

# Amphibole CPO in retrograded gabbro from the Lyngen Magmatic Complex (Northern Scandinavian Caledonides, Norway)

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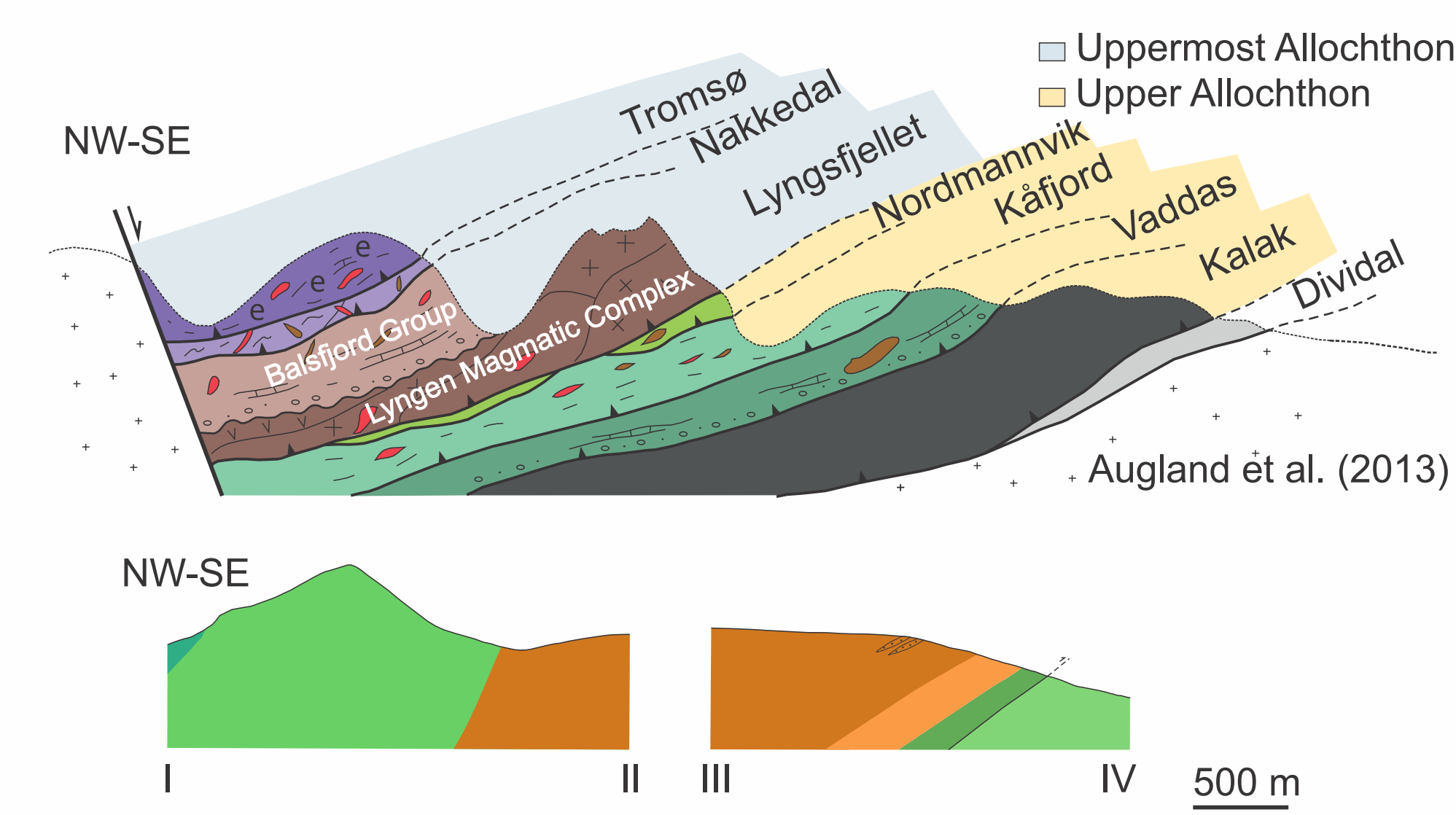


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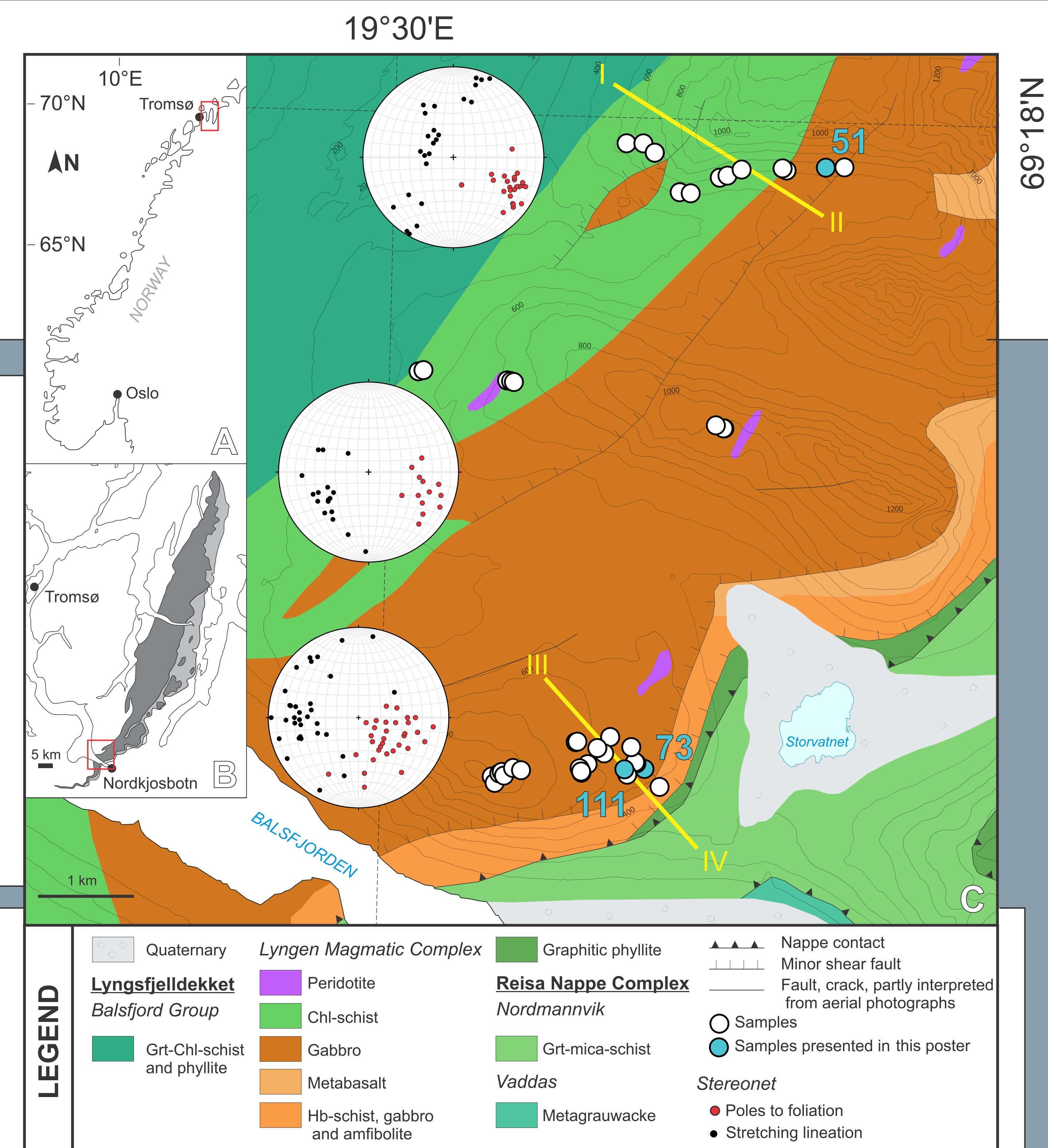
## 1. MOTIVATION

- Natural mafic rocks such as gabbro are composed by strong minerals (pyroxenes and plagioclases).
- At low temperature conditions, viscous deformation mechanisms can still operate in the deformation of mafic rocks. However, due to temperature constrains, crystal plastic mechanisms are not active. Instead, simultaneous mineral reactions may facilitate deformation.
- We aim to explore the interrelationship between mineral reactions and deformation at low temperature conditions. For instance, by determining if Crystal Preferred Orientation (CPO) can be generated by preferential mineral growth.
- Here we present textural data of retrograded gabbro of the Lyngen Magmatic Complex (LMC). We analysed the CPO of each phase of three representative samples at different metamorphic grades. Location of the samples is indicated in the Map. Modelling was done by using MTEX toolbox in MATLAB.

## 2. GEOLOGICAL SETTING

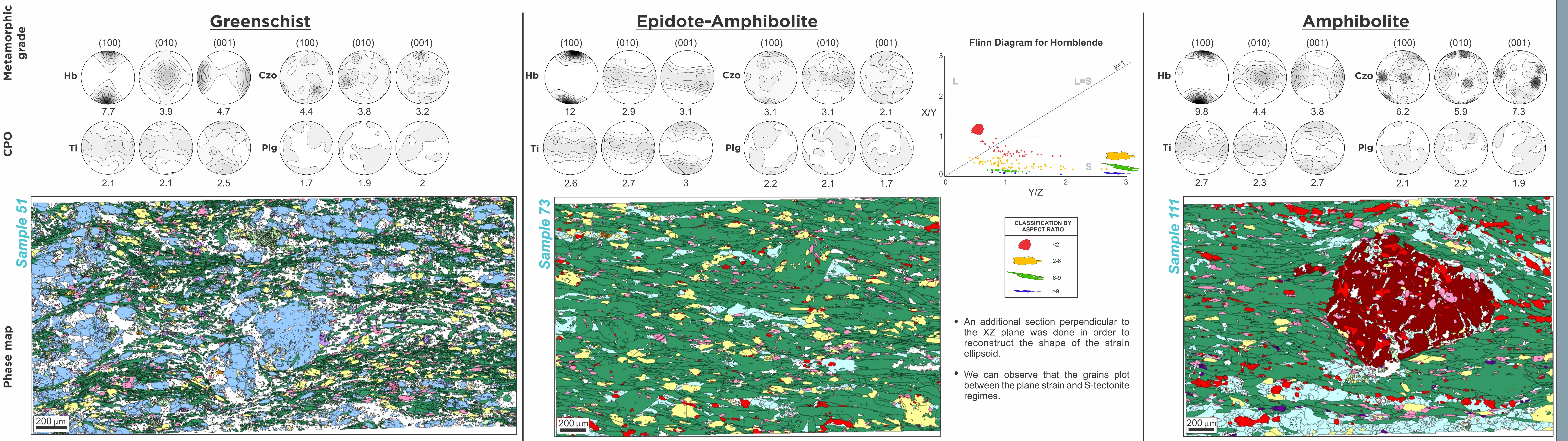


- The Nord Norwegian Caledonides are formed by a series of thrust Nappes, with transport direction towards the SE. We focus on the Lyngsfjellet Nappe, the base of the Uppermost Allochthon, which overlays the Nordmannvik with an out-of-sequence thrust.
- The LMC constitutes the bottom unit of the Lyngsfjellet Nappe, and contains the gabbroic rocks used in this study. The rocks are part of the oceanic crust, interpreted as part of a fore-arc or back-arc basin.
- The gabbro from the LMC has been metamorphosed. At the base (geographically in the E), the rocks are overprinted by epidote-amphibolite mineral assemblages, locally reaching lower amphibolite m.f. We interpret the latter as relict lenses which preserves the higher metamorphic grade. At the top of the unit (geographically in the W), the rocks present greenschist facies assemblages. Thus, there is a decreasing metamorphic grade towards the top of the unit (W).
- The rocks are strongly deformed at low temperature conditions. In addition, mylonites are present in the outer parts of the gabbro. An increasing steepness of the foliation is recorded towards the top of the unit (W).



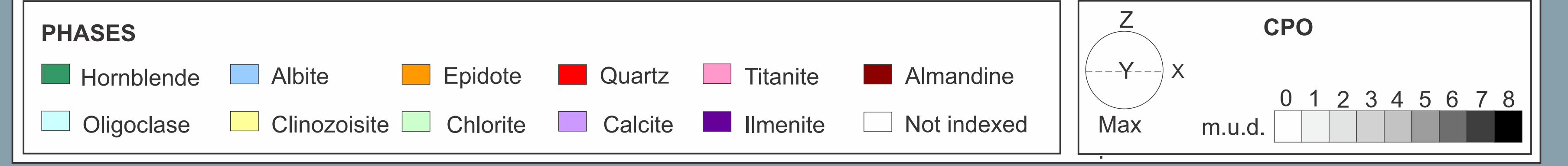
## 3. REPRESENTATIVE MICROSTRUCTURES

- Hornblende (Hb) shows a well developed CPO in all three samples, and it records the strongest CPO. Maximum clusters are perpendicular to foliation in (100). Girdles are parallel to foliation in (010) and (001), with clusters showing 90° relationship: [010] perpendicular and [001] parallel to the lineation.
- Titanite (Ti) shows a well defined CPO in all three samples, but less strong compared to Hb. Maximum clusters are perpendicular to foliation in (001), and parallel to foliation in (100) and (010).
- Clinzoisite (Czo) shows a well developed CPO in the epidote-amphibolite sample. This texture is less evident in the other samples. However, 90° relationship is still visible in the greenschist m.f. sample and could perhaps suggest the presence of a CPO.
- The remaining phases do not show CPO.



## 4. CONCLUSIONS

- Both Hb and Ti have a well defined CPO, indicating that they were deformed at the same time. Ti is inferred to be formed during the breakdown of the original pyroxenes. Therefore, we estimate that dating of Ti would give us the maximum age for the beginning of the deformation. Future work includes the dating of Ti.
- The lack of dynamic recrystallisation microstructures and CPO in Plagioclase (Plg) and Quartz (Qtz) indicates absence of crystal plastic deformation. We explore the possibility of preferential growth by diffusion creep as the responsible mechanism for the CPO of the phases. Rigid body rotation is excluded due to the high percentage of Amphibole and the lack of a matrix where particles can rotate in.
- Flinn diagram indicates that most Amphiboles have a "platy" crystal form. We attribute rotation in the YX plane as responsible for the girdles in (010) and (001).



References: Augland, L.E., Andresen, A., Casser, D., Steltenpohl, M.G., 2015. Early Ordovician to Silurian evolution of exotic terranes in the Scandinavian Caledonides of the Ofoten-Troms area - terrane characterization and correlation based on new U-Pb zircon ages and Lu-Hf isotopic data. Geological Society, London, Special Publications, 390(1), 655-678.