# Coupled deformation and fluid flow modeling of a listric fault geometry: implications for the Palmerville Fault, northeast QLD, Australia
# -
# preliminary results

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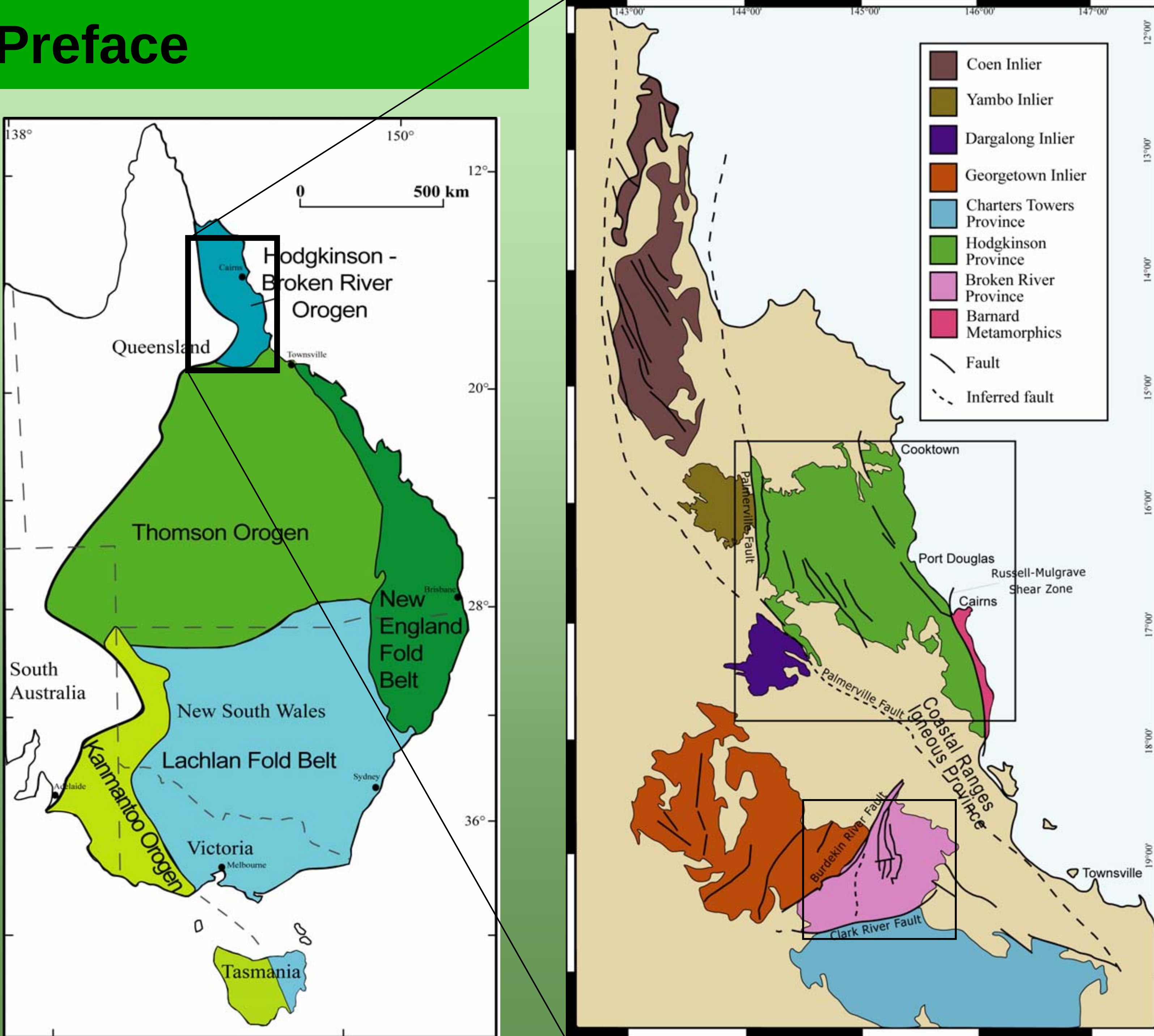
# Preface

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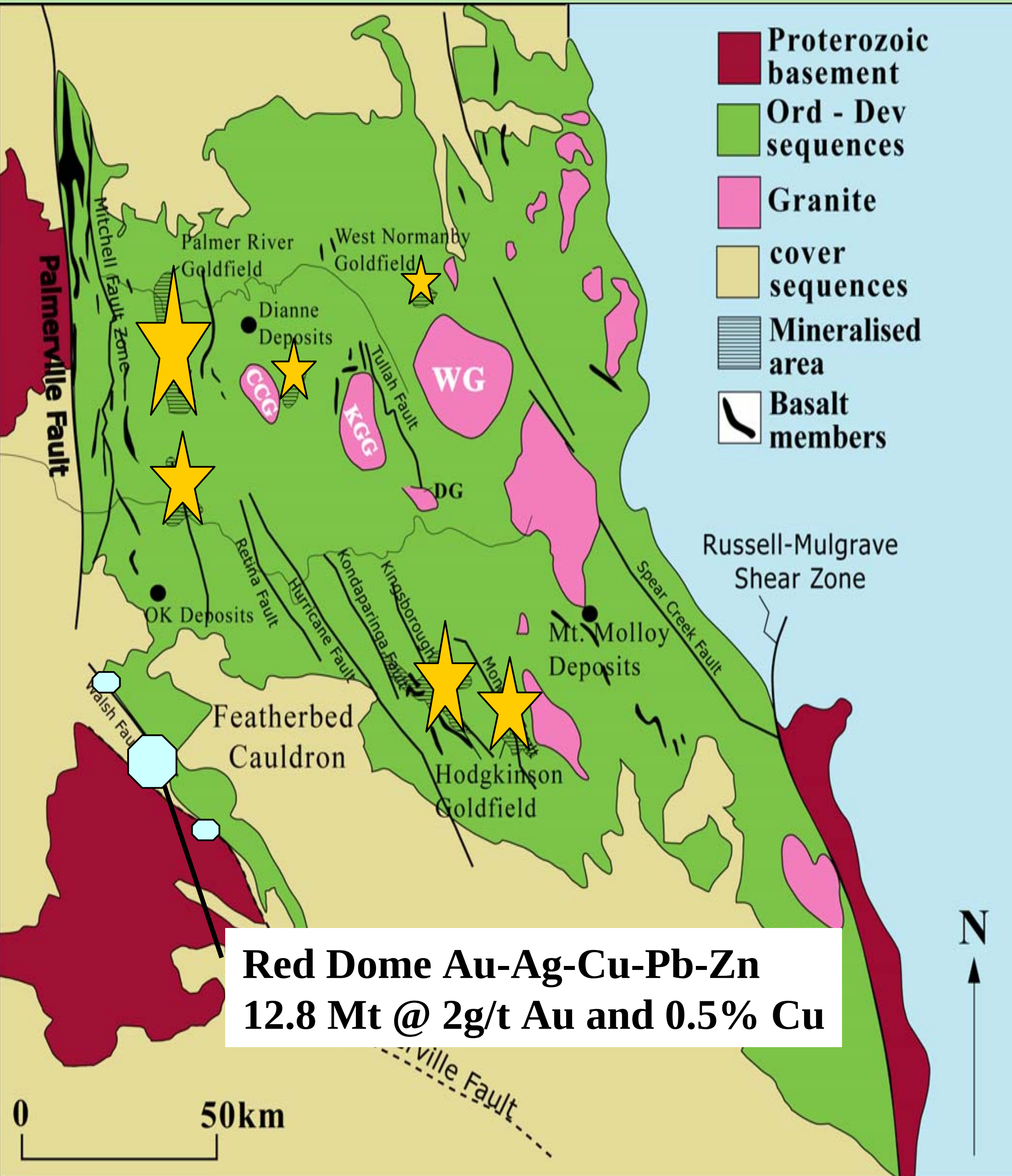
# Preface

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- Terrane boundary between Proterozoic and Palaeozoic sequences
- No direct association with mineralisation along northern section
- Significant ~335 Ma orogenic gold mineralisation associated with subparallel secondary faults
- Southern SE-striking section spatially associated with Permo-Carboniferous granites that host porphyry and skarn deposits (e.g. Red Dome)

# Preface

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## Inferences from spatial and temporal distribution of magmatism and gold deposits:

1. **North section of Palmerville Fault remains barren at all times suggesting absence of significant fluid flow**

2. **<u>Structurally controlled</u> gold deposits are associated with sub-parallel (N)NW-striking faults**
   ***Under what conditions does fluid flow focus on these faults while not activated along northern part of the Palmerville Fault ??***

3. **Magmatism is spatially associated with southern NW-SE striking portion of the fault**
   ***Under what conditions does significant dilation and extension occur along this portion of the fault ??***

4. **Temporal discordance between magmatism and gold deposition infers that controlling processes may be decoupled (i.e. change in far-field stress orientation)**

# Preface

**What did we set out to do?**

1. **Create a number of simple 3D model geometries that can be used to interrogate the control of a listric fault geometry on fluid flow and deformation**
   *** Vary number of active faults**
   *** Vary lithological distribution and characteristics**

2. **Apply a variety of boundary conditions to our geometry to understand effects of:**
   ***Compression vs. transpression**
   *** Pore fluid pressure variations**
   *** Forced fluid flux through faults or sediments**

3. **Interrogate results from a generic viewpoint and compare results to NE QLD situation**

# Modelling setup

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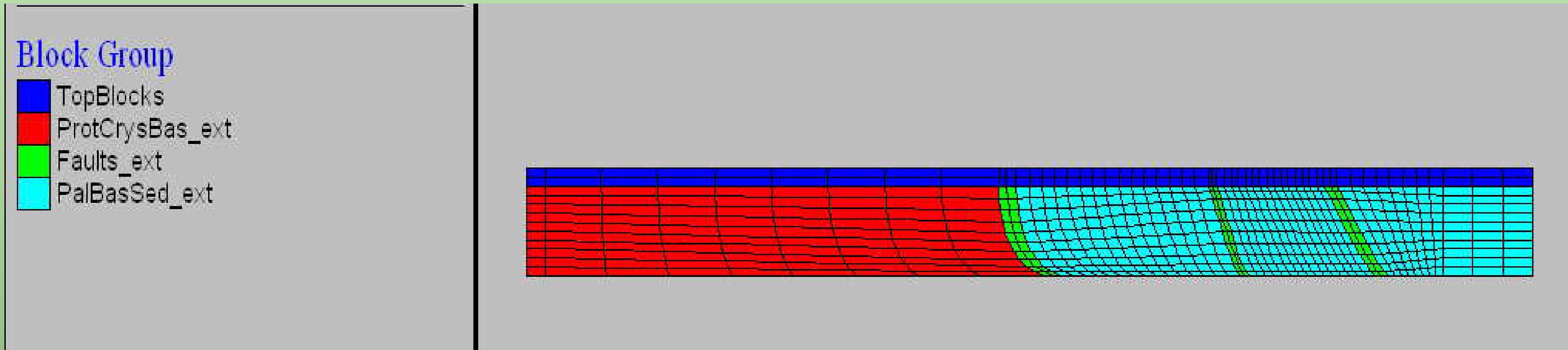
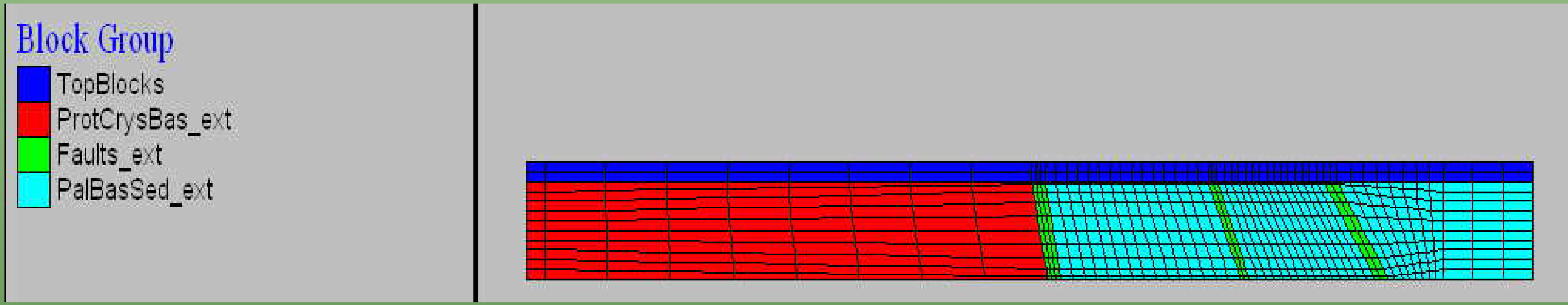
## Geometries

### Listric vs Planar fault



# Modelling setup

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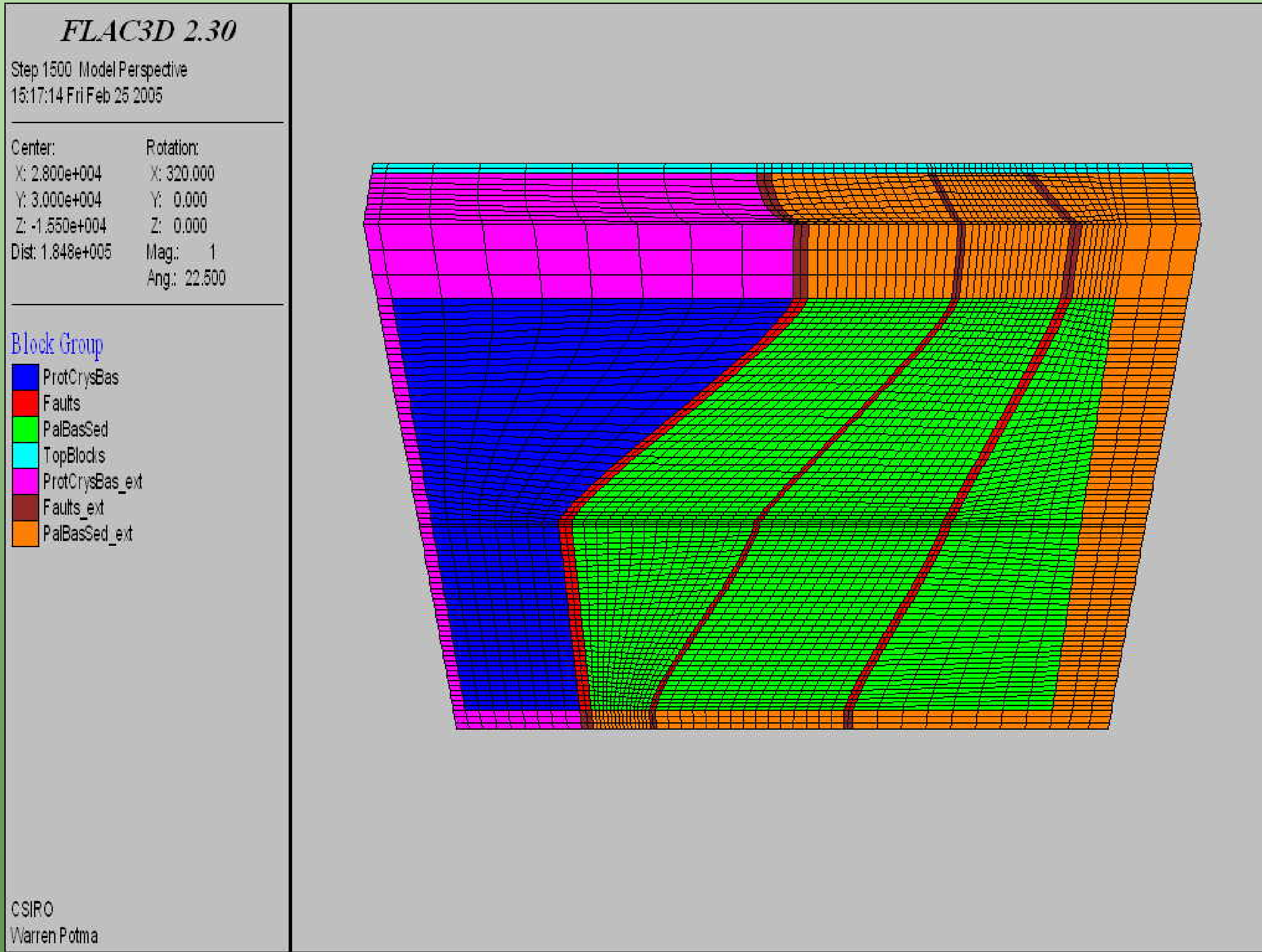
## Geometries

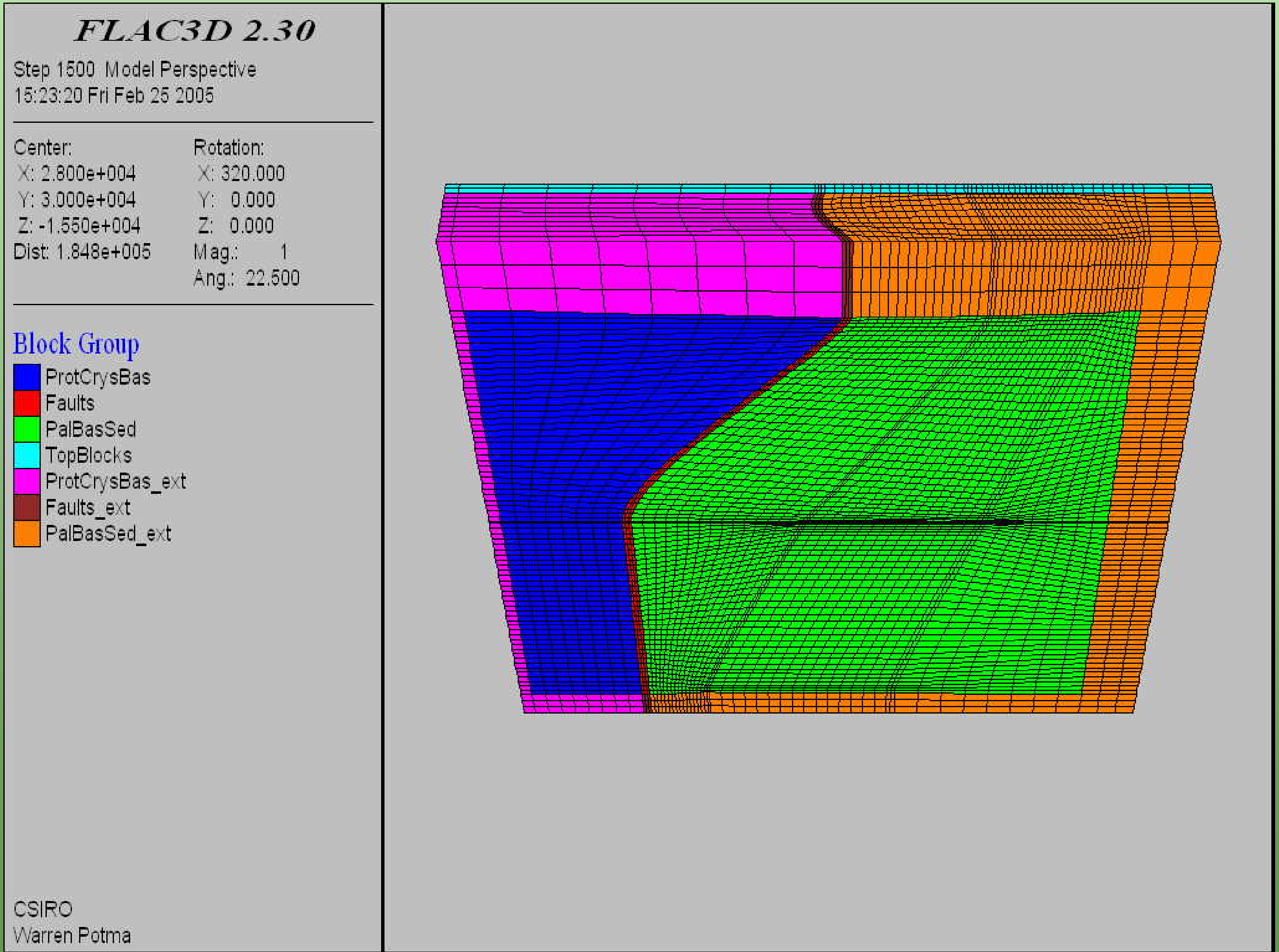
**1. Three faults, two lithologies, 0.5 x lithostatic pp**



# Modelling setup

## Geometries

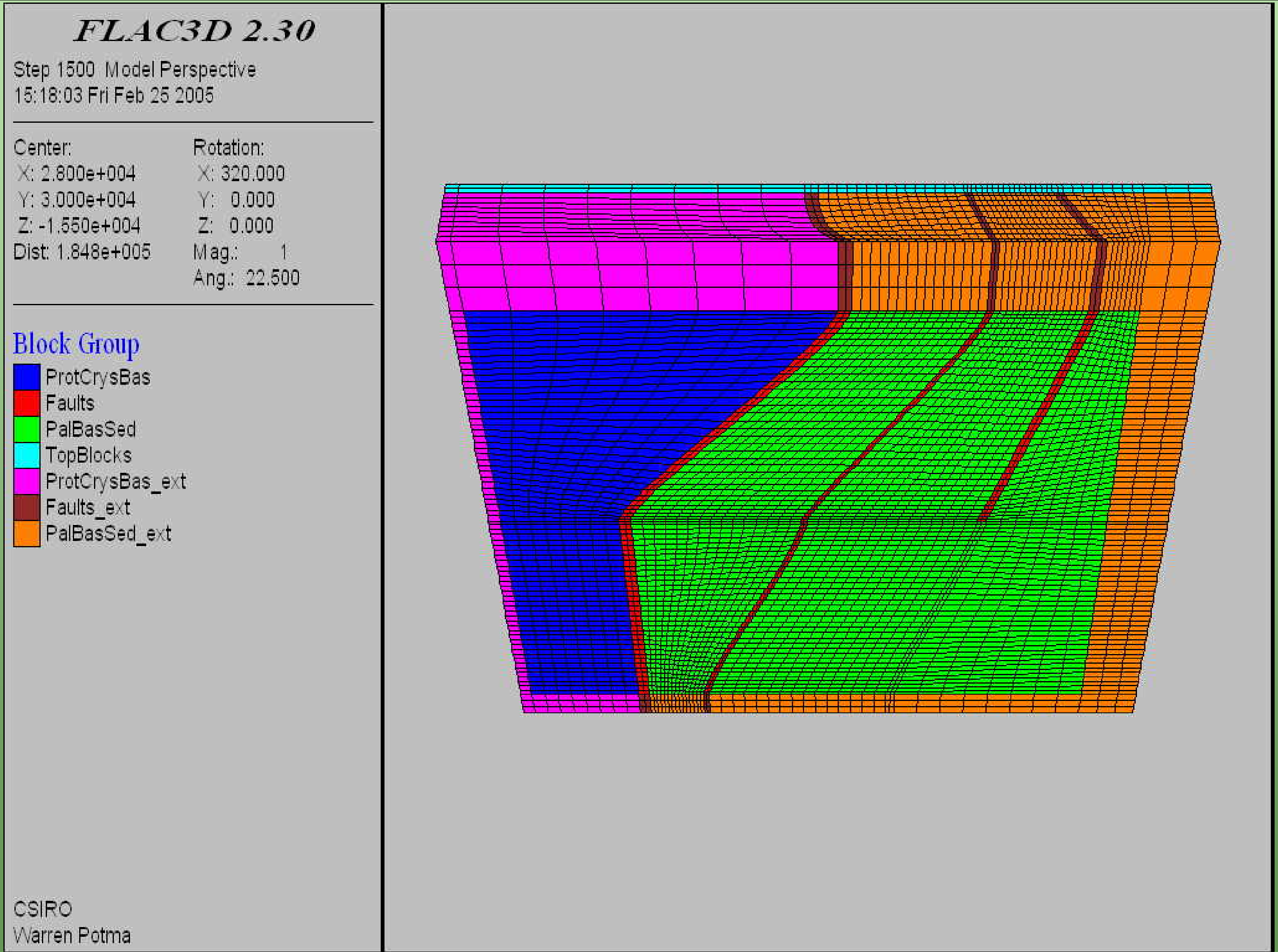
### 2. One fault (PF), two lithologies, 0.5 x lithostatic pp



# Modelling setup

## Geometries

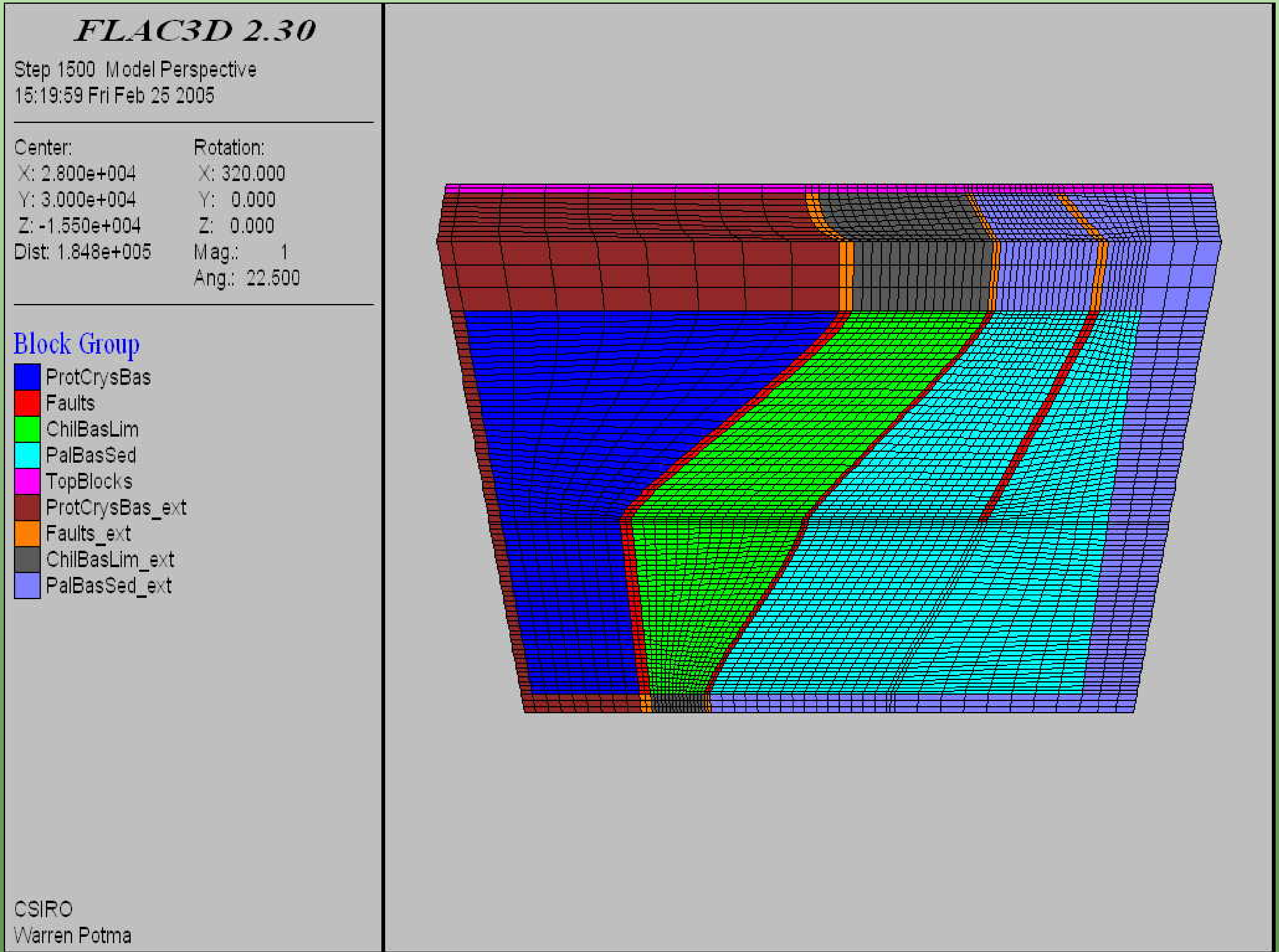
**3. Two and a half faults, two lithologies, 0.5 - 0.8 x lithostatic pp**



# Modelling setup

## Geometries

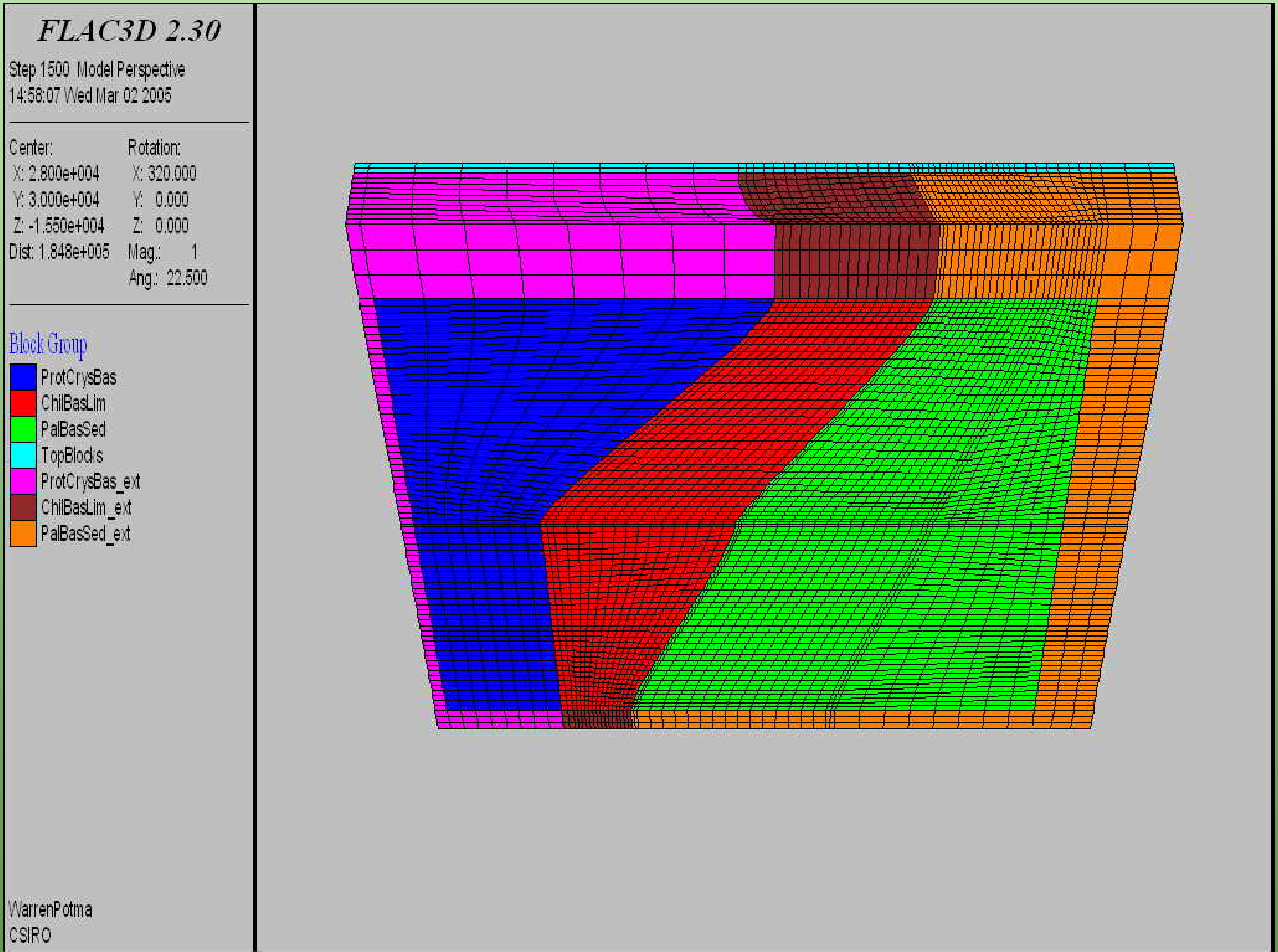
**4. Two and a half faults, three lithologies, 0.5 x lithostatic pp**



# Modelling setup

## Geometries

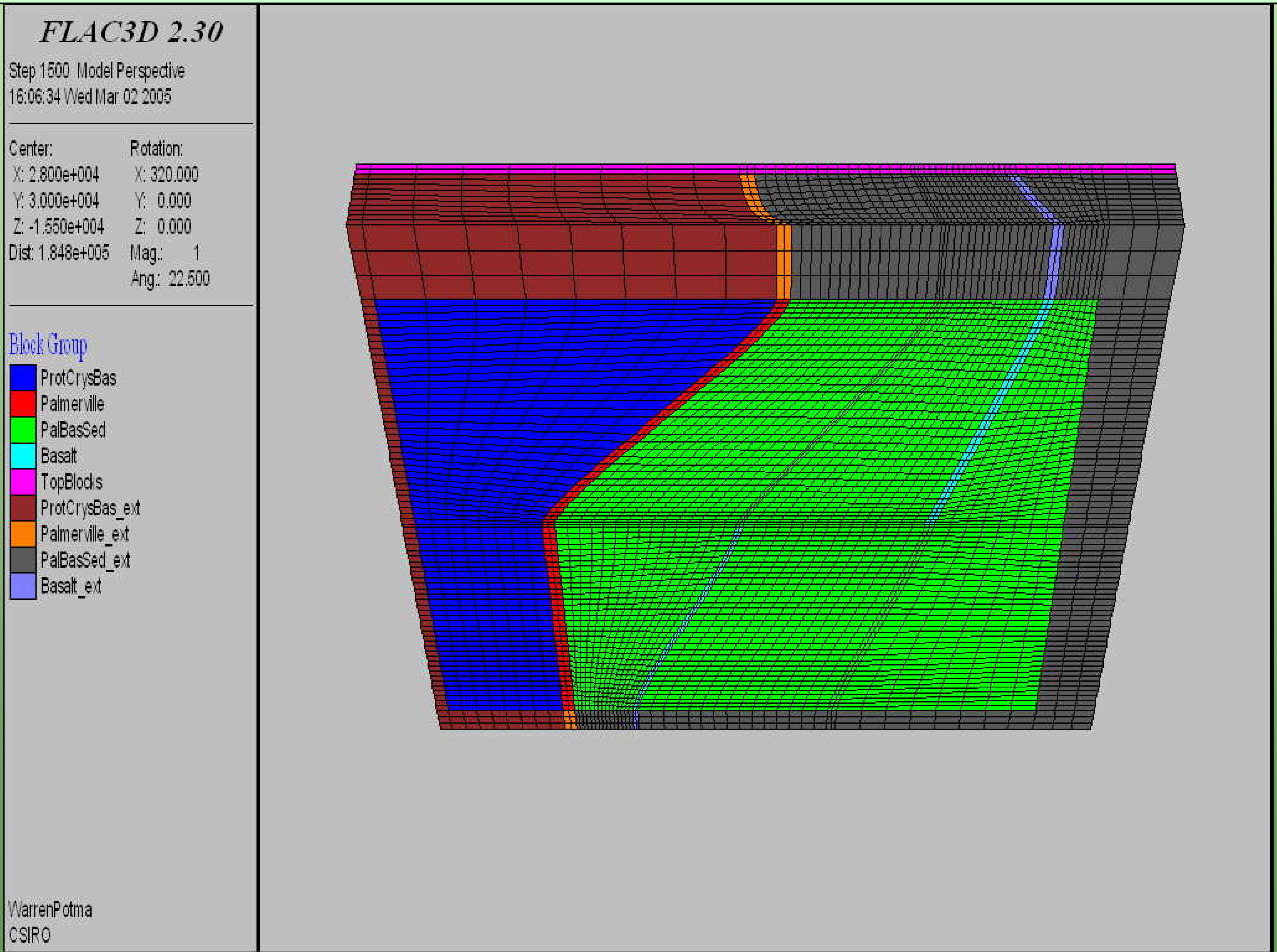
### 5. No faults, three lithologies, 0.5 x lithostatic pp



# Modelling setup

## Geometries

### 6. One fault, two lithologies + basalt layers



# Modelling setup

**Initial model conditions (equilibrium file):**

- **Burial depth of 12.5 km**
- **Metamorphic devolatilization provides fluid source**
  **(Inferred  from fluid inclusion studies of gold deposits)**

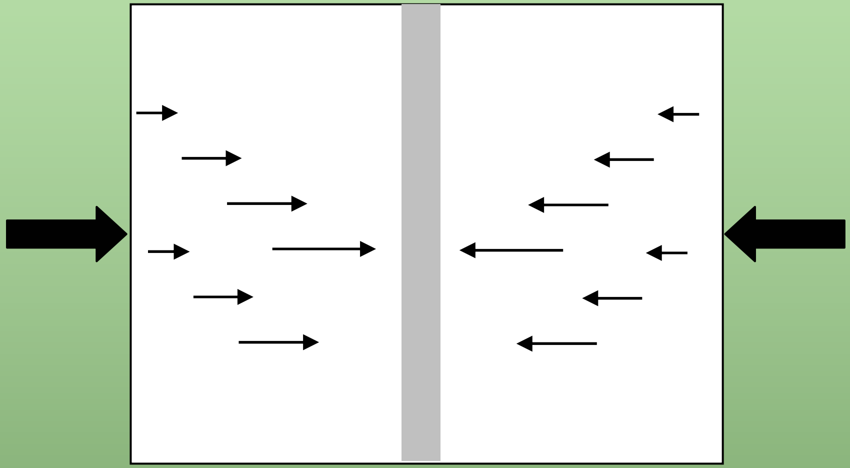
**Deformation and fluid flow conditions:**

- **E-W compression**
- **E-W compression with strike-slip component**
- **Even fluid influx at bottom of model**
- **Forced fluid influx through sediments or faults**

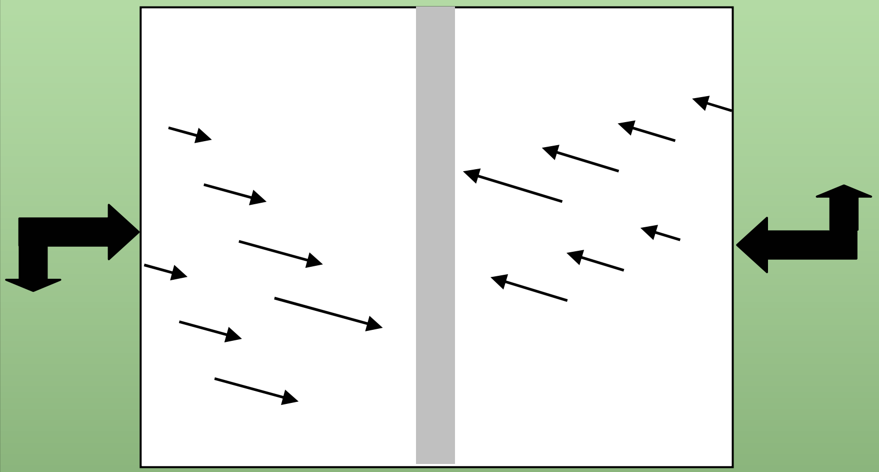
**………combined with various geometries**

# Modelling setup

pure shear



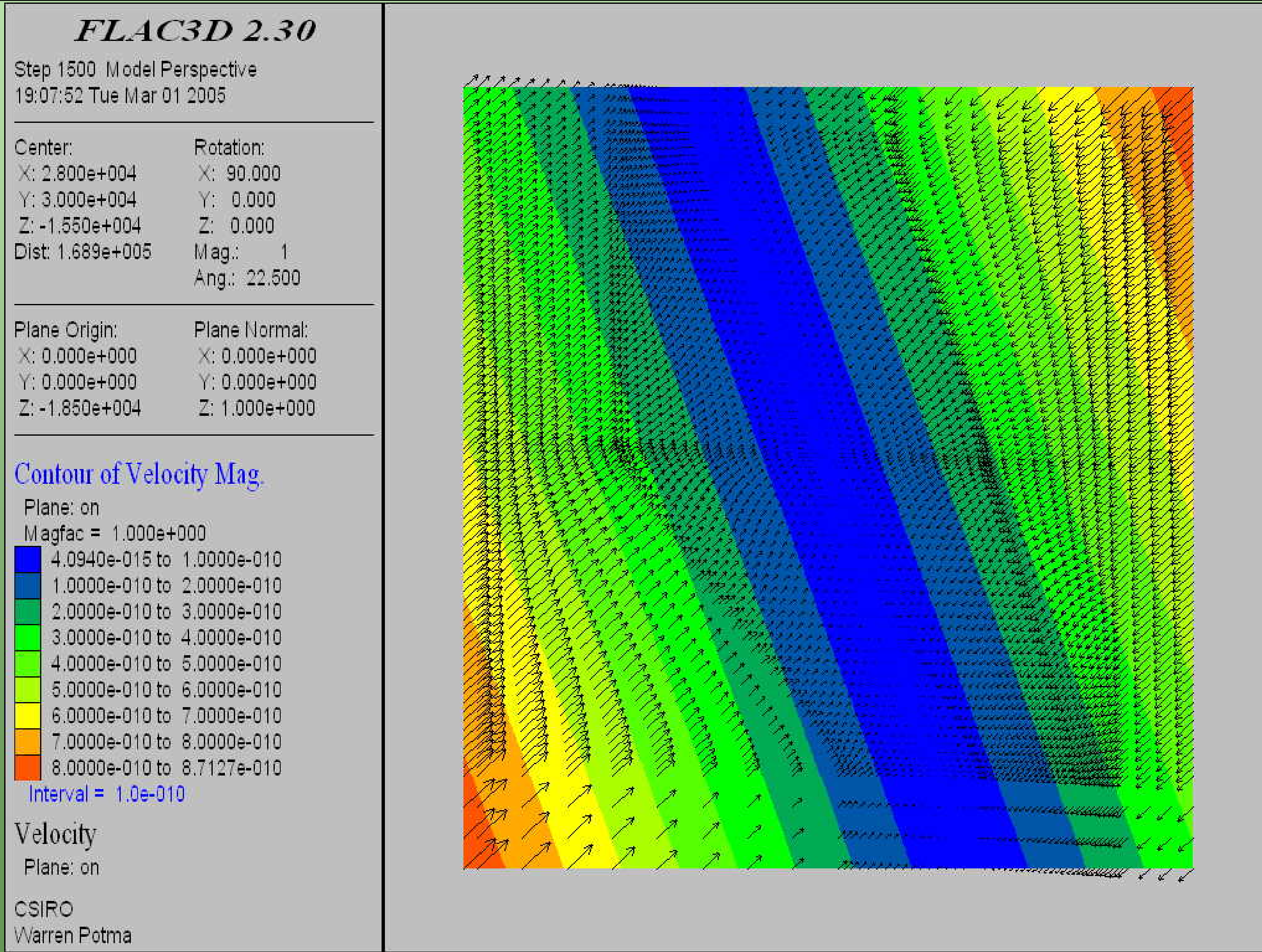
pure shear + simple shear (sinistral)



strike-slip is set 0.5 x pure shear

# Modelling setup

## As compared to simple shear / dextral strike slip (note central zone)

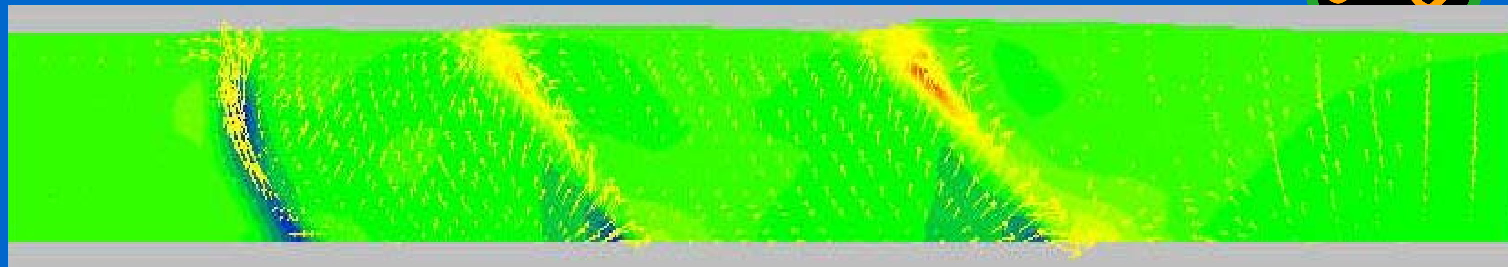


# Prelim results

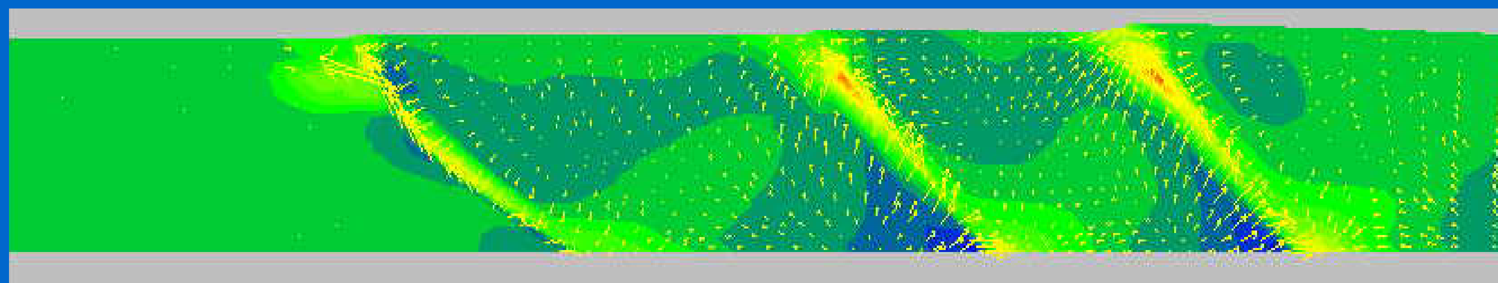
## Dilation

**Listric**

**North**

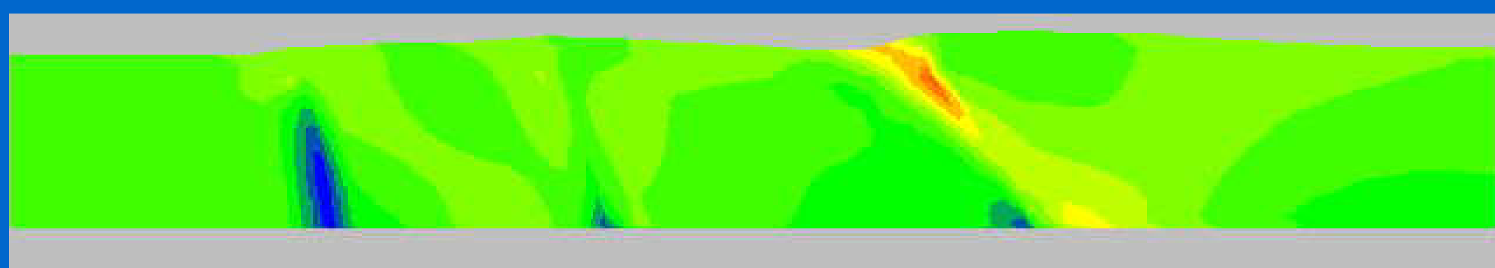


**South**

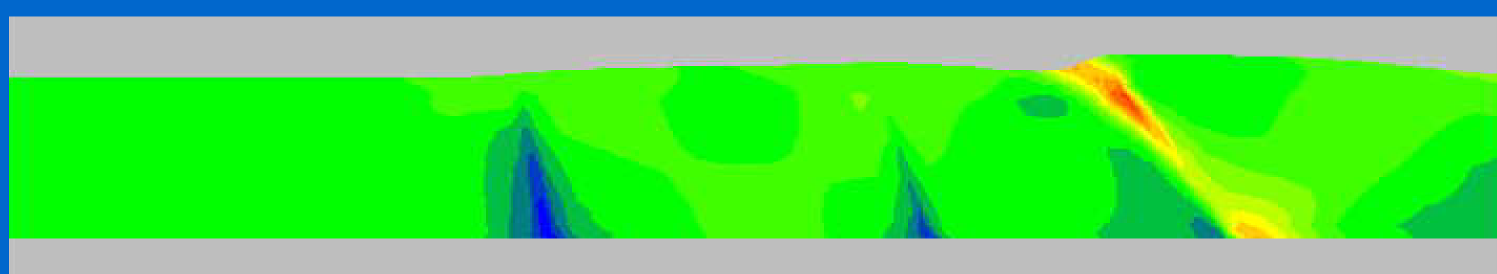


**Planar**

**North**

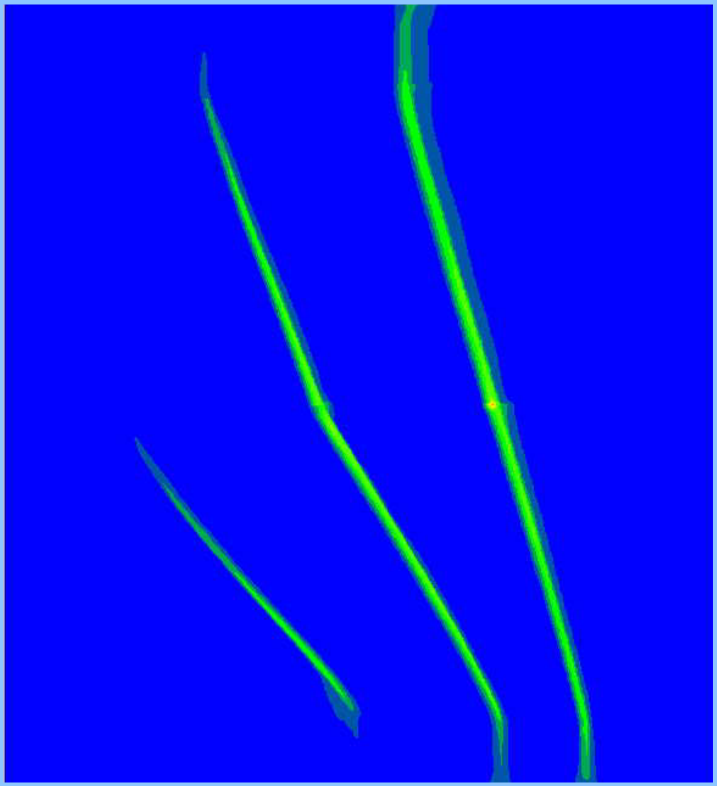


**South**

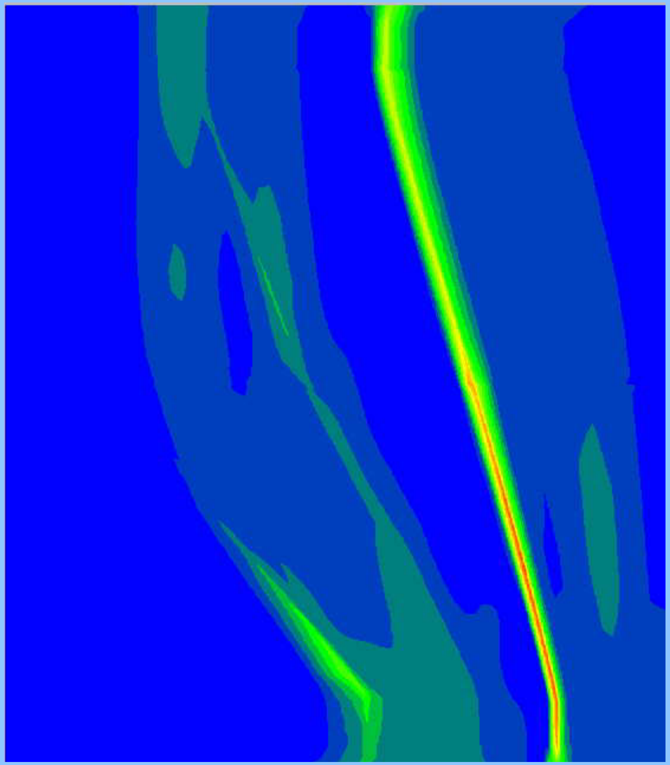


# Prelim results

## Shear Strain



**Listric**

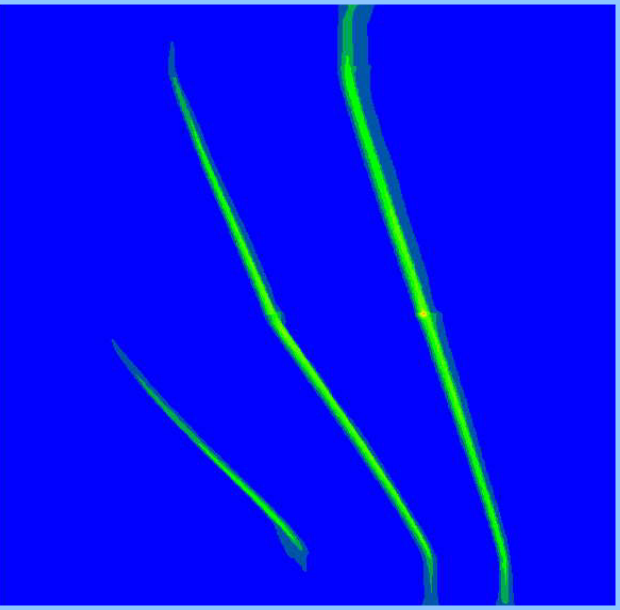


**Planar**

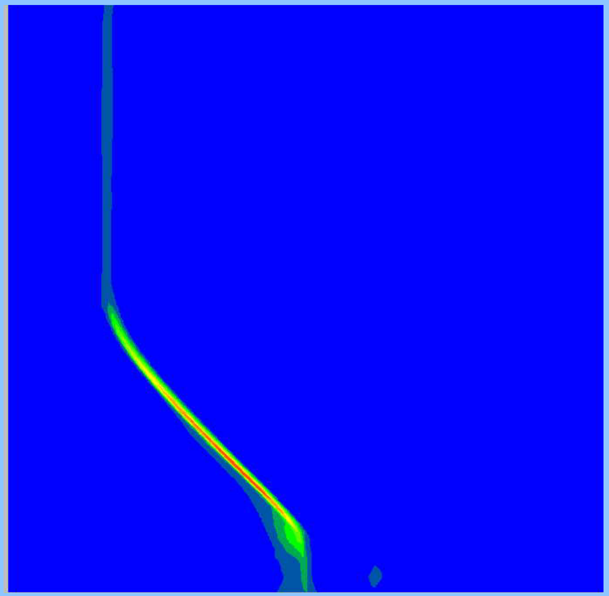
# Prelim results

## Shear Strain

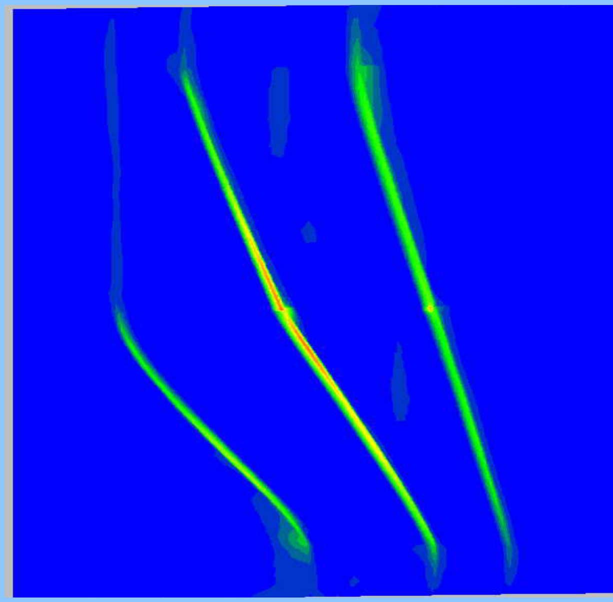
**Listric**



**Three faults – pure shear**



**One fault – pure shear**

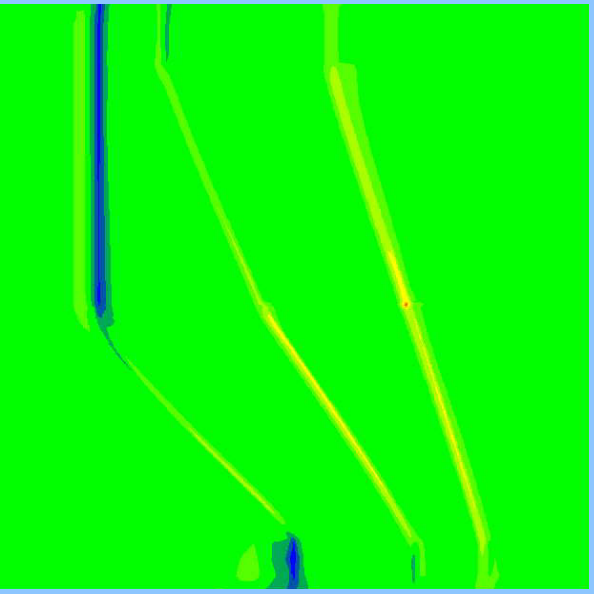


**Three faults – simple shear**

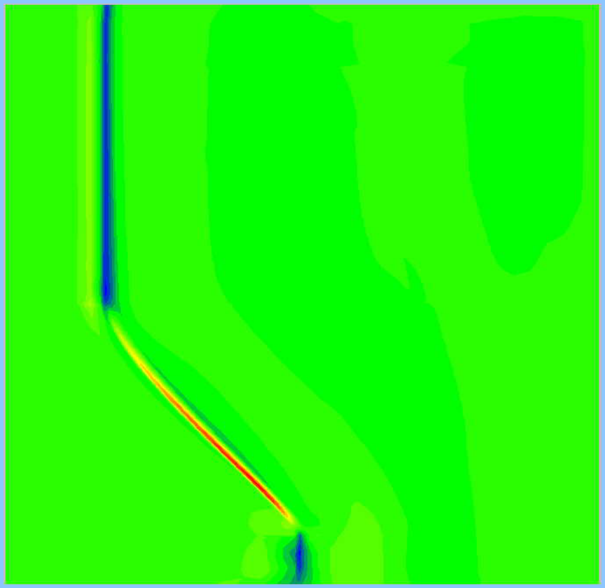
# Prelim results

## Dilation

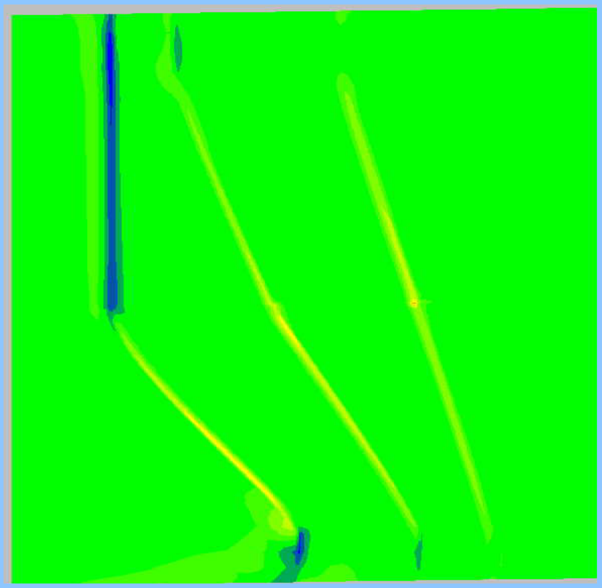
**Listric**



**Three faults – pure shear**



**One fault – pure shear**



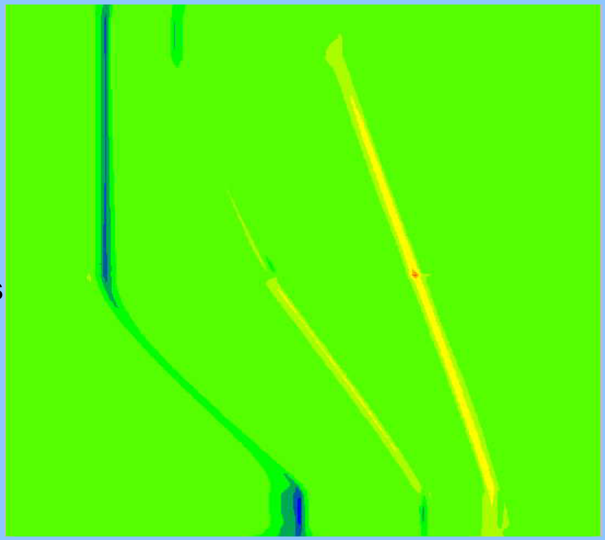
**Three faults – simple shear**

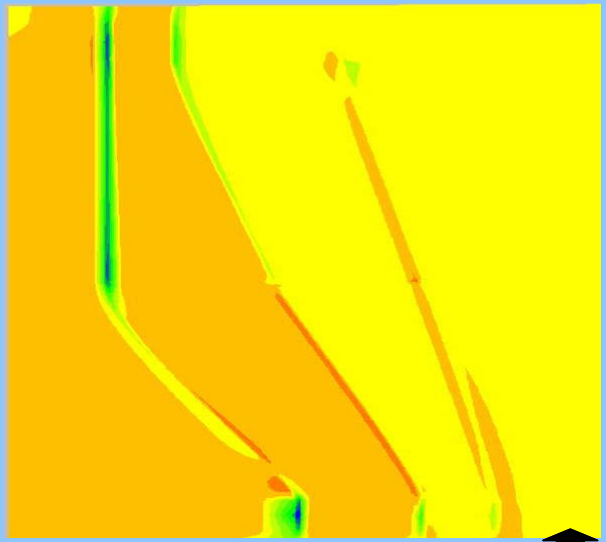
# Prelim results

## Dilation

**Listric – three lithologies**

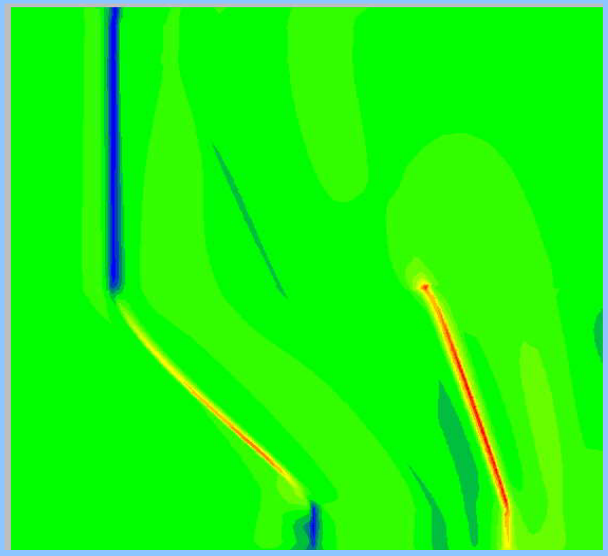
**Three faults**

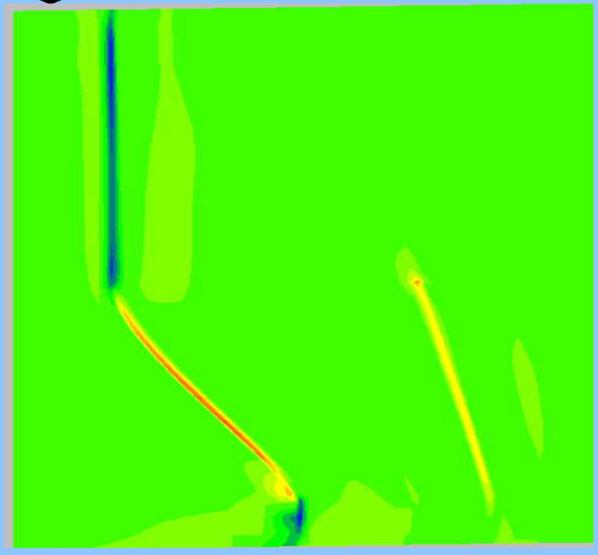




**pure shear** | **simple shear**

**No faults**





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# Thanks!!

**Special thanks to Warren, Peter, Thomas, Heather and Alison for their contributions to this work**