The pmd*CRC A1 ('Architecture') Project

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predictive mineral discovery

MONASH UNIVERSITY

MORE

Mineralisation = Faults

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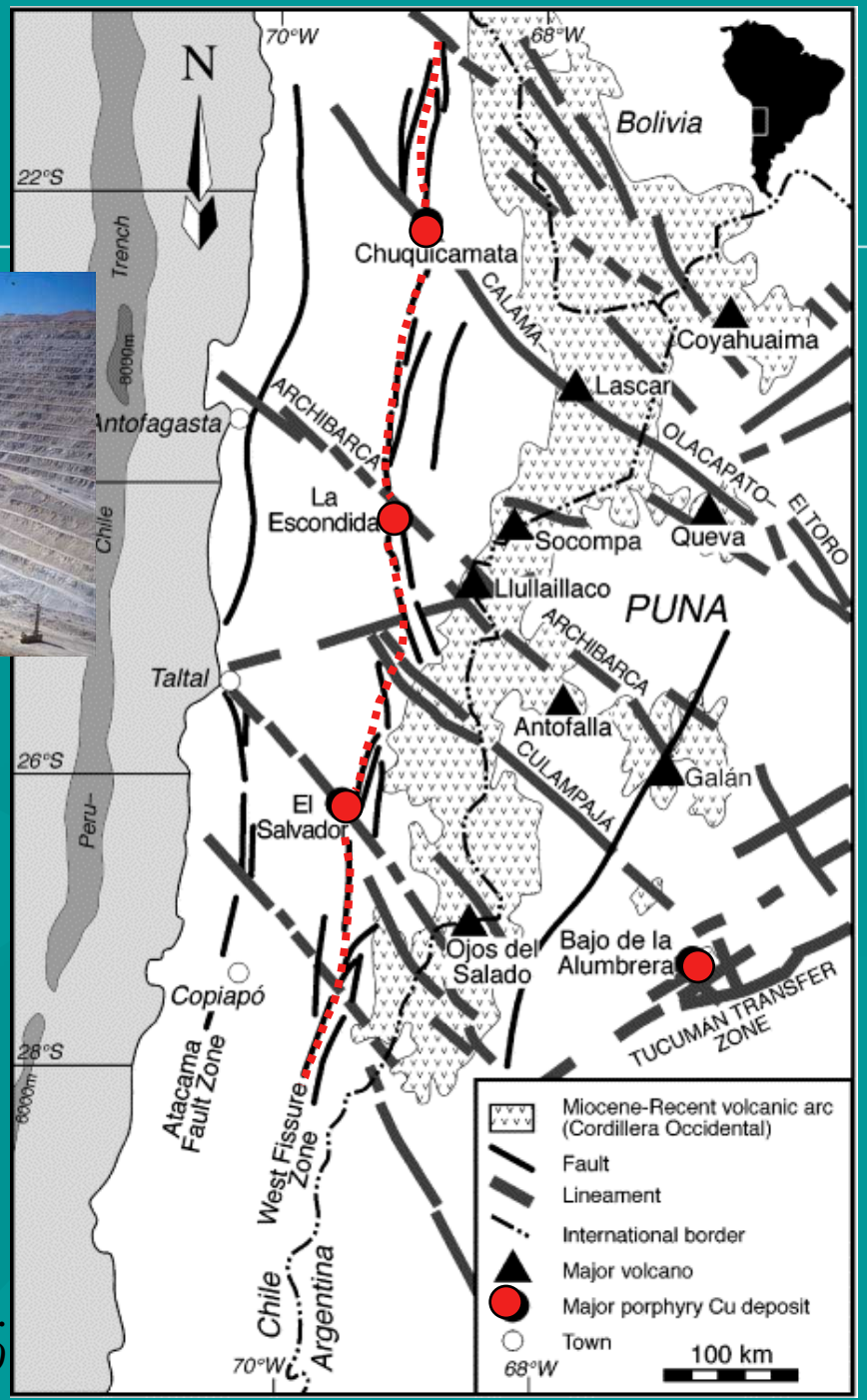
Capacity to focus fluid/melt flux

Chuquicamata

Columns of low-strength/ high-permeability (long-lived)



from Chernicoff et al. (2002)

KHSTAN

Karatau Mountains

Kyzylkum Desert

Darya

Bishkek

KYRGYZSTAN

Muruntau

Kumtor

Tien Shan Mountains

45°

80°

Basin

Tarim

UZBEKISTAN

TAJIKISTAN

CHINA

0 200

kilometers

after Yakubchuk et al. (2001)

L E G E N D

- Suture Zone
- Shear Zone
- Hercynian Tectono-Stratigraphic Unit
- Ophiolites
- Gold Deposit

Yet....

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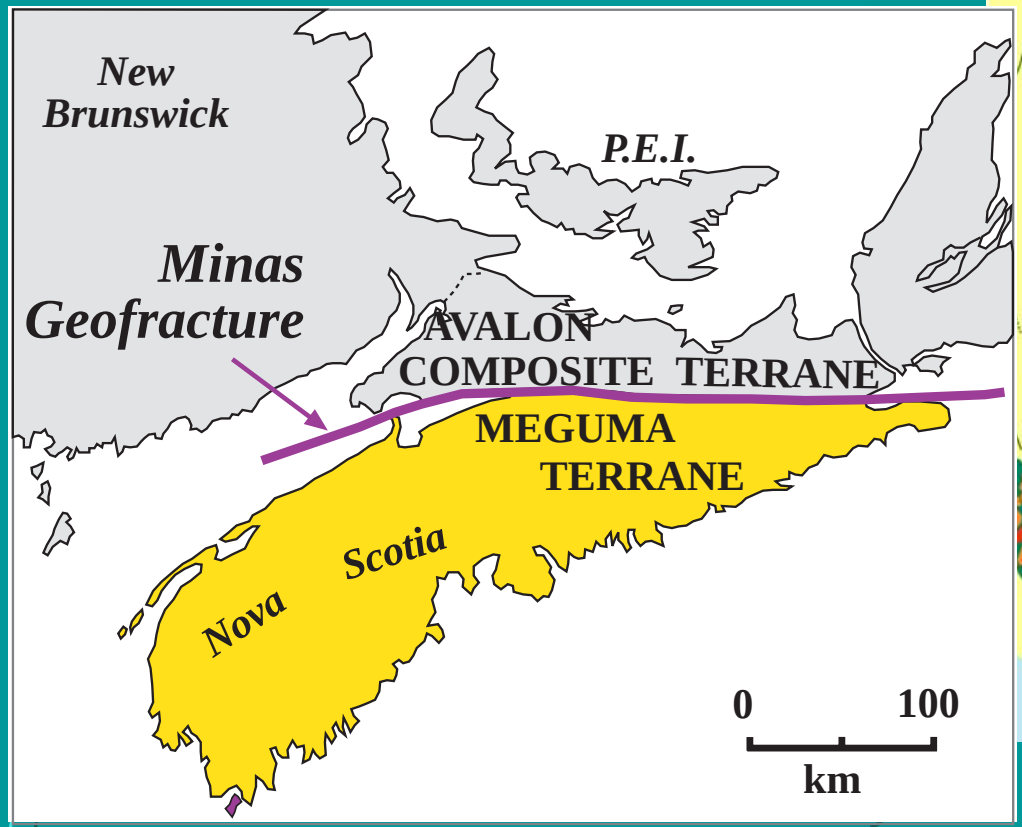
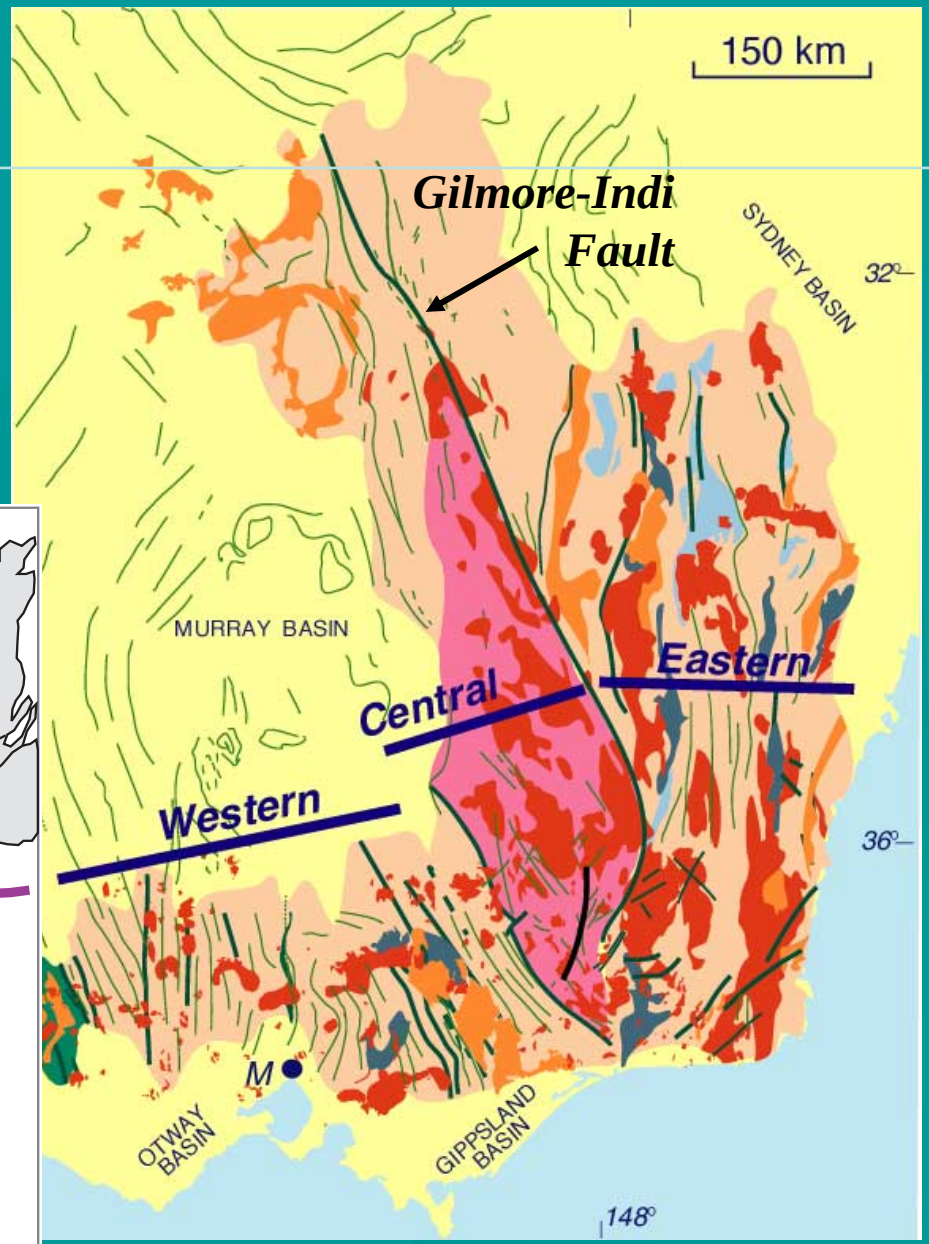
Faults ≠ Mineralisation !





What if…

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…. one could predict which faults are mineralised?

significant aid to *predictive* mineral exploration

drill here!

The pmd*CRC A1 Project

Monash University
Geoscience Australia
2002 - 2005

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"What are the fundamental characteristics of mineralised (trans-lithospheric) fault systems?"

➡ **Generic parameters common to all well-endowed faults?**

(e.g., is a mantle component essential to form major ore deposits?)

- **set of geological, geochemical and geophysical criteria for distinguishing mineralised from non-mineralised faults**
- **better understanding of role, significance of deep-seated structures in generating major ore deposits**

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The A1 Project - approach (I)

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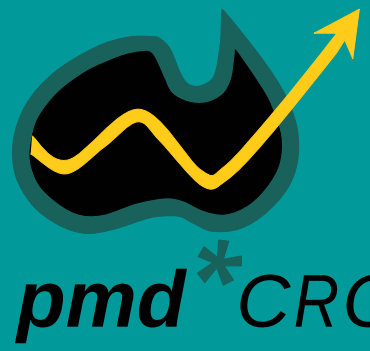
Data base illustrating commonalities between structures that host major ore deposits

- Global
- Independent of commodity or time
- Portable, searchable, expandable

e.g.,…

Alpine Fault
Ashanti Belt
Atacama
Boulder-Lefroy
Carlin trend
Colorado Mineral Belt
Gilmore-Indi
Henty
Mt Isa
Noril'sk – Kharayelakh
Pine Mountain Thrust
Redbank Zone
San Andreas
Tan Lu

etc.,…



Fault ID

- **Dimensions**
  - range of strike length
  - width of fault zone/corridor
  - dip geometry
- **Dynamics**
  - tectonic setting
  - kinematic evolution
  - duration of fault movement
- **Lithology and metamorphism**
  - dominant lithology hosting fault
  - nature of basement
  - metamorphic grade
- **Magmatism**
  - nature of dominant magmatism
  - timing of magmatism
  - method used to determine age
- **Mineralising events**
  - MIME?
  - age of mineralising event
- **Mineralisation and alteration**
  - endowment
  - alteration
  - fluid source
- **Most important deposit**
  - name of deposit
  - fault kinematics during ore stage
  - source of ore-stage fluid
- **Geophysical data**
  - depth of Moho & LAB
  - interpreted strike length
  - Magnetics
- **Additional Information**
  - key reference number
  - reliability rating
  - Comments (key words)
- **References**

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Fault ID: The Moyston Fault (#13)

Geographic information:

Australia; western Lachlan Orogen; Palaeozoic

Dimensions:

single fault structure; not applicable; continuous; 50 - 100km

Dynamics:

active; reverse top-west; 140-160˚; 60-90˚; compressional; brittle-dominated; complex; terrane; accretionary prism; 440 - 90 Ma; Ar/Ar, fission-track

Lithology and metamorphism:

continental; 500 Ma; basement exposed; oceanic;sub-greenschist; mid-amphibole

Magmatism:

major felsic-intermediate; I-type; post-tectonic; 390-400 Ma; SHRIMP U-Pb; zircon, none

Mineralisation and alteration:

significant; irregular; orogenic gold; silicification; no data

Most important deposit:

Moyston goldfield; 440 -390 Ma

Geophysical:

251-500km; discrete structure; 31-60 km; 151-200 km

Additional information:

15, 16, 17, 18, 28, 46, 90; excellent

References:

(15) Gray, D.R., Foster, D.A. 1998: Journal of Structural Geology

The A1 Project - in search of the holy grail?

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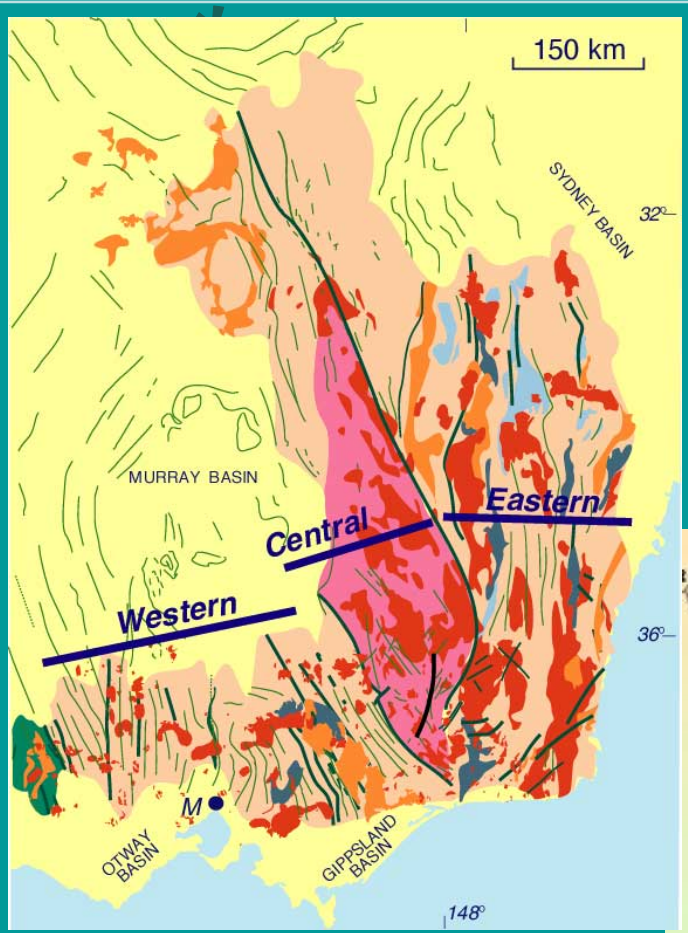
Some important limitations:

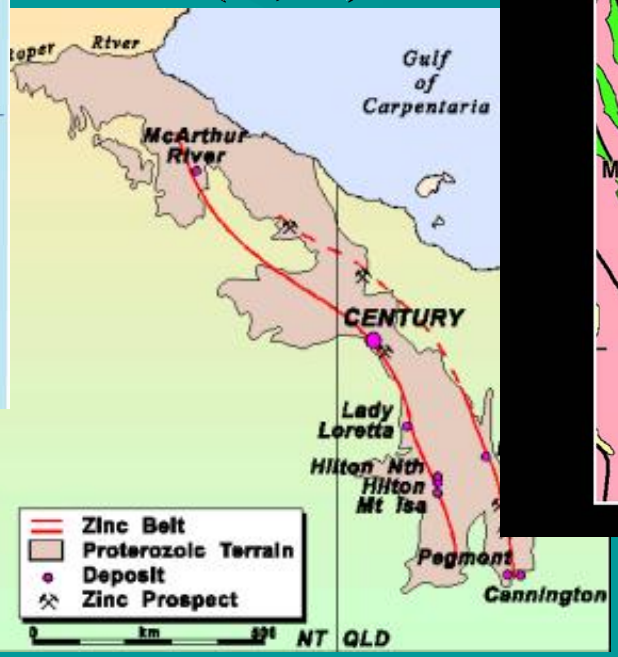
- **Faults are not cause, just provider**
- **Mineral deposits can occur away from faults**
- **Detection of 'obscure(d)' faults**
- **Influence of local-scale processes**
- **Low base rate effect**

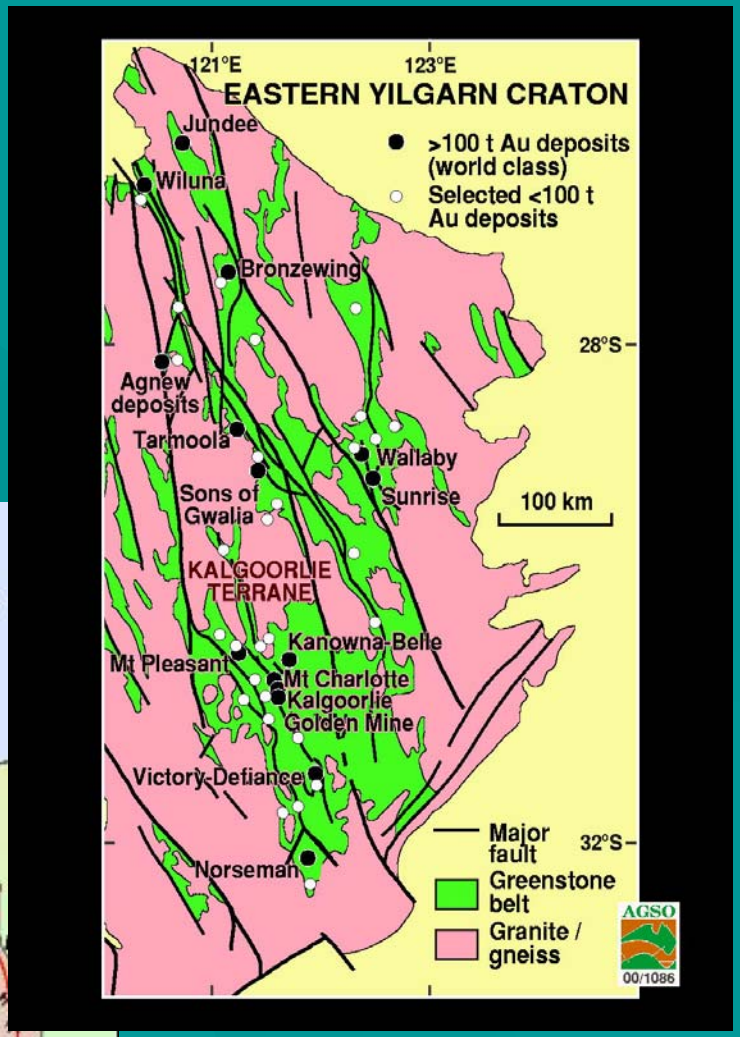
The A1 Project - key area studies



Lachlan Orogen
(H1, H4, T5)

western succession,
Mt Isa (I1, I4)





eastern Yilgarn (Y2, Y3)

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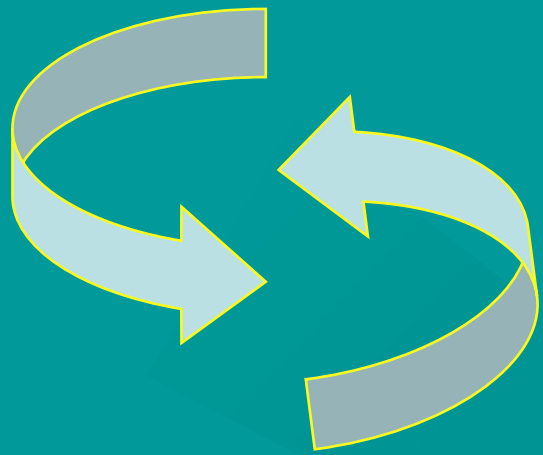

SoG/VIEPS: P. Betts
G. Lister
A. Wilde
G. Mark
I. Cartwright
R. Keays
D. Phillips
J. Miller
and others…

UWA
CODES
ANU
UoB
GA
GSV
CSIRO

mining & exploration industry,
international research organisations, etc.

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The A1 Project - future directions

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- Web-enabled interactive data base
- Set of geological, geochemical and geophysical criteria for distinguishing mineralised from non-mineralised faults
- Improved understanding of role, significance of deep-seated structures in generating major ore deposits
- Provision of scenarios for numerical modelling
- Powerful predicitive tool in exploration for major mineral deposits