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Unifying features of gold systems in the central Gawler Craton: alteration, mineralisation and fluids

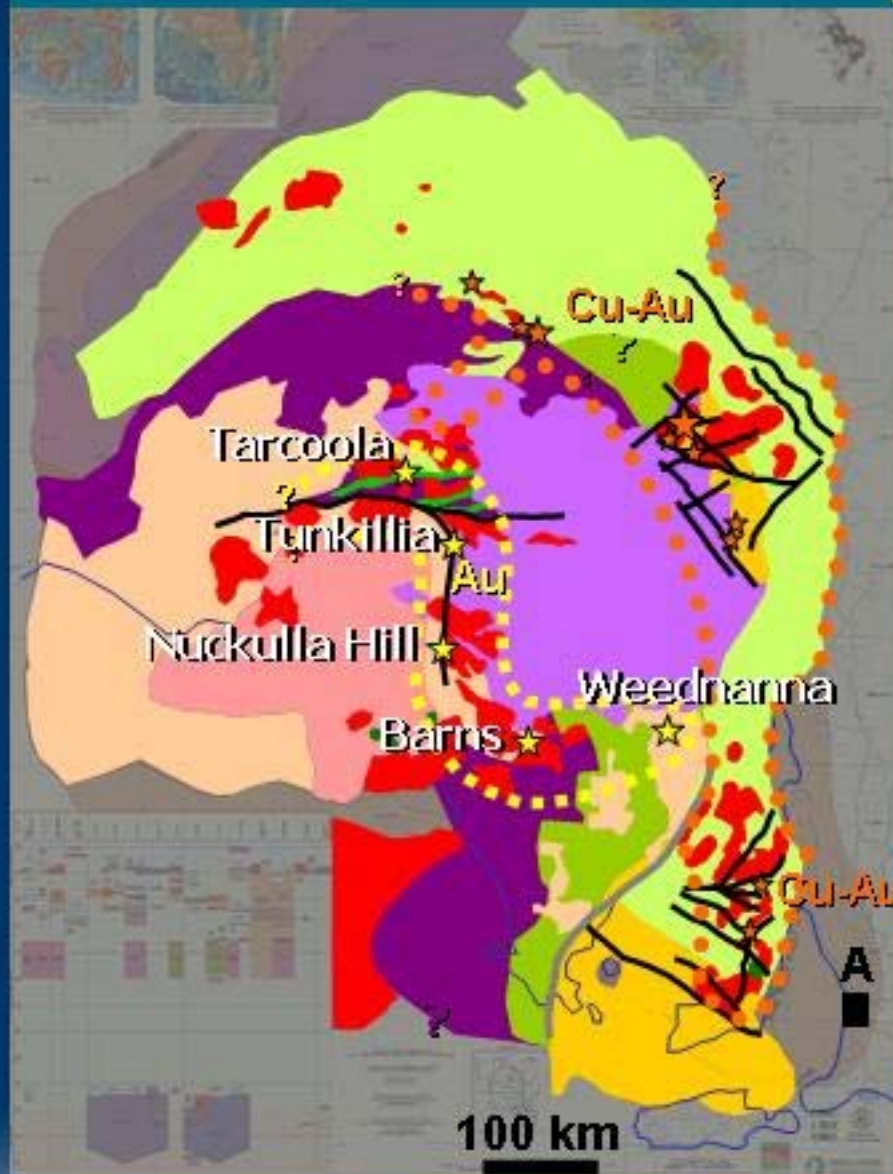
Roger Skirrow (GA)

Andreas Schmidt-Mumm (Uni of Adelaide)

Geoff Fraser (GA)

Anthony Budd (GA)

Central Gawler gold province



Olympic Cu-Au province

Central Gawler Au prov.
(Drown, 2002; Budd, 2002; Ferris & Schwarz, 2003)

Collaborators:
Companies
PIRSA
CRCLEME
Uni of Adelaide

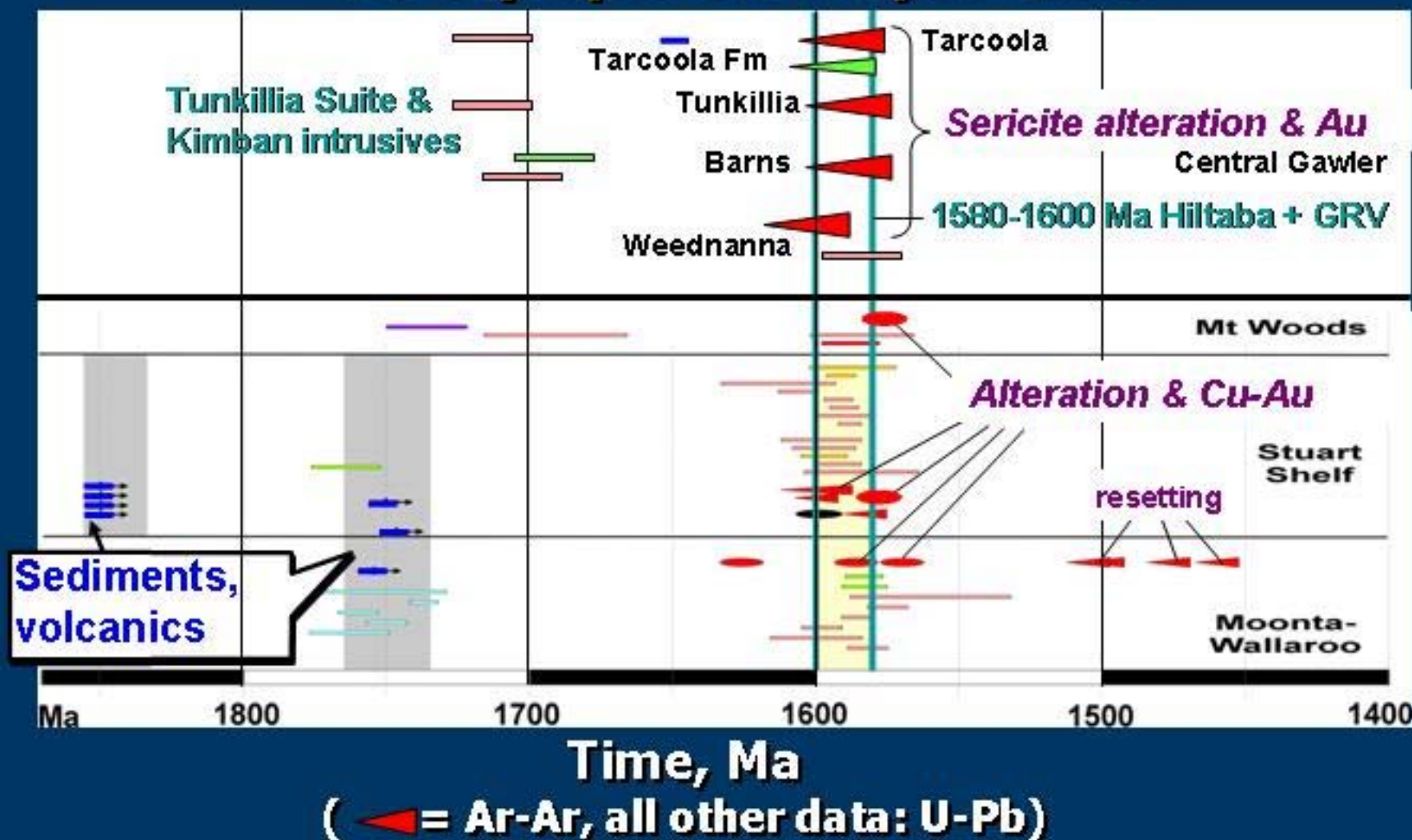
CGG Reconnaissance studies 2003/04

- **Questions:**
 - Are the main gold prospects of similar age, character, and origins, forming a gold province?
 - What features will help locate Au thru' cover?
- **Sampled:** core from Tunkillia (+ RC holes), Barns, Nuckulla Hill & Weednanna for petrography, Ar-Ar dating, Pb-isotopes, fluid inclusions

CGG - Host rock and alteration ages

- **New SHRIMP U-Pb & Ar-Ar dates for host igneous rocks (Oli Holm, Anthony Budd, Geoff Fraser)**
- **Sericite at Tarcoola, Barns, Tunkillia, Weednanna: ~1570-1600 Ma (Geoff Fraser – next talk)**

Event timing: Central Gawler Au province vs. Olympic Cu-Au province



(A. Budd, G. Fraser, O. Holm, E. Jagodzinski, O. Raymond, R. Skirrow)

Regional controls on gold

- **Tunkillia Suite granitoids + mafics host all of the known main Au prospects**
- **Yarlbrinda Shear Zone hosts Tunkillia & Nuckulla Hill, and also marks transition to more evolved crust (lower epsilon-Nd values – Stewart, unpubl. data)**
- **Is the YSZ a terrane boundary, that controlled emplacement of Tunkillia Suite (1680-1720 Ma), and was re-activated at 1570-1600 Ma?**
- **Intermediate to mafic dykes & Au controlled by these re-activated deep-crustal structures?**
- **Hiltaba granites: only indirectly related to Au.**

Barns, Tunkillia, Tarcoola, Nuckulla footprints: alteration zoning in granitoid host

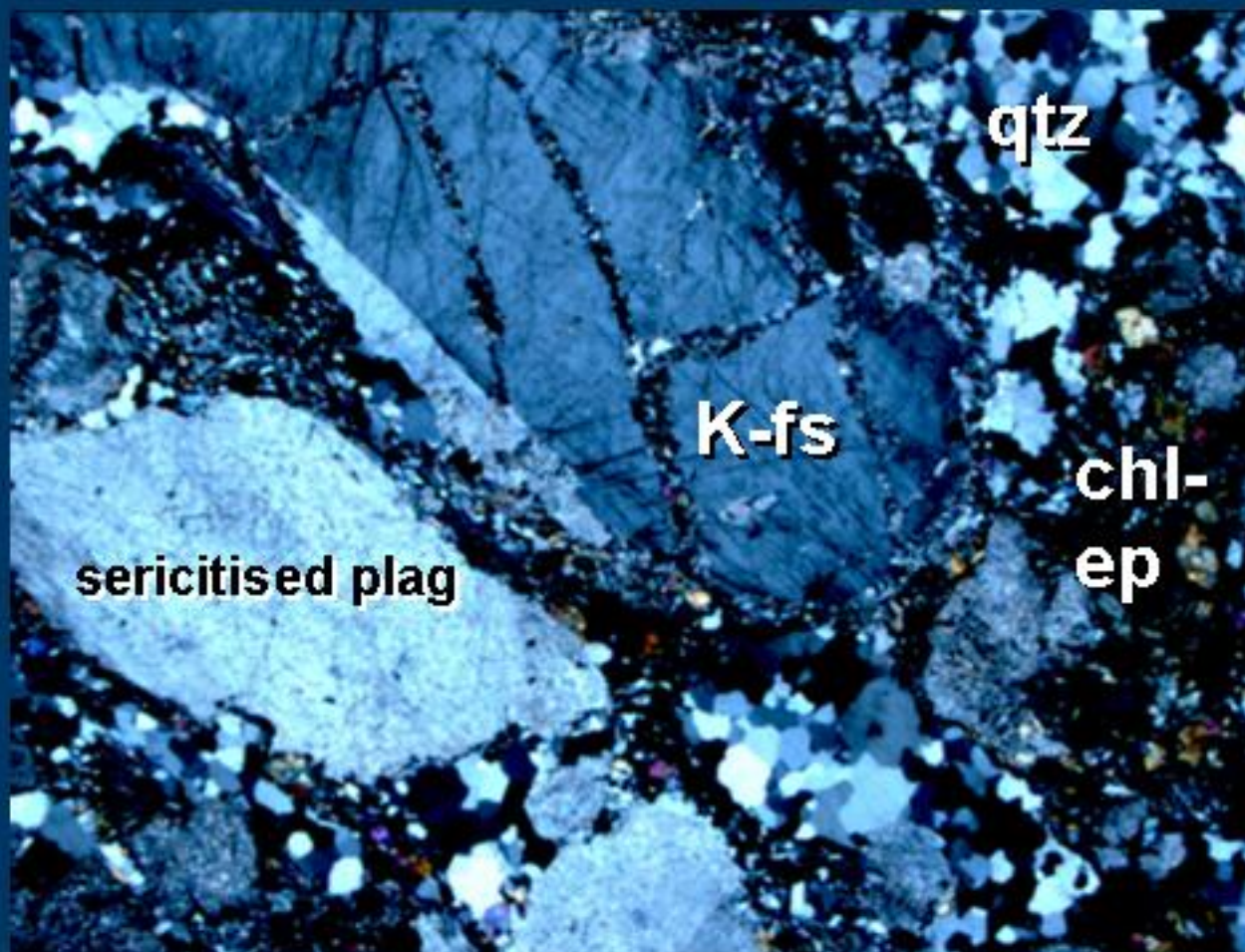
Least altered	Outer/ less intense	Inter- mediate	Inner/ intense
Kfs-qtz -plag-mt	chl-ep-ser (-rut-hm)	ser-chl (-rut-py)	ser-py- qtz (-chl) Au, gal

← carbonate →

[Based on petrography by A. Budd, R. Skirrow, and Drown (2003); supported by HyLogger data (Keeling & Mauger, 2004)]

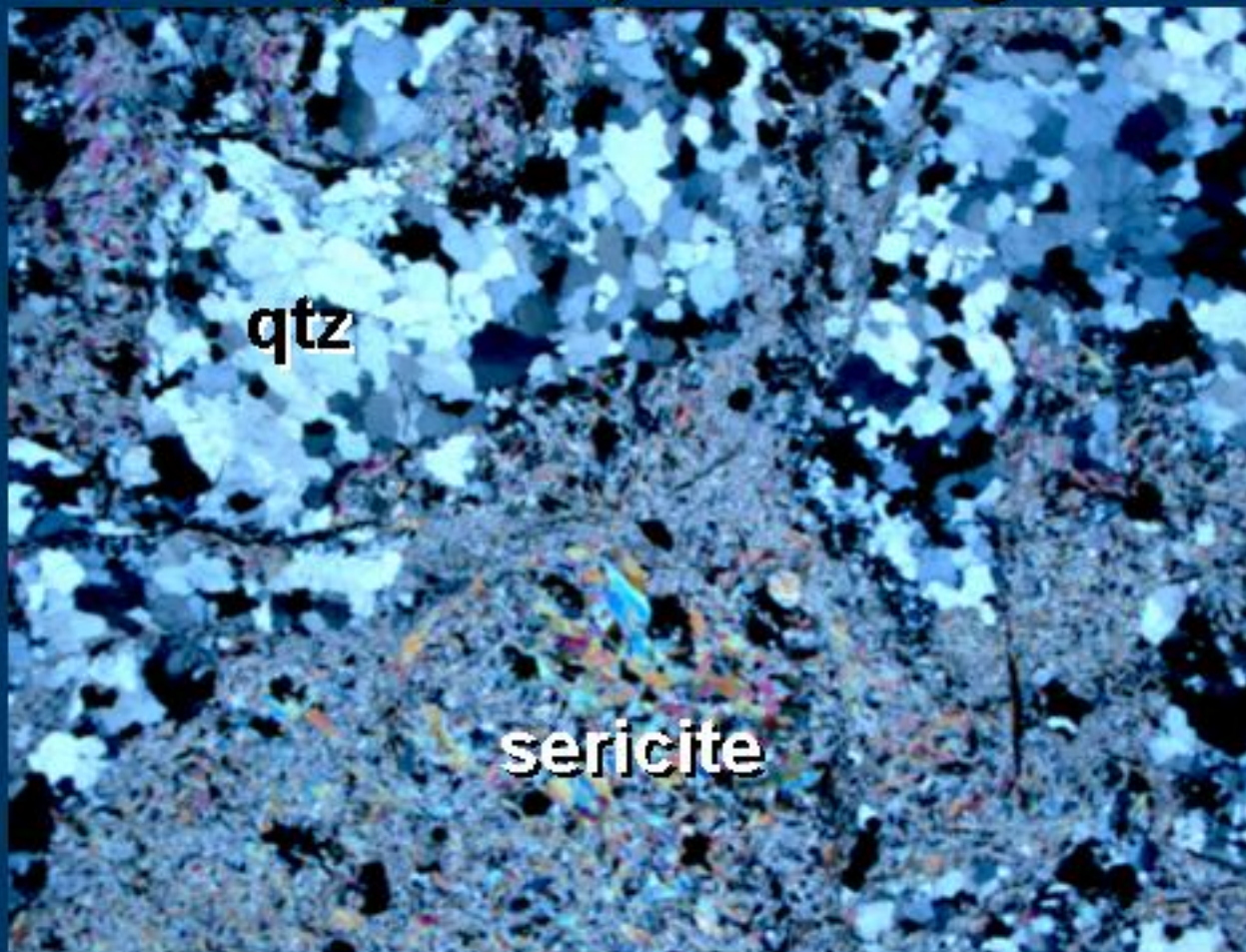
Barns

Outer/weaker alteration: chlorite-epidote-ser altered granite



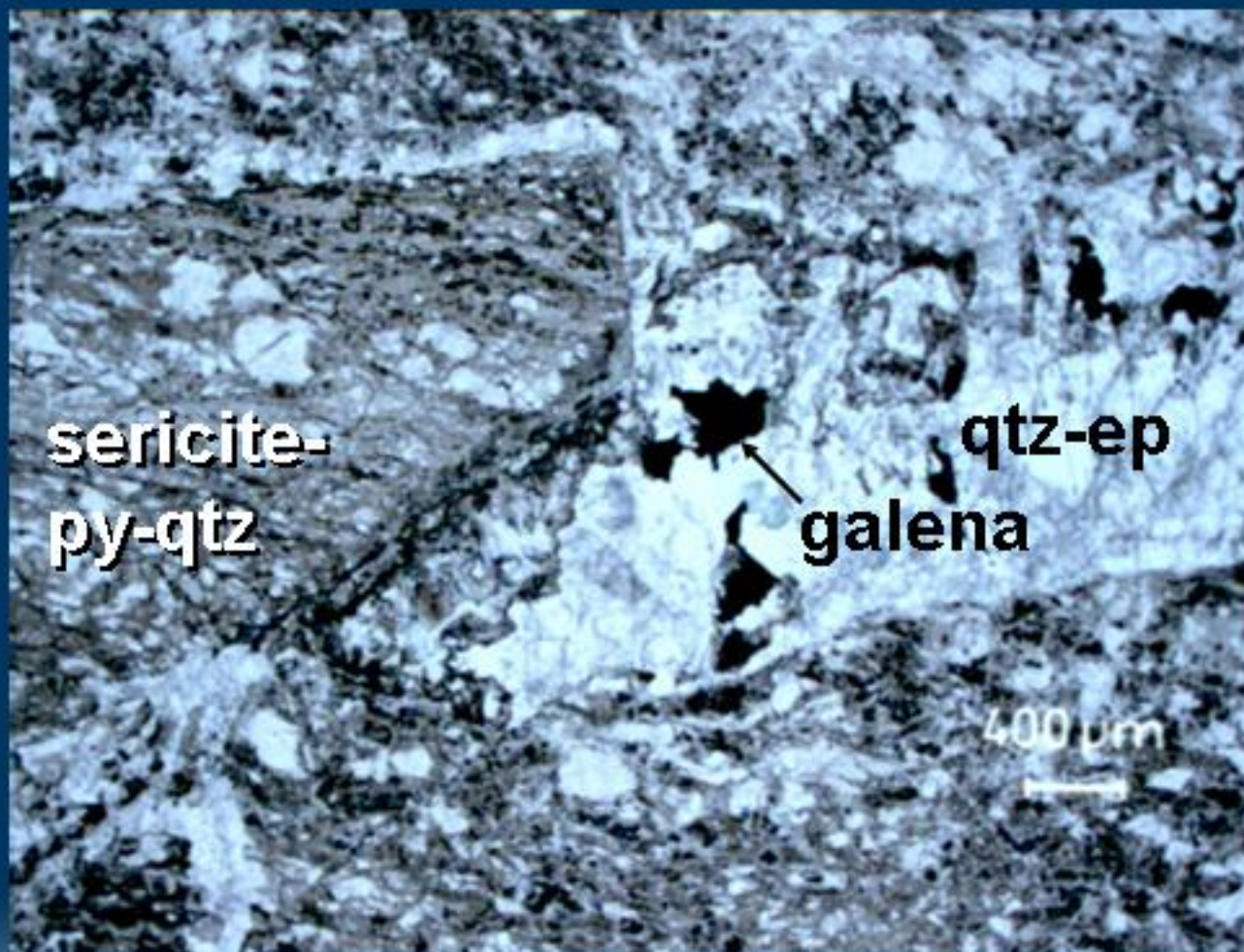
Barns

Inner/intense alteration:
sericite(-pyrite) altered granite



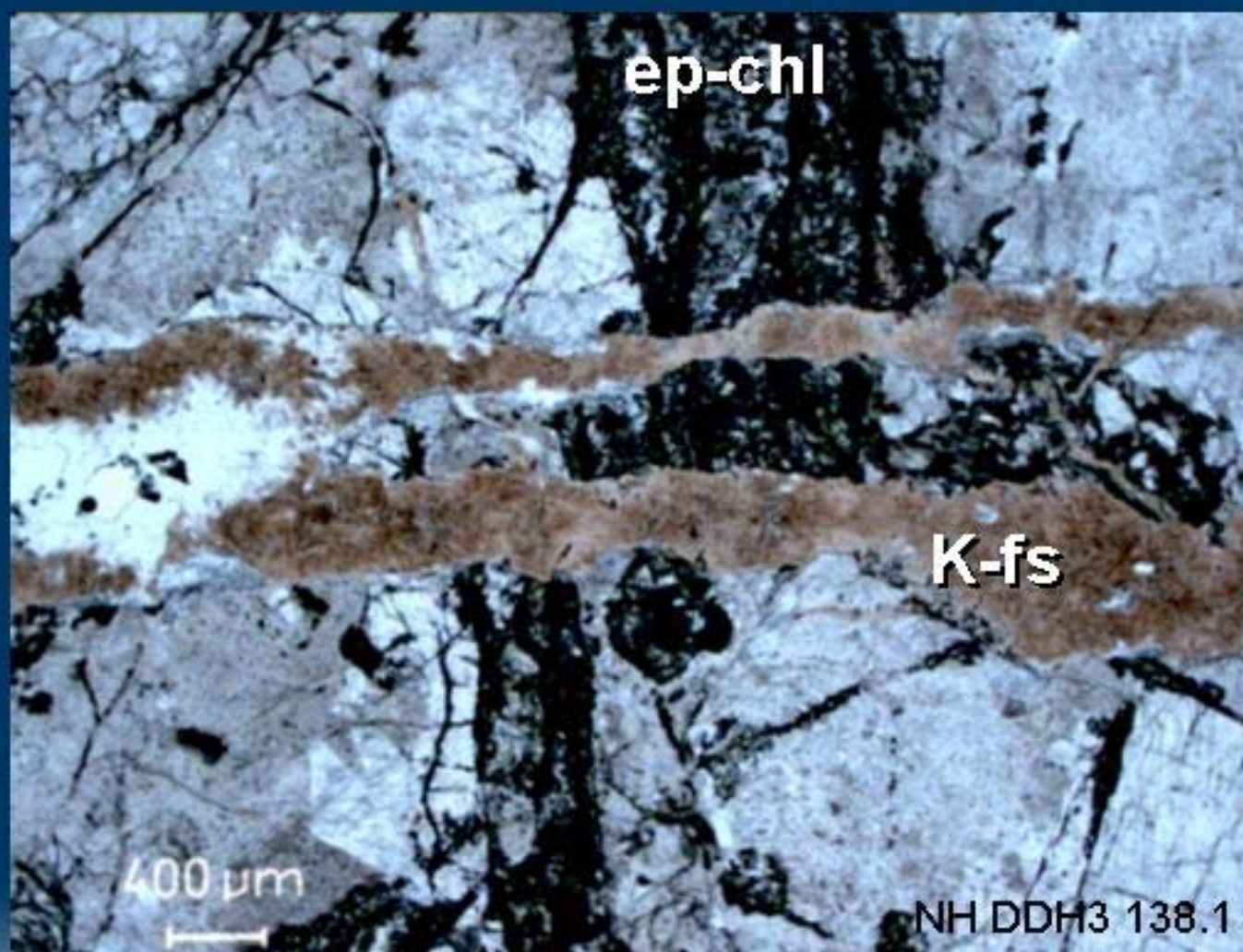
Nuckulla Hill

Sericite-pyrite altered sheared granitoid(?)
cut by quartz-epidote-galena vein



Nuckulla Hill

Sericite-pyrite altered sheared granitoid(?) cut by epidote-chl veins, then by K-feld epithermal veins



Paragenetic sequences

	Stage 1 high-temp	Stage 2: Au? syn-def'm	Stage 3 post-def'm	Stage 4 epithermal
Tunkillia		inner: ser-py outer: chl-hm	chl qtz-gal-sph	
Nuckulla Hill		ser-py	ep-chl-gal- sph- py -pre-flu	fs (adularia?) carb, flu, alb
Barns		inner: ser-py outer: chl-hm- ep; carb	carb, pre	
Weednanna	mt, cpx, ol, po, Bi, bt?	ser , chl, serp, talc, carb	qtz, pre, gal, py , Fe-Mn ox	silica, carb

CGG similarities in alteration-mineralisation characteristics

- Gold in disseminated and veinlet-hosted styles**
- Zoned alteration: inner ser-py-qtz-Au ($\pm$ galena), outer zones of chlorite $\pm$ epidote, hem**
- Ser-chl-py alteration is syn- to post-shearing**
- Sericite Ar-Ar ages are similar, $\sim$ 1570-1600 Ma**
- Multiple fluids, but one type occurs in all prospects: $\sim$ 3-6% NaCl eq., 200-300°C homog temps, with CO₂**

Conclusions

- Central Gawler mineralised systems do not neatly fit well known gold deposit classes.
- **New data provide a firmer foundation for the Central Gawler gold province's age, extent and origin.**
- **Au systems were active along a >300km belt at similar times – a positive indicator for Au prospectivity.**
- **Weednanna: a hybrid IOCG-Au system?**
- **Potential for epithermal mineralisation.**



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Fluid inclusions

Andreas . . .