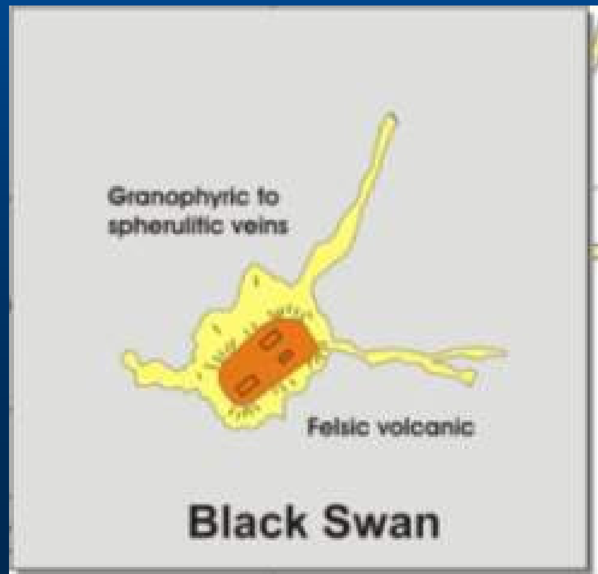
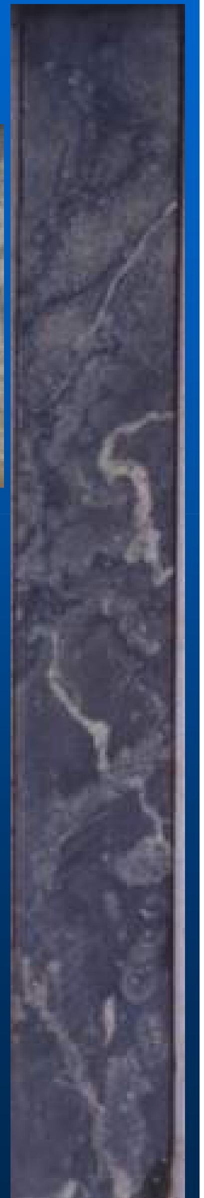
Tangible evidence of assimilation is common in the felsic-hosted deposits

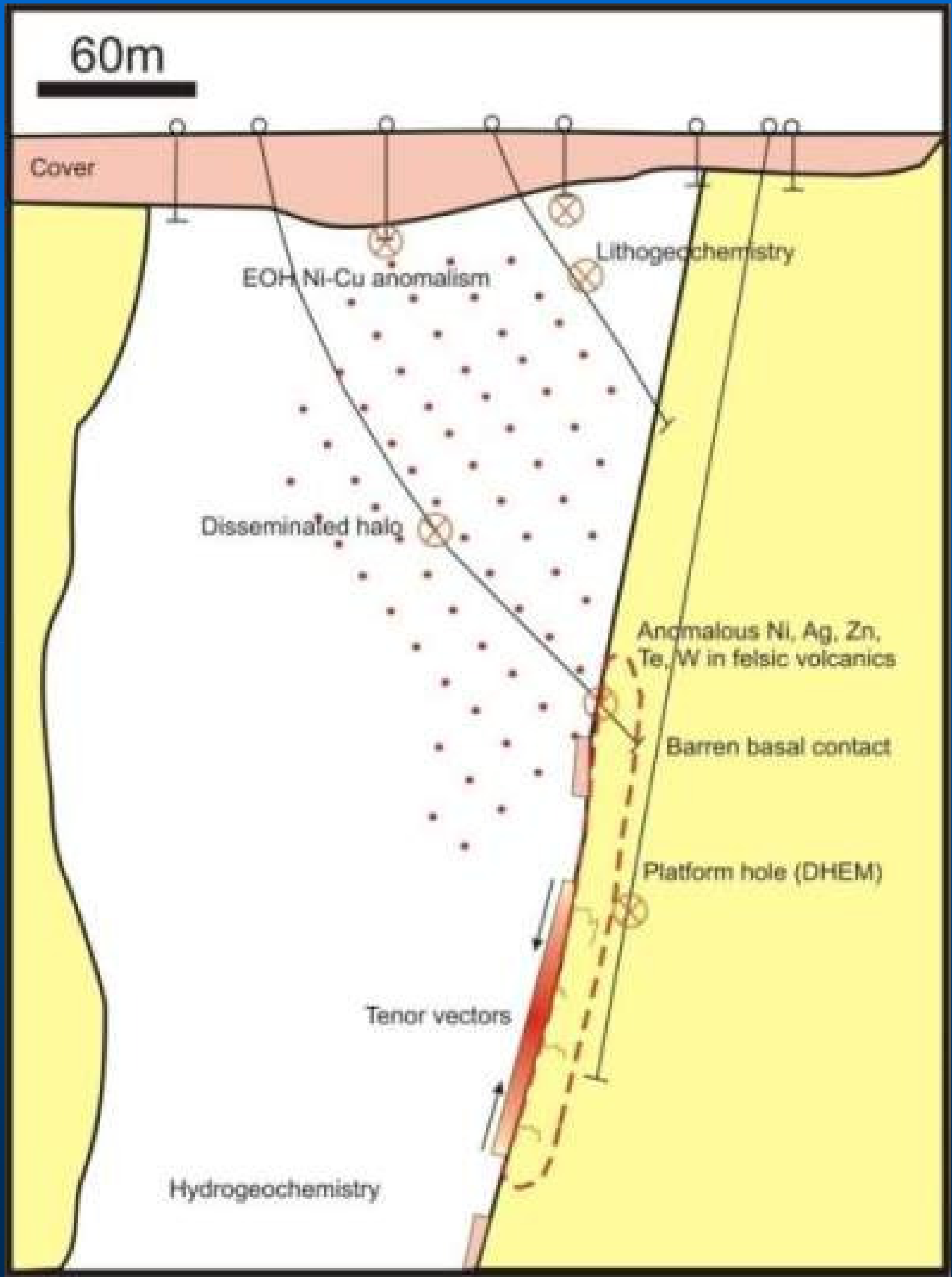


Irregular eroded basal contact, Alexo, Houle et al 2002

Irregular felsic xenoliths in Silver Swan massive sulphides







Footprints

- **Proximal footprints: Disseminated sulfides and channels.**
- **Invest in a structural understanding of your prospects – provides basis for predictive targeting**
- **We MUST maximise in hole geophysical AND geochemical data.**
- **3D tenor variation is an under utilised exploration vector**
- **We know little about non ore elements in sulfides eg Te, Se, W, Zn as exploration vectors. Large enough datasets have never been collected.**
- **Distal footprints: New techniques as we push under cover, hydrogeochemistry, magnetic inversion**
- **Search for improving whole rock and mineral scale lithogeochemical techniques (indicator minerals)**

3. CAMP FOOTPRINTS

Camps

- **Regional targeting for komatiite Ni-Cu-(PGE) deposits relies heavily on concepts rather than empiricism and detective techniques.**

- **Are all isolated deposits parts of camps?**
- What is a camp?

- **Lets address controls on camps at three different scales:**
  - Yilgarn
  - Greenstone belt
  - Camp itself

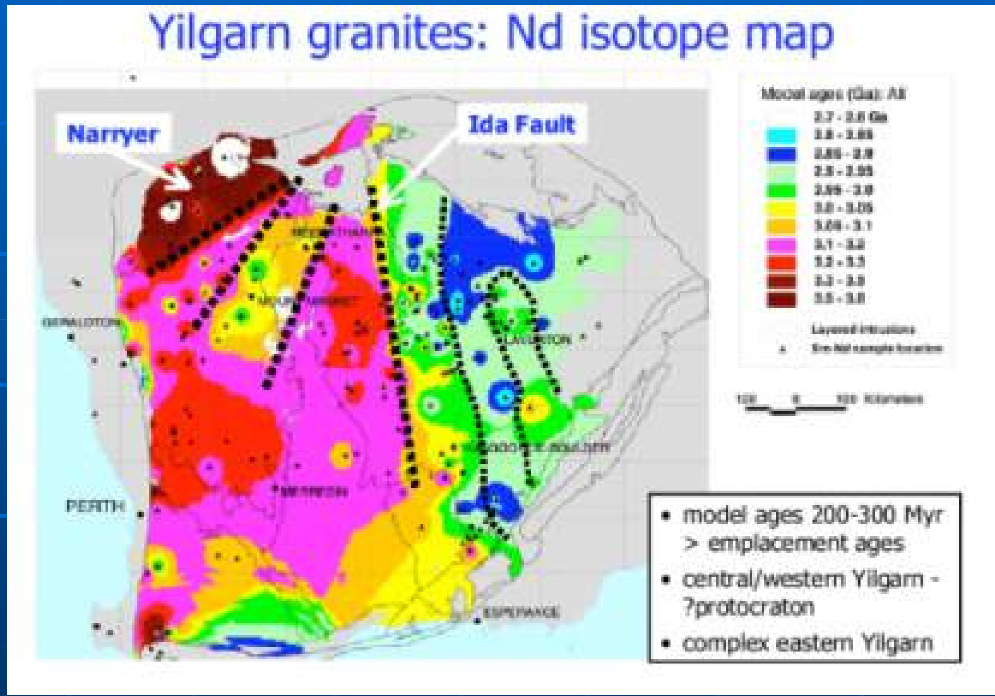
- Predicting camps at Yilgarn or craton scale
  Understand Yilgarn assembly and 'active' lithospheric structures at 2710 Ma

- **Predicting camps at greenstone belt scale**
  - Return of the inverted rift concept

- Predicting camps
  - sub domains, transforms – Identify the highest flux sub domains

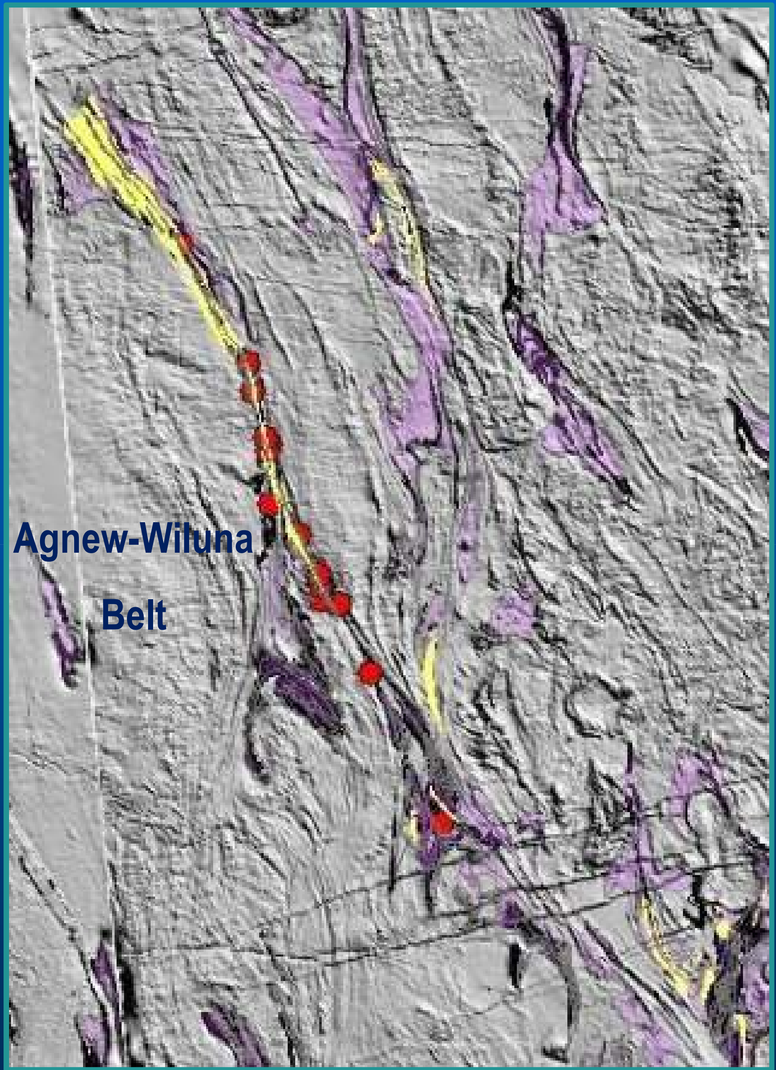
Craton scale

- **The worlds most endowed komatiite belts, Agnew-Wiluna Belt, sits along the eastern proto Yilgarn craton at 2.7 Ga parallel to the Ida Ft.**



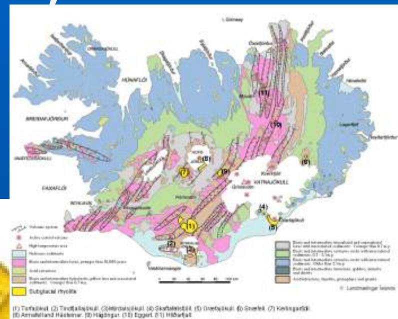
Champion and Cassidy 2007

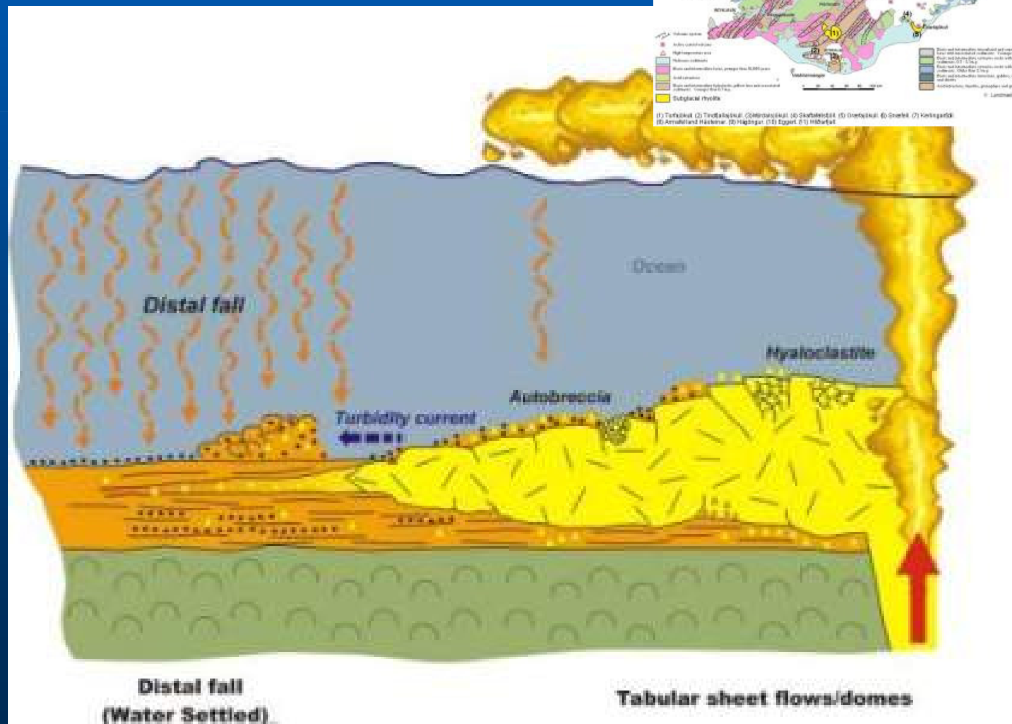
Predicting camps at greenstone belt scale:
Lets start by pulling apart the Agnew-Wiluna Belt



NB: Felsic volcanics MUST be consanguineous!

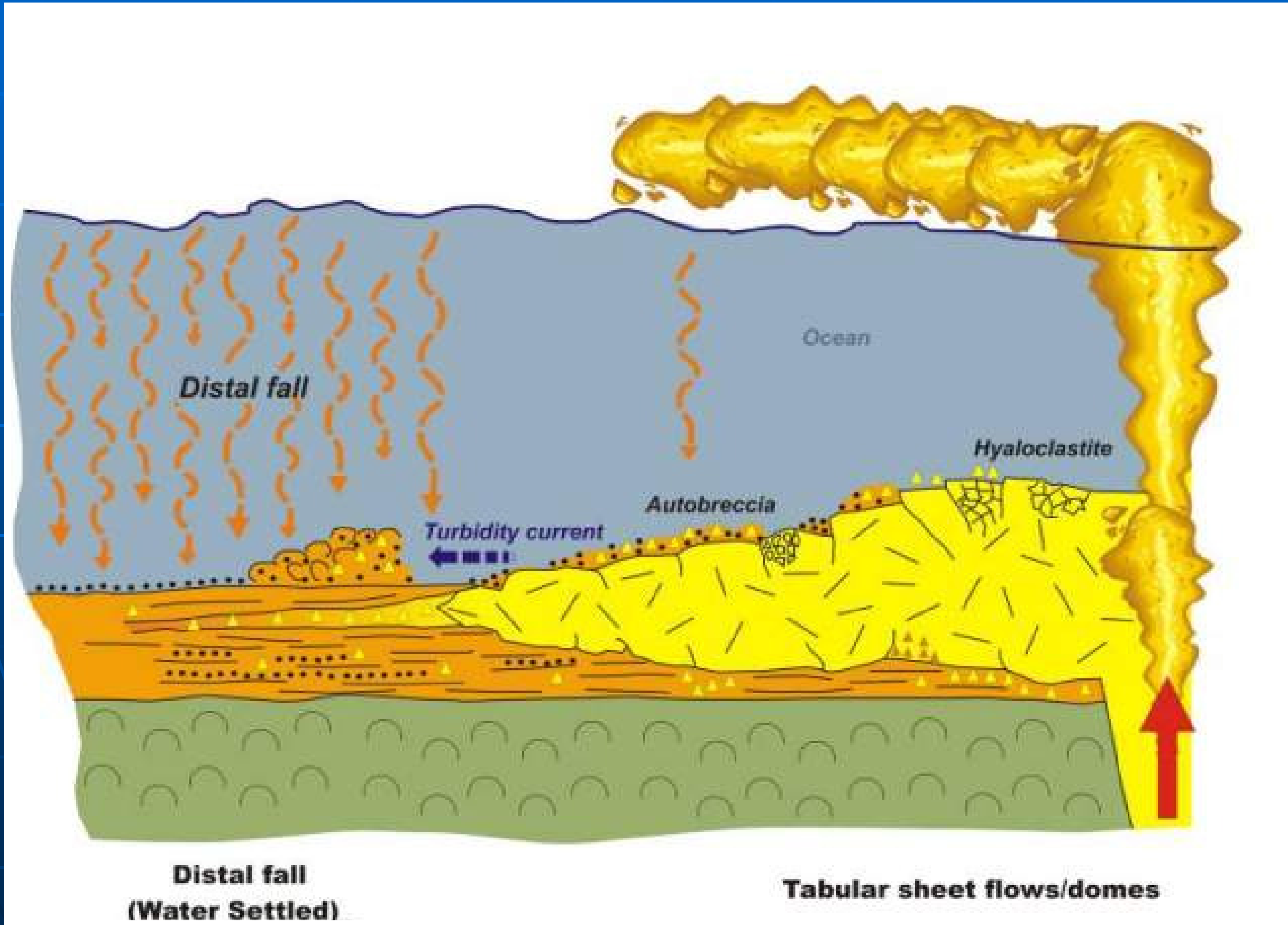
- 9 million Ni tonnes and growing
- Not like Kambalda – diversity of ore styles etc
- Proximal felsic volcanics, exhalative sulfides,





Felsic volcanic mark their vents

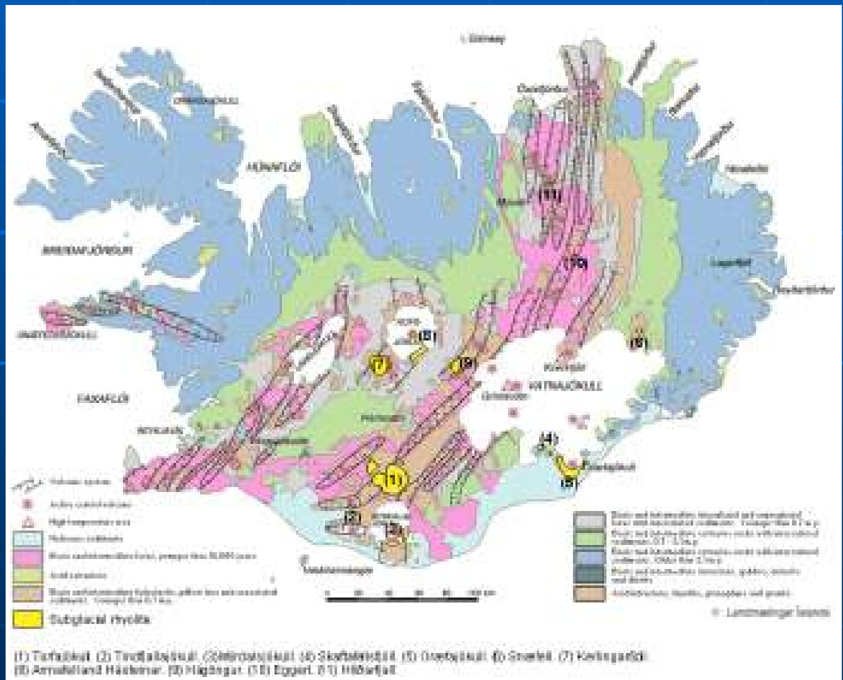
Felsic volcanic mark their vents

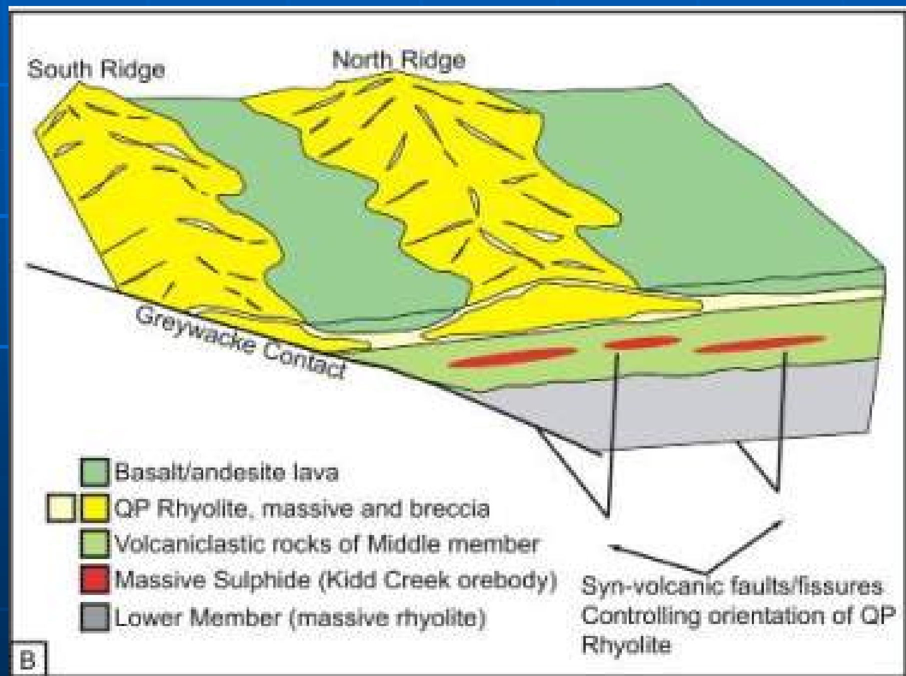


Analogues: Ethiopia, Iceland, and the Archean

Felsics aligned parallel to vents in continental flood basalt provinces

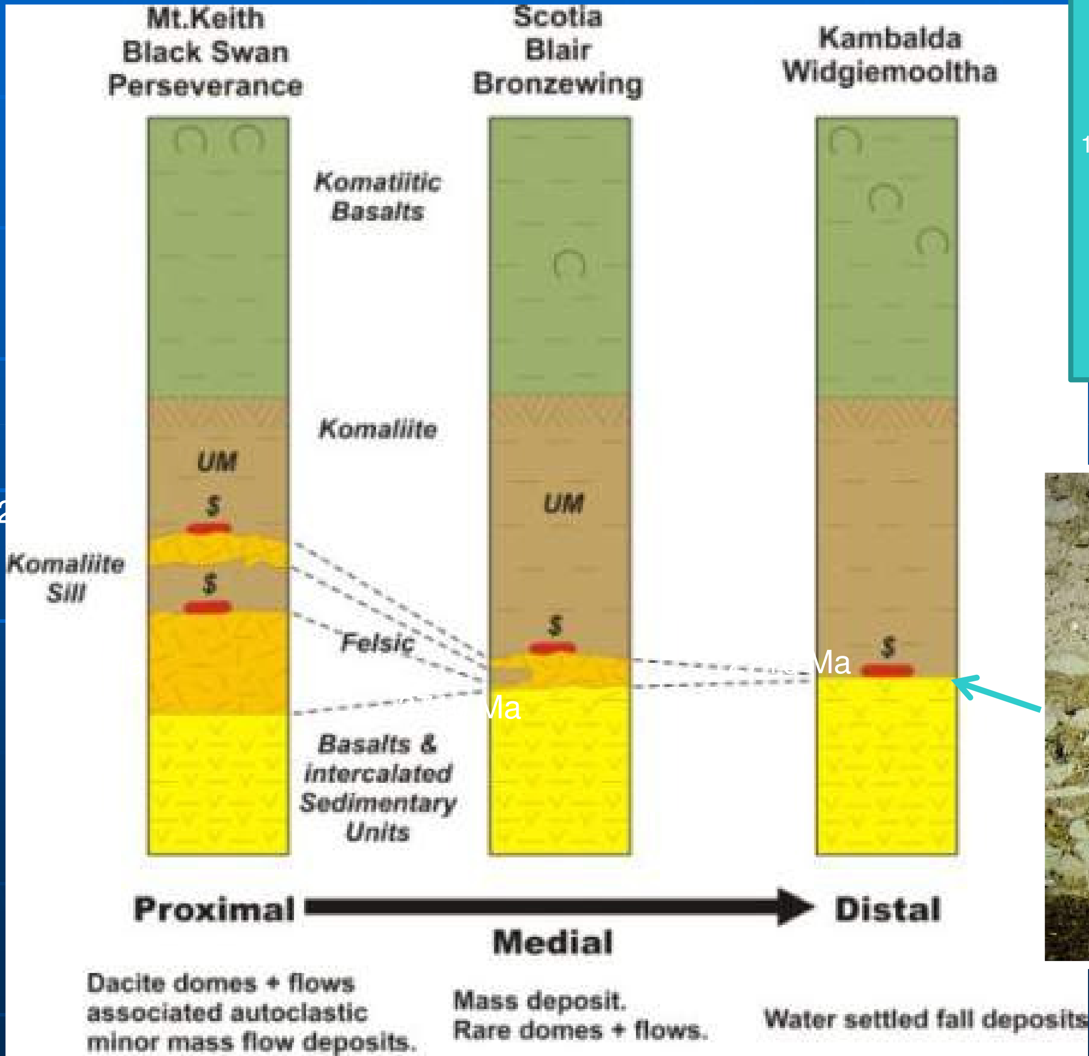
- **Elongate felsic domes, Felsic dykes swarms**
- **Felsic association <u>unambiguously</u> mark the vent sites**
- **Felsics do not form all along fissure but are discontinuous**

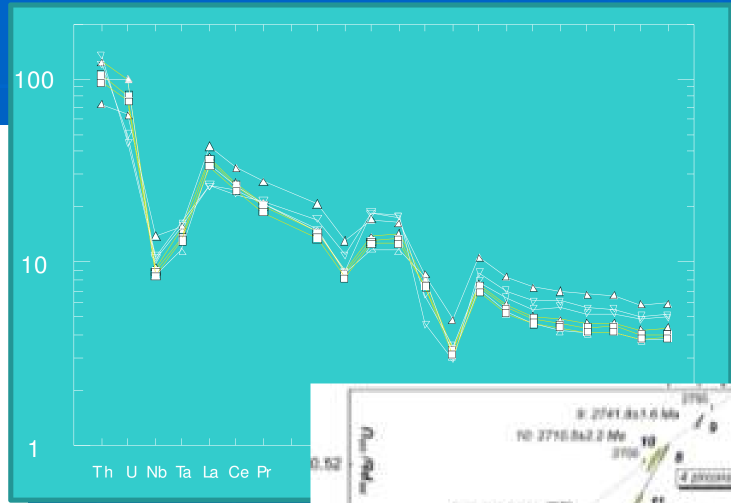


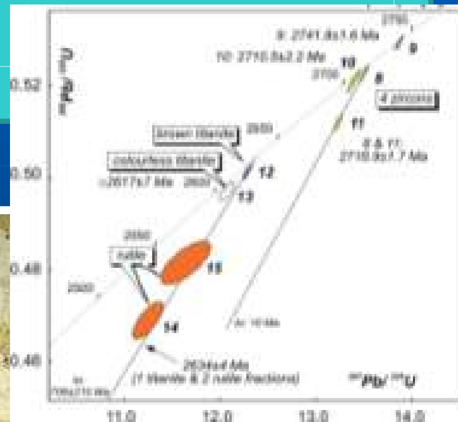


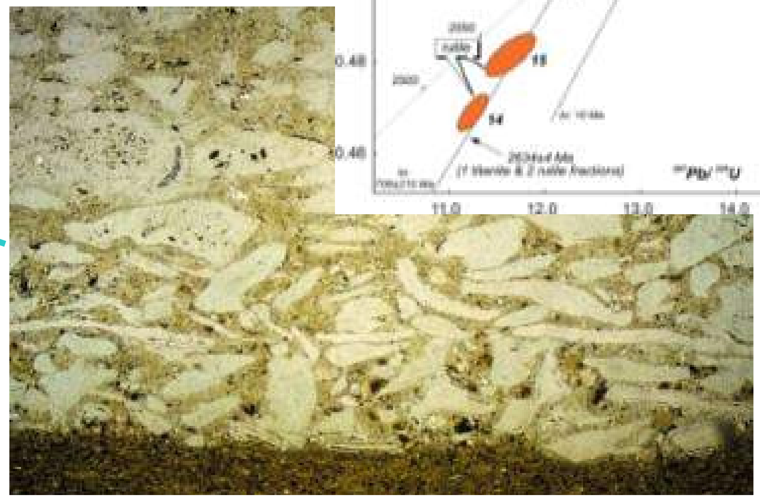
Felsic volcanic turbidites represent distal volcaniclastics marginal to rift controlled domes

Stratigraphic significance of felsic volcanics

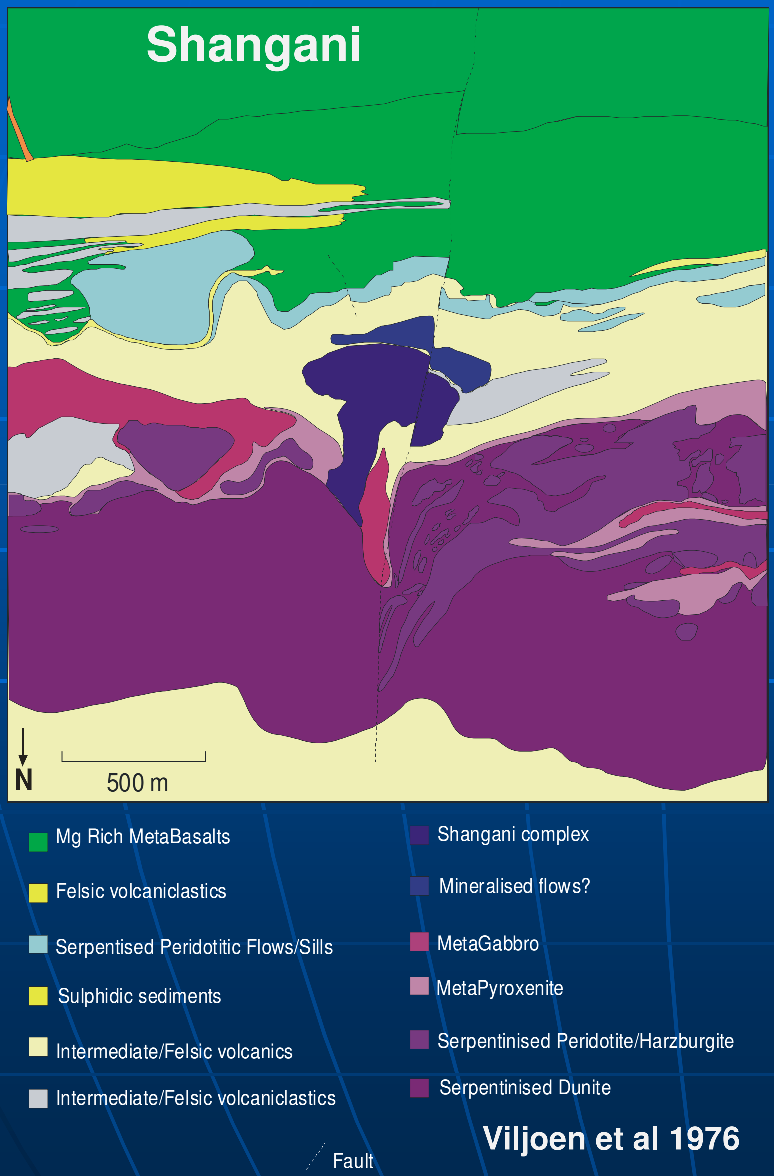








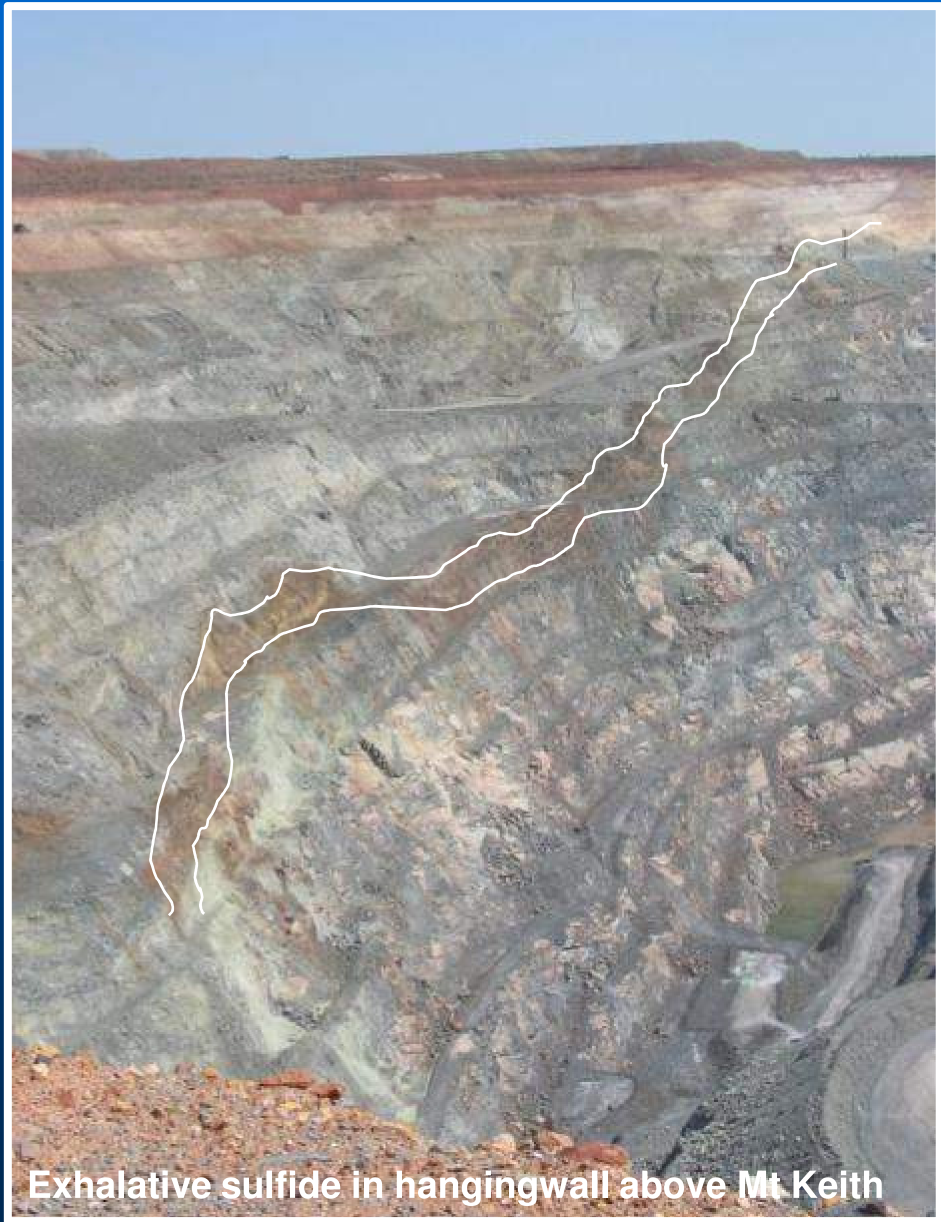
Felsic and associated exhalites mark domains of heat loss and mark their vents i.e inverted rifts --- but what about komatiites?

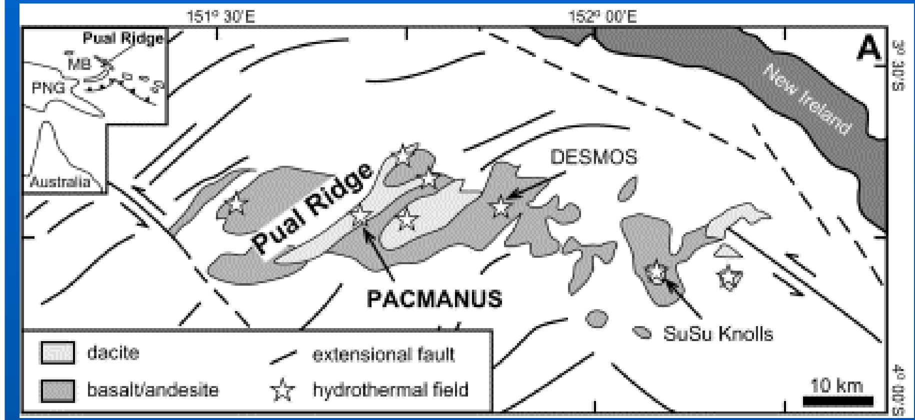


Viljoen et al 1976

- Examples of komatiites and felsic volcanics using the same vent systems are common worldwide
- Discordance, transforms etc

Exhalative sulphide also mark rift axis





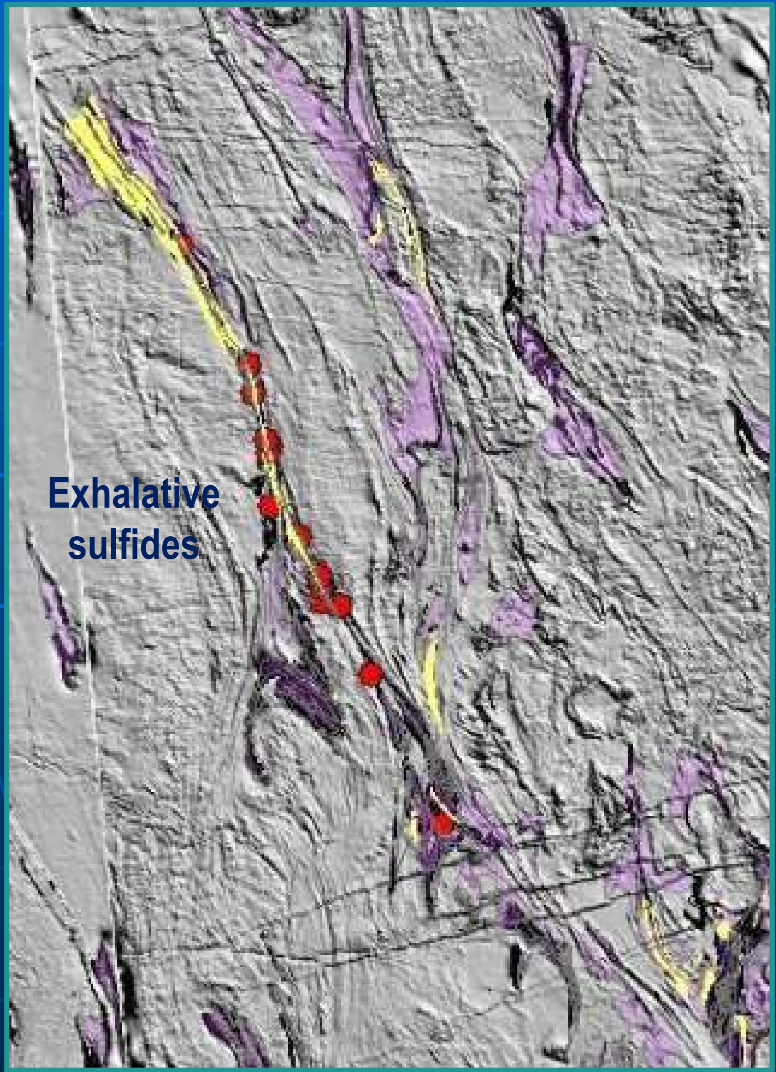
Turn question around:

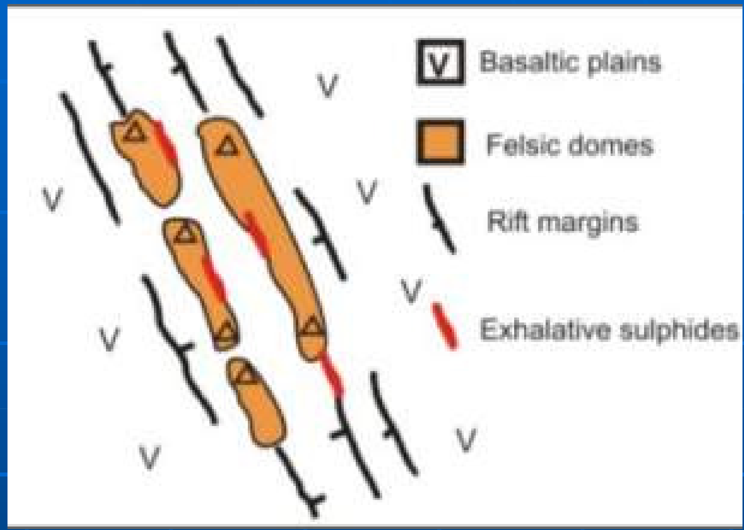
Irrespective of genetic models

Instead of what controls the komatiite-hosted Ni-Cu-(PGE) deposit distribution

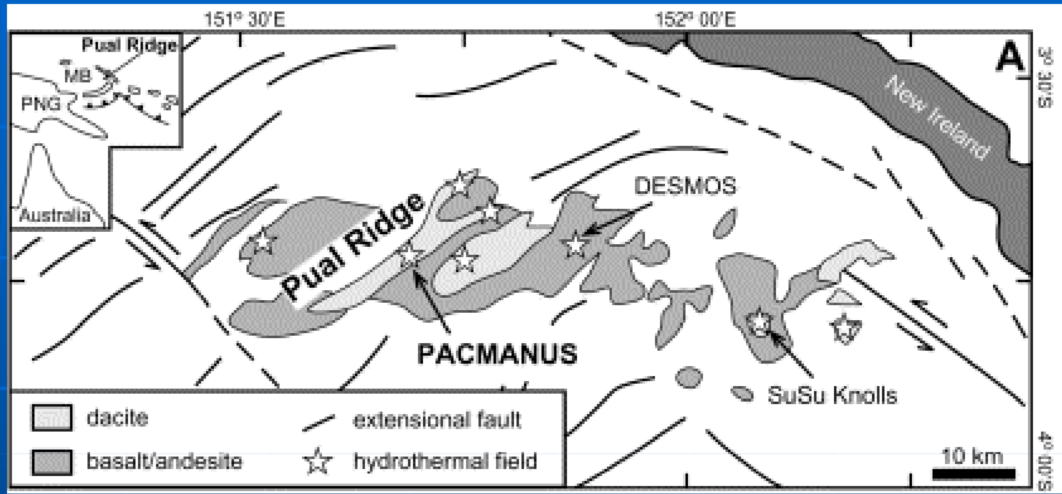
What controls the distribution of exhalative sulfides?

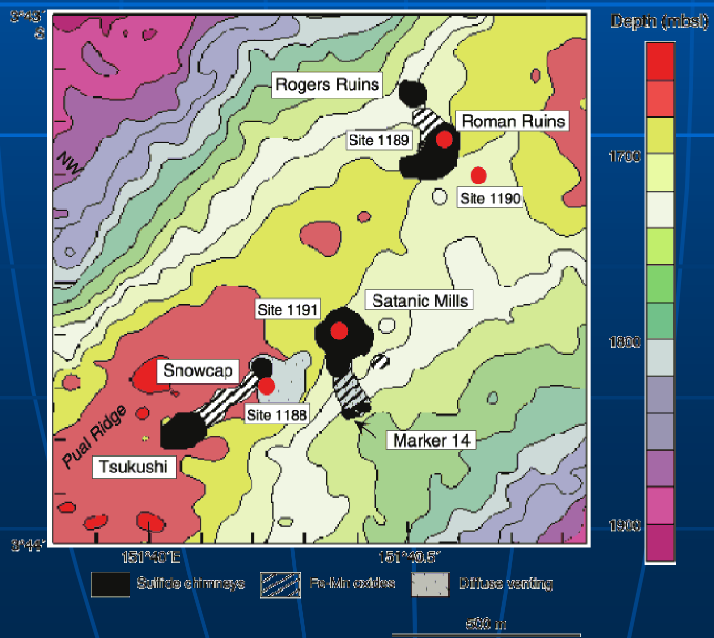
Distribution of exhalative sulfides



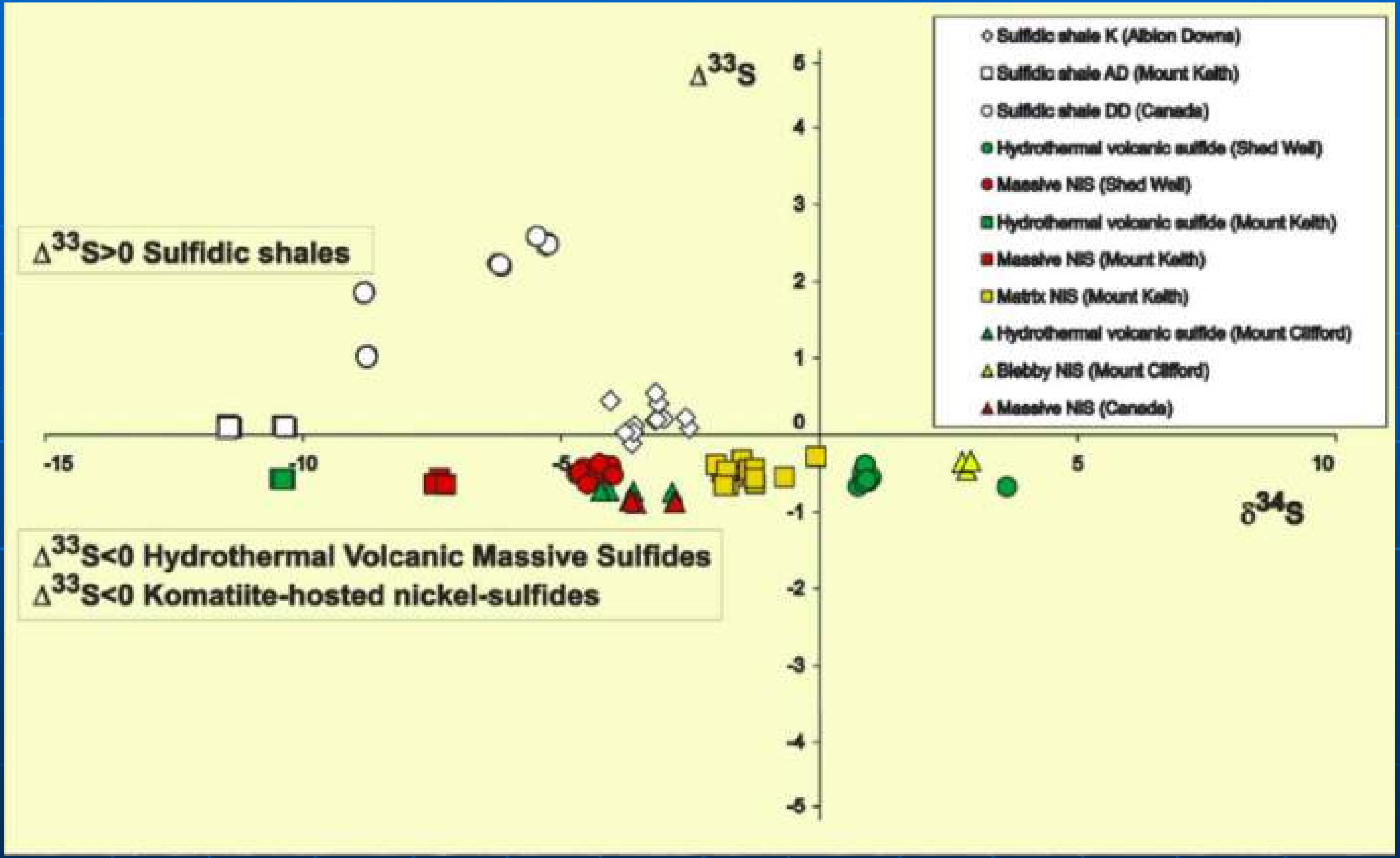


Exhalative sulphide rift analogues, Pacmanus





Komatiite can not have assimilated sulfidic shale



Example: Belt to Camp scale

- **Data utilised: Felsic volcanic thickness, facies variations, exhalative sulfide presence, thickness, Cu %, ultramafic volume and thickness, total MgO*, sulfide tenor, channel vol% etc.**

- **CAN THIS BE DONE IN THE DATA RICH NORSEMAN WILUNA?............YES.**

- **CAN THIS BE DONE IN DATA POOR ENVIRONS ?............YES because many of these features have a gravity, magnetic and/or geochemical expression**

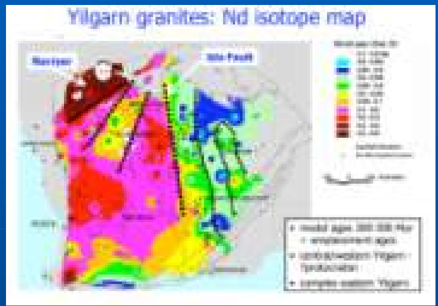
Putting it all together

Task

Competency

Province (Craton to Greenstone belt)

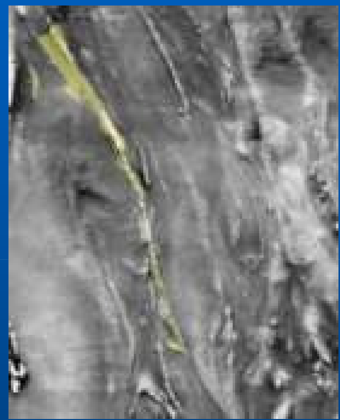
Identify prospective greenstone belts



- Identify greenstone belts on stable continental crust, marginal to cratonic nuclei?
- Structural interpretation of potential field and geochronology data
- Translithospheric fault controls on original extensional architecture

Camp

Evaluate for permissive komatiites, komatiite volume and ID potential rifts



- Ultramafic volume (a proxy for flux)
- Identify inverted rift (felsic volcanics, exhalative sulfides) and proximal facies komatiites
- Early petrology (understand the style, tenor, confirm sulfides are magmatic etc)
- Targeted Lithogeochemistry eg PGE
- Establish working stratigraphy

Prospect/ Deposit

Screen for mineralising system

- Optimise geochemical and geophysical exploration strategy for deposit style
- Identifying channelised komatiites (buffer distances around disseminated and channel positions)
- Structural controls on geometry (keep open mind to plunge)
- Invest in a structural understanding
- 3D tenor, Ni in footwall?

Where to from here?

- Deposit
  - **Primary and secondary diversity of deposits DOES IMPACT on geophysical, geochemical and geological exploration strategies**
  - **Develop new techniques for under cover: hydrogeochemistry, constrained inversions, hard rock seismic**
  - **Invest in a structural understanding of your prospects –provides basis for predictive targeting**
  - **3D tenor variation is an under utilised exploration vector**
- Camp
  - **Understand craton assembly and improve prediction and detection of 'active' lithospheric structures at time of ore genesis.**
  - **Detailed datasets such as granitoids and greenstone inheritance data have provided a step change in targeting of key structures.**
  - **Continue the search for improving whole rock and mineral scale lithogeochemical techniques (indicator minerals)**