

Asymmetric extension and subsequent unroofing of the Pohorje pluton at the western margin of the Pannonian basin, NE Slovenia.



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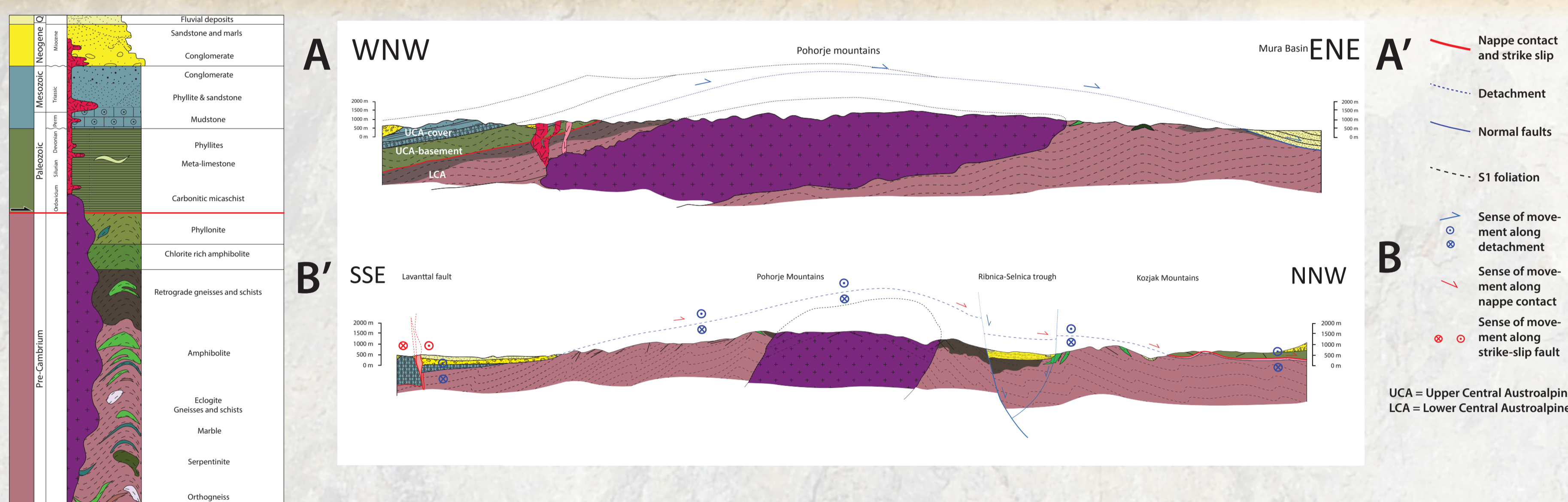
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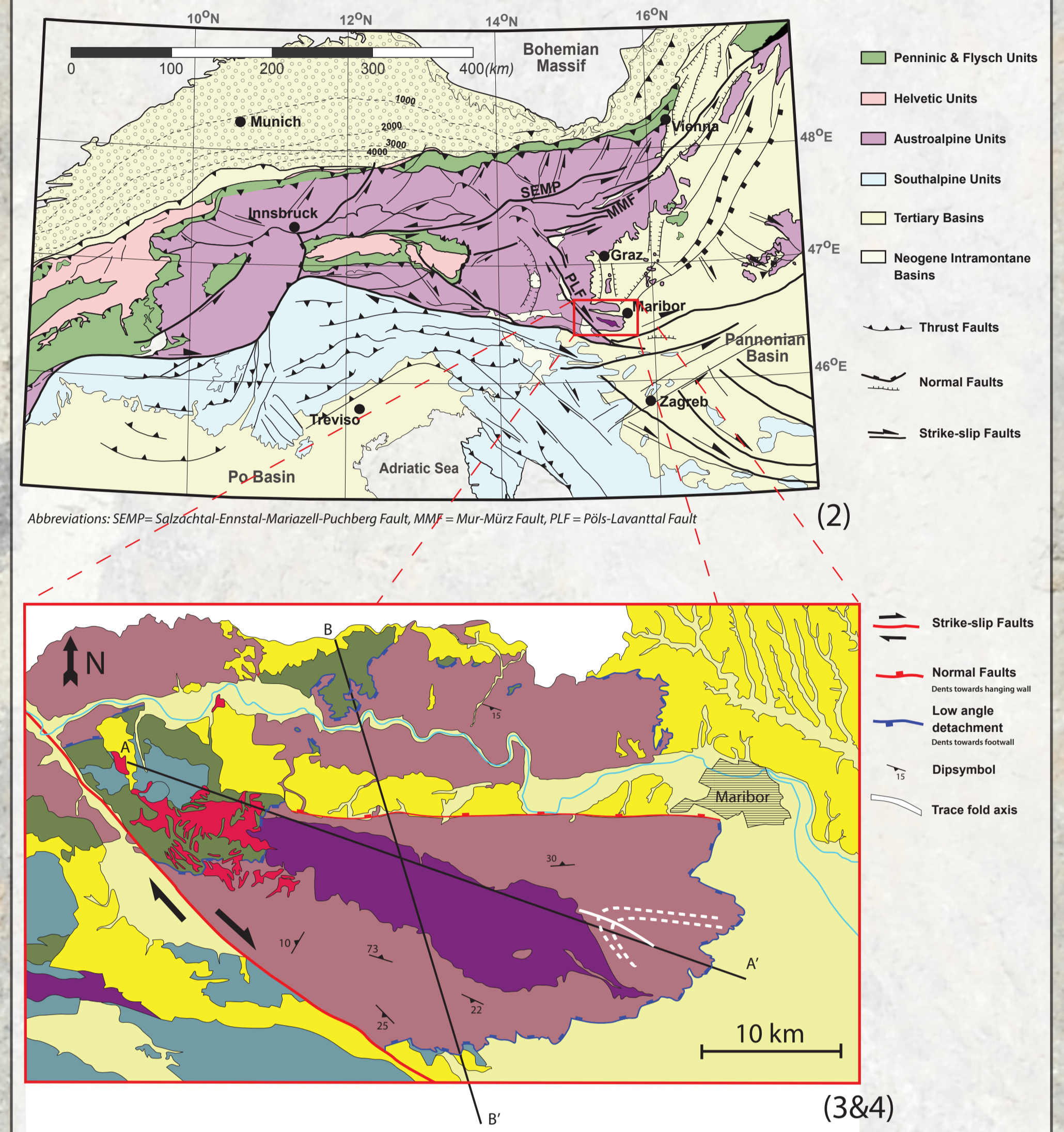
Introduction

The Pohorje mountains in northern Slovenia consist of two nappes of Austroalpine metamorphic rocks. This nappe stack has been intruded by a granodioritic-tonalitic pluton, which is situated in the center of the mountain range. U-Pb data constrain a Miocene (18.6 ± 0.11 Ma) age of crystallization at mid-crustal levels. (Fodor et al., 2008)
Emplacement of the Pohorje pluton was followed by rapid cooling related to its exhumation to the surface within approximately 3 Myrs. Although the temperature-time evolution of the pluton and surrounding rocks is well known, the mechanism by which the igneous rocks got exhumed is still debated. This study addresses this fundamental question through detailed field- and micro structural analysis.

Tectono-stratigraphic column and profiles

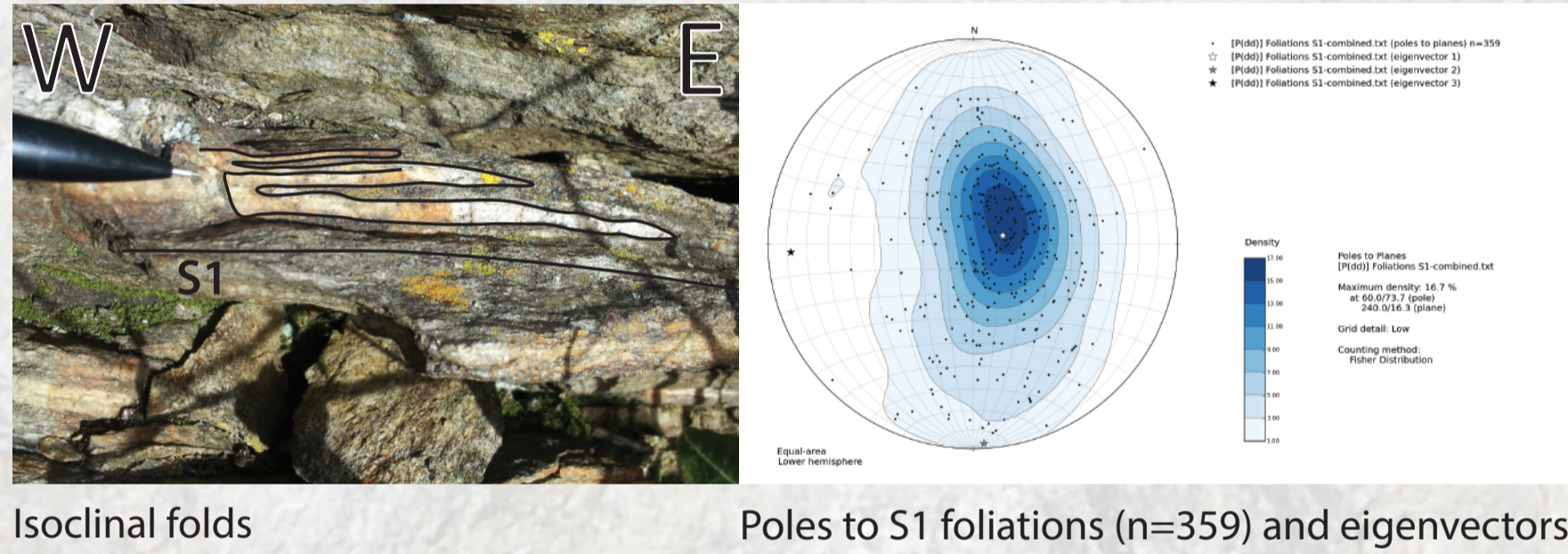


Geological background

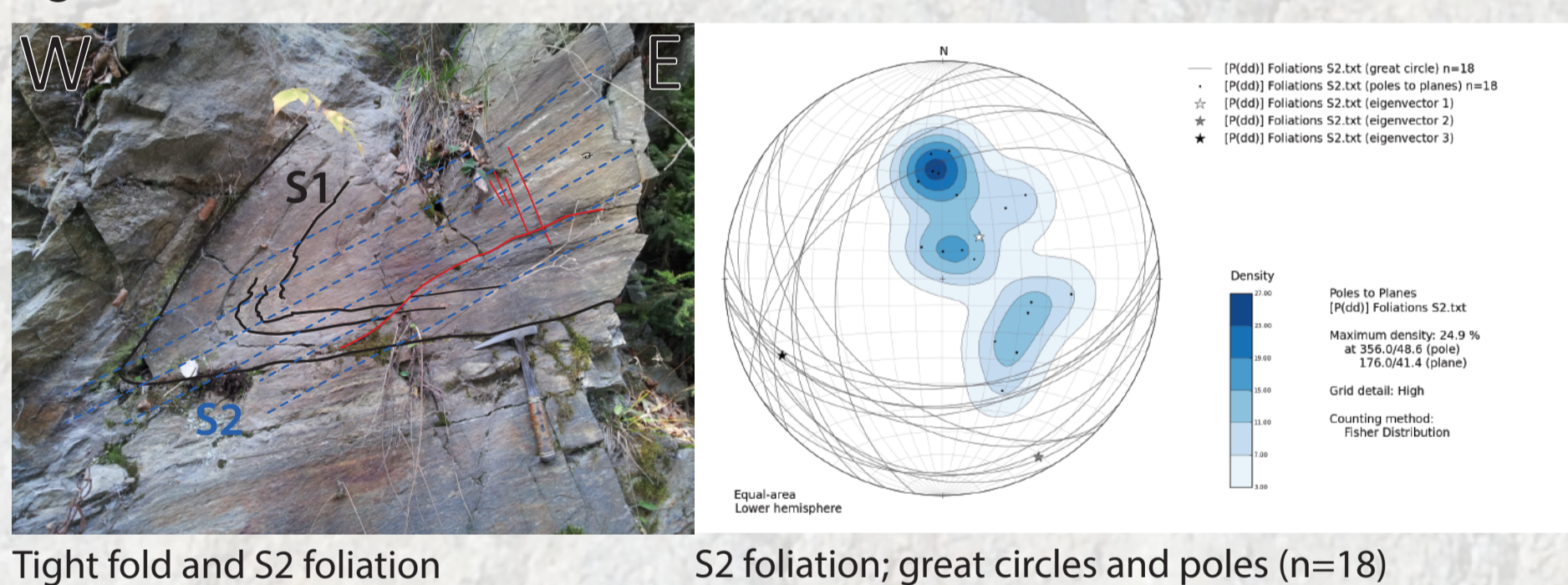


Field results

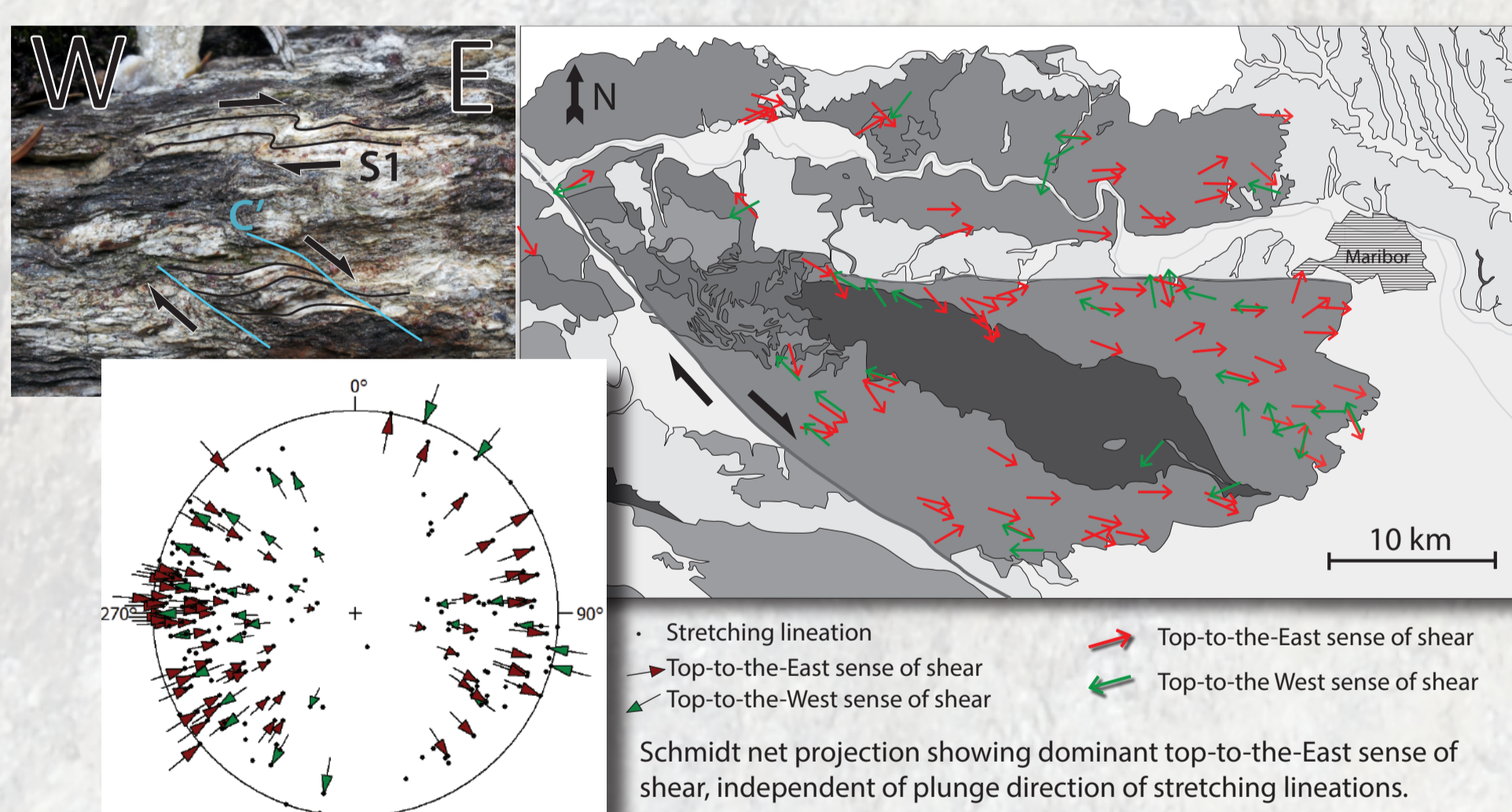
D1: Recumbent isoclinal folds and S1 foliation



D2: Tight folds and S2 foliation



D3: Top to the east shearing, brittle faulting and large scale folding

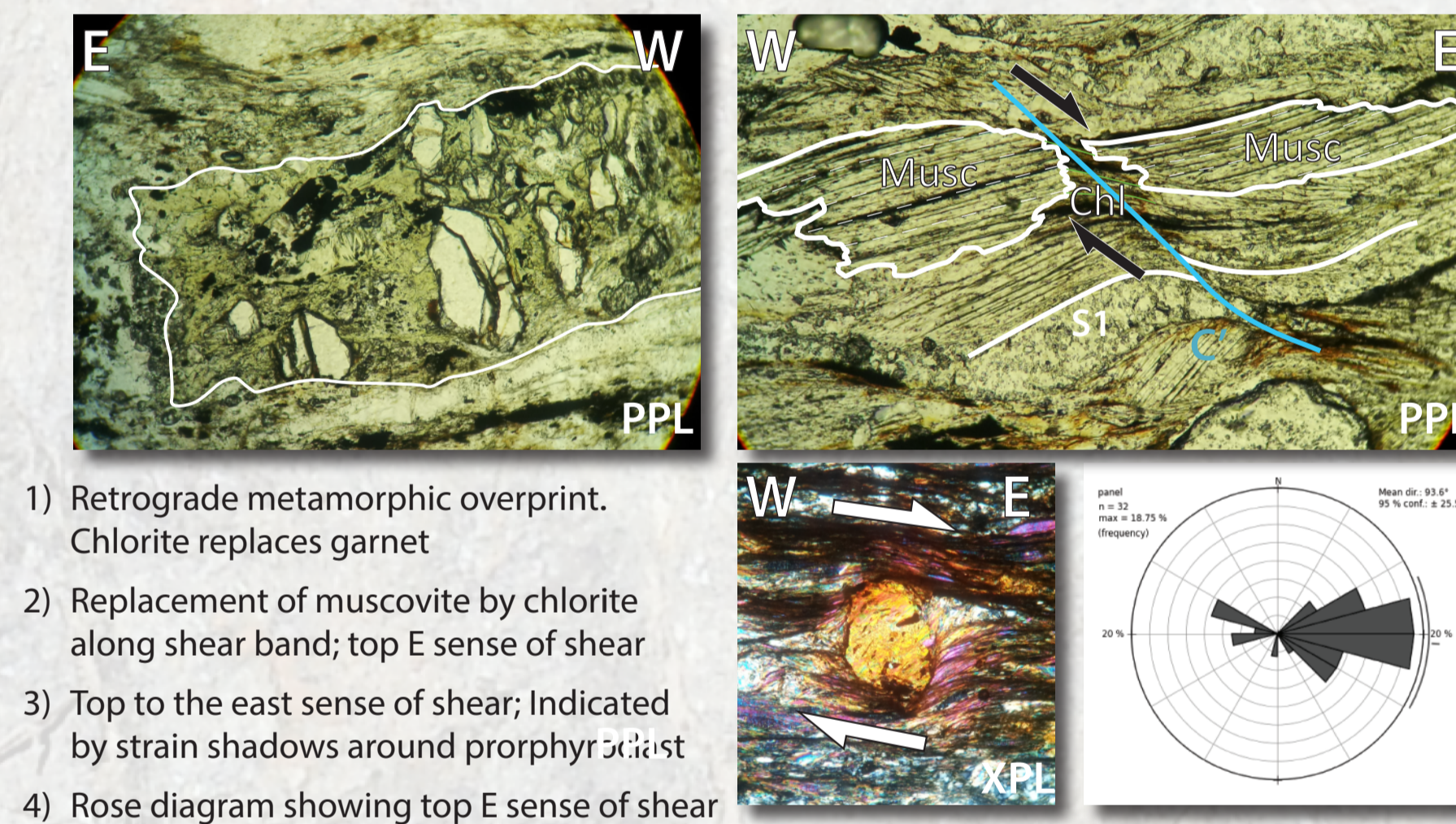


Microstructures & metamorphism

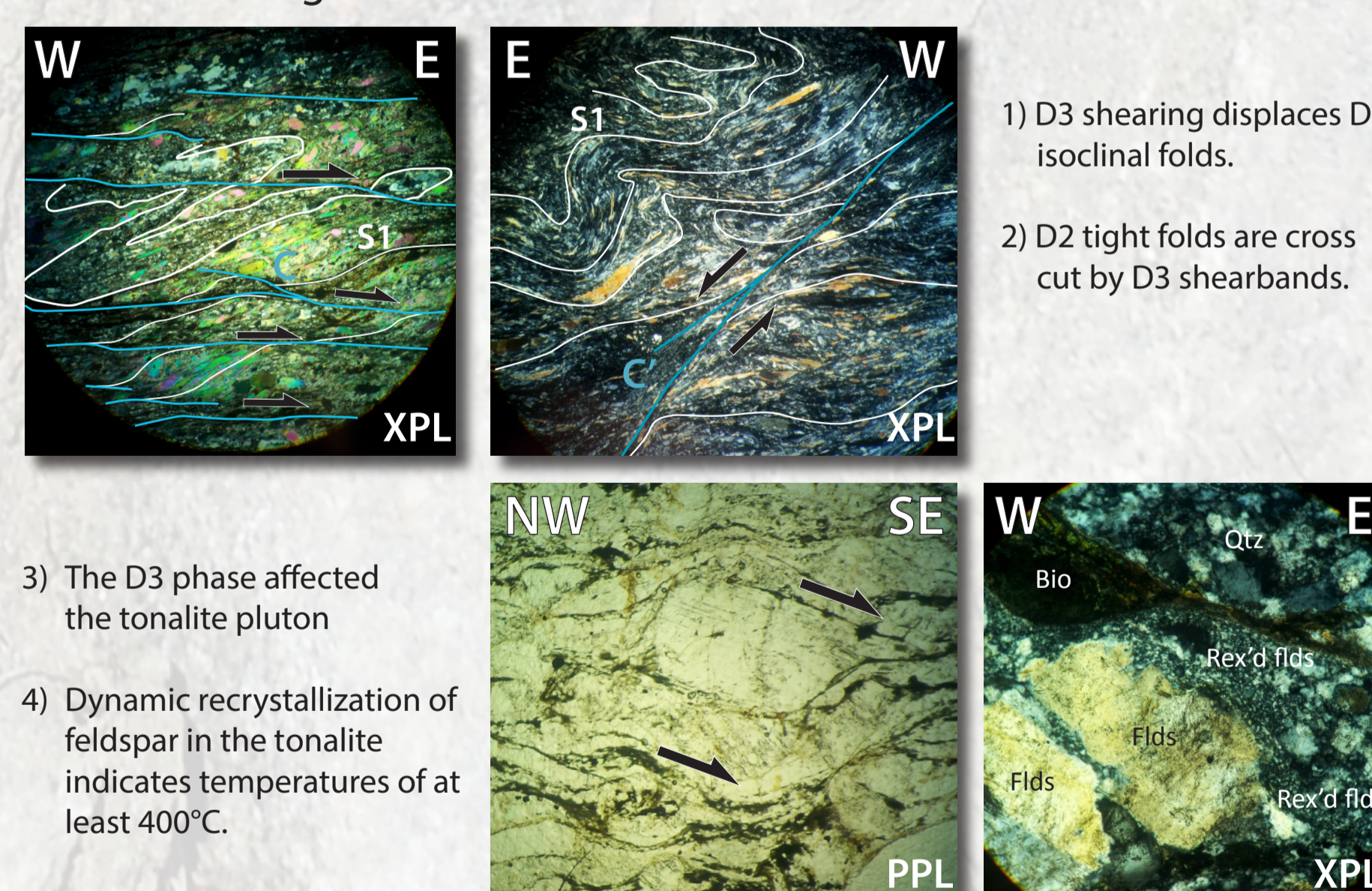
M1: Peak metamorphic conditions

A high grade metamorphic mineral assemblage consists of quartz, plagioclase, biotite, muscovite, garnet, staurolite, kyanite and opx, representing upper Amphibolite facies metamorphism.

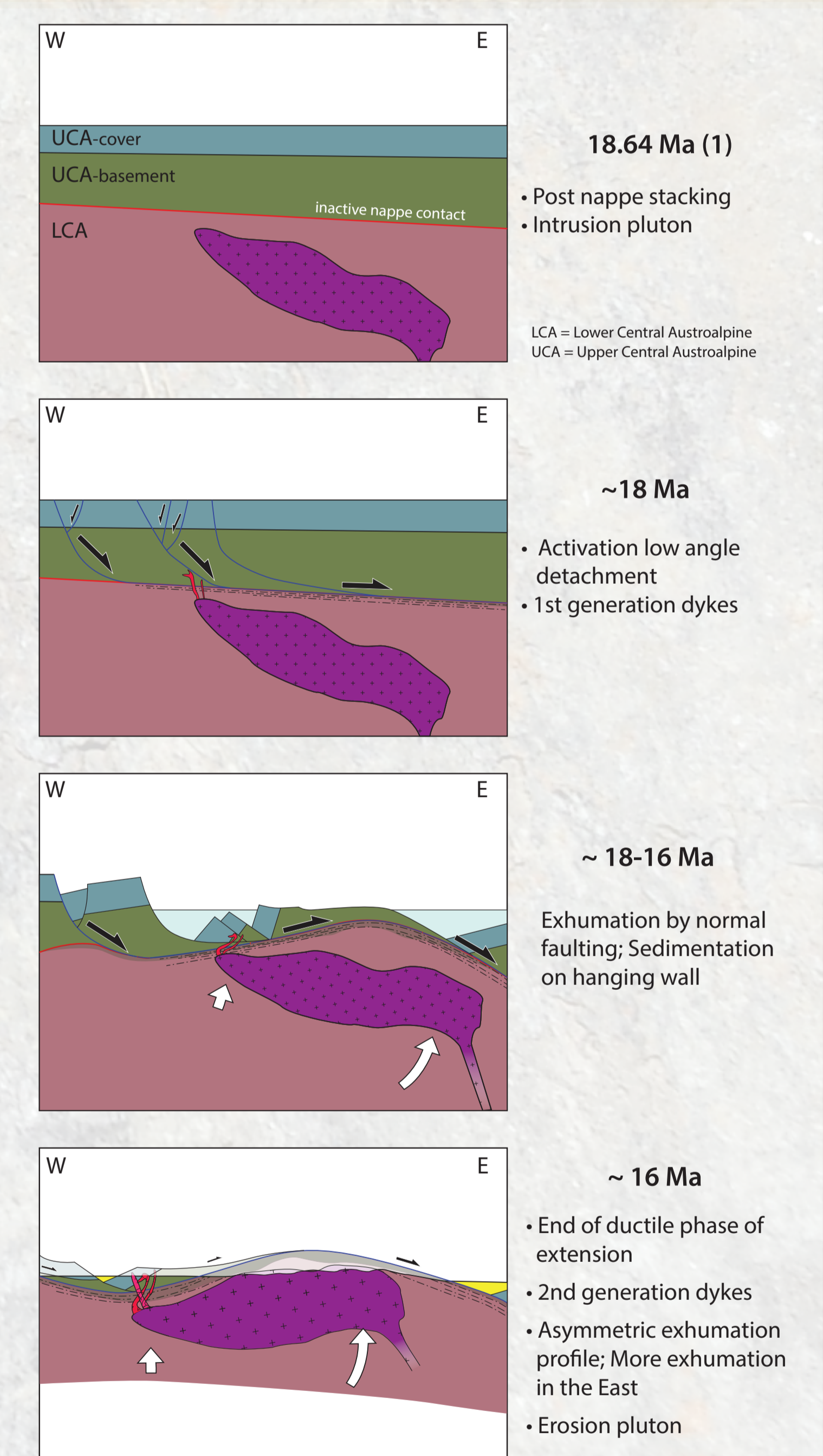
D3 deformation under retrograde metamorphism (M2)



Relative timing of deformation



Interpretation



Summary

- D1 & D2 structures overprinted by D3 shearing event
- Dominant top-to-the-East sense of shear (D3)
- D3 associated with retrograde greenschist facies metamorphism
- Retrograde metamorphism most intensive near the detachment
- D3 affected the Tonalite pluton
- Differential amount of exhumation: increasing amount of exhumation to the East
- East-west striking foldaxes

Conclusions

From the field kinematics combined with the microstructural analysis we conclude that the Pohorje pluton was exhumed by a low-angle detachment with top to the east kinematics. The detachment represents the reactivated Cretaceous nappe contact between the Upper Central Austroalpine and the Lower Central Austroalpine nappe. Shearing occurred under greenschist facies conditions and led to a strong retrograde overprint of Cretaceous amphibolite grade metamorphic assemblages. We link low angle normal faulting to the opening of the Pannonian basin which induced eastward directed extension in the Miocene. The domal shape of the pluton is amplified by synchronous shortening related to northward indentation of Adria during exhumation of the pluton.