Timing, nature and characteristics of orogenic gold deposits in the Broken River Province, NE Queensland, Australia

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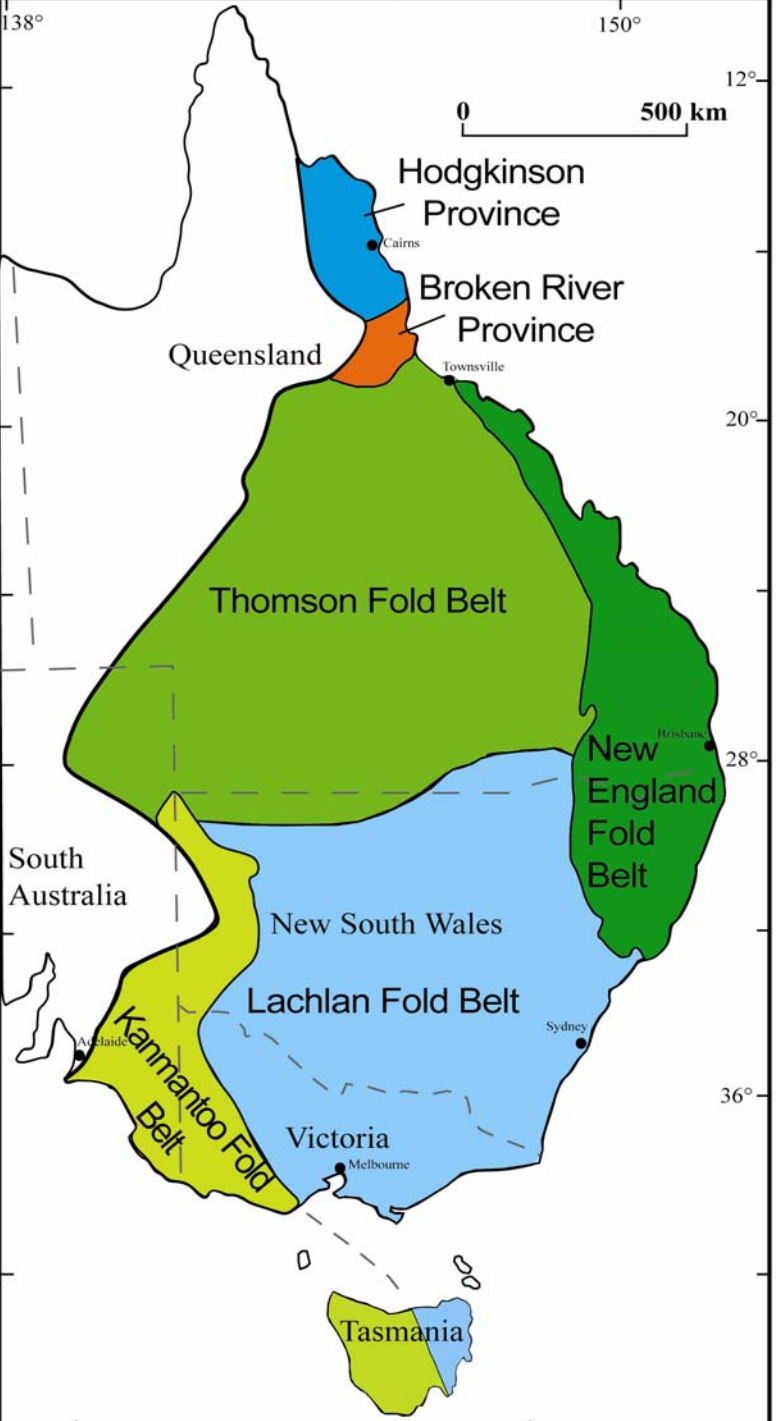

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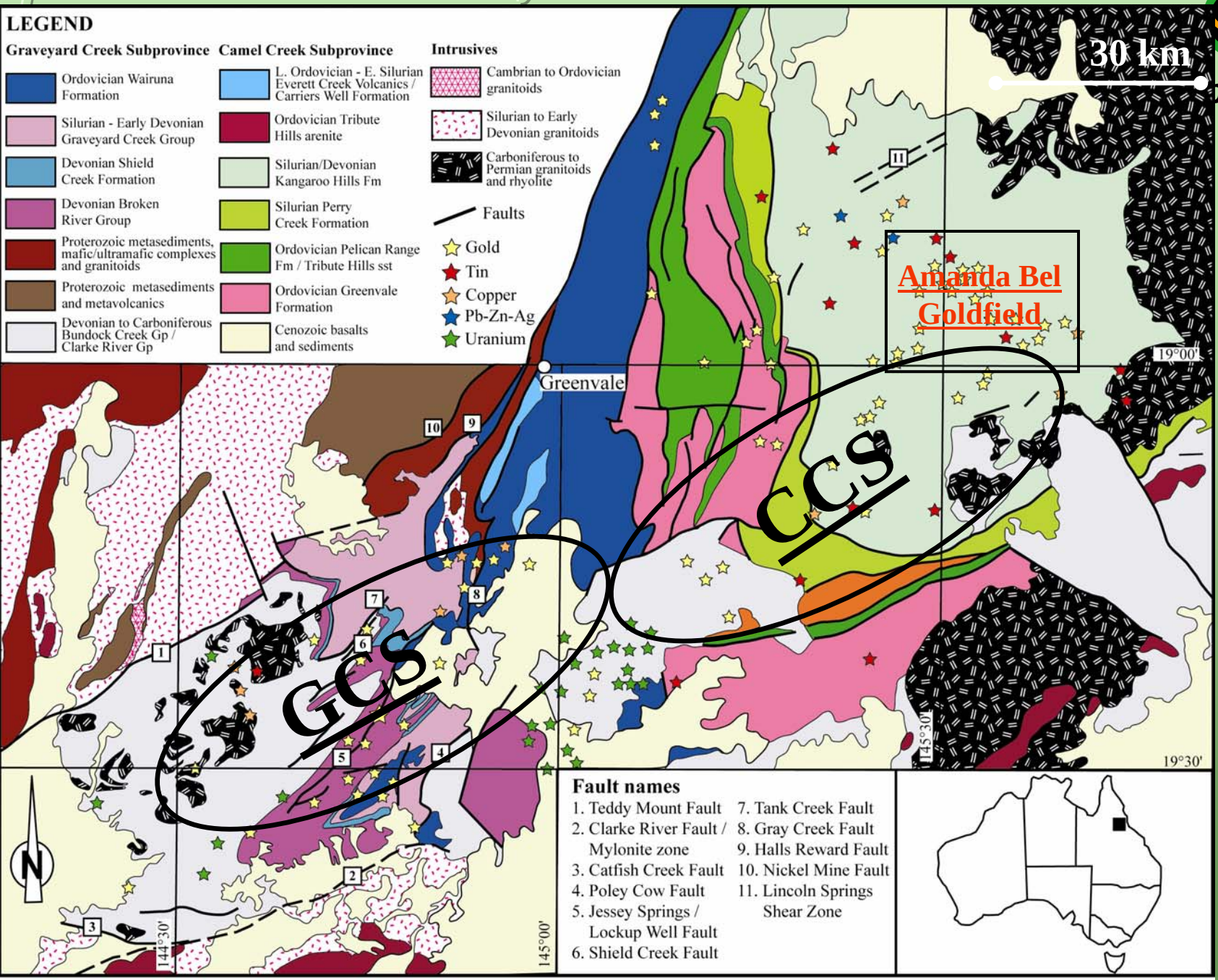
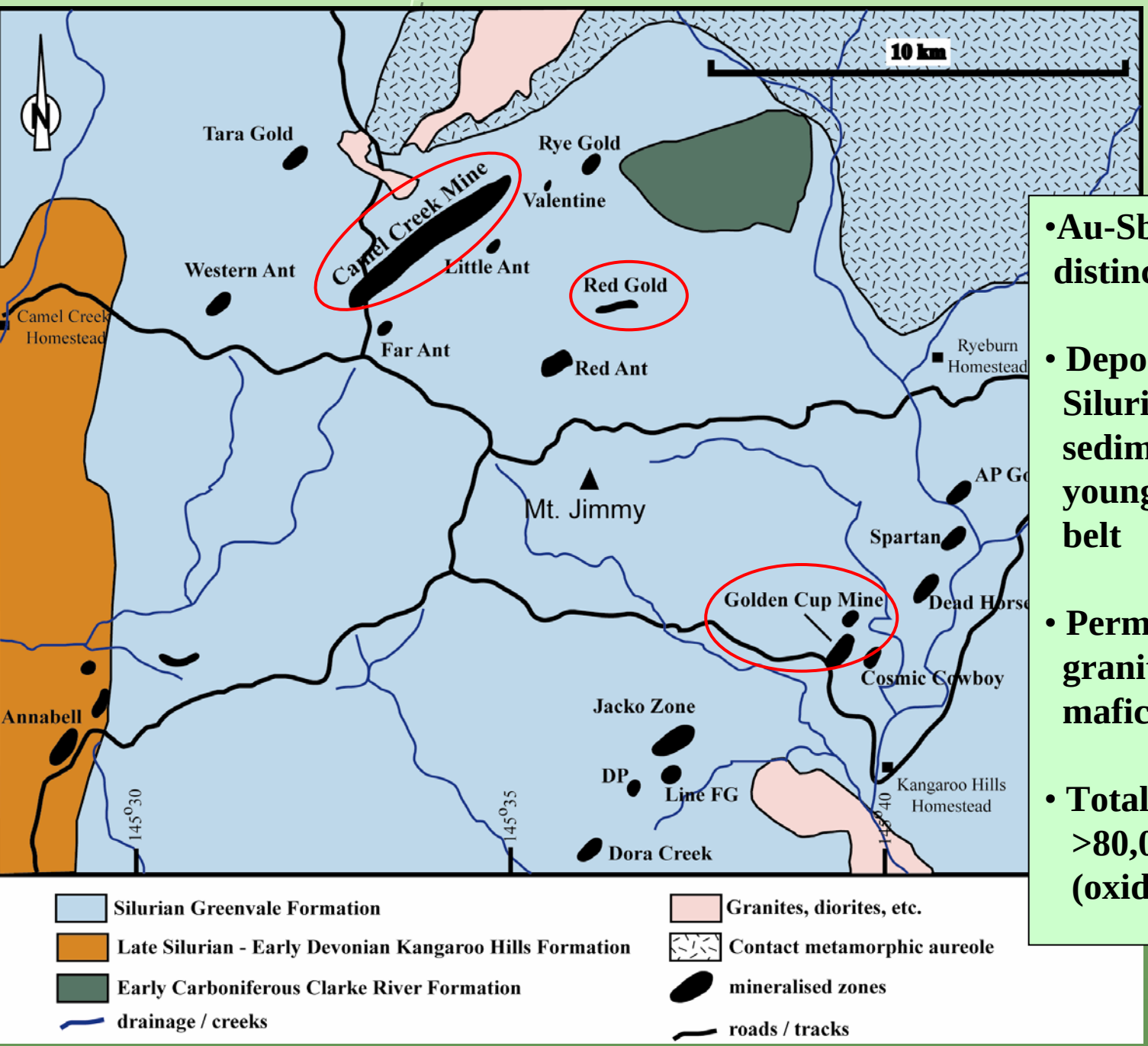
Talk outline

- **Geological setting**
- **Structural framework**
- **Sulphide paragenesis**
- **Fluid inclusions**
- **Implications and applications of this study**

The Palaeozoic Tasman Fold Belt System in Eastern Australia


LEGEND
Graveyard Creek Subprovince
Ordovician Wairuna Formation
Silurian - Early Devonian Graveyard Creek Group
Devonian Shield Creek Formation
Devonian Broken River Group
Proterozoic metasediments, mafic/ultramafic complexes and granitoids
Proterozoic metasediments and metavolcanics
Devonian to Carboniferous Bundock Creek Gp / Clarke River Gp
Camel Creek Subprovince
L. Ordovician - E. Silurian Everett Creek Volcanics / Carriers Well Formation
Ordovician Tribute Hills arenite
Silurian/Devonian Kangaroo Hills Fm
Silurian Perry Creek Formation
Ordovician Pelican Range Fm / Tribute Hills sst
Ordovician Greenvale Formation
Cenozoic basalts and sediments
Intrusives
Cambrian to Ordovician granitoids
Silurian to Early Devonian granitoids
Carboniferous to Permian granitoids and rhyolite
Faults
Gold
Tin
Copper
Pb-Zn-Ag
Uranium
30 km
Amanda Bel Goldfield
Greenvale
GCS
CCS
19°00'
19°30'
145°30'
144°30'
145°00'
N
Fault names
1. Teddy Mount Fault
2. Clarke River Fault / Mylonite zone
3. Catfish Creek Fault
4. Poley Cow Fault
5. Jessey Springs / Lockup Well Fault
6. Shield Creek Fault
7. Tank Creek Fault
8. Gray Creek Fault
9. Halls Reward Fault
10. Nickel Mine Fault
11. Lincoln Springs Shear Zone



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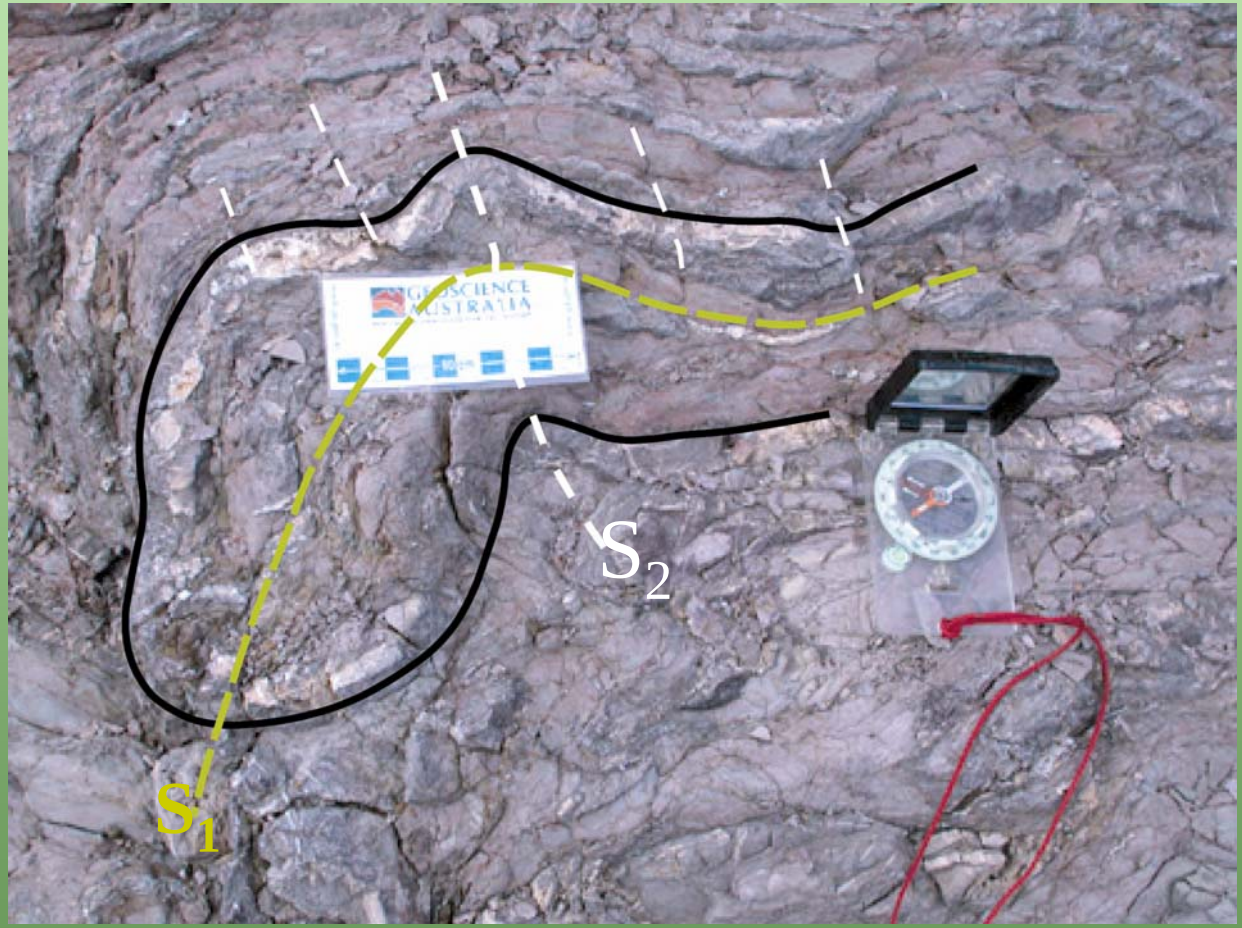
- **Au-Sb deposits along distinct NE-SW trend**
- **Deposits hosted by Silurian to Devonian sediments in eastward younging fold/thrust belt**
- **Permo-Carboniferous granitoids and felsic to mafic dykes**
- **Total production '89-'94 >80,000 oz of gold (oxide zone)**

Structural framework

At least 3 deformation phases



Recumbent F_1-fold overprinted by NE-SW trending S_2 foliation co-axial to S_1 (Camel Creek deposit)

Quartz-filled D_3 reverse fault (Camel Creek deposit)

Deformation history

Structural and temporal framework for deformation (GSQ):

D_1: NE-SW recumbent and isoclinal folding *(E. Dev)*

D_2: NE-SW upright isoclinal folding *(L.Dev-E. Carb)*

D_3: NW-SE striking thrust fault and open folding *(L. Carb)*

Our work:

Testing application of temporal framework to mineralisation (Re-Os, Ar-Ar)

Deformation history and mineralising episodes

Syn-D1 mineralisation

- **Refolded NE-SW trending quartz-stibnite-gold lenses**
- **Confined within folded carbonaceous shale horizons**

D_1: NE-SW recumbent and isoclinal folding ***(E. Dev)***

D_2: NE-SW upright isoclinal folding ***(L.Dev-E. Carb)***

D_3: NW-SE striking thrust fault and open folding ***(L. Carb)***

Gold-bearing quartz-stibnite vein from the Camel Creek deposit

Deformation history and mineralising episodes

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Syn-D2 mineralisation

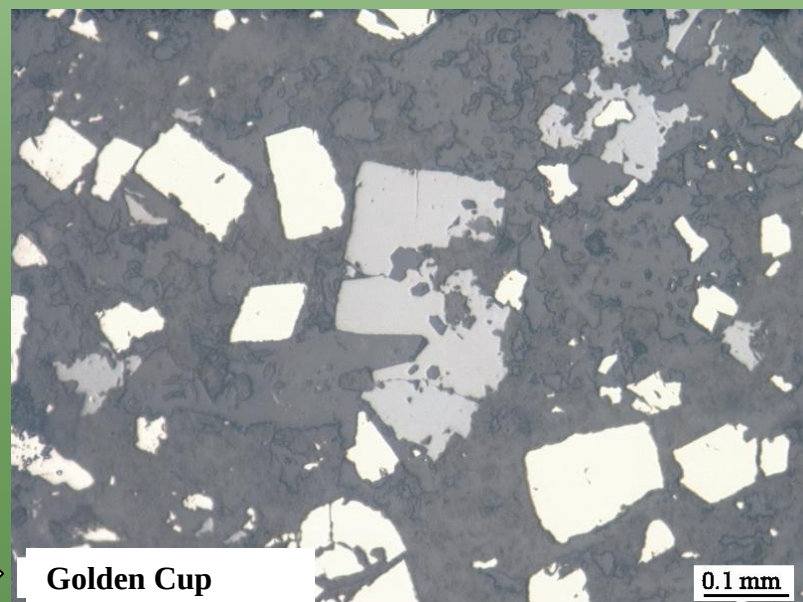
- **Boudinaged quartz veins / stockworks**
- **Confined within carbonaceous shales in NE-SW-striking shear zones // F2 axial plane**

D_1: NE-SW recumbent and isoclinal folding *(E. Dev)*

D_2: NE-SW upright isoclinal folding *(L.Dev-E. Carb)*

D_3: NW-SE striking thrust fault and open folding *(L. Carb)*

Gold-bearing arsenopyrite and pyrite at Golden Cup



Deformation history and mineralising episodes

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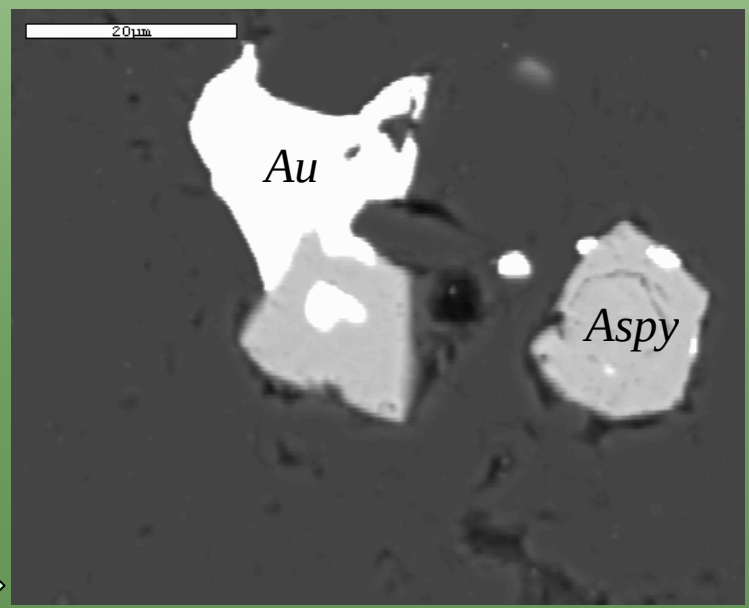
Post-D2/D3 mineralisation

- **Gold-stibnite-aspy veins**
- **Confined within NW-SE trending extension fracture zones**

D_1: NE-SW recumbent and isoclinal folding *(E. Dev)*

D_2: NE-SW upright isoclinal folding *(L.Dev-E. Carb)*

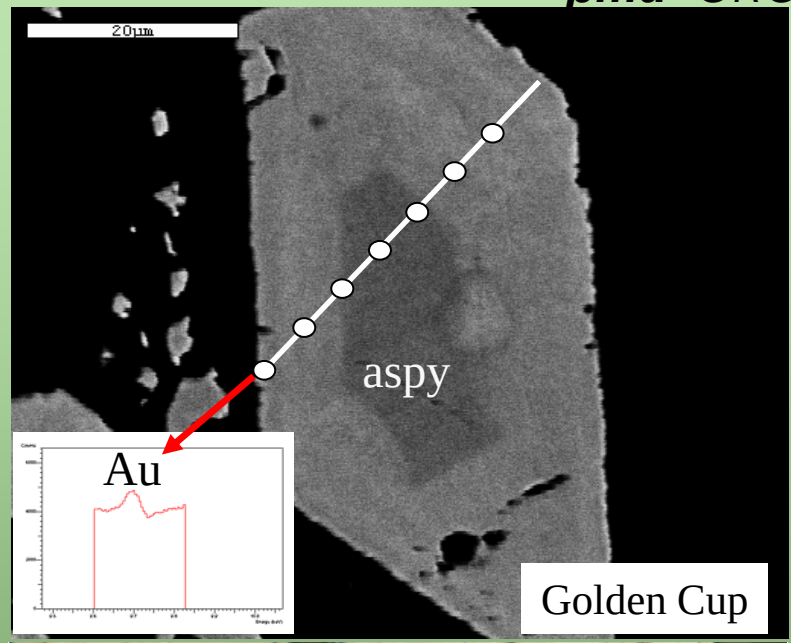
D_3: NW-SE striking thrust fault and open folding *(L. Carb)*



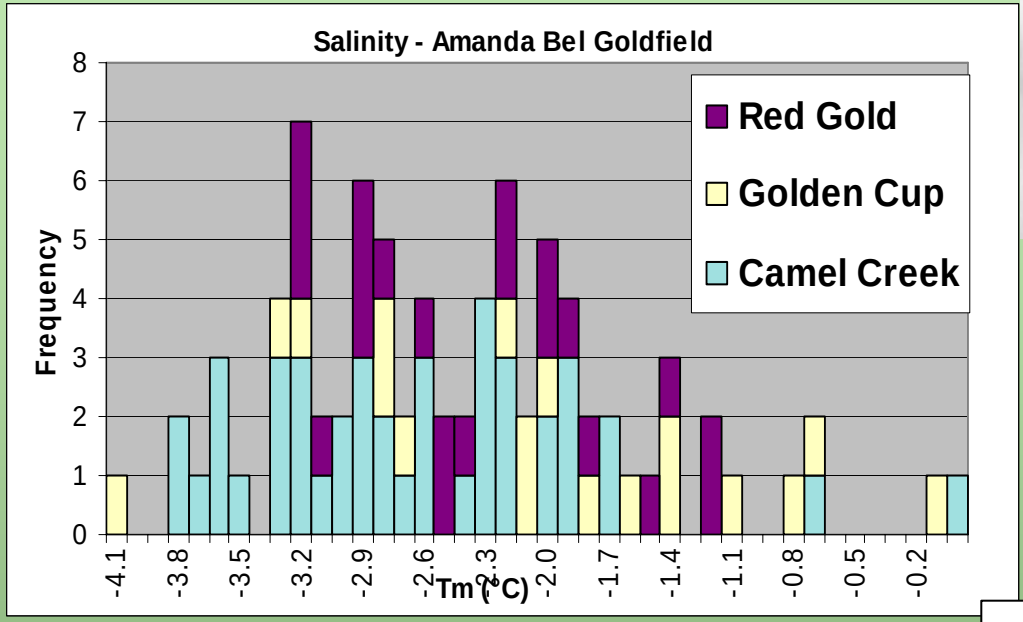
Gold-Aspy association at Blue Gold (SEM image)

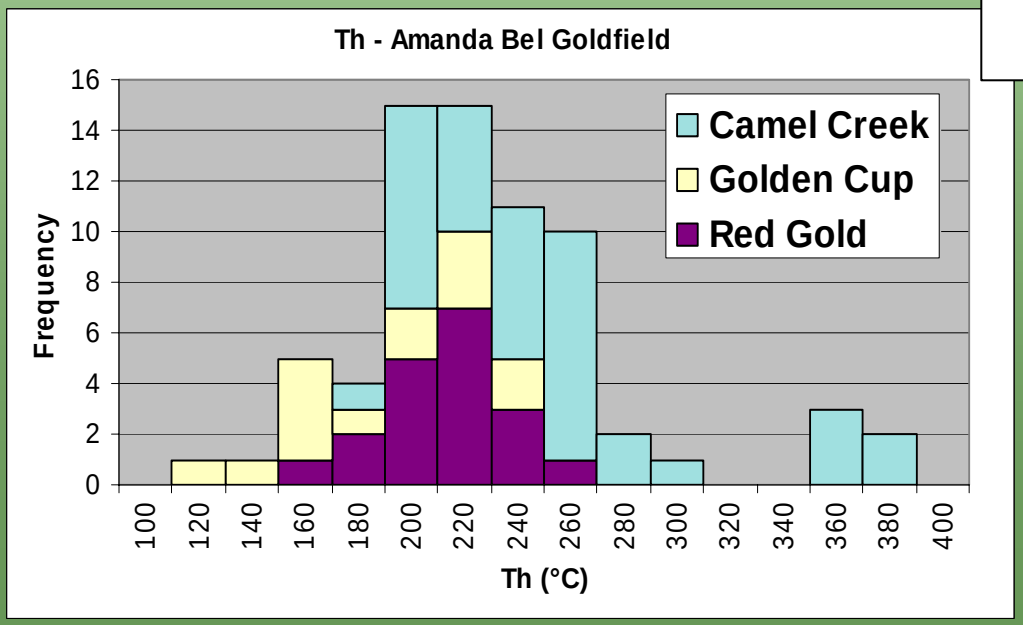
Sulphide paragenesis

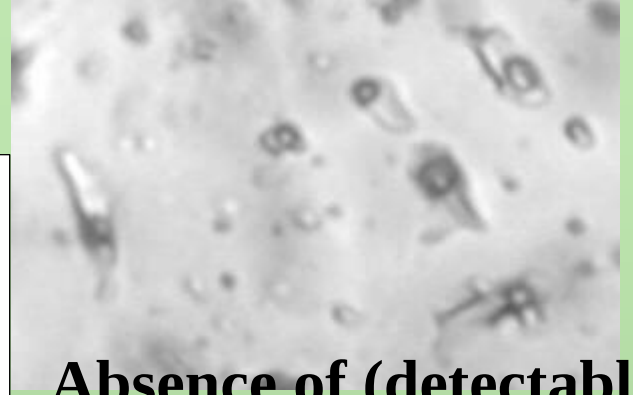
		D_1	D_2	post-D_2/D_3
Airport Gold	Sphalerite Pyrite Arsenopyrite Gold			
Blue Gold	Arsenopyrite Rutile Galena Gold Pyrite Stibnite			
Camel Creek	Sphalerite Pyrite Arsenopyrite Stibnite Gold Aurostibite			
Golden Cup	Chalcopyrite Tetrahedrite Sphalerite Galena Pyrite Arsenopyrite Gold			
Red Gold	Chalcopyrite Tertrahedrite Pyrite Gold			



Fluid inclusions







Absence of (detectable) gas phases from Laser Raman

- **Fluid salinities between 2 and 5 wt% NaCl equiv.**
- **Th suggest minimal fluid trapping T between 160°C and 300°C**
- **D1 slightly higher salinities and Th then D2**

Implications and applications

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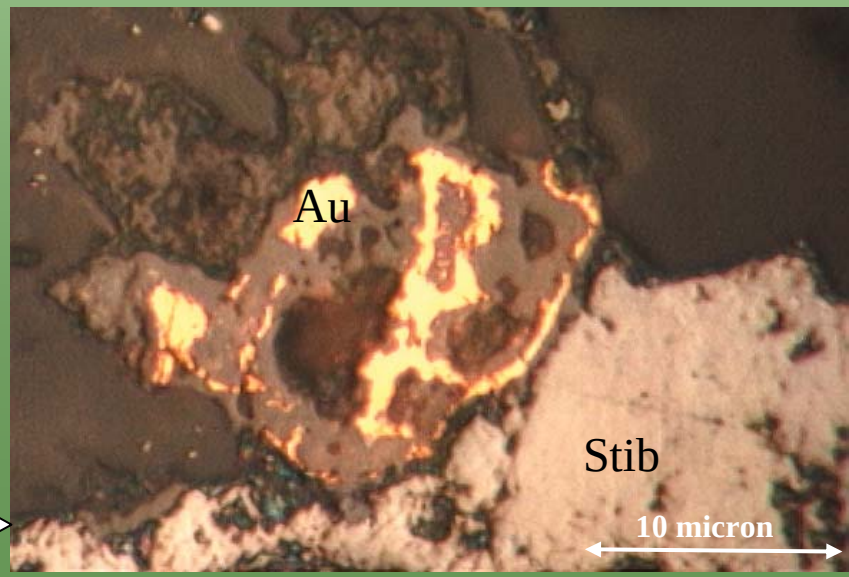
Timing of gold mineralisation
(before major magmatic activity)

Nature of fluids
(metamorphic origin trapped at epizonal conditions)

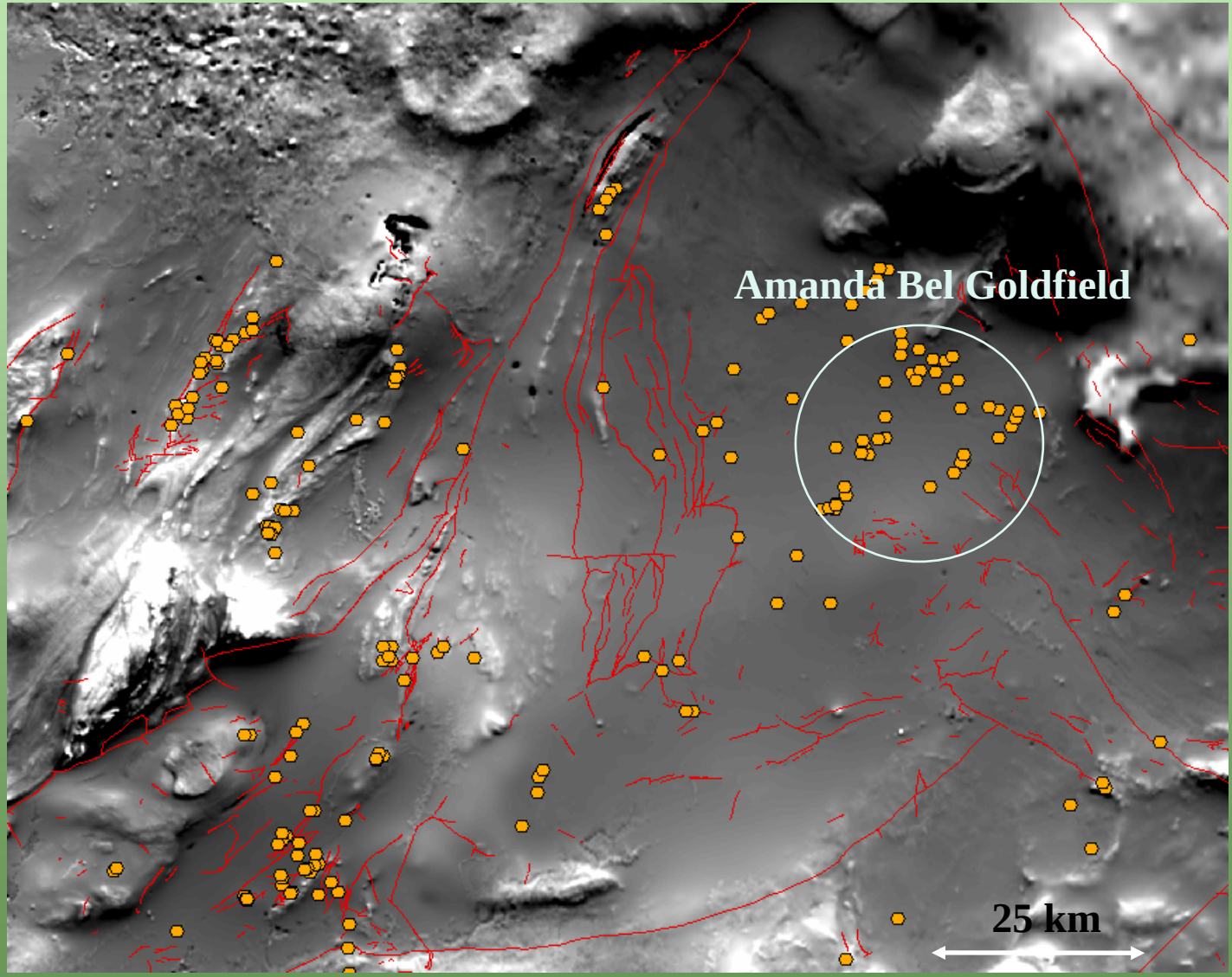
Orogenic gold deposits

Close relationship with deformation
(in eastward younging fold-thrust belt)

Visible gold, aurostibite and stibnite from the Camel Creek deposit



Implications and applications



Potential for gold mineralisation away from recognized fault structures

Challenge for future exploration

Implications and applications

Controls on mineralisation

Comparison with Vic Au deposits

metallogeny as a key to tectonic evolution of TFBS

predictive mineral discovery

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Stafford McKnight, Terry Mernagh, Mike Barlow, Lynch Mining Pty Ltd