Structural and Metamorphic Implications of the Final Emplacement of the Lyngen Nappe

A tectonometamorphic investigation of a nappe contact in the Northern Norwegian Caledonides

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/ OVERVIEW

-Juxtaposition of Greenschist-facies rocks (Lyngen Nappe) overlying Amphibolite- to Granulite-facies rocks (Nordmannvik Nappe)

-Wide, gradational, Greenschist-facies shear zone comprises boundary between the nappes

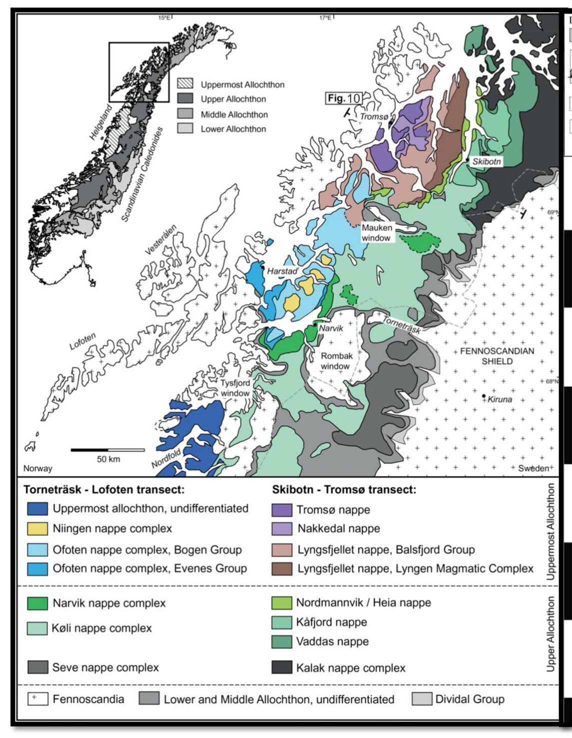
-Emplacement and deformation related to the Scandian phase of the Caledonian Orogeny

-Mineralogical and structural similarities between the shear zone phyllites and the rocks of the Nordmannvik Nappe below suggests a common origin and a retrograde metamorphic evolution

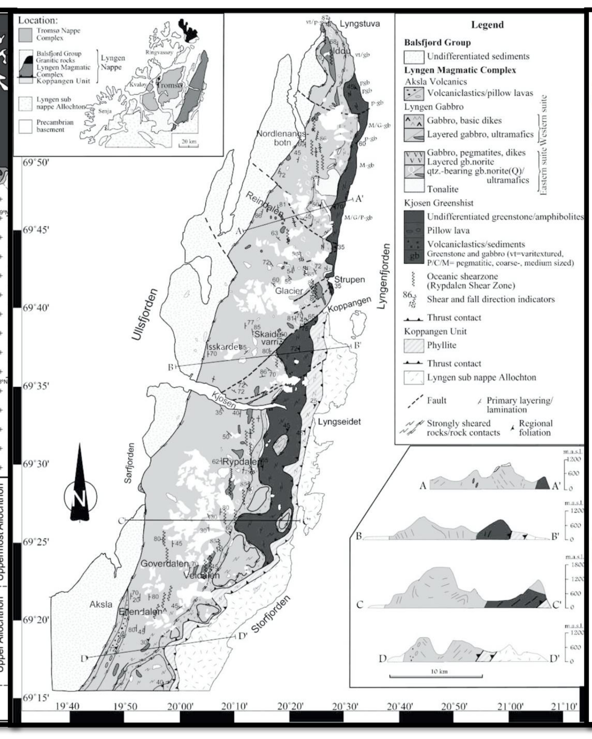
-Transitional schists at the base of the shear zone provide evidence for a prograde metamorphic history

-Micro- and macrostructural evidence points to an extensional, top-to-the-West, normal-faulting movement of the Lyngen Nappe during final emplacement

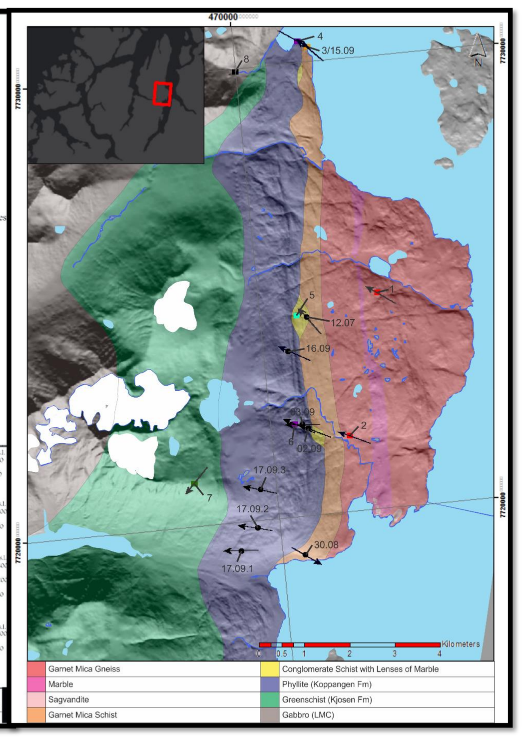
/ CONTEXT & LOCATION



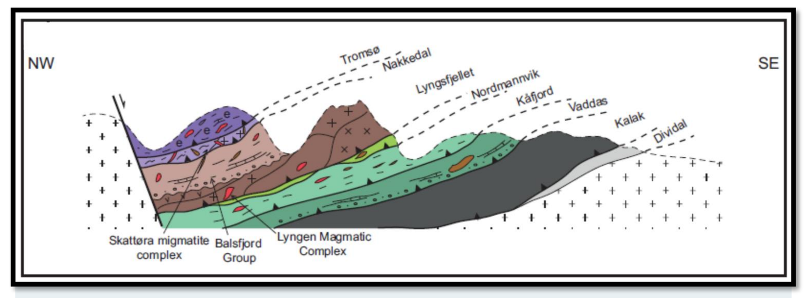
Regional map and cross section showing the tectonostratigraphy of the Northern Norwegian Caledonides, after Augland et al., 2014.



Map of the Lyngen Peninsula and its geologic units, from Kvassnes et al., 2004



Geologic map of the primary study area, showing mapped units, sample locations, and kinematic indicators.



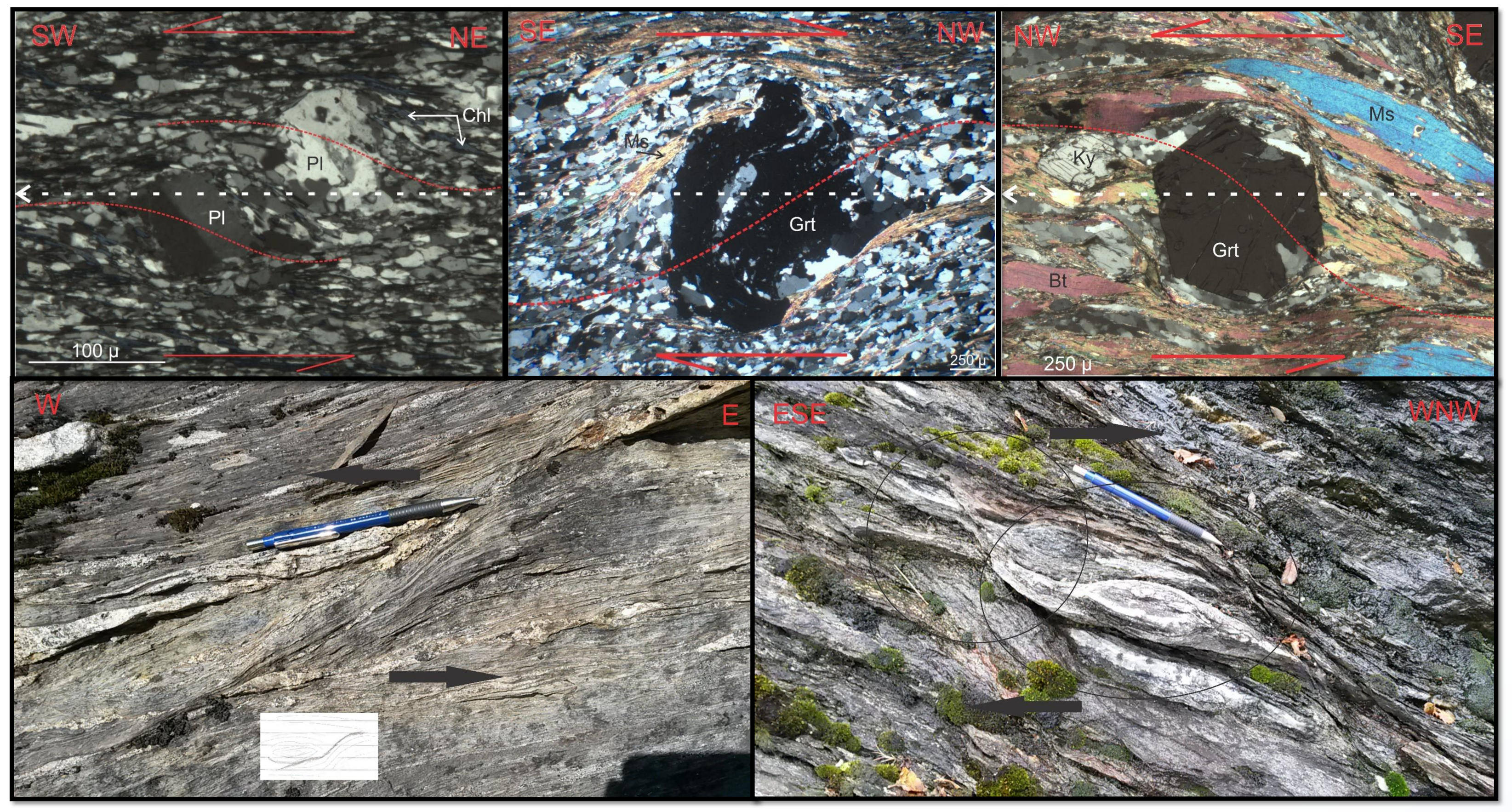
Key Questions

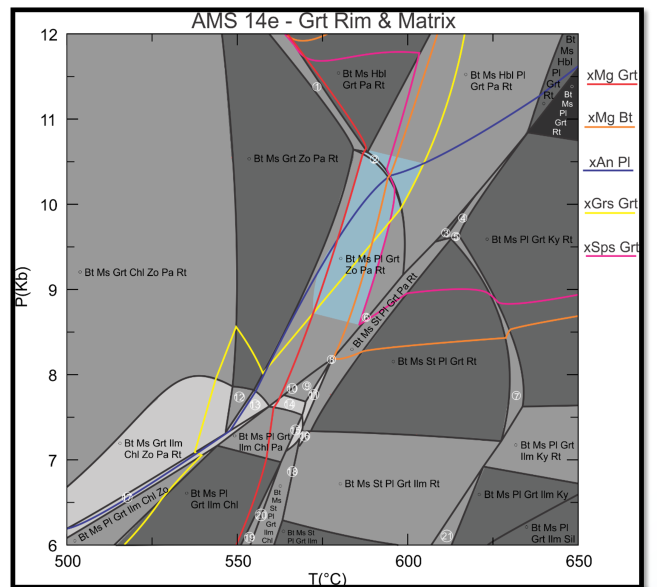
-Which tectonic model best accounts for the observed structural and petrological features?

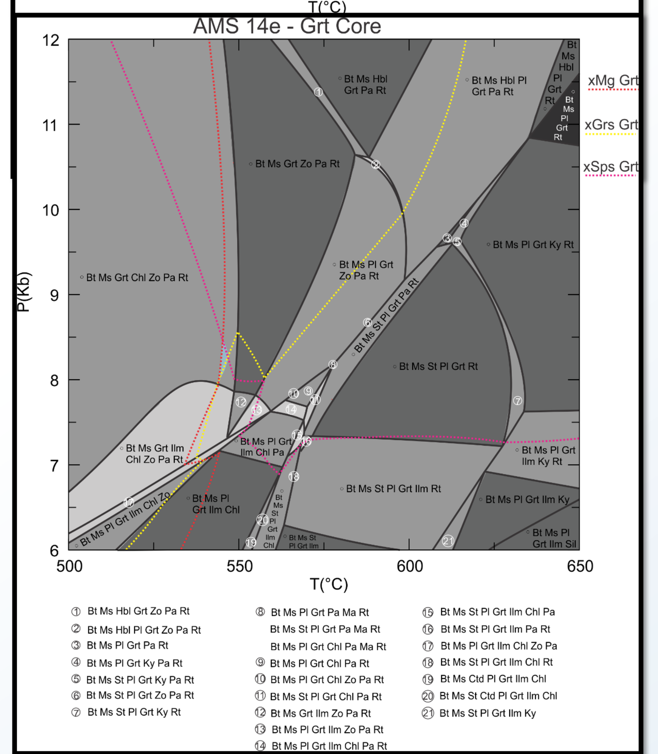
-Are the shear zone units retrograde or prograde derived rocks?

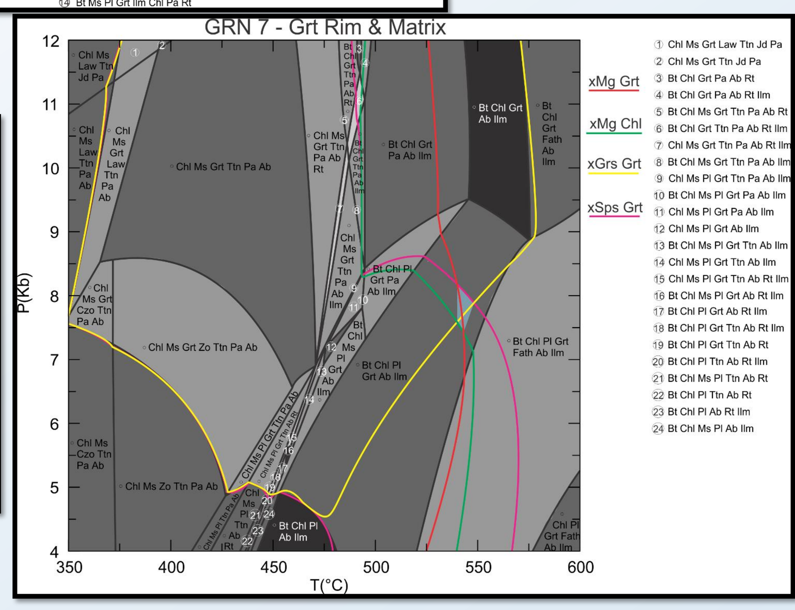
-Did these rocks originate from either of the bounding nappes?

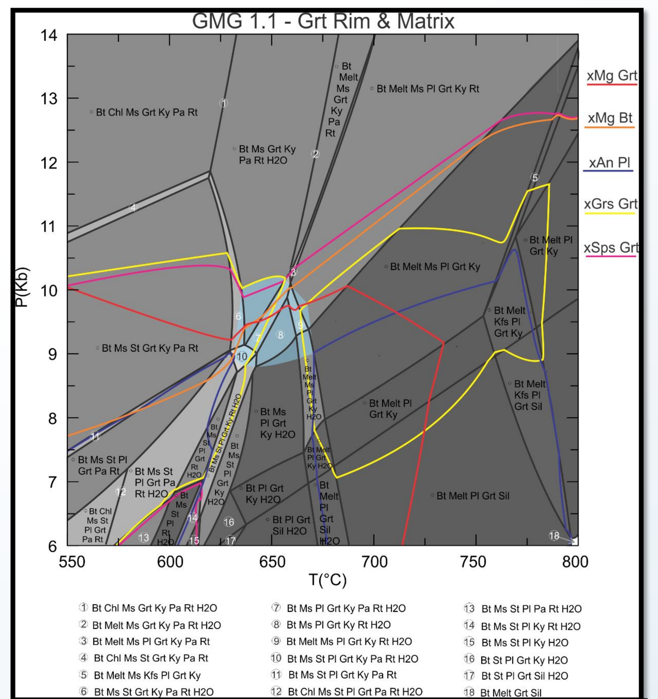
/ STRUCTURE, KINEMATICS, & PETROLOGY

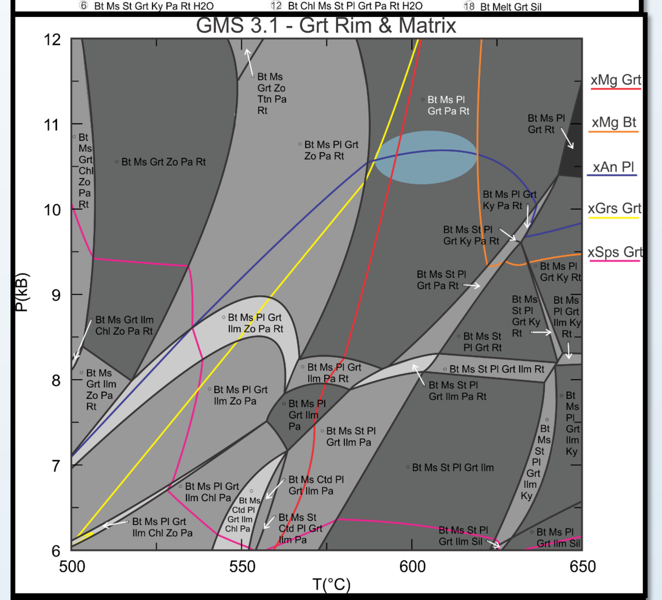


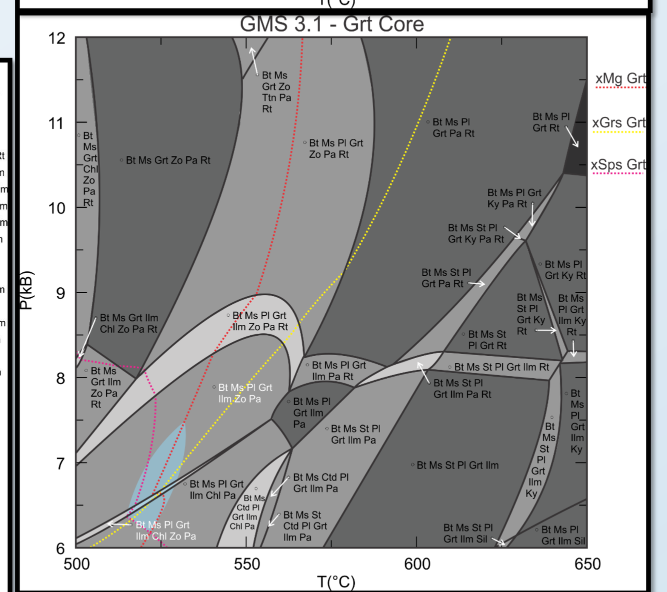


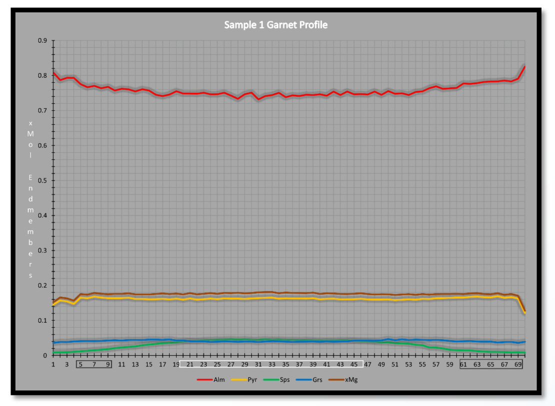


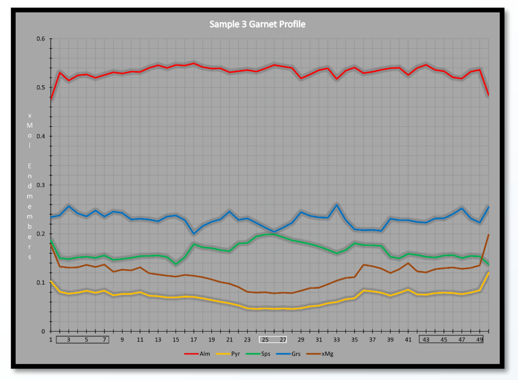


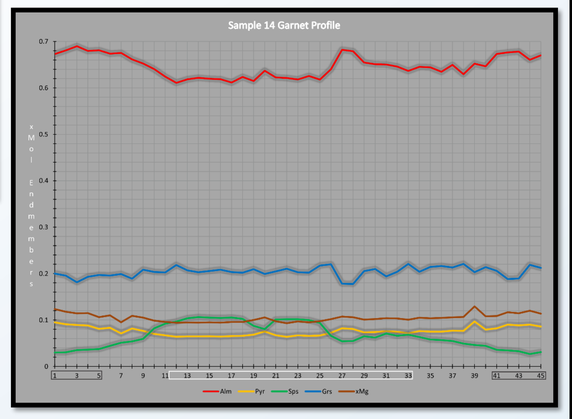






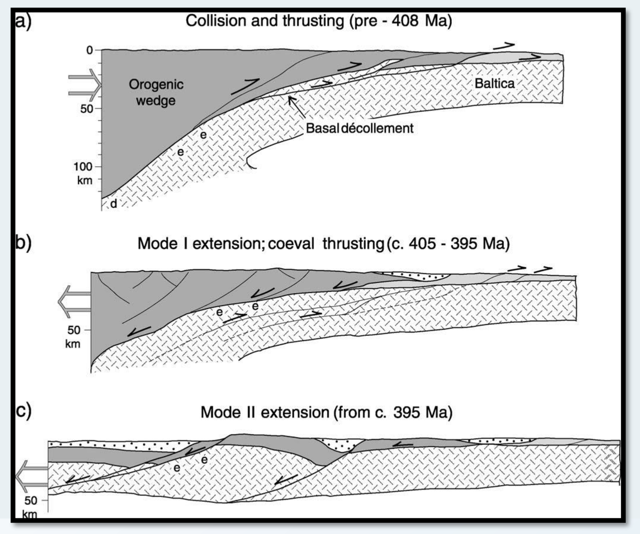






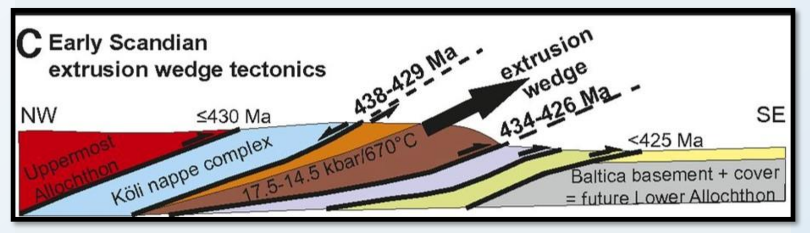
/ TECTONIC MODELS

Top-to-the-west shear sense indicators in the shear zone point to a normal faulting movement sense for the Lyngen Nappe. The simplest model to explain the findings of this project is a low-angle normal faulting tectonic scenario, as seen below in a figure from Roberts, 2003.



/ CRUSTAL EXTRUSION

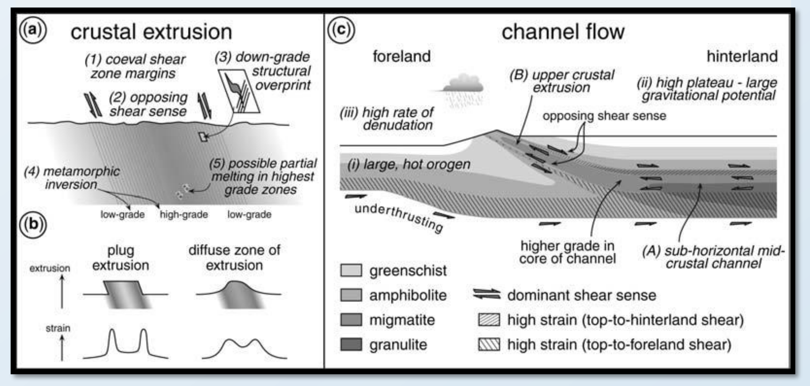
A crustal extrusion tectonic model may help to explain the opposing shear senses at the top and base of the shear zone. Here, the bounding faults define a wedge and converge downwards. The motion along these faults occur simultaneously.



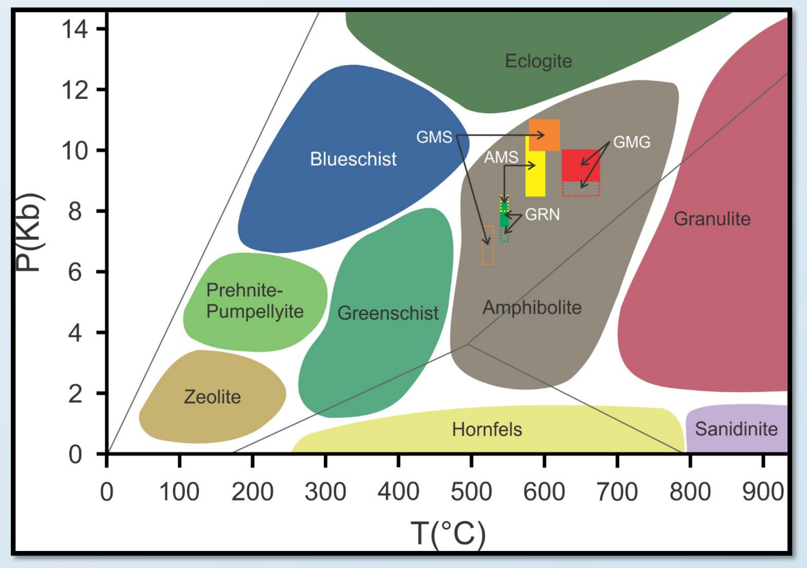
Schematic cross-section of Caledonian nappes and their boundary shear zone kinematics, from Grimmer et al., 2015.

/ CHANNEL FLOW

Channel flow, also proposed in the Himalayas, occurs during crustal extrusion, and is driven by a horizontal gradient in lithostatic pressure. The bounding faults here are nearly symmetric.



Schematic diagrams showing features of channel flow in relation to crustal extrusion, from Jones et al., 2006.



References

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