

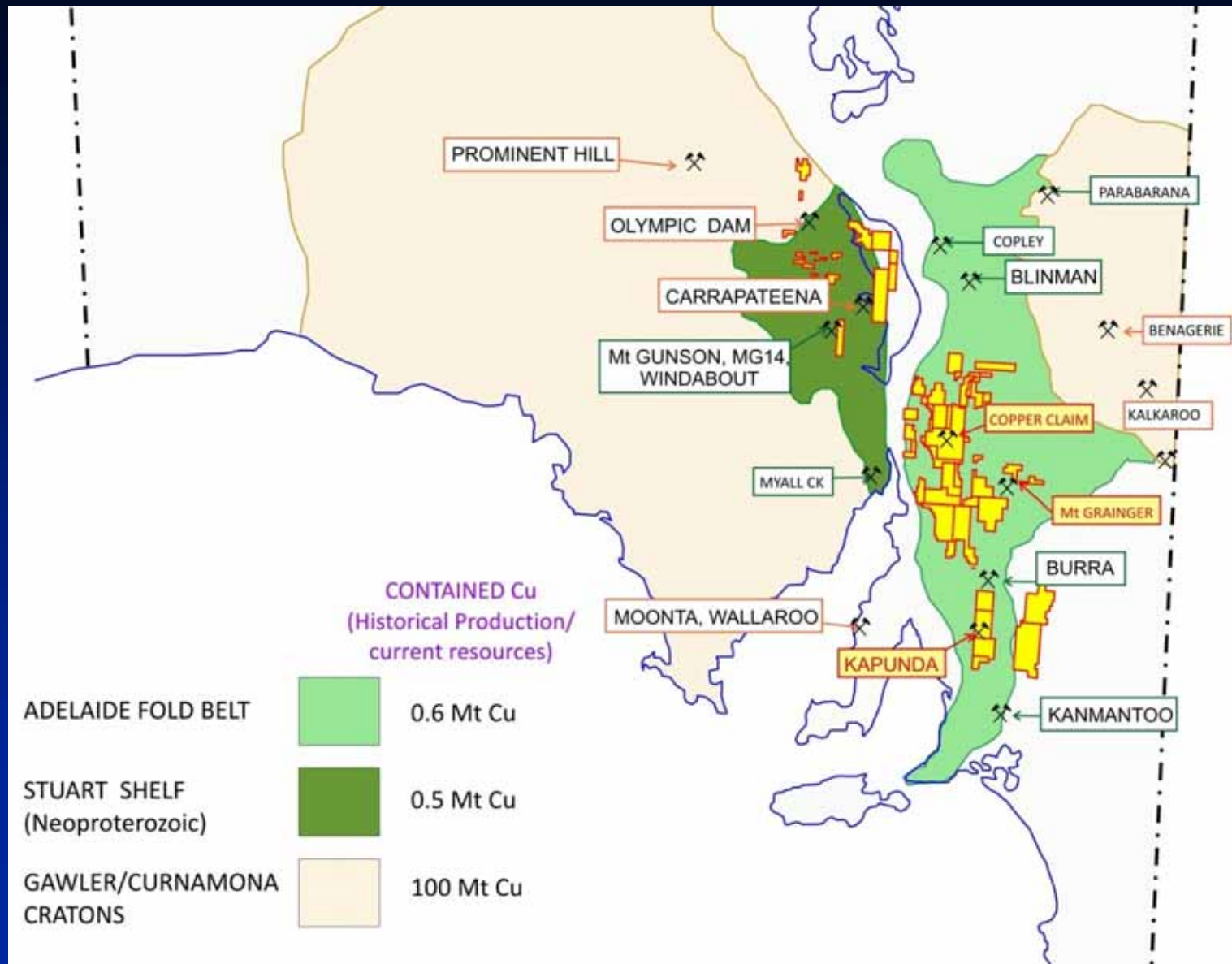


# ***Sediment-hosted Copper***

***Exploration potential of  
the Adelaide Fold Belt,  
South Australia***

JOSEPH OGIERMAN  
*November, 2008*

# CRJ in South Australia



# Cu Mining in South Australia – a brief summary

**1842** - first Cu Mine in Australia - Kapunda

**1850s** - Burra Mine producing 10% world's Cu

**1860** - Discovery Moonta / Wallaroo

**1940s** - Cu mining essentially ceased

**1970s** - revival of Cu Mining with re-opening of Burra,  
Kanmantoo and Mt Gunson

**1988** - opening Olympic Dam

**2007** - opening Prominent Hill

# Cu Exploration in the AFB in 21<sup>st</sup> C

## WHY ??

- Last “serious” attempt at SSC was in the 1970s (Utah) - exploration approach “model driven” using Zambian syngenetic Cu template.
- Since recognition of IOCG-style mineralisation in 1980s the AFB has been largely forgotten
- Understanding of sediment-hosted mineralisation has advanced since 1970s – multiphase diagenetic/epigenetic models
- Copper Range is applying new understanding of sediment-hosted Cu mineralisation to the AFB.

# Sedimentary-Cu deposits;

- SUB-TYPES**
- **REDUCED FACIES** eg. African Copper Belt ; Kupferschiefer;
  - **REDBED Cu** eg. Corocoro
  - **REVETT** eg. Dzhezkazgan (450 M tonnes @ 1.5% Cu)
  - **PARADOX BASIN** eg. Constellation

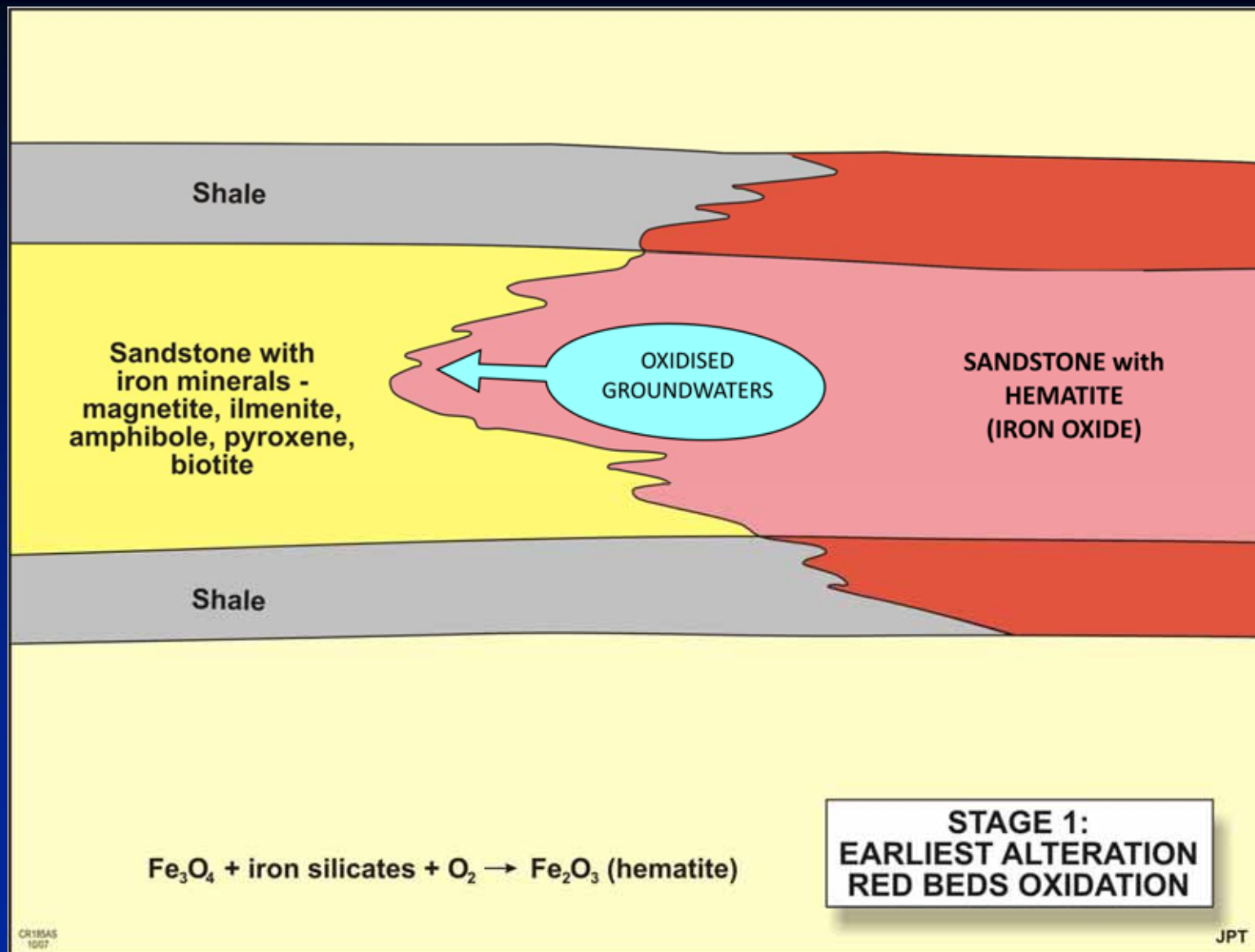
Several Types but Similar Processes involved;

Multiple fluid events ranging from initial **Diagenetic** to late-stage **Epigenetic** (syn or post-Orogenic)

# PARADOX BASIN – UTAH

## (Thorson Model)

- SANDSTONE HOST FOR DISSEMINATED Cu – favourable lithology due to high porosity / permeability
- MULTIPLE FLUID EVENTS NECESSARY FOR DEPOSIT FORMATION
- 1<sup>st</sup> STAGE - Diagenetic Fluids Form Iron Oxides – “RED BEDS”



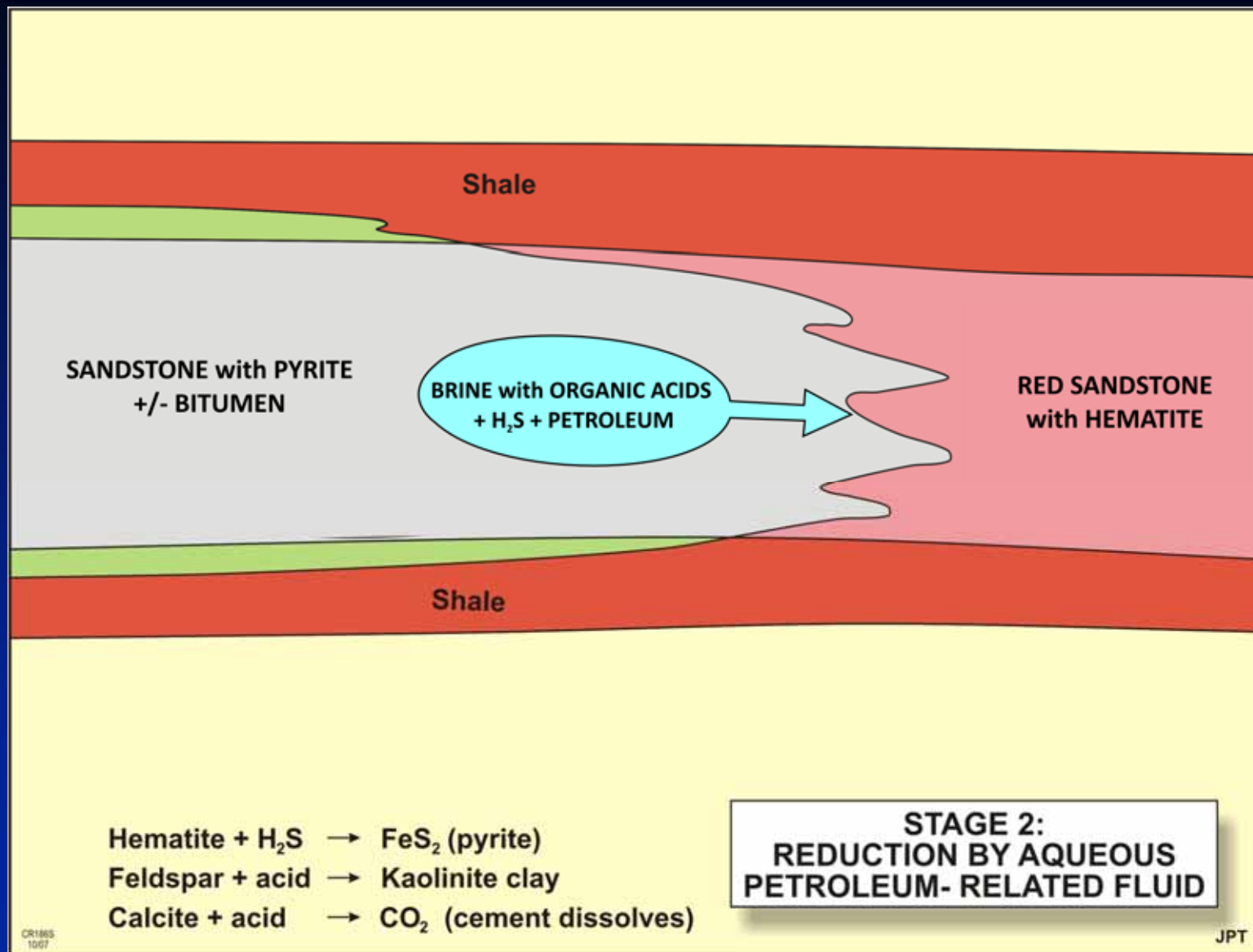
# PARADOX BASIN – UTAH

## (Thorson Model)

- **MULTIPLE FLUID EVENTS NECESSARY FOR DEPOSIT FORMATION**

- **1<sup>st</sup> STAGE** - Diagenetic Fluids Form Iron Oxides – “**RED BEDS**”

- **2<sup>nd</sup> STAGE** - Reducing Fluids “Prepare” host sandstone by converting hematite to pyrite , hydrocarbons important as source of reductant  
Reducing fluids bleach Red Beds ---- “**Grey Beds**”



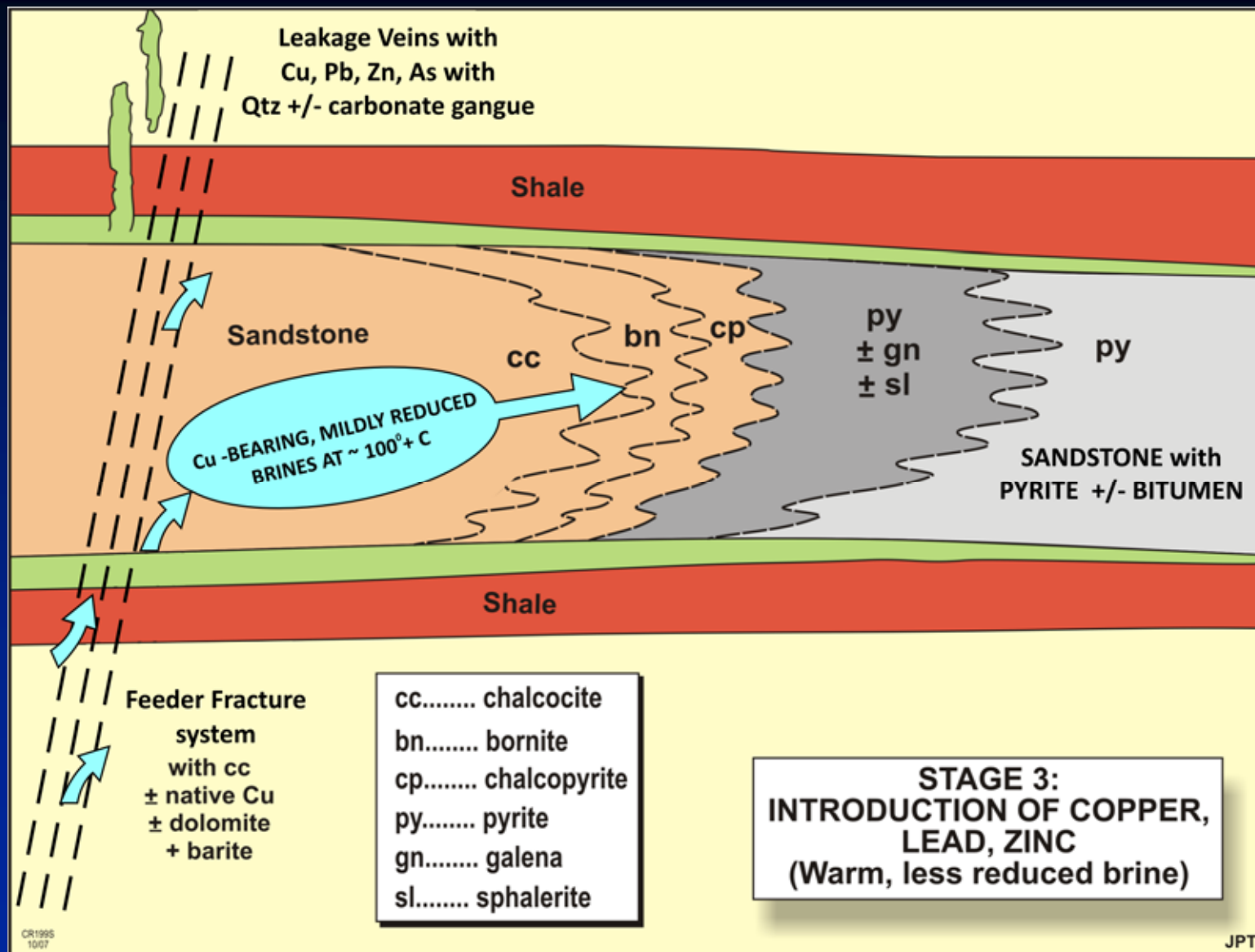


**Fracture control of bleaching, Salt Anticline, Utah**

# PARADOX BASIN – UTAH

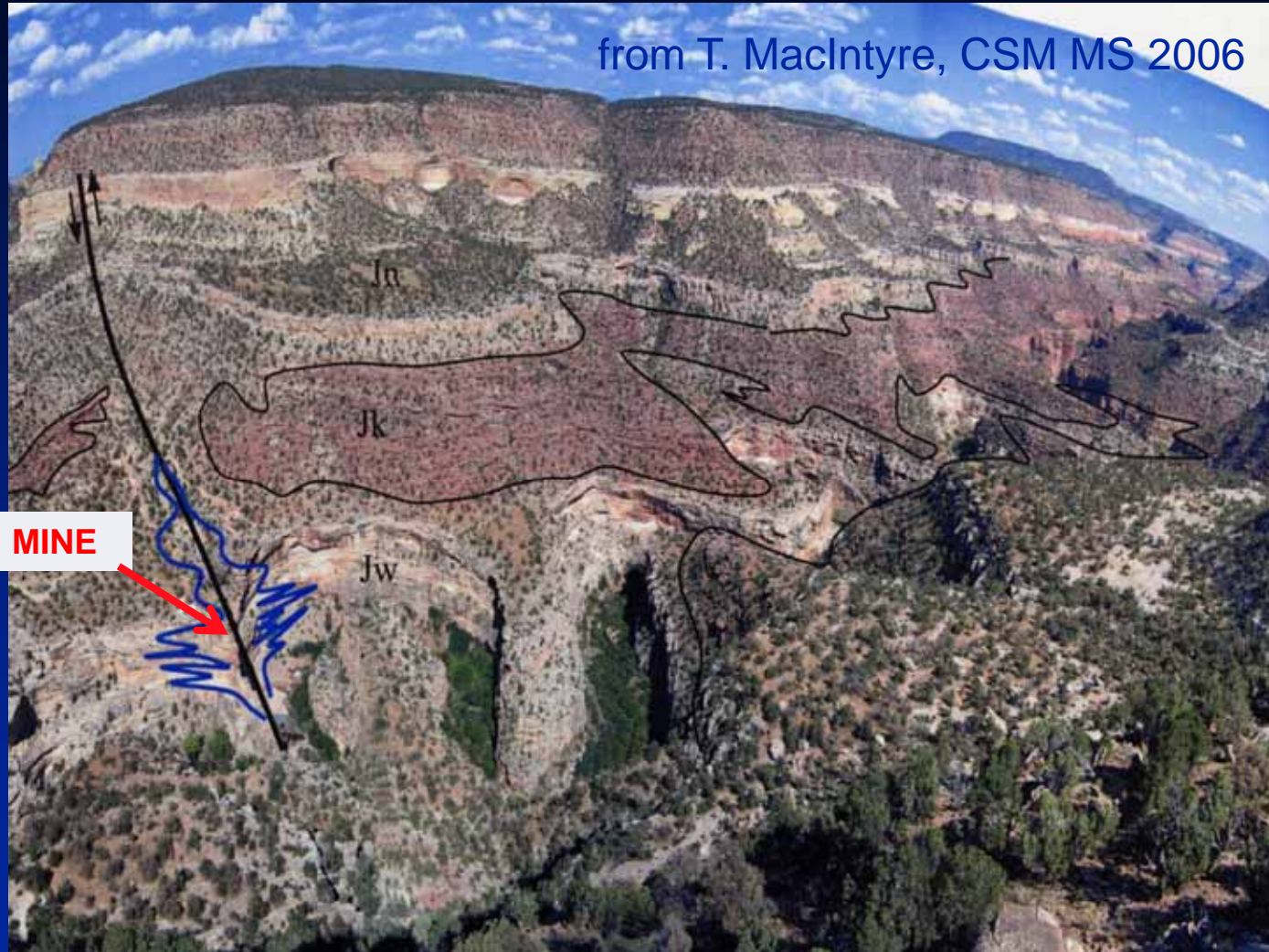
## (Thorson Model)

- **MULTIPLE FLUID EVENTS NECESSARY FOR DEPOSIT FORMATION**
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- **2<sup>nd</sup> STAGE** - Reducing Fluids “Prepare” host sandstone by converting hematite to pyrite , hydrocarbons important as source of reductant
- **3<sup>rd</sup> STAGE** - Epigenetic Cu-Bearing saline fluids introduced along structural feeder zones. Ppt Cu on contact with reductants in “**Grey Beds**”



# Broad Scale Alteration — Bleaching

from T. MacIntyre, CSM MS 2006



Thorson, 2008

Cashin mine area (Utah) with bleaching (iron oxide destruction) of Wingate Sandstone and upper units moving out from Cashin fault.

# AFB – FACTORS FOR SSC MINERALISATION

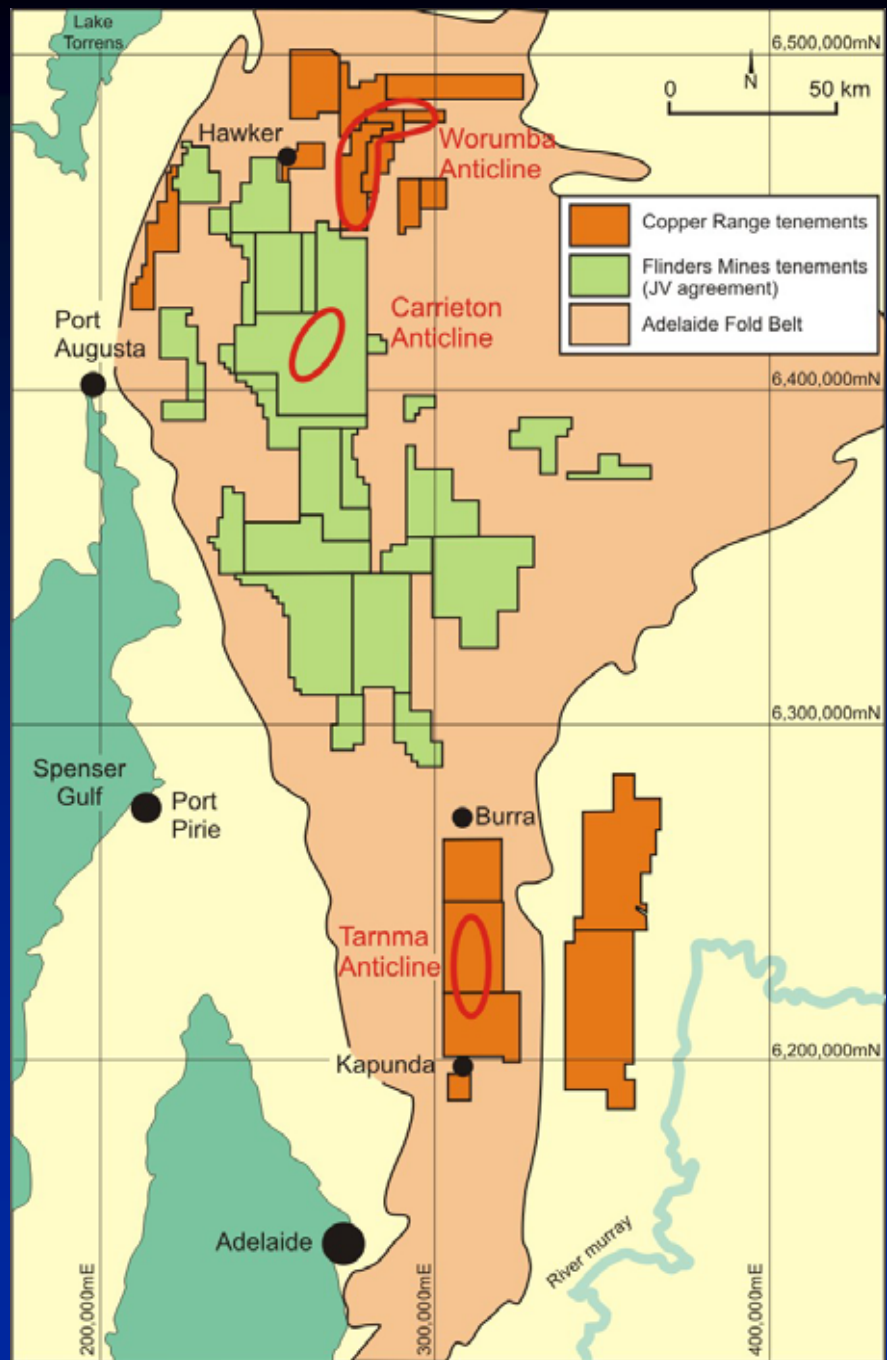
- **LARGE BASIN**                      The AFB has sufficient sufficient subsidence (>3km) to generate petroleum and warm aqueous reducing brines
- **SOURCE ROCKS**                Arkosic Red Beds and Mafic Volcanics in basal Callana Gp  
Cu-endowed Basement (Gawler/Curnamona Craton)
- **SALINE BRINES**                 Evaporite horizons in Callana + possibly in Burra Gp
- **STABLE FLUID FLUX**            Sr-Rb isotopes suggest stable, convectional intrabasinal fluids leaching Cu from volcanics - terminated 580Ma (Foden et al, 2001)
- **REDUCTANTS**                    Carbon and Py-bearing shales (eg Tindelpinna); Hydrocarbons in Burra Gp rocks (Belperio,1987) and Cambrian Limestone (Santos, 1956)
- **FLUID FOCUS**                    Basin-bounding faults ,sub-basins / basement highs, diapirs
- **KNOWN Cu MINES**                Over 800 recorded Cu occurrences in AFB including several small mines

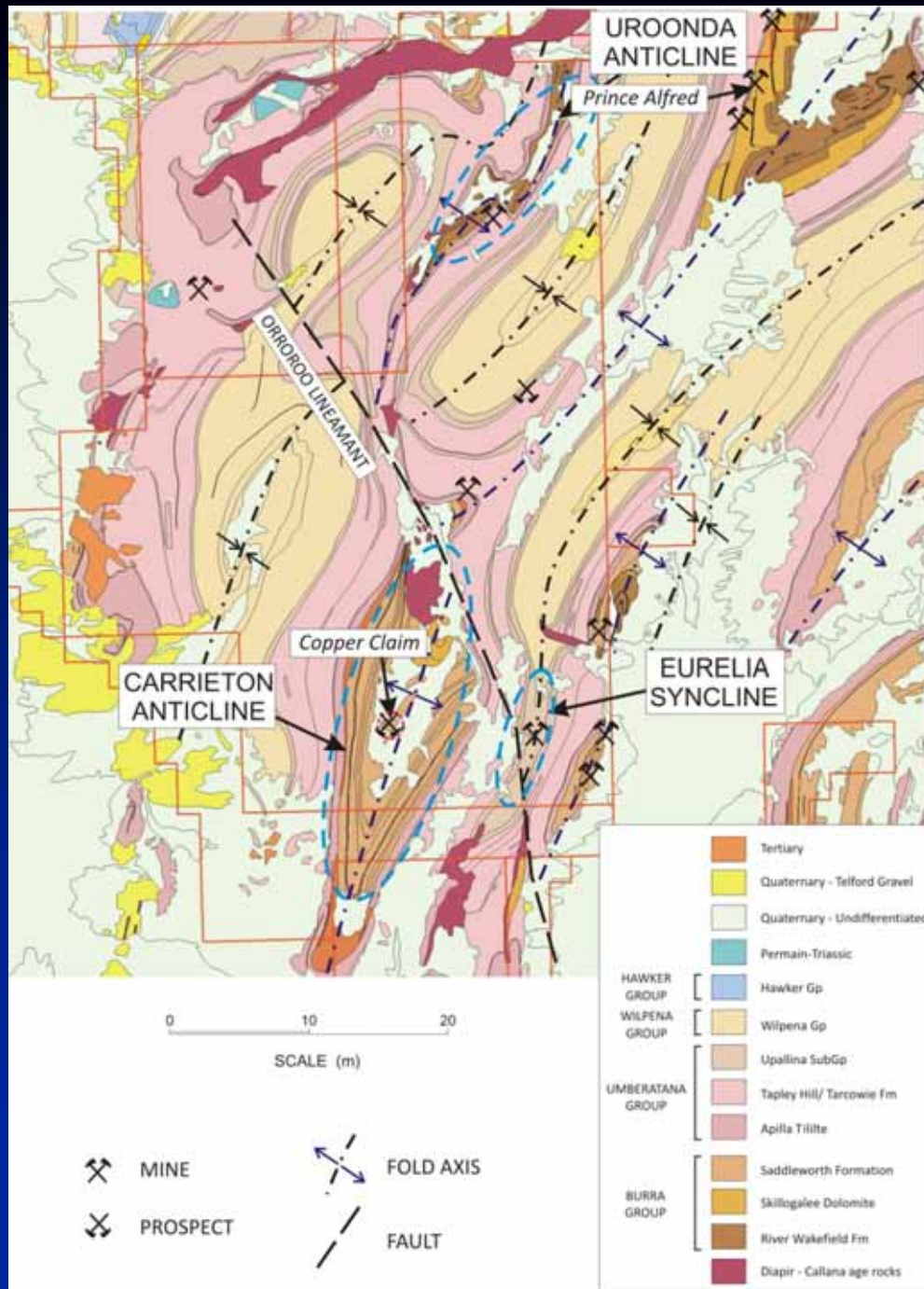
# AFB – SIGNS of SSC MINERALISATION

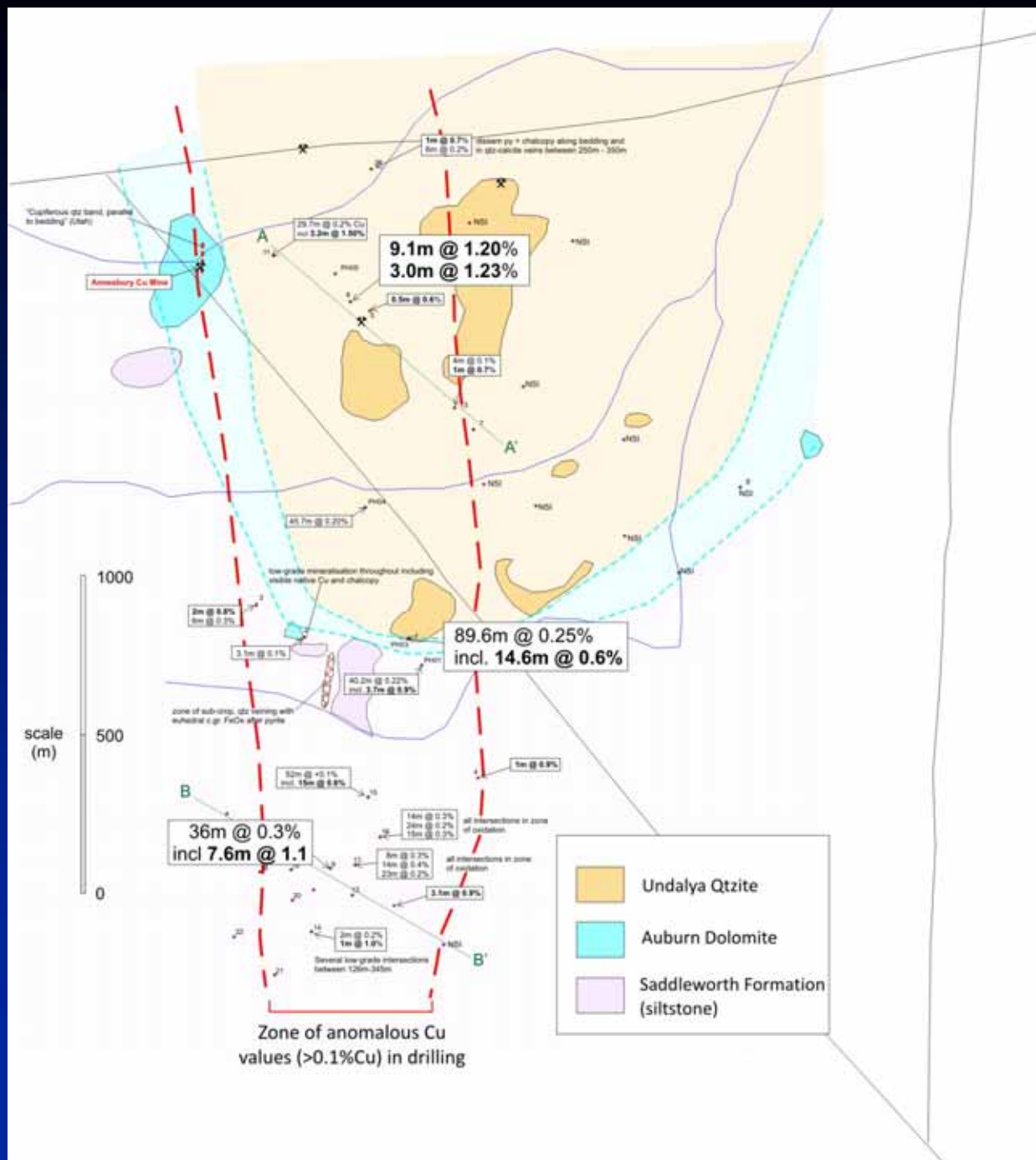
- **REDOX SETTINGS** – PPT of Cu at multiple REDOX interfaces throughout basin eg **Tapley Hill Formation** (Kapunda, Copley, Stuart Shelf), **Skillogalee Dolomite** (Burra, Copper Claim?)
- **SANDSTONE-HOSTED** – Never been tested in AFB. Mention of sst-hosted Cu mineralisation at various prospects eg. **Kanyaka, Copper Claim**, “Thorson-like” model can be applied to explain sst-hosted mineralisation at **Mt Gunson** on Stuart Shelf.
- **FEEDER ZONES** - Structures with Qtz+Cu sulphide veining associated with stratabound mineralisation at **Kapunda** and **Copper Claim**
- **CHALLENGES** - One of biggest problems in Australia is the “regolith problem” – difficult to distinguish alteration from weathering

# TARGET SELECTION

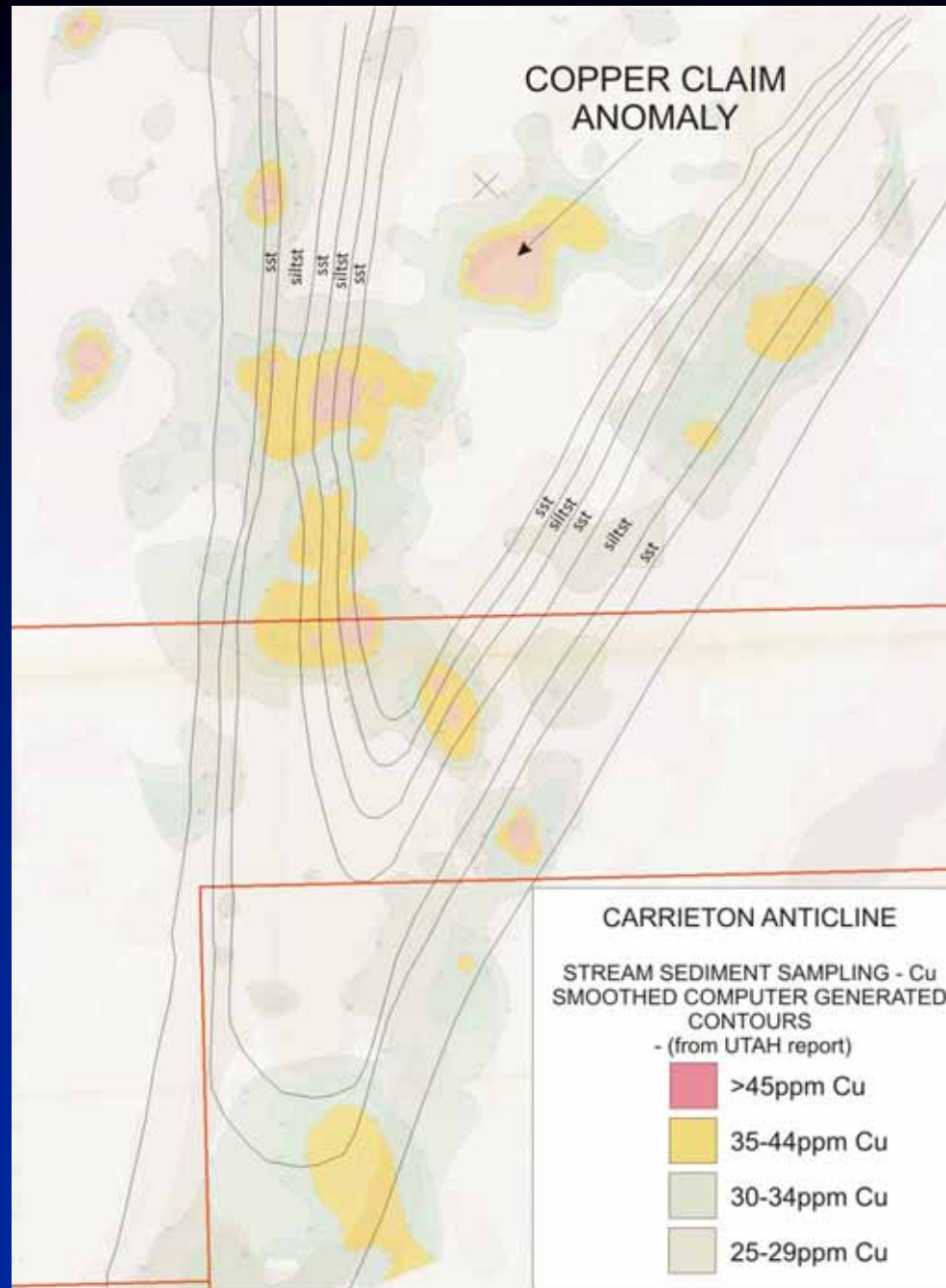
- **BREACHED ANTICLINES** – WORUMBA,  
CARRIETON ANTICLINE
- **UNBREACHED ANTICLINES** – TARNMA  
ANTICLINE

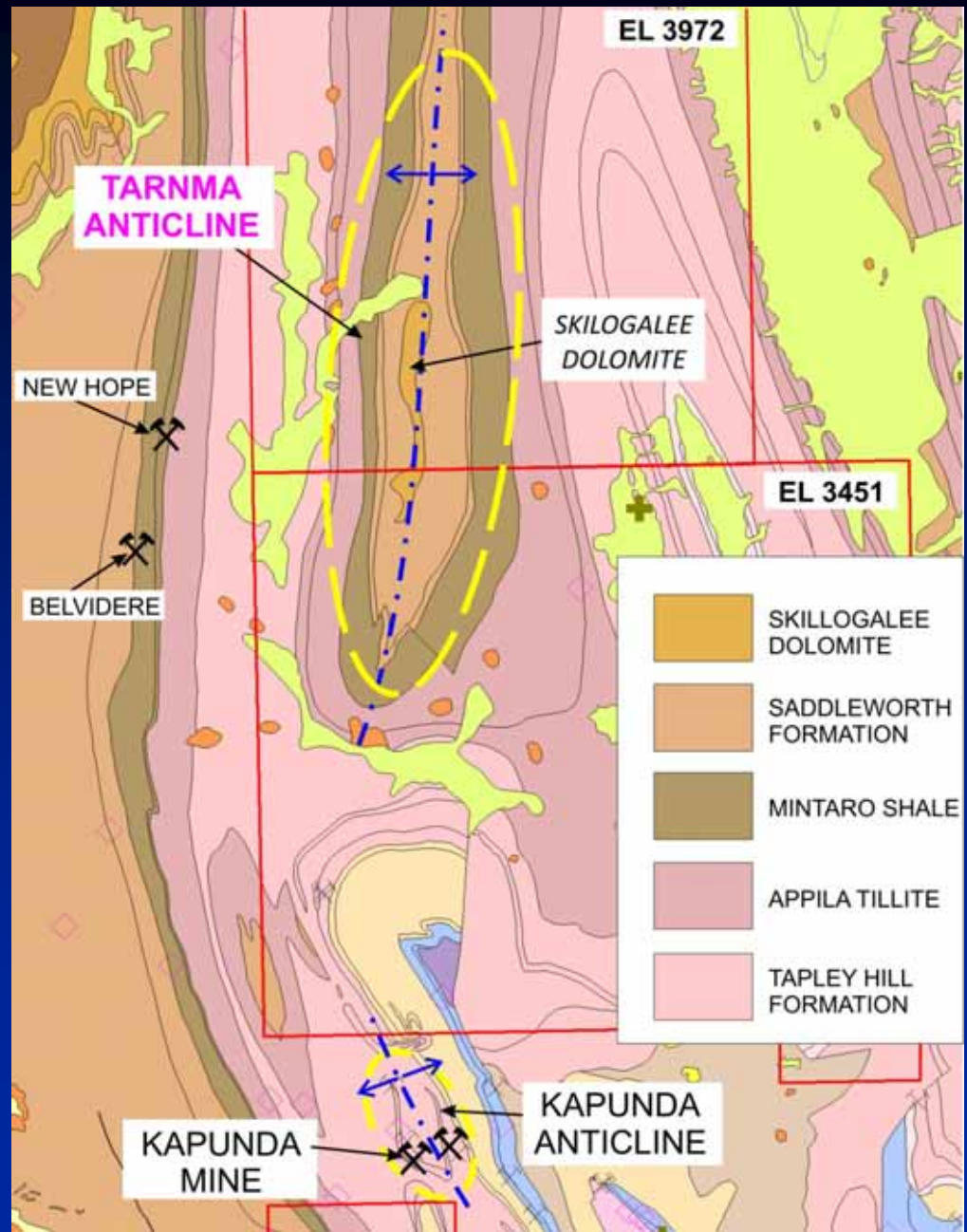






## COPPER CLAIM ANOMALY





- Although there is evidence for various styles of SSC mineralisation, CRJ is not ‘Model-driven’
- We are not looking for replicas of Paradox or other basins – not restricted by “basin envy”
- Its all about the process – each basin is unique
- Need understanding of evolving basin history – hydrology, diagenesis, hydrocarbon production, metamorphism, alteration etc
- CRJ has generated drill targets for 2009, “there is still life in the AFB”

