A novel solution for the tectonic evolution of the Eastern Fold Belt, Mt Isa Inlier (I/2+3)

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Acknowledgments
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Previous Tectonic Models for the Eastern Fold Belt, Mt Isa Inlier

Background

- **West-vergent thin-skinned or nappe-style folding followed by thick-skinned or upright folding and faulting based on the Mt Isa Deep Seismic Section (MacCready et al., 1998) with some field examples (e.g., Betts et al., 2000)**

- **N-S shortening followed by E-W shortening based on outcrop geology (e.g., Bell et al., 1992)**

In either models no polymetamorphic significance of crustal scale deformation events have been addressed, which is key in the understanding of tectonic processes (e.g., Pattison et al., 1999)

P-T paths and metamorphic evolution of the Eastern Succession, Mt Isa Inlier

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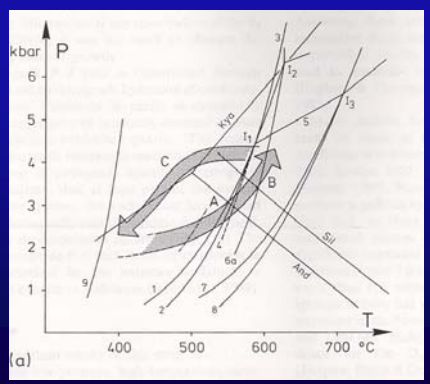
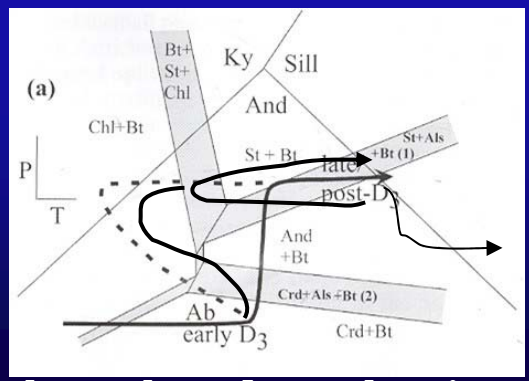
Background

- Low pressure / high temperature (LP/HT) counterclockwise P-T paths have been proposed for the metamorphic evolution of the Eastern Succession

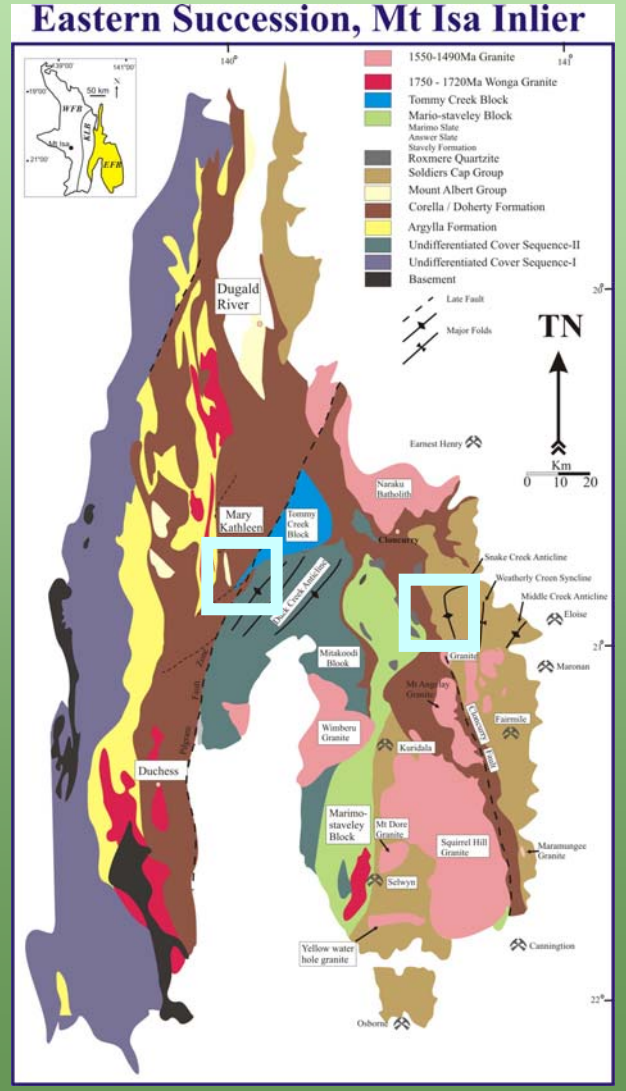
- Examples of LP/HT include And-Crd-St-Bt-Ms schists in the Snake Creek Anticline (Rubenach and Lewthwaite, 2002) and Rosebud Syncline (Reinhardt, 1992)



Reinhardt,1992



Rubenach and Lewthwaite, 2002



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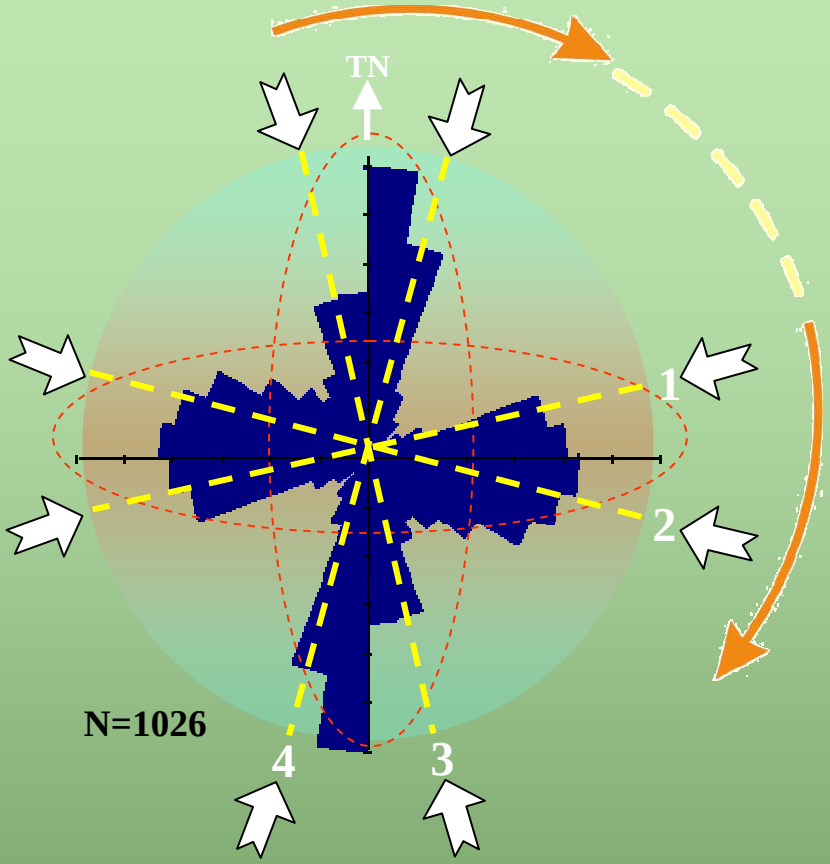
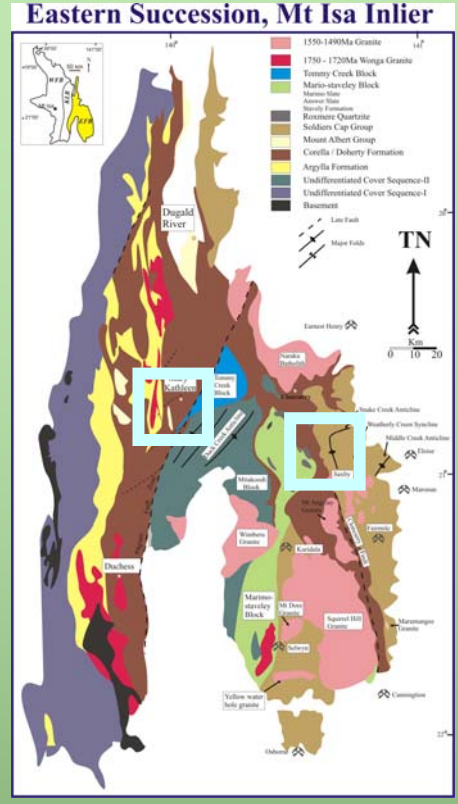
P-T paths and metamorphic evolution of the Eastern Succession, Mt Isa Inlier

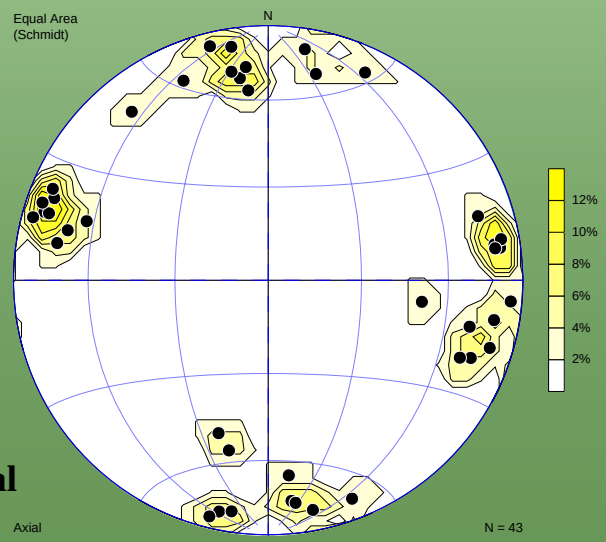
Focus

- To understand the polymetamorphic nature of the Eastern Succession with crustal scale deformation episodes
- To refine the P-T paths by thermodynamic modeling by constructing P-T pseudosections using Thermocalc-3.21 in a 9-component model chemical system (MnCaNaKFMASH)
- To get P-T estimates from chemically zoned garnet porphyroblasts of different generations based on microstructural relationships



Trends of ‘Si’ and ‘Se’ from horizontal oriented thin sections





Trend and plunge of ‘Si’ and ‘Se’ from horizontal and vertical oriented thin sections

P-T paths and metamorphic evolution of the Eastern Succession, Mt Isa Inlier

P-T pseudosections

- **P-T pseudosection is a map of stable mineral assemblages in P-T-X space, which uses bulk XRF analysis (mol%) in a given rock sample**
- **The P-T pseudosections in MnNaCaKFMASH reveal a much more complete picture of chemical and mineralogical inter-relationship in a area of P-T space**
- **This method can reliably model the P-T conditions of garnet core growth based on the intersection of Fe, Mn, Ca compositional isopleths by microprobe point analysis and combined with aX software can calculate matrix mineral end-member activities e.g., garnet rim, plagioclase, biotite and their respective P-T estimates**

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Snake Creek Anticline

Sc192 – *Grt-Bt-St schist*

Sc189 – *Grt-Bt schist*

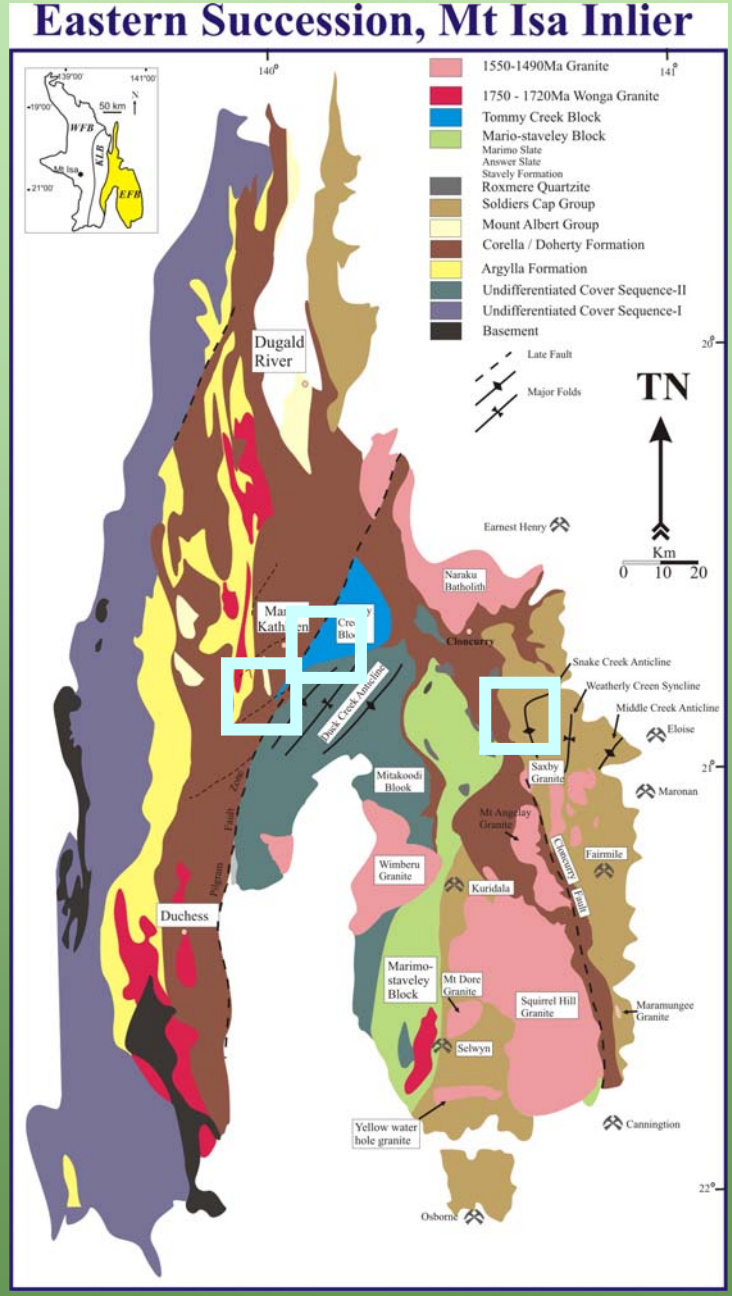
Sc112 – *Grt-Bt schist*

Tommy Creek Block

Tc186 – *Grt-Bt-schist*

White Blow Formation

WB45 – *Grt-Bt-St schist*



Snake Creek Anticline – SC192

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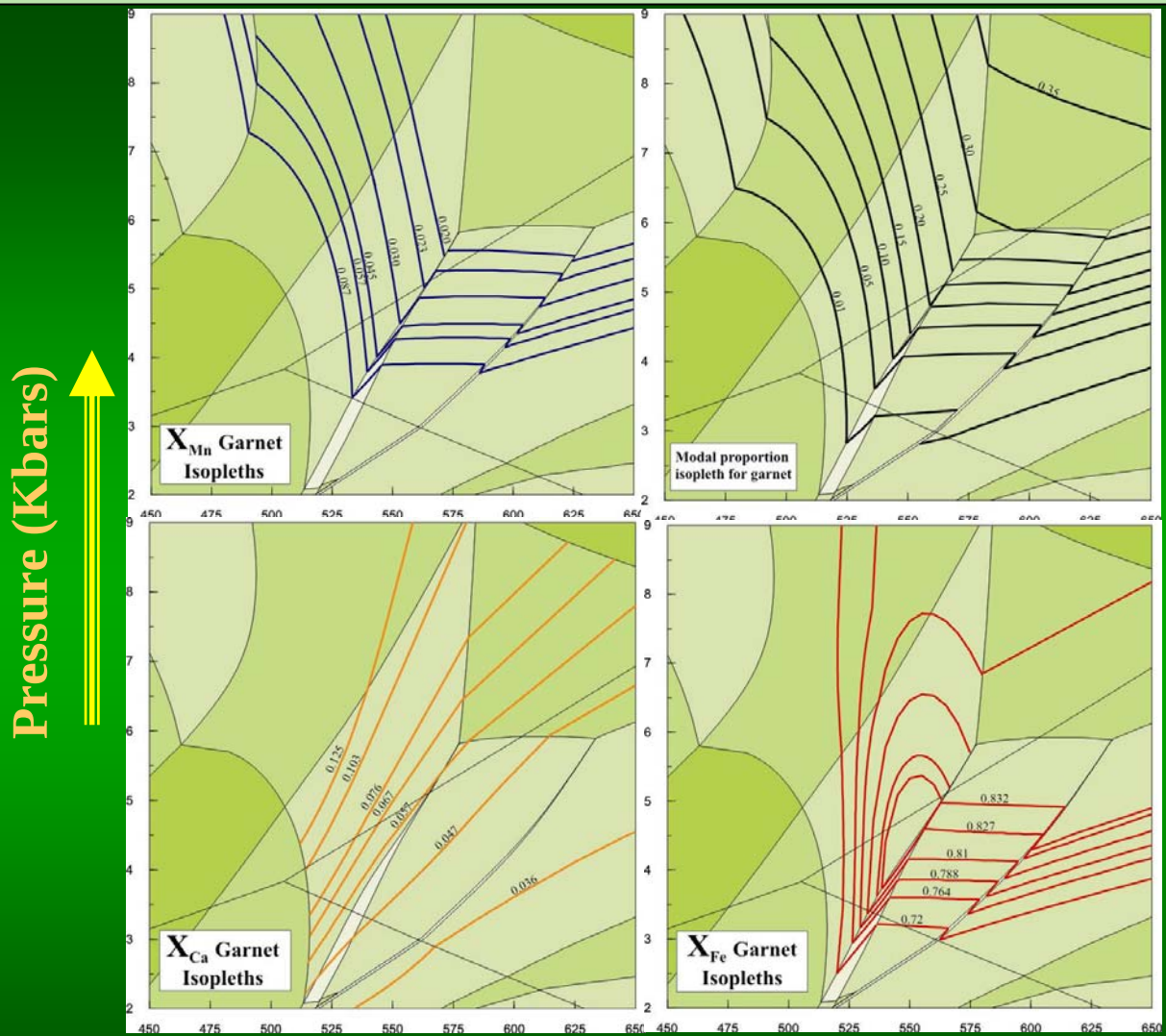
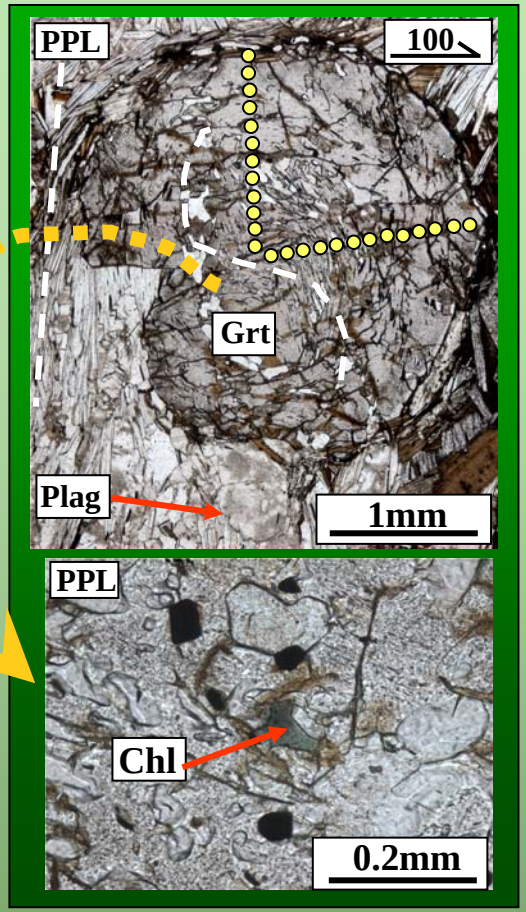
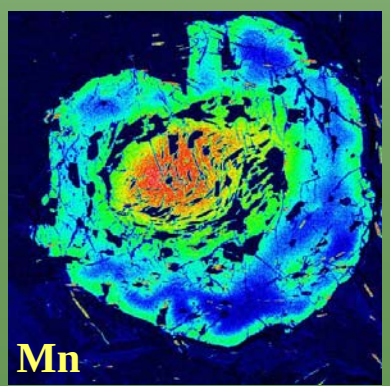
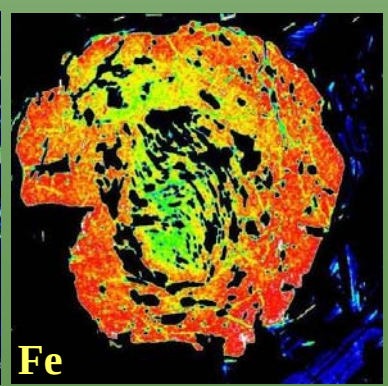


Available on pmd-twiki website

Snake Creek Anticline – SC192 *pmd* CRC

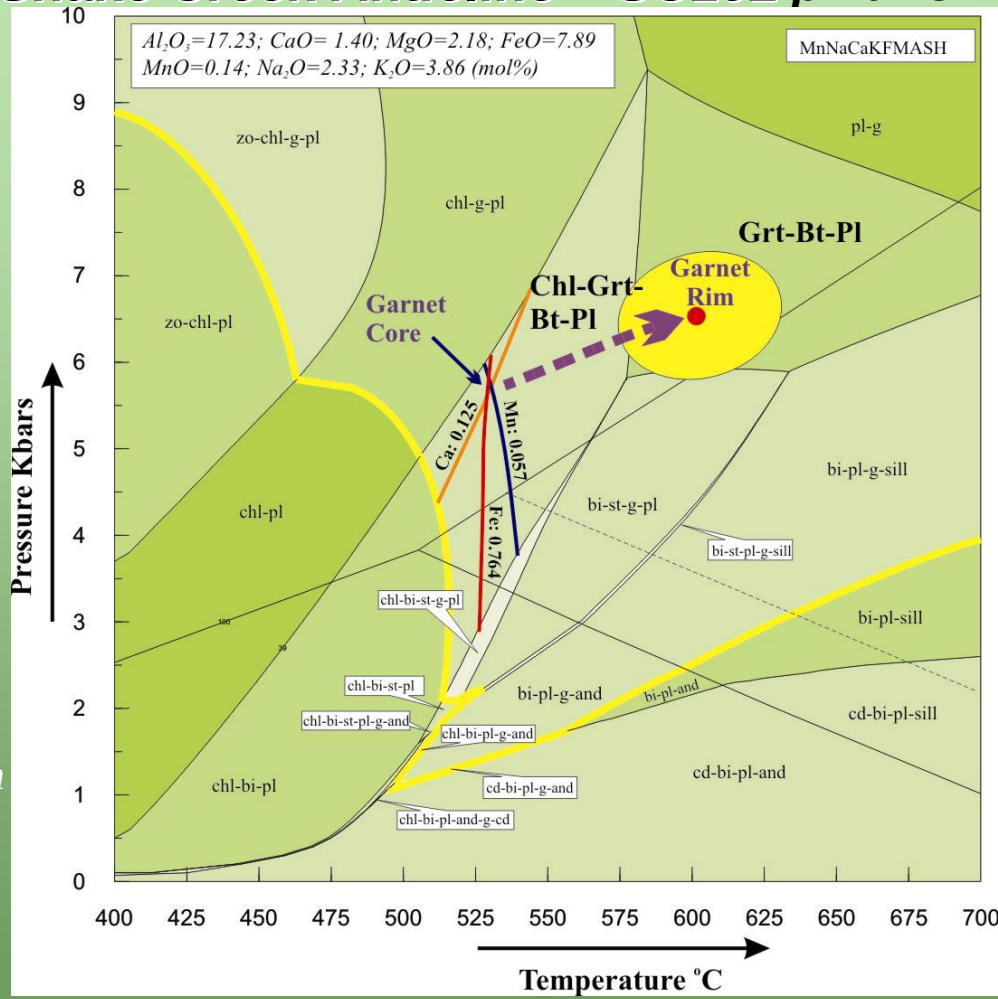






High

Low



Garnet core: 5.6-5.8Kb/526-528°C

Garnet Rim: 6.5±1.1Kb/602±27°C

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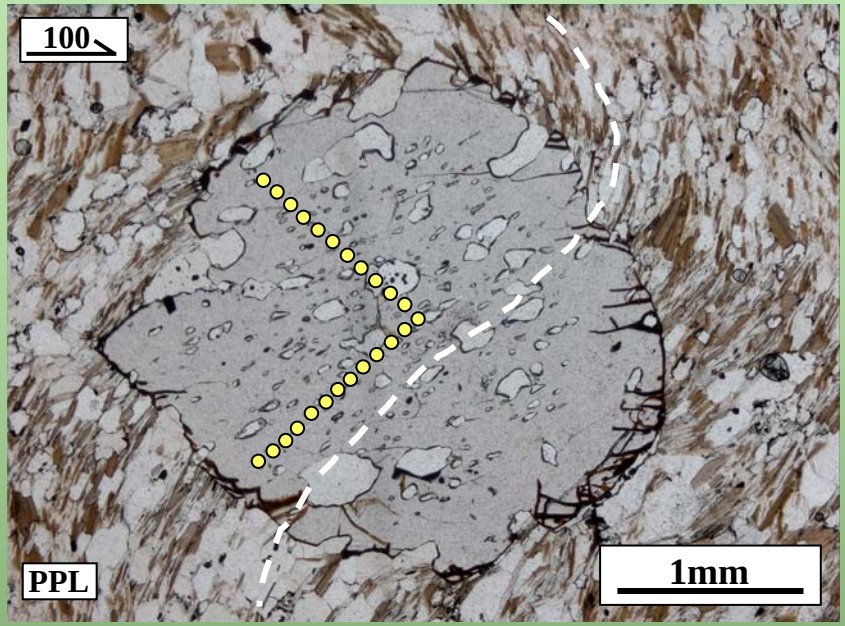
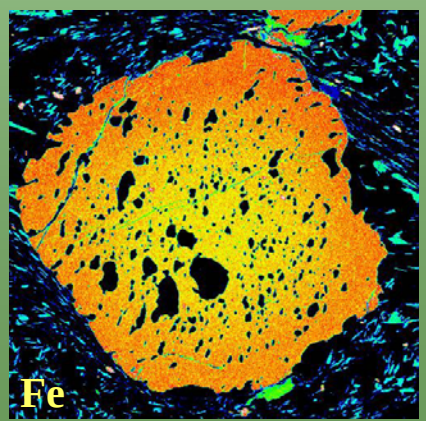
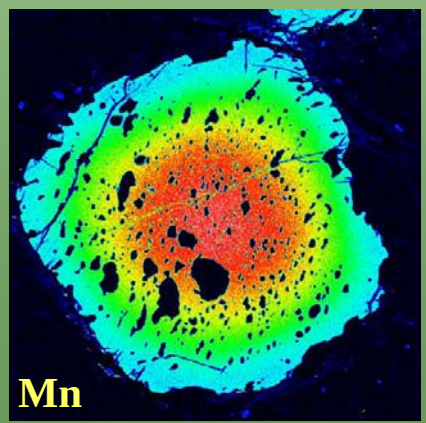
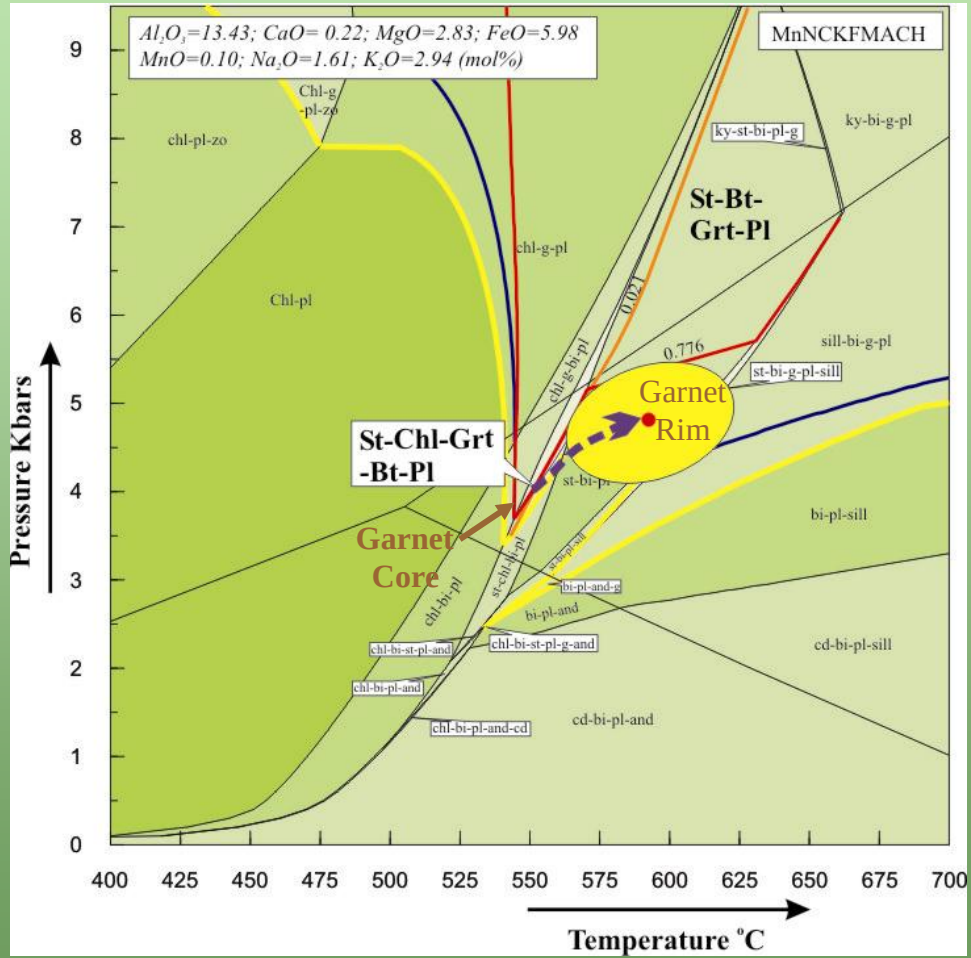
Snake Creek Anticline – SC112







High *Low*



Garnet core: 3.7-3.9Kb/548-550°C

Garnet Rim: 4.8±1.2Kb/592±32°C

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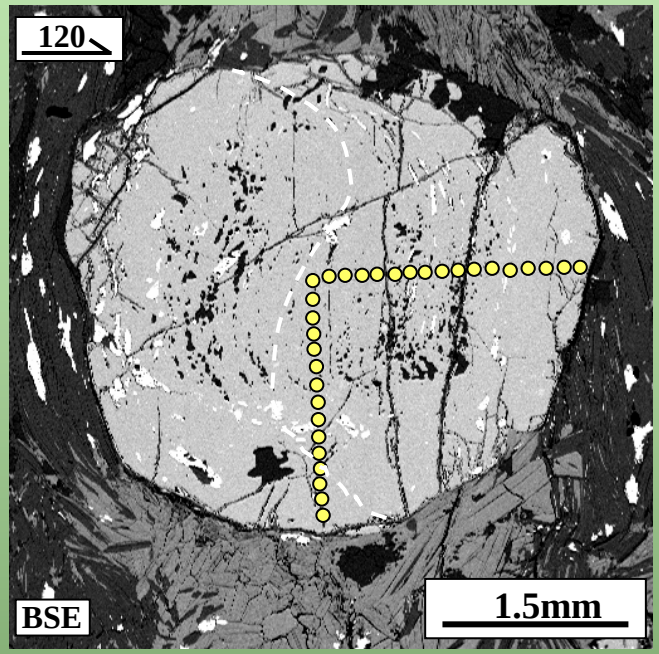
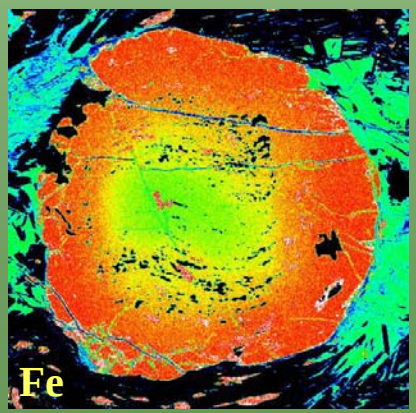
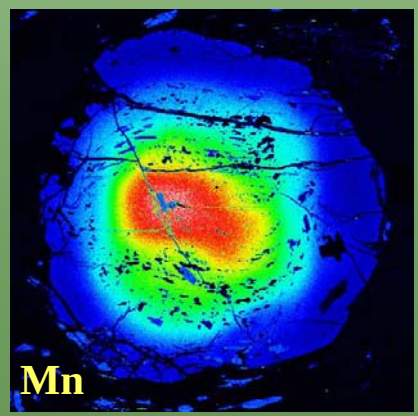
pmd*CRC

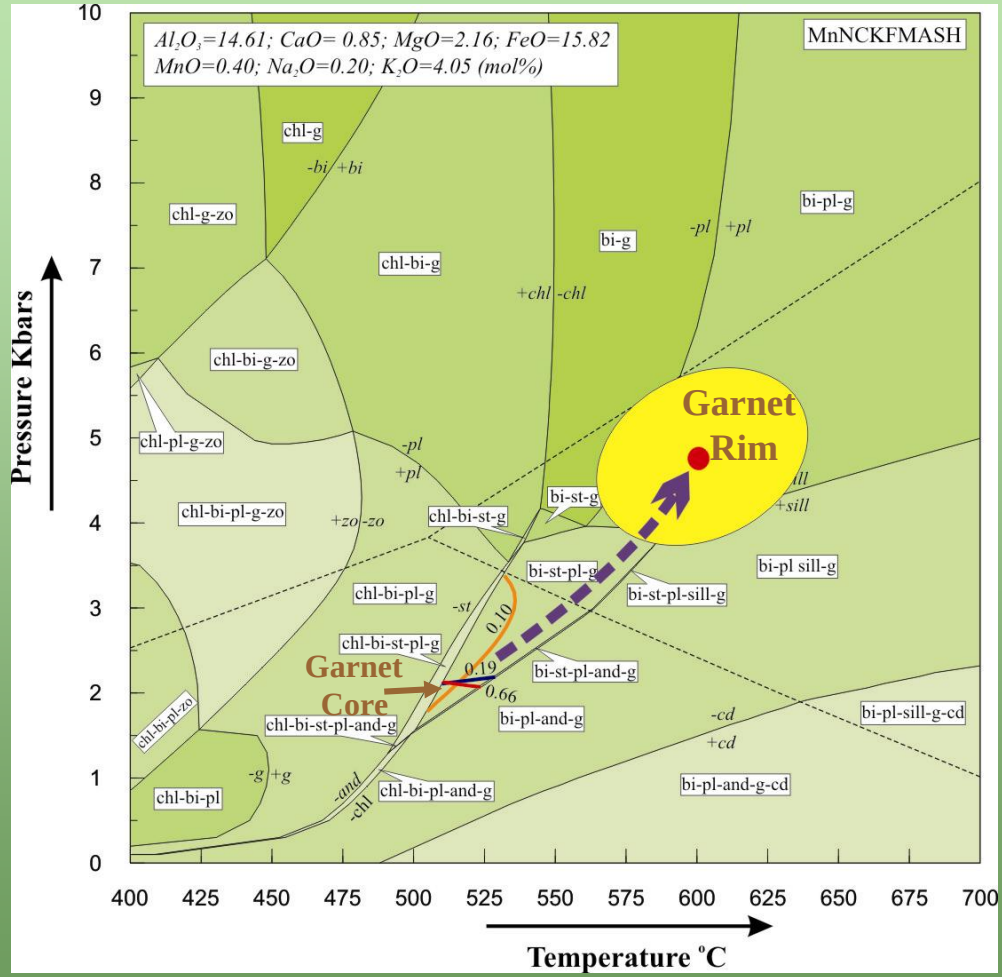
Tommy Creek Block – TC186







High — Low



Garnet core: 2.1-2.3Kb/510-515°C
Garnet Rim: 4.8±1.1Kb/600±29°C

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MnO profiles across garnet porphyroblasts from the studied samples

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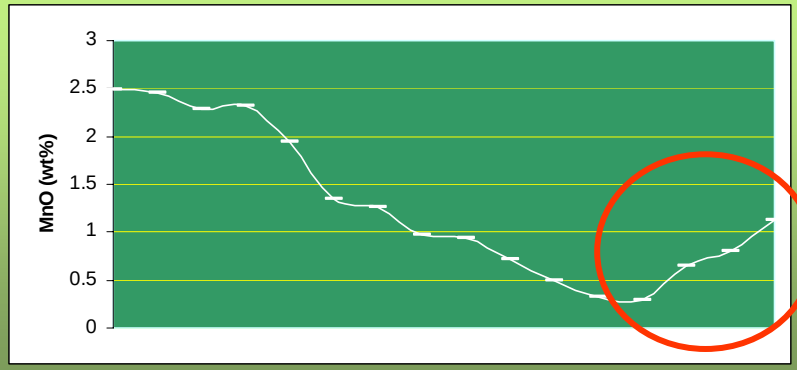

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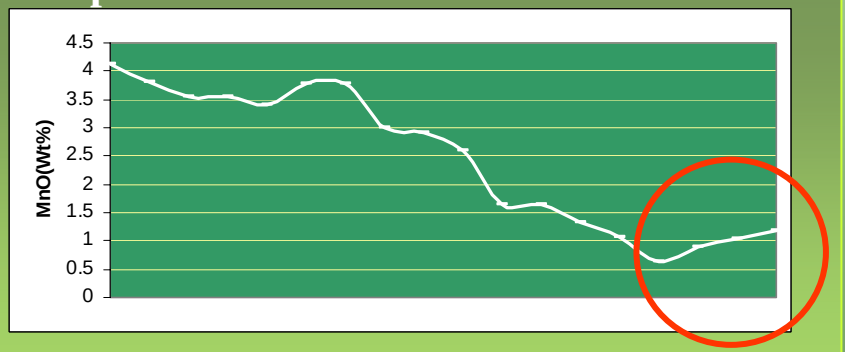
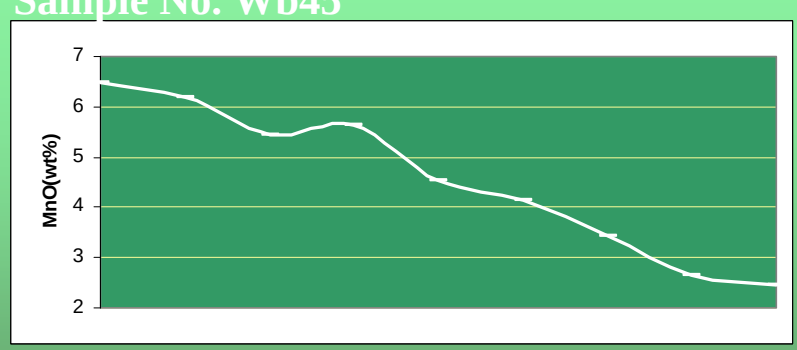


Garnet Core → Garnet Rim

Sample No. Wb45



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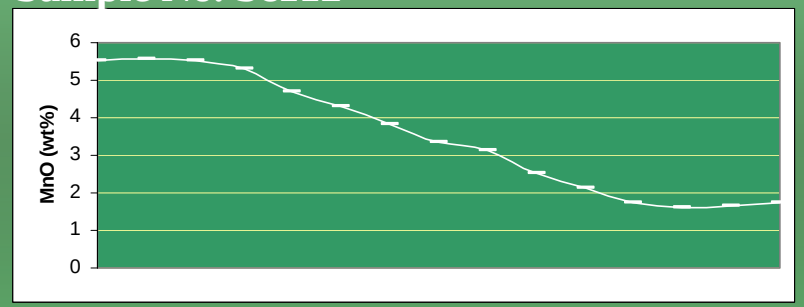

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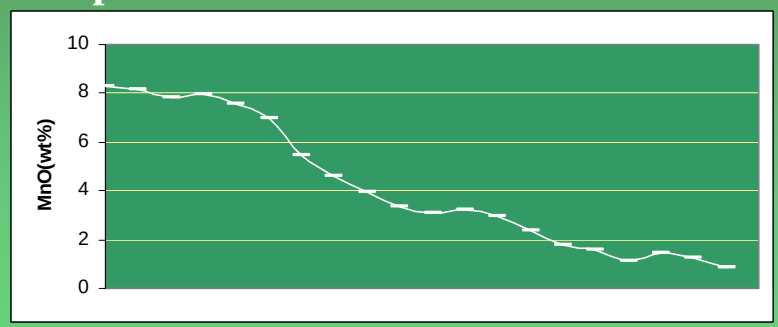

Garnet Core → Garnet Rim

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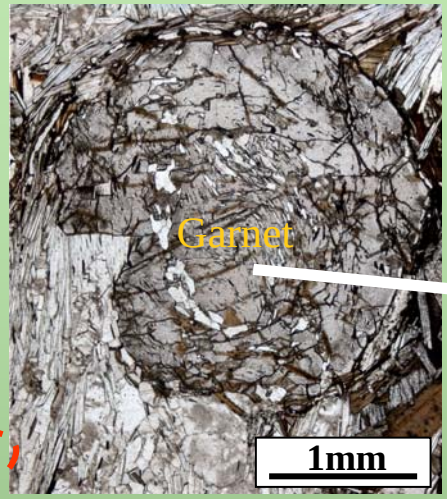

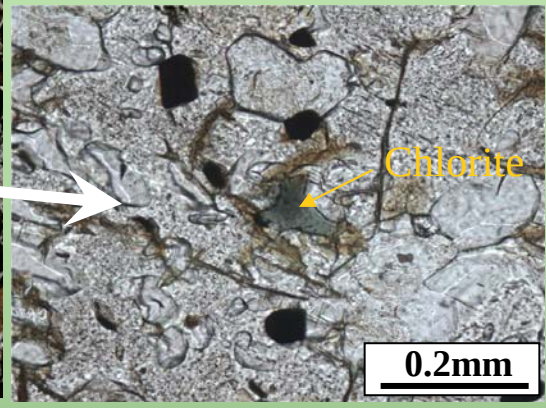

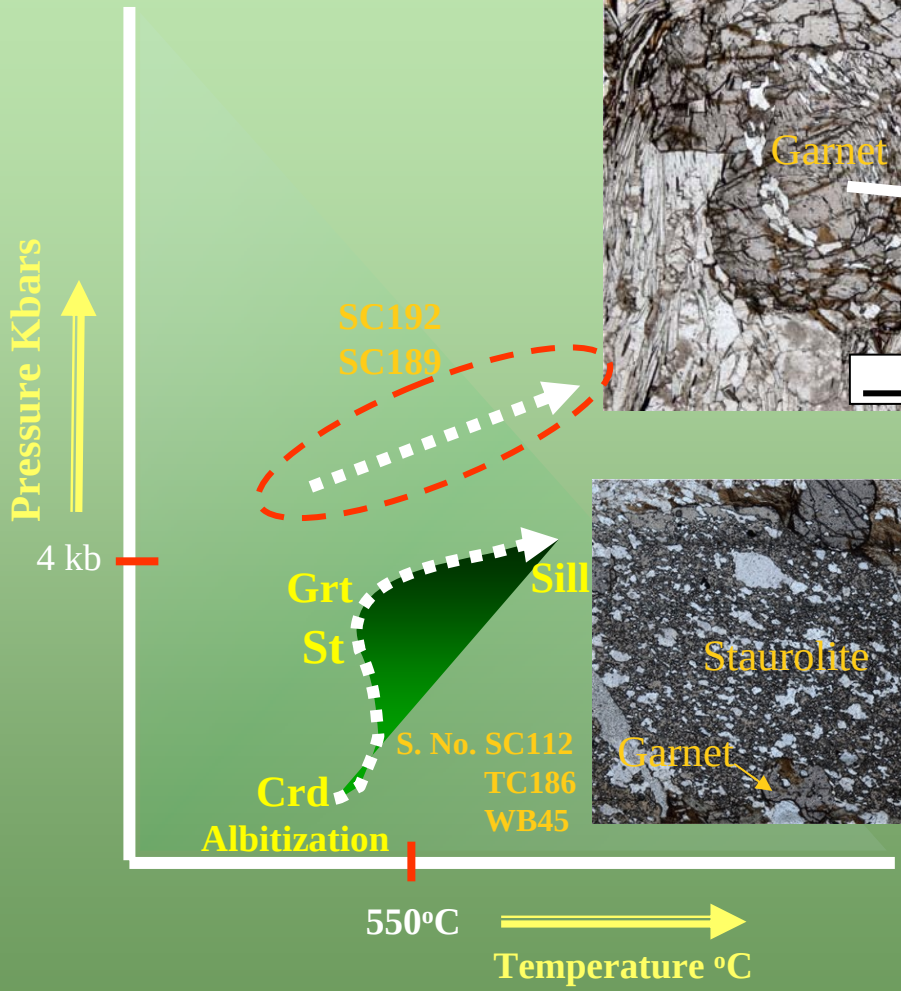

1. Cordierite pseudomorphed by Ms
2. Staurolite
3. Garnet
4. Sillimanite

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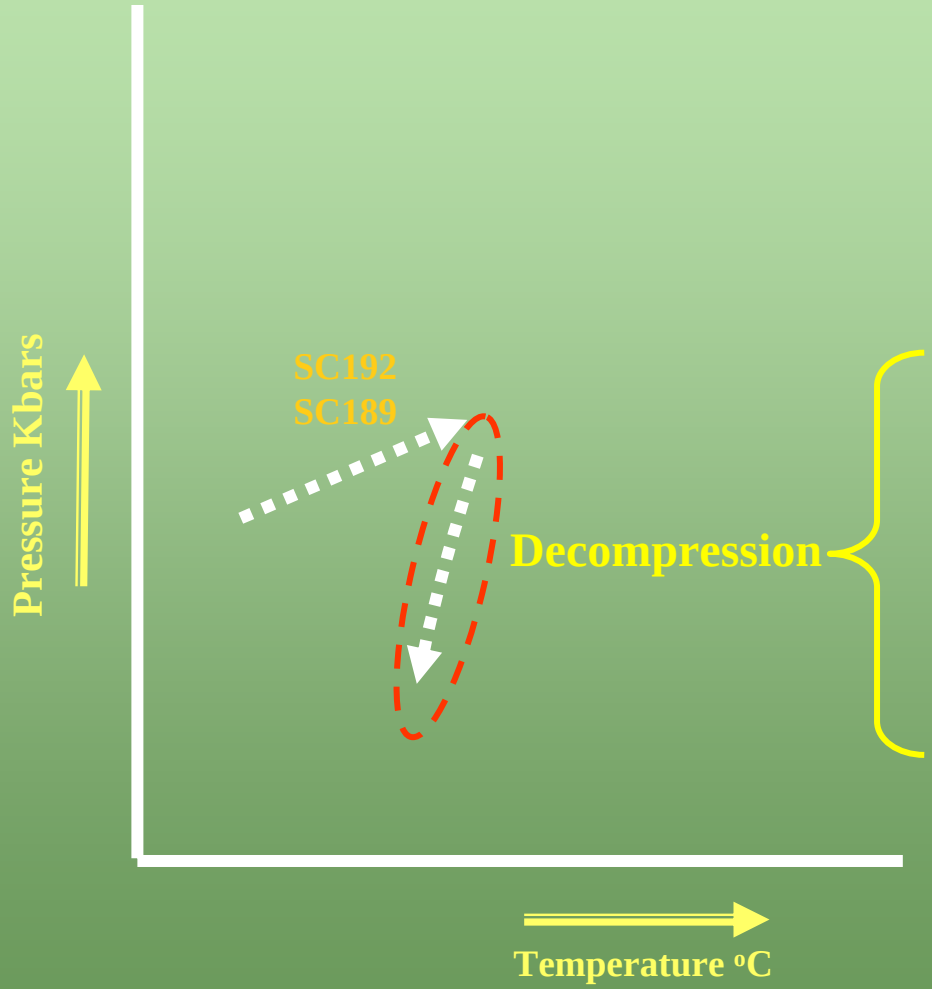
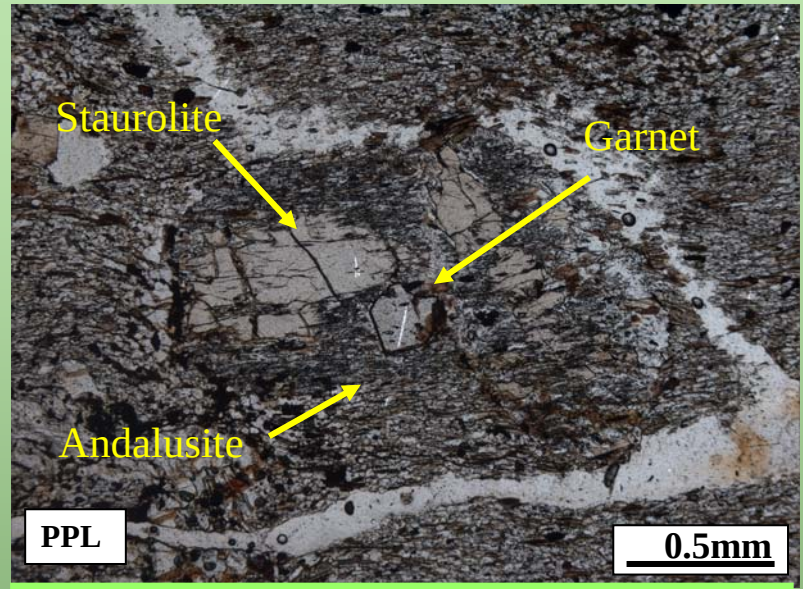
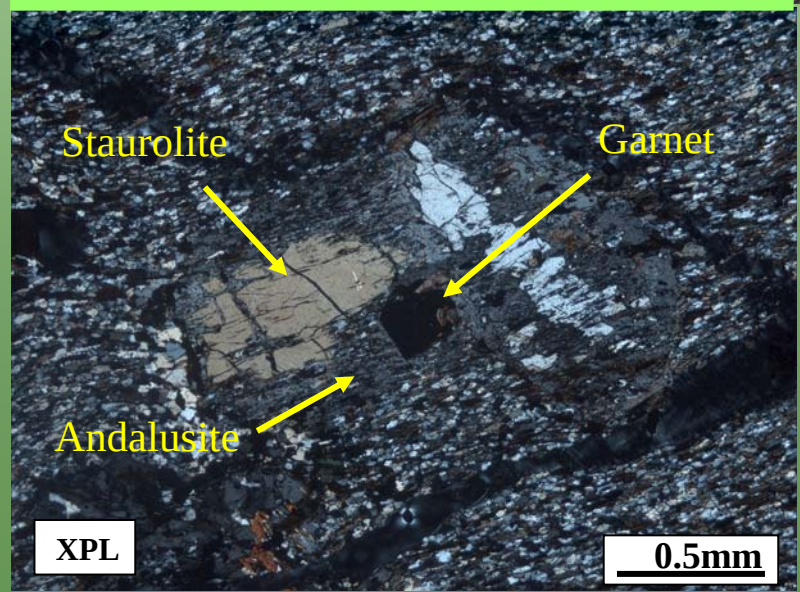
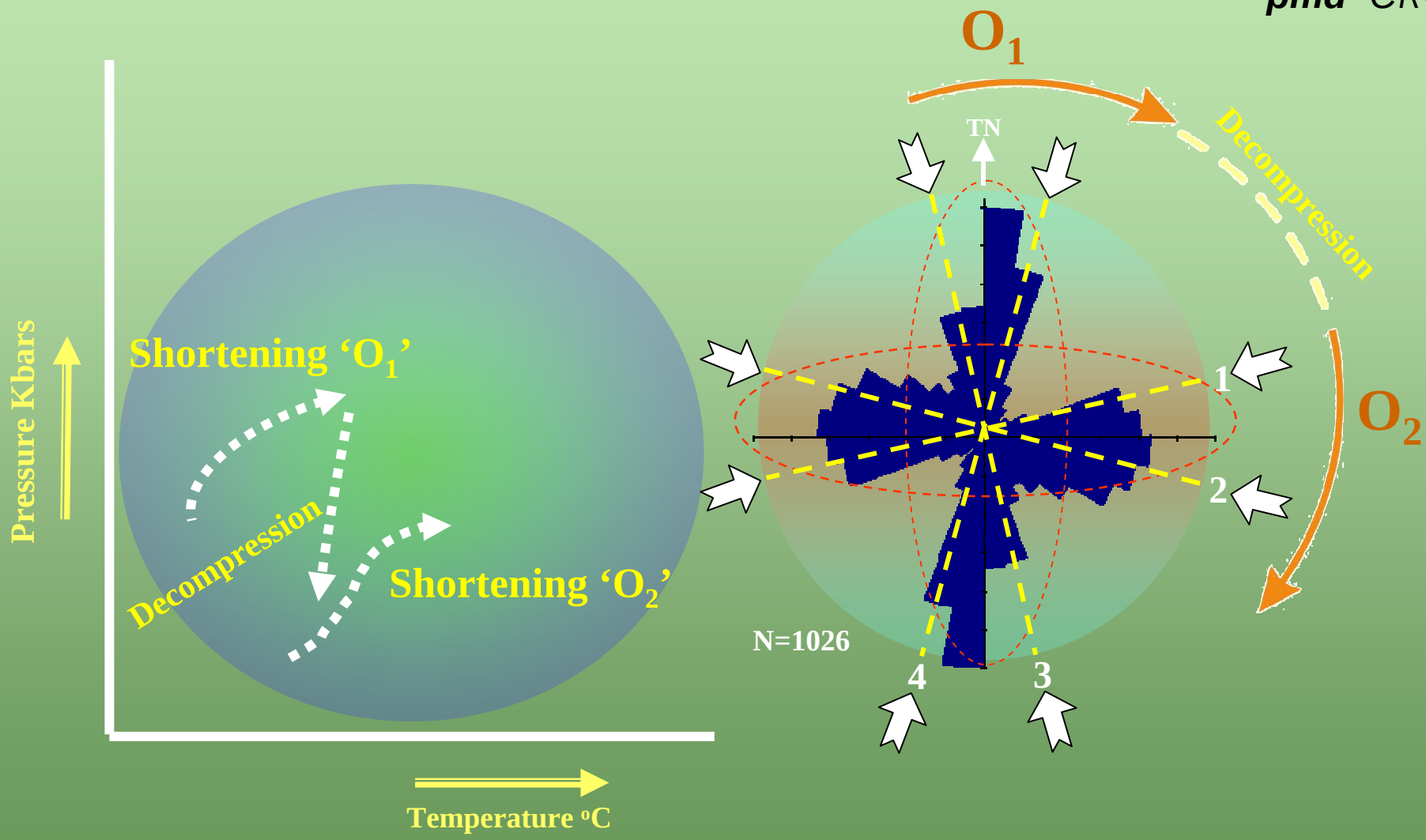

Pressure Kbars
SC192
SC189
Decompression
Temperature °C


Staurolite
Garnet
Andalusite
PPL
0.5mm


Staurolite
Garnet
Andalusite
XPL
0.5mm

Conclusions - I



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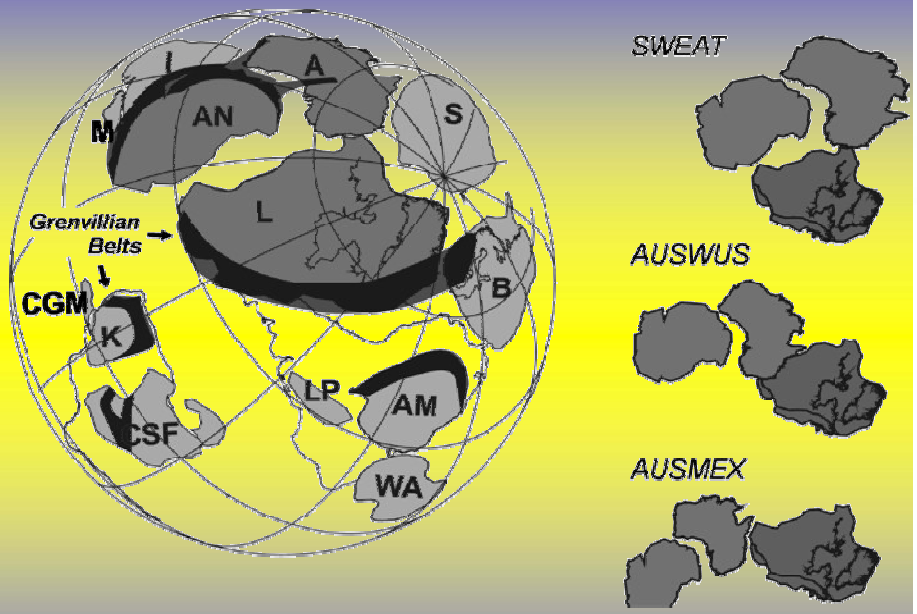
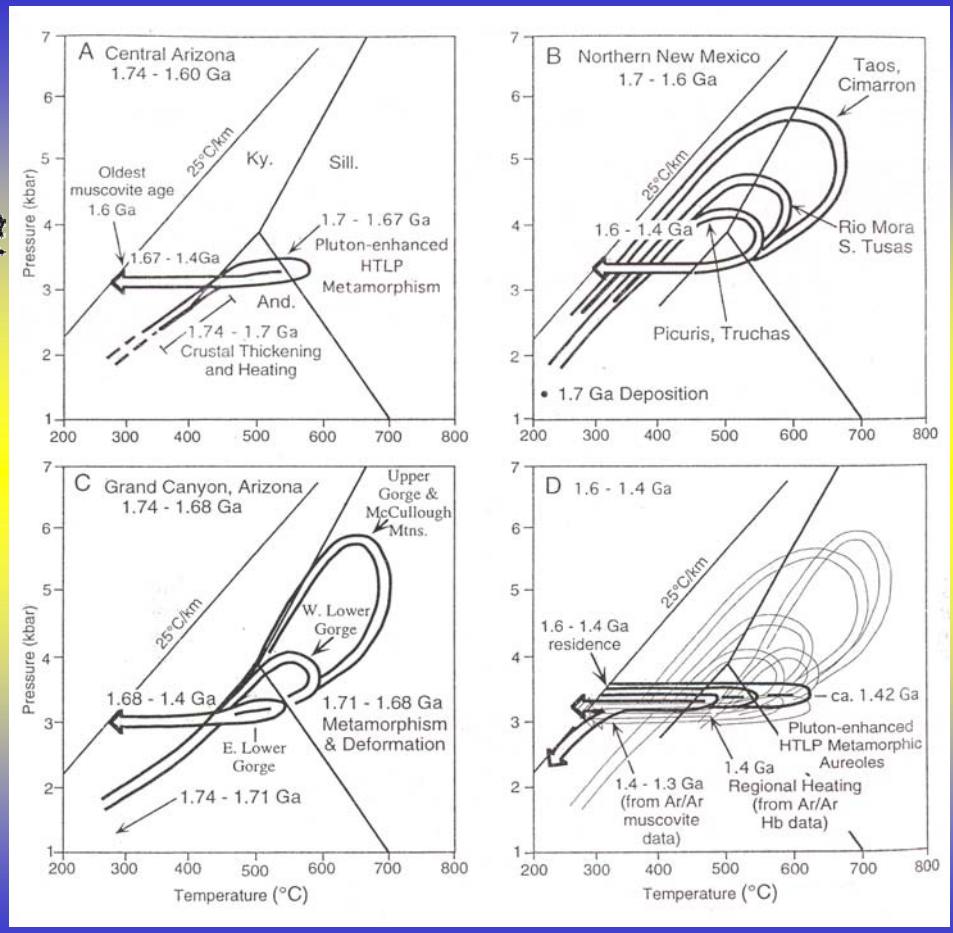
Conclusions - II

Implications for Mesoproterozoic Tectonics

Refining Rodina





Cordani et al., 2003