

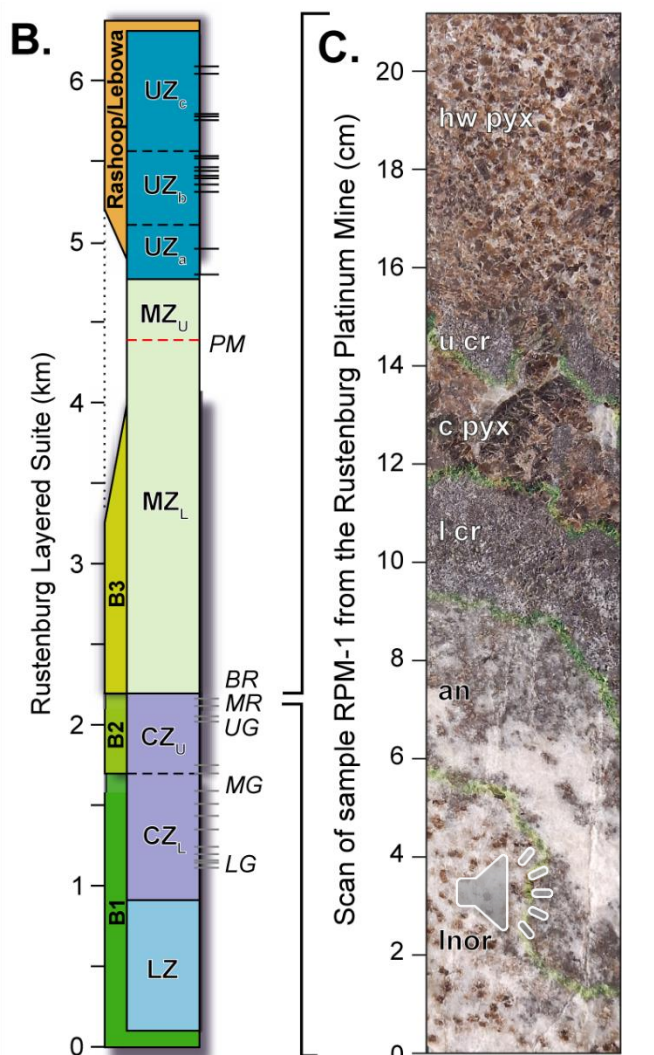
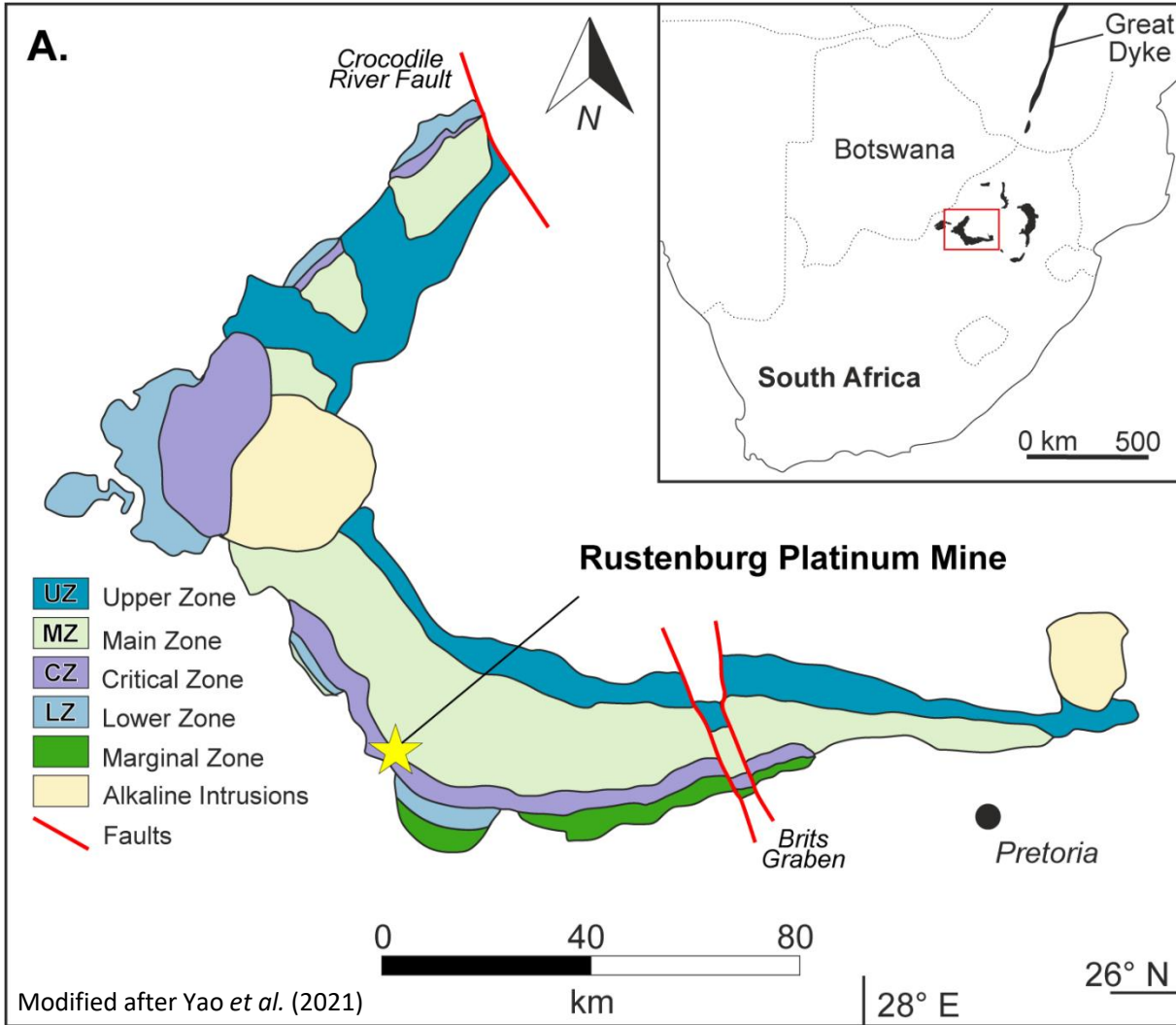


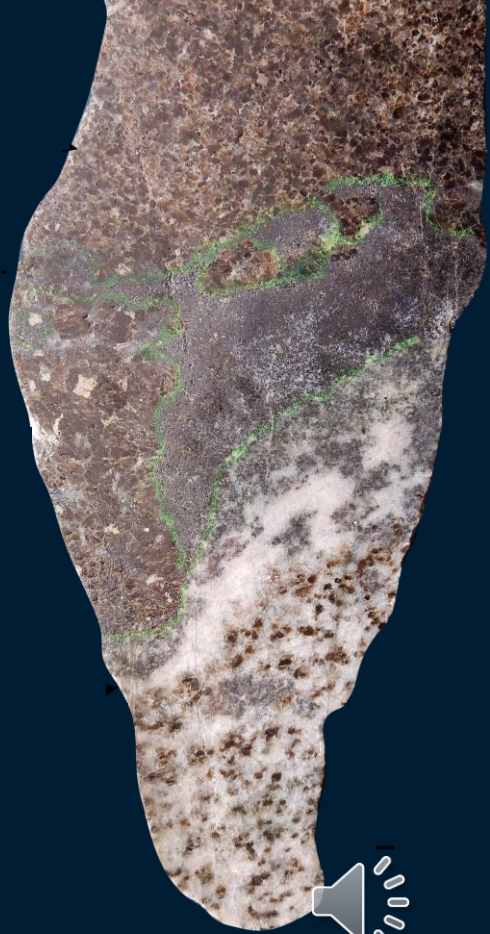
Reconstitution of the Merensky Reef Footwall

Chamber replenishment, microtextures, and trapped liquid shift

William D Smith | 6-8th August 2024



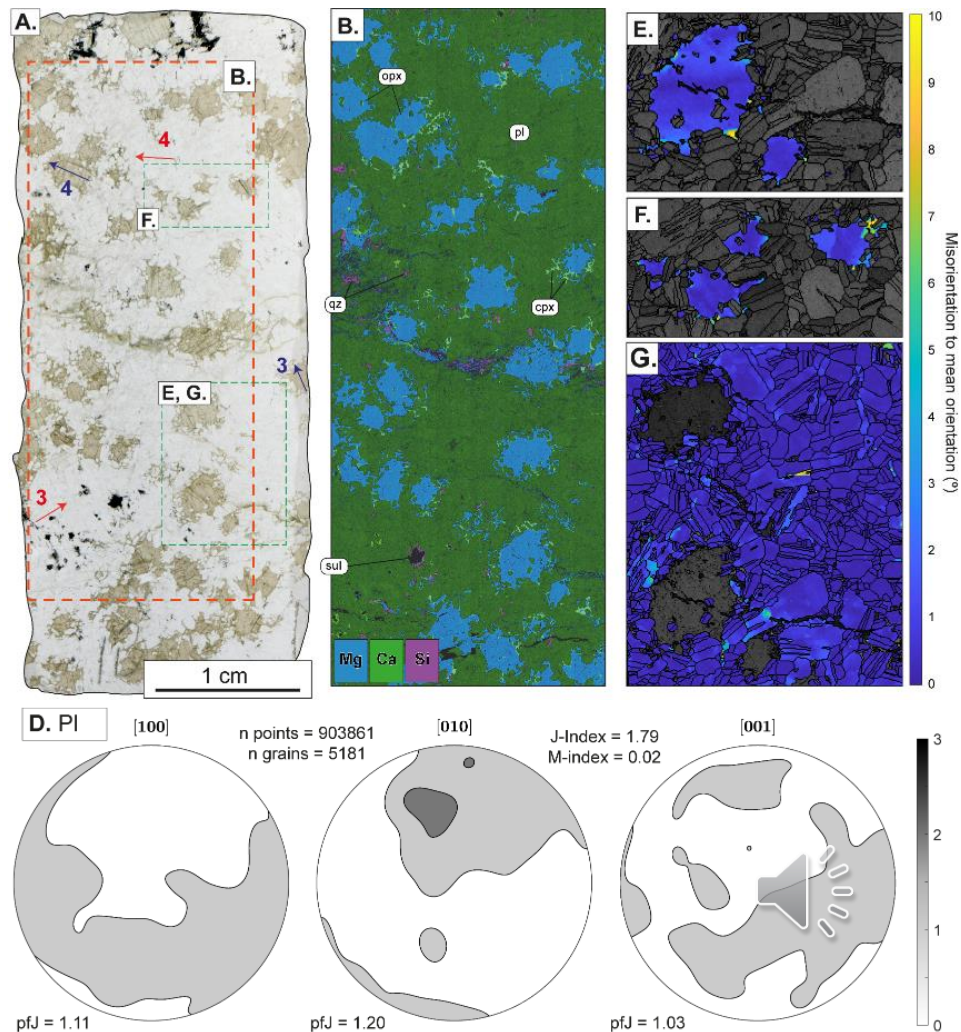




Is the footwall anorthosite a primary cumulate or a restite?

Footwall leuconorite

- Cumulus plagioclase and cumulus orthopyroxene with poikilitic overgrowths.
- Cumulus phases are oriented normal to the compositional layering
- No evidence for deformation.



Water-in-orthopyroxene being acquired



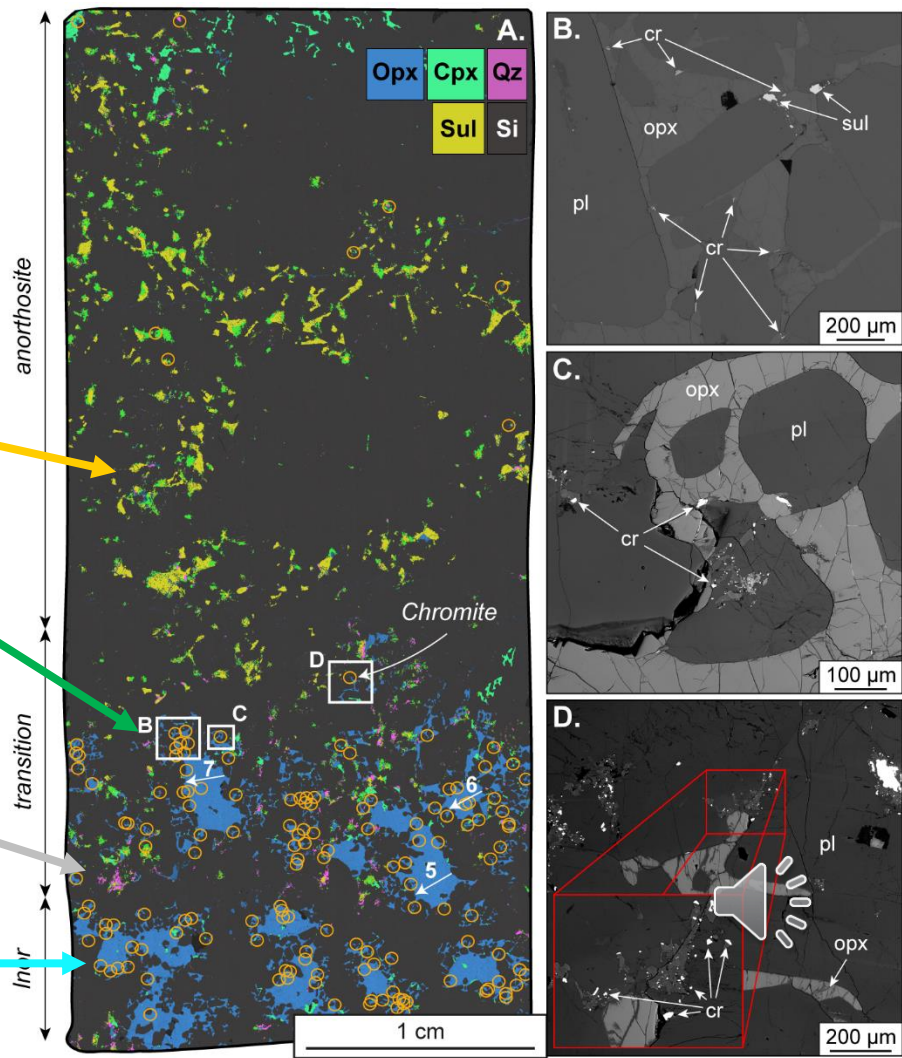
Leuconorite-Anorthosite contact

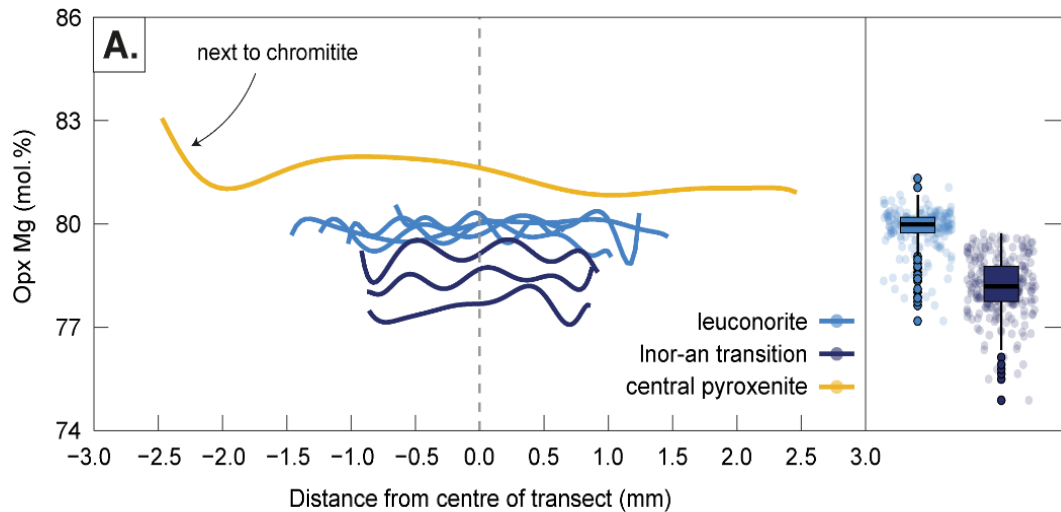
Sulfides stop at leuconorite

Spike in chromite abundance

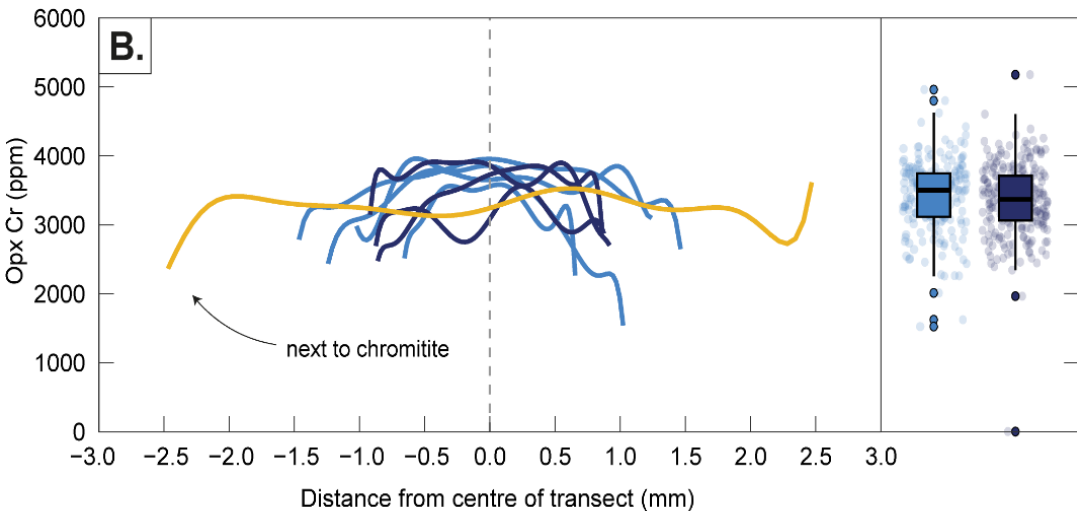
More quartz, phlog, and cpx

Increase in poikilitic overgrowths





Orthopyroxene at the leuconorite-anorthosite contact have lower Mg# contents...

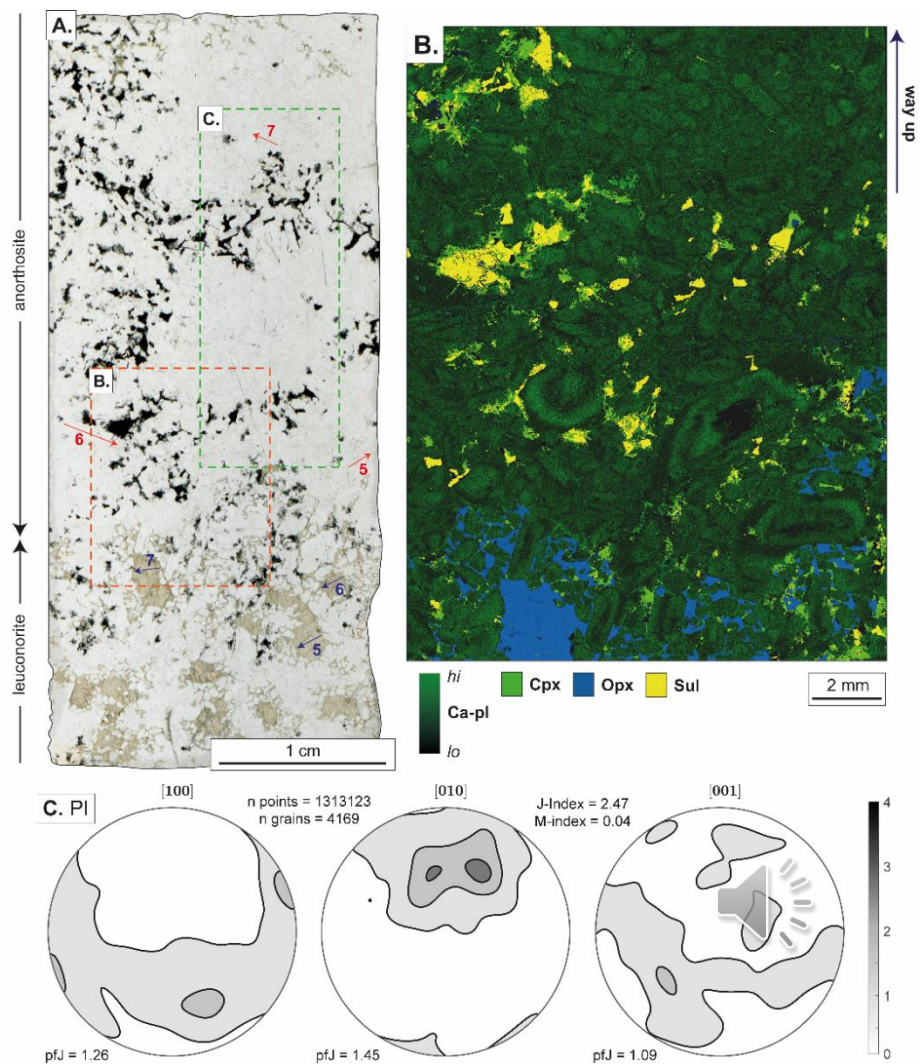


... but the Cr and Ti concentrations are the same as orthopyroxene below.



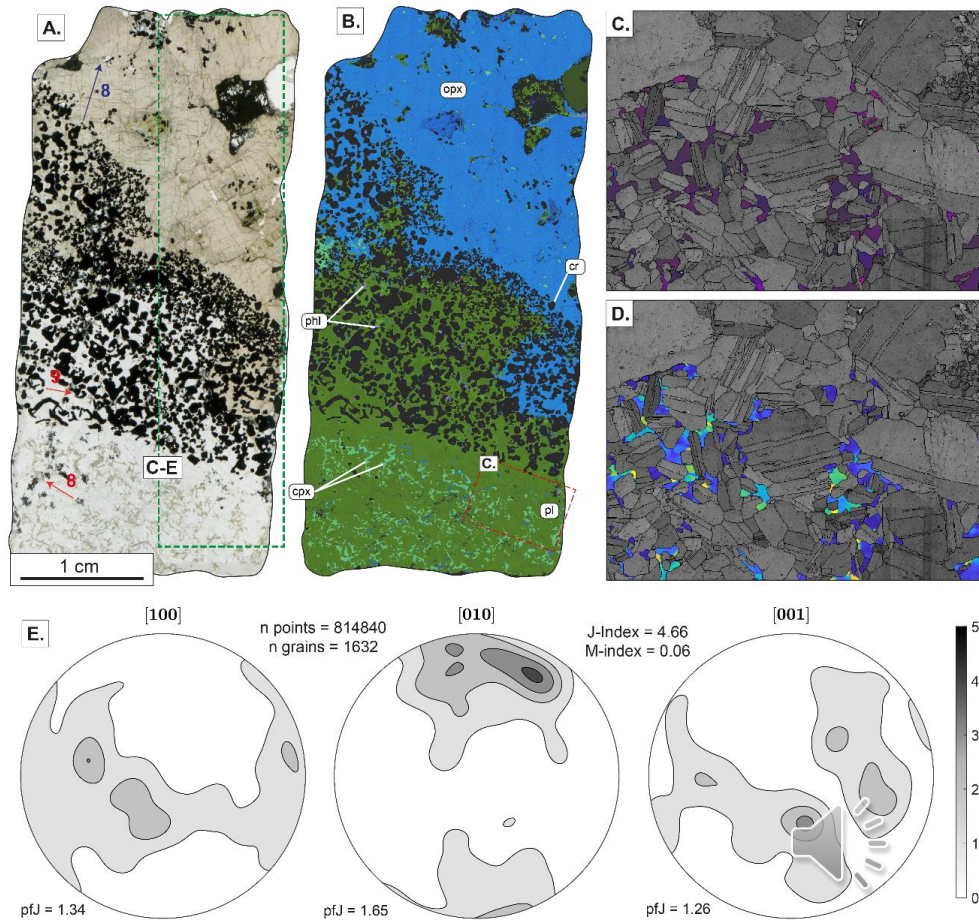
Footwall anorthosite

- Diverse array of compositional zoning.
- Stronger fabric, where orientation is normal to the compositional layering.
- No evidence for deformation.
- Meandering sulfide networks host accessory phases.



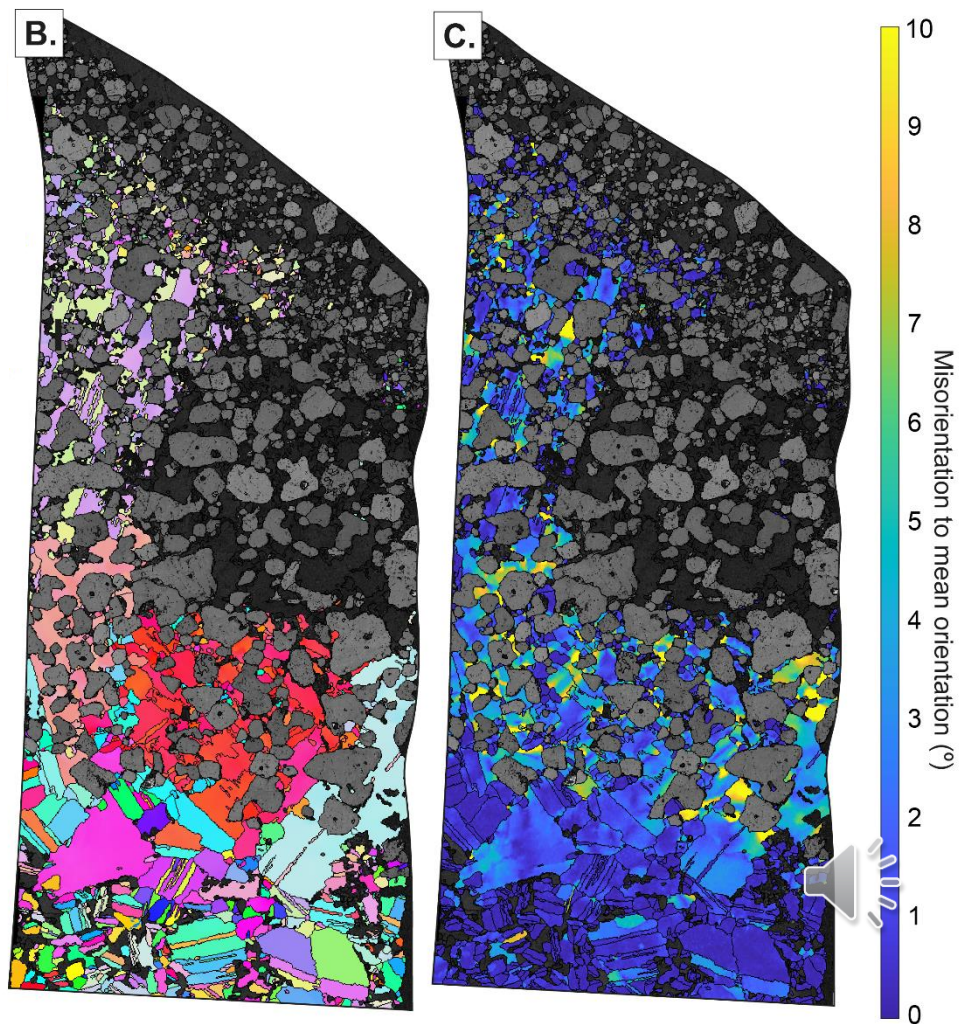
Anorthosite-Chromitite contact

- Plagioclase exhibits strong reverse zoning.
- Plagioclase records a strong fabric, where orientation is normal to the compositional layering.
- Clinopyroxene oikocrysts are plastically deformed.



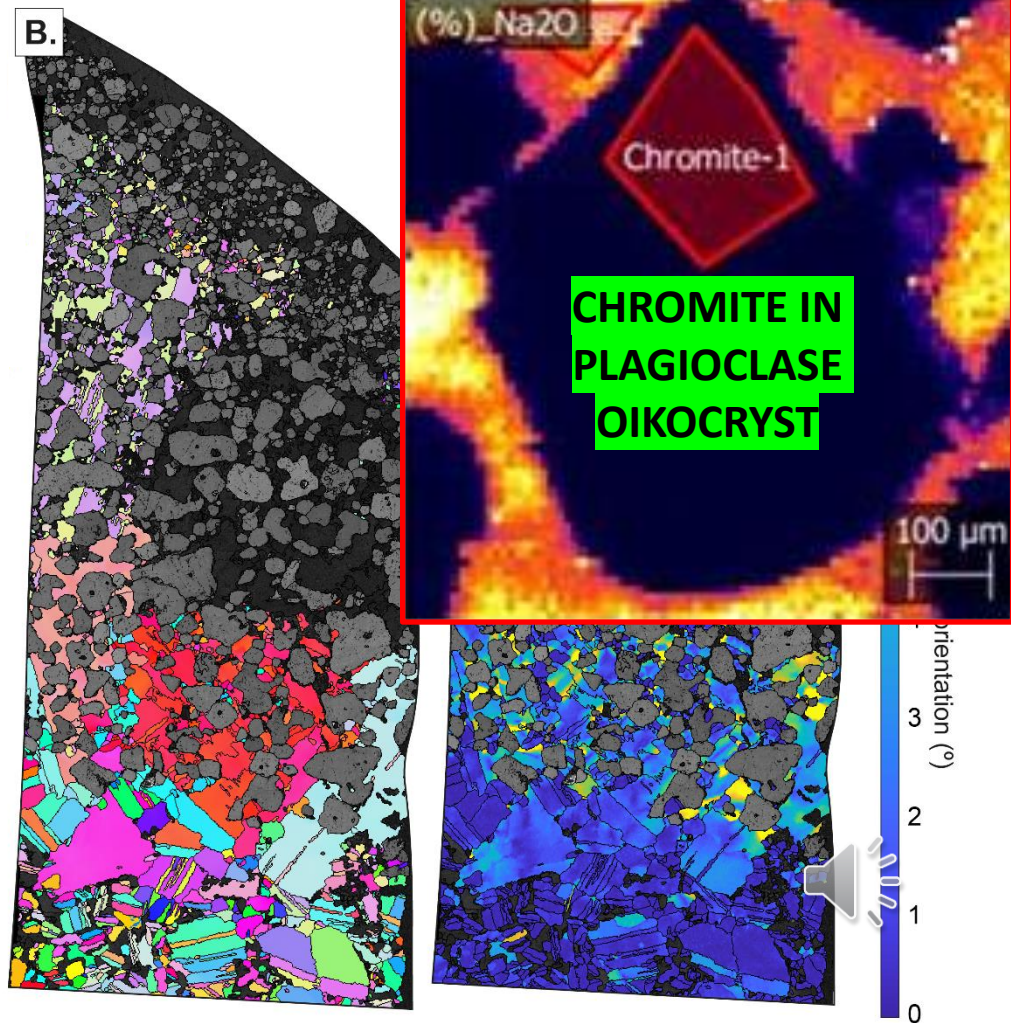
Lower Chromitite

- Plagioclase oikocrysts oriented with their (010) plane is normal to layering.
- Orthopyroxene oikocryst (010) planes coincident to layering.
- Plagioclase oikocrysts exhibit strong internal misorientation.



Lower Chromitite

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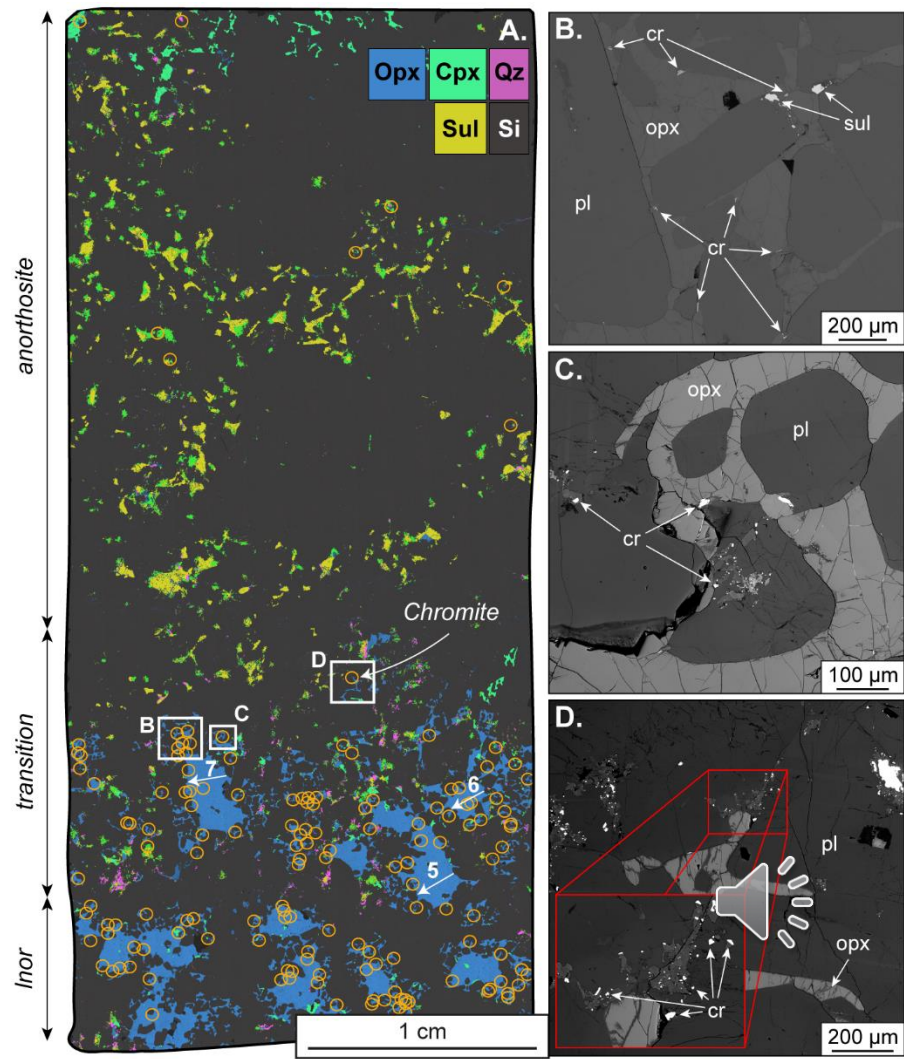


Modelling and interpretations





- **Mineralogical changes.**
Orthopyroxene textures, disappearance of chromite, *sulfide distribution*, quartz.
- **Chemical changes.**
Orthopyroxene Mg#, plagioclase zoning, *upper chromitite*.
- **Microtextural changes.**
Upward strengthening fabrics, *bimodal chromite population*.





- **Mineralogical changes.**

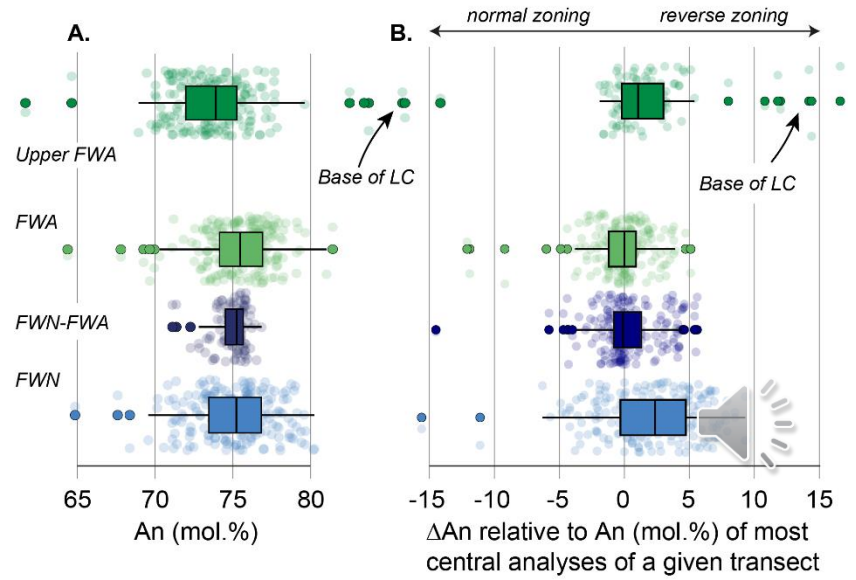
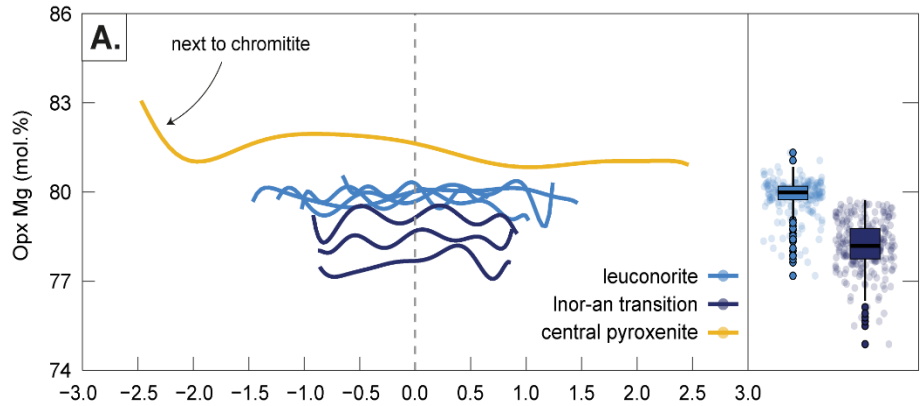
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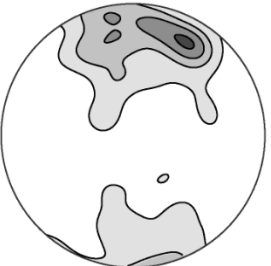
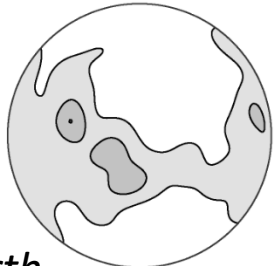
Upward strengthening fabrics, *bimodal chromite population*.



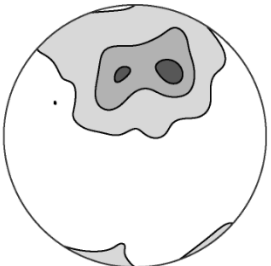
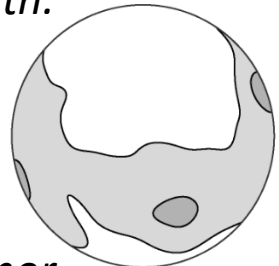


Upper anorth. [100]

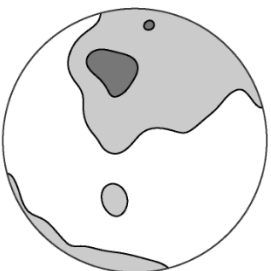
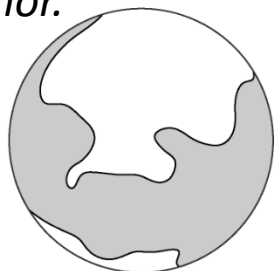
[010]



Anorth.

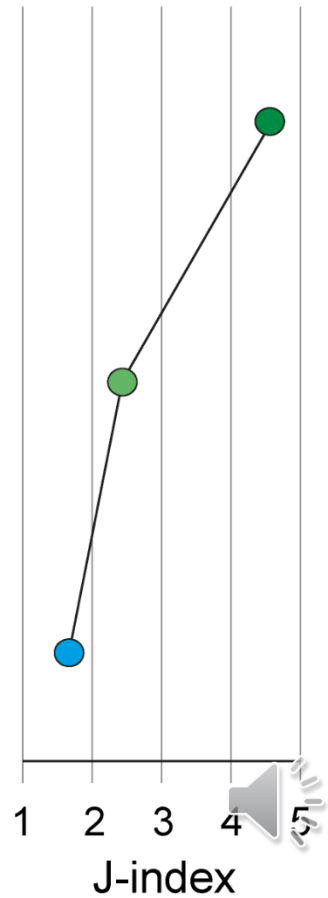


Leuconor.



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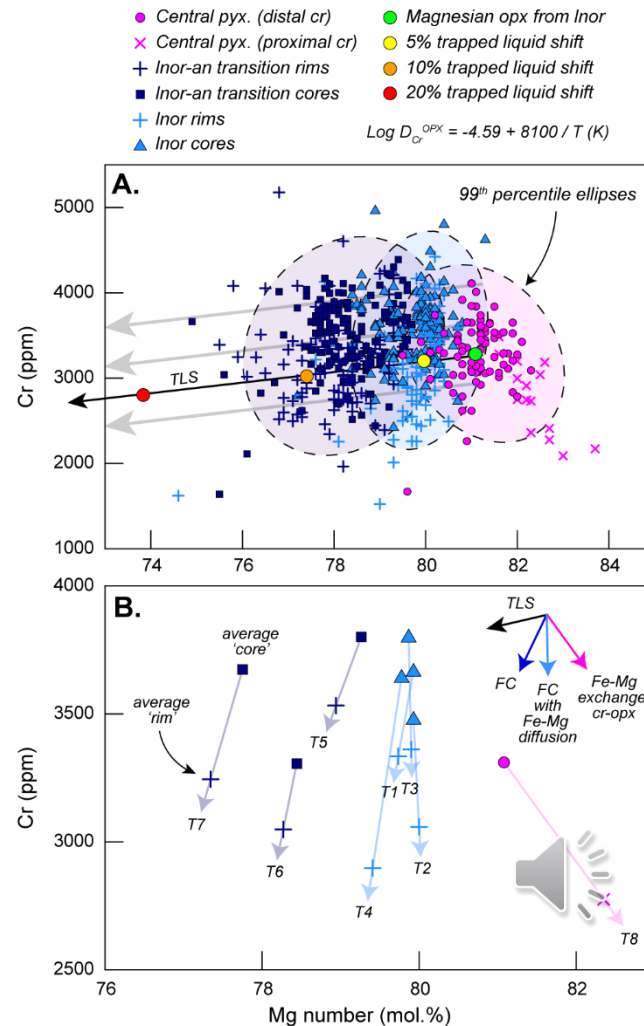
Pole figures of cumulus plagioclase



To the reef

Trapped liquid shift

- Orthopyroxene compositions consistent with 5-10% trapped liquid shift.
- Increased abundance of quartz, apatite, and clinopyroxene at contact.
- Diverse plagioclase zoning. *Perhaps coincidental.*





- Magma Chamber Simulator.
- B1 and 60B1:40B2 melts
- Leuconorite, norite, and melanorite.
- Each footwall lithology can be made under the right circumstances.





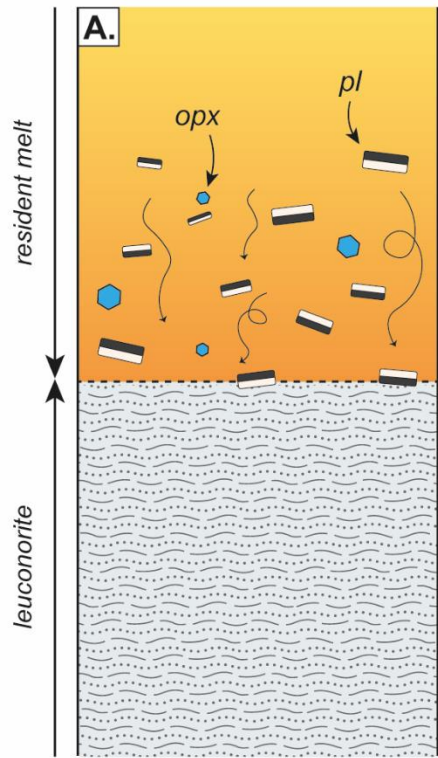
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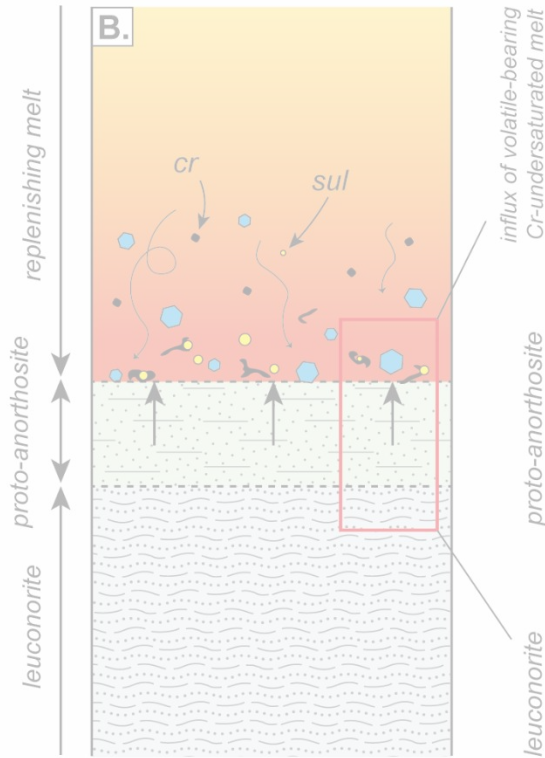


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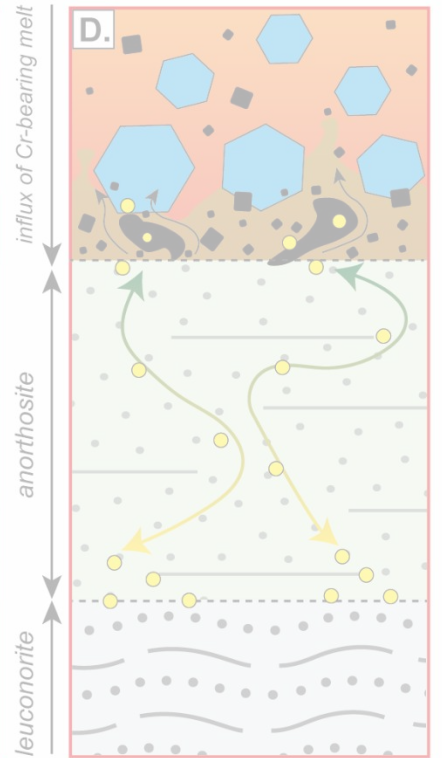
1) Differentiating resident melt



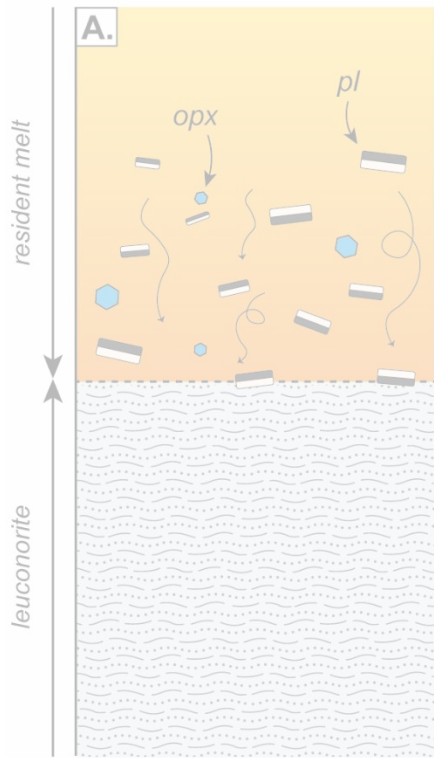
2) Replenishment by Cr-saturated primitive melt sheet



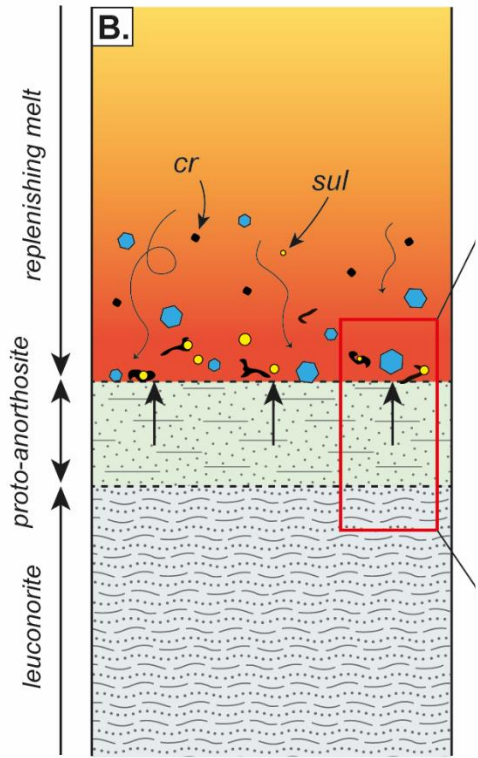
3) Liberation of evolved melts from resident cumulates



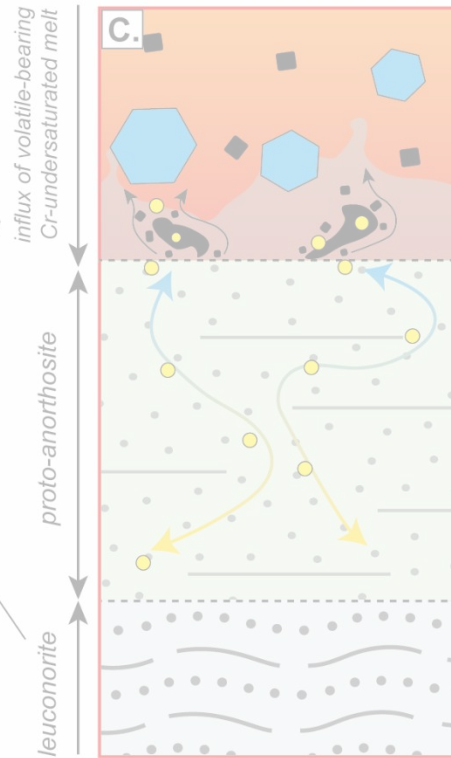
4) Liberation of silicate melt with concomitant sulfide percolation



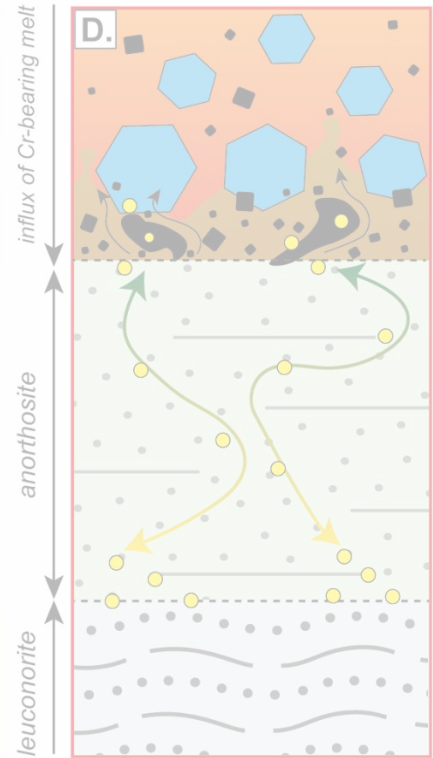
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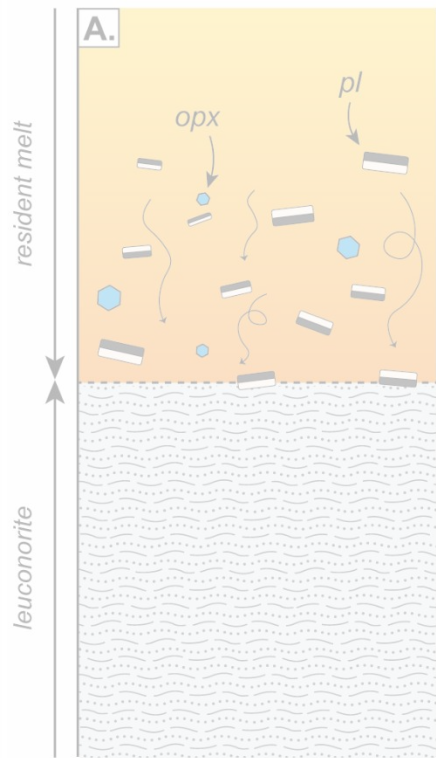
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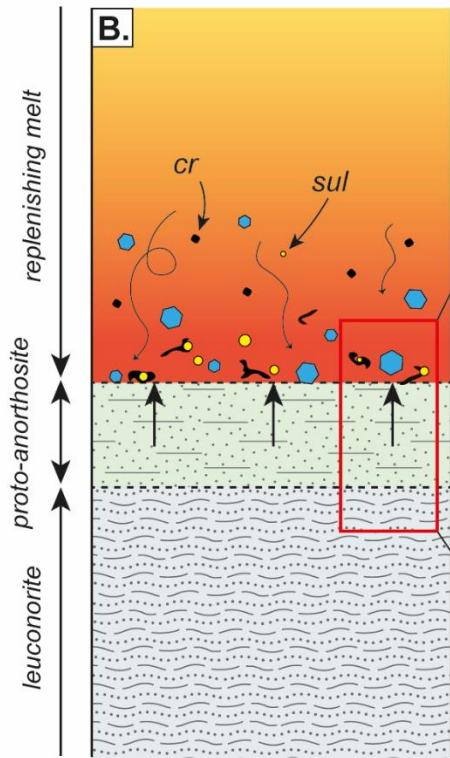
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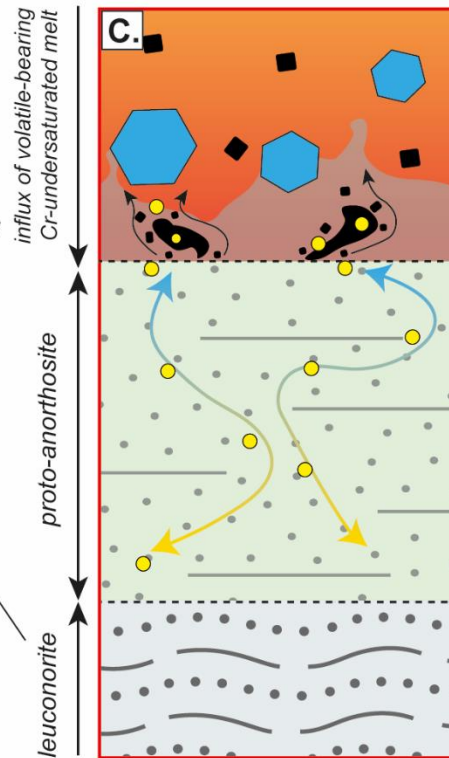
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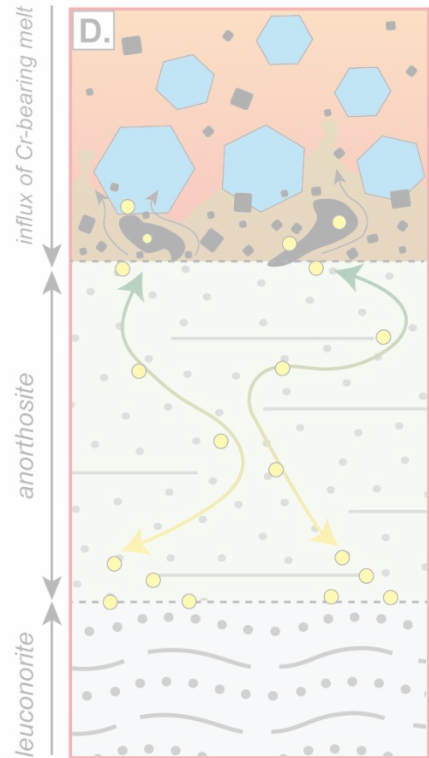
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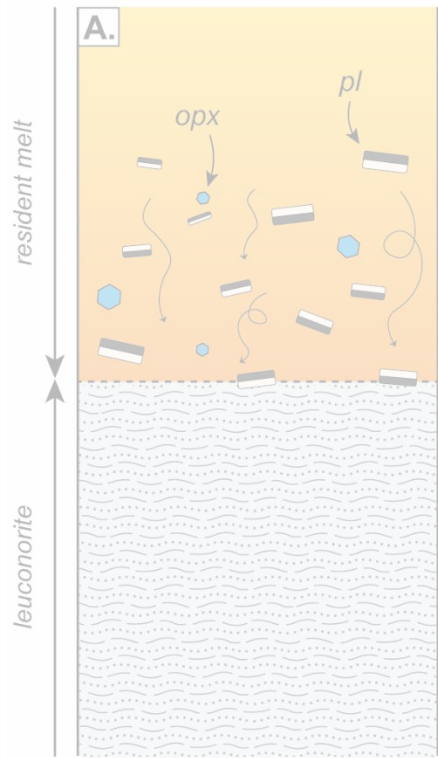
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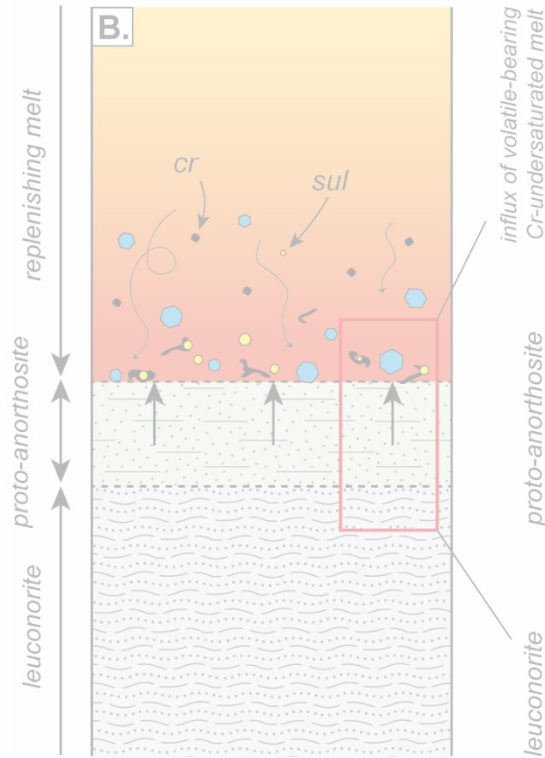
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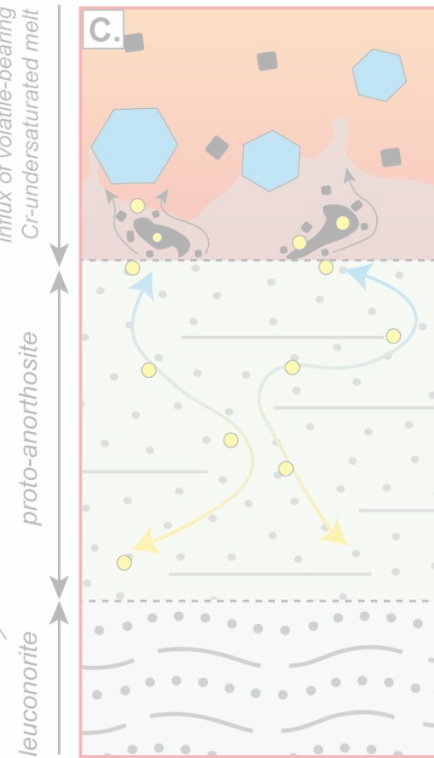
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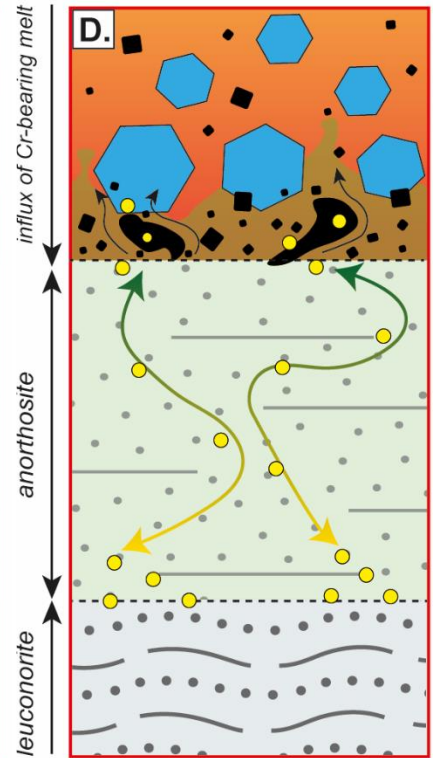
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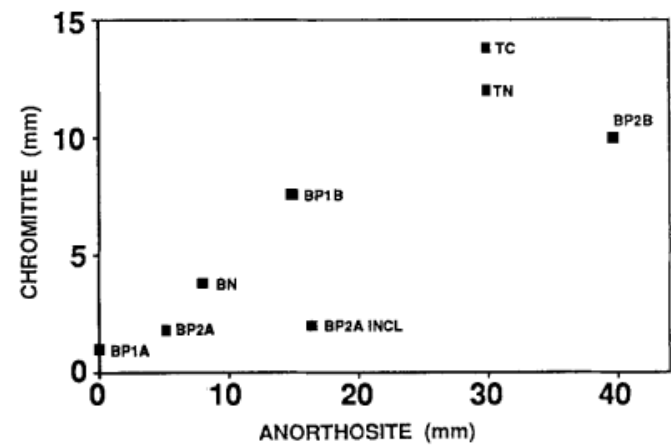
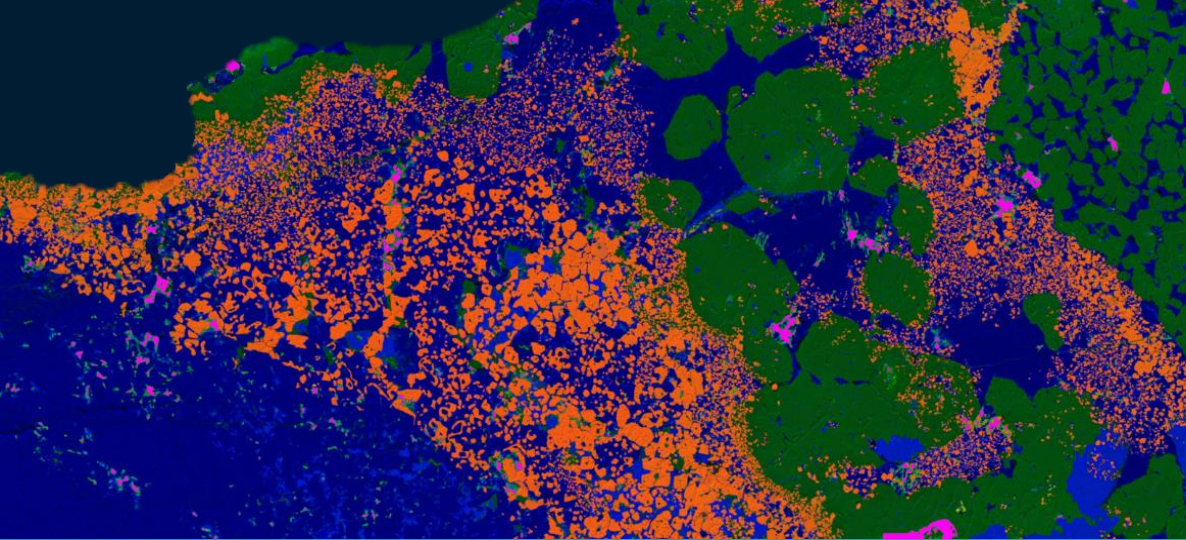


Fig. 4. The relationship between thickness of the basal chromitite seam and underlying anorthosite (“bleached zone”) as measured in thin section

Thank you!

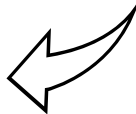


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Contact for questions and discussions!



Correlations in thickness of the lower chromitite and anorthosite (Nicholson and Mathez 1991)