

# Local variations of metamorphic record from compositionally heterogeneous rocks: Inferences on exhumation processes of (U)HP-HT rocks (Cima di Gagnone, Adula-Cima Lunga unit)

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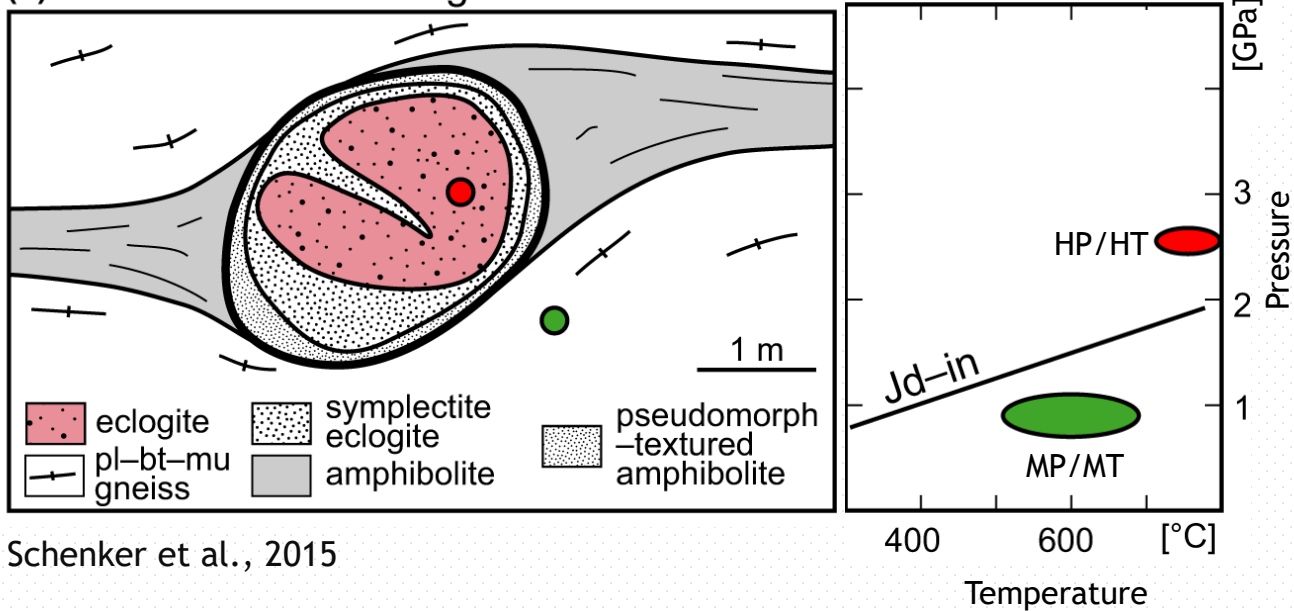




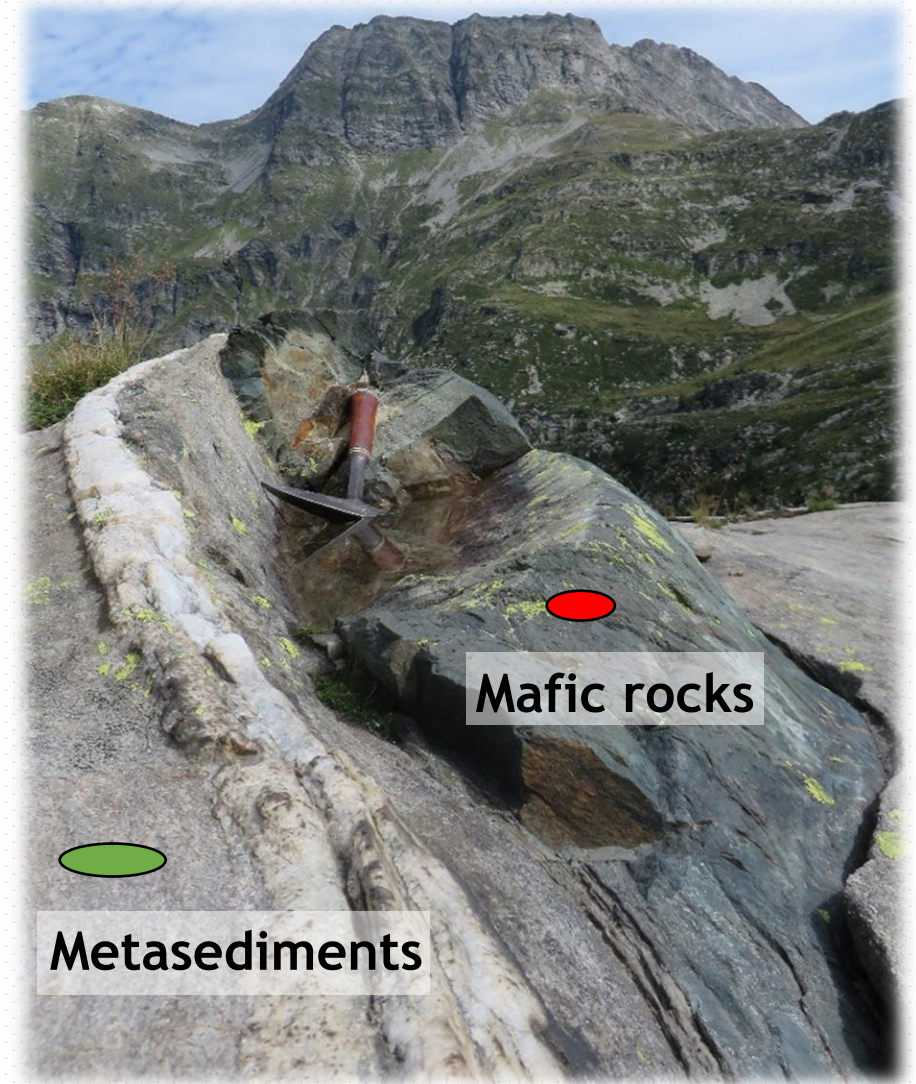
# Introduction

How different paired rock types  
record contrasting metamorphic conditions  
despite a structural coherence?

(b) Adula — Cima di Gagnone

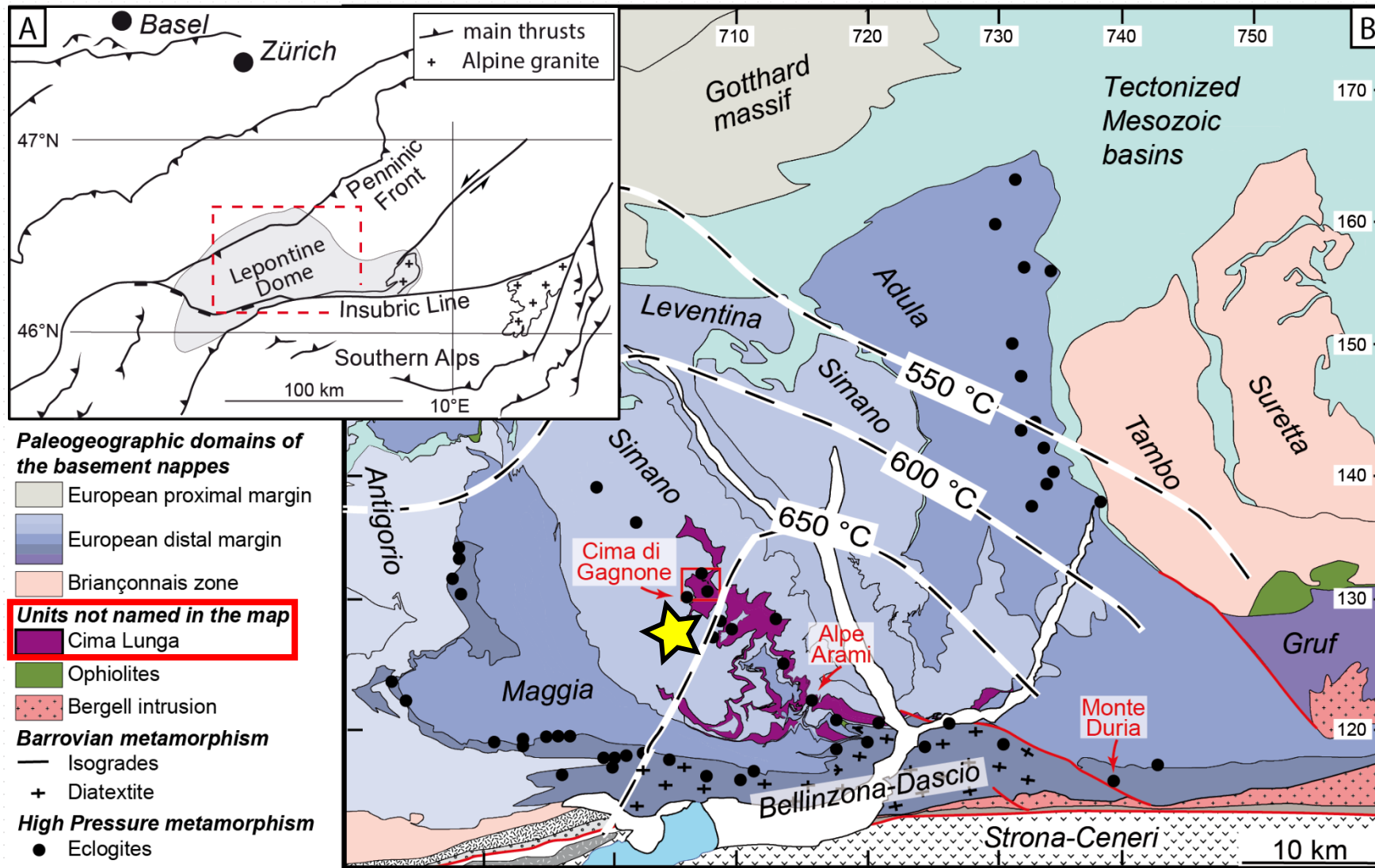


Schenker et al., 2015



Outcrop in Trescolmen, Swiss Alps (S. Corvò)

# Cima di Gagnone area (Central Alps)



The **Cima di Gagnone** area represents an example of **(U)HP** and **HT ultramafic** lenses (UM) enveloped within amphibolite facies **(MP-MT) metasediments** as the result of the Alpine subduction and collision deformation phases.

The UM rocks have been intensively investigated; less attention has been devoted to their **host rocks**.

Corvò et al., (2021) - *Lithos*



# *Aims*

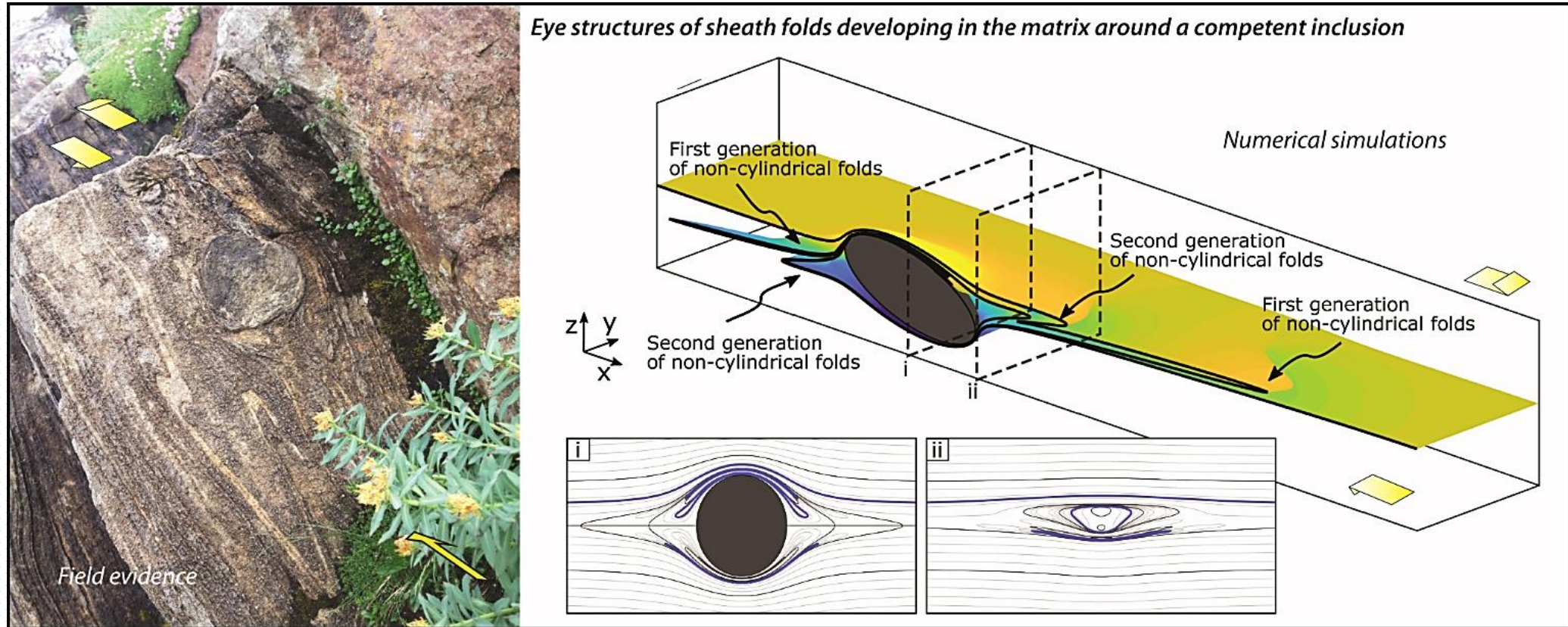


- 1) Constraining the P-T-t-D-X path of micaschists**
- 2) Comparing the P-T-t-D conditions between micaschists and ultramafics**
- 3) Shed light on the processes at the compositional boundary**
- 4) Discuss these new data in relation to the exhumation models**





# Field observations



**Metasediments and UM share the same deformation features.**

**Sheath folds in the weak metasediments enveloping more competent ultramafic lenses that experience oscillation/rotation.**

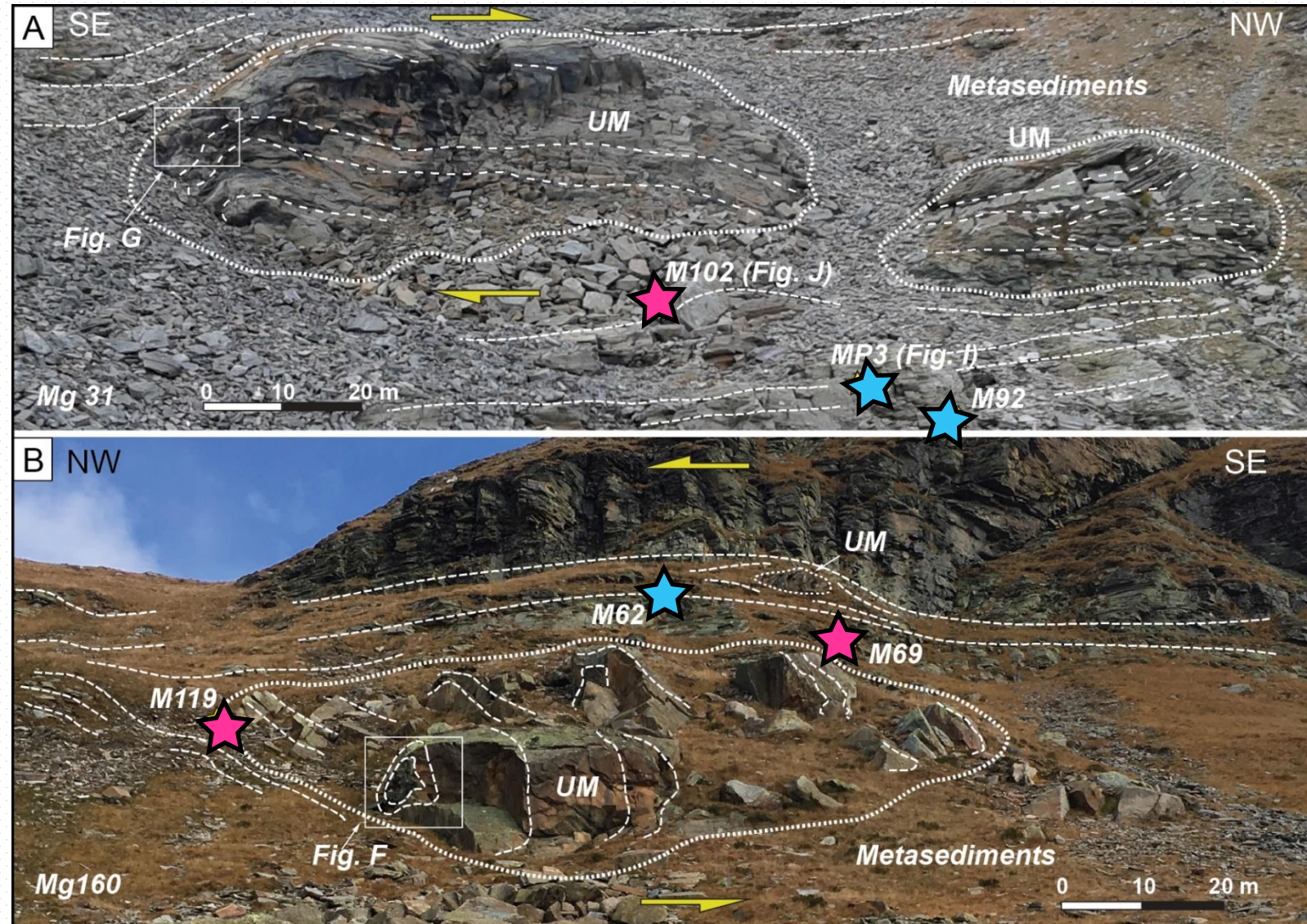


# Sampling strategies

Representative *host rocks* samples (60) were collected at different distance from ultramafics:

★ Increasing distance, between **10-50 m**, respect to the UM lenses, samples named ***Country rocks*** (40 samples);

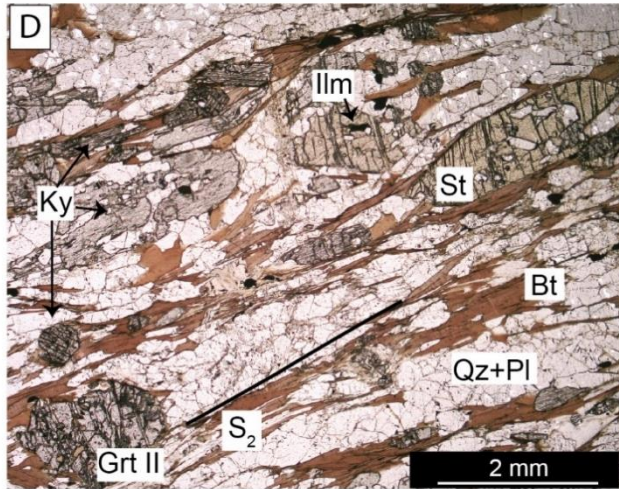
★ Samples from the contact of (**< 2 m**) UM lenses named ***Halos*** (20) to better describe the metamorphic and geochemical influence close by ultramafics.





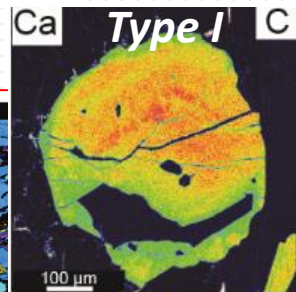
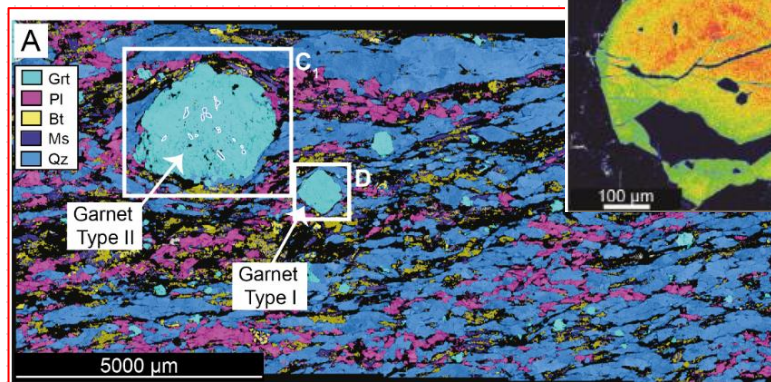
# Results: Heterogeneous features in metasediments

## Country rocks

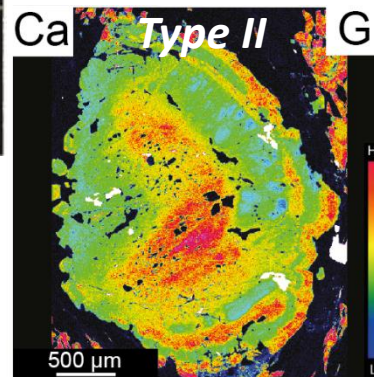


Mineral assemblage:  
 $Pl + Qtz + Grt + Bt + Ms$   
 $\pm Ky \pm St$

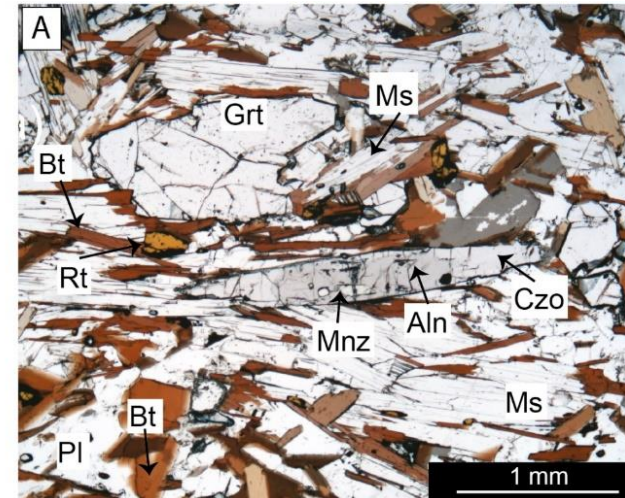
## EBSD map



## Garnet



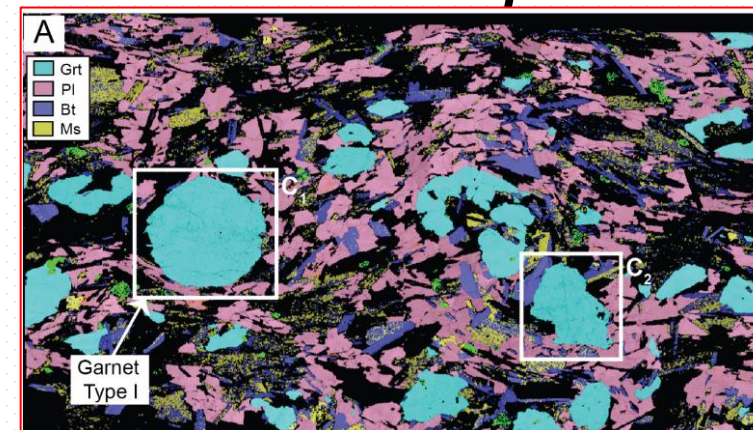
## Halos



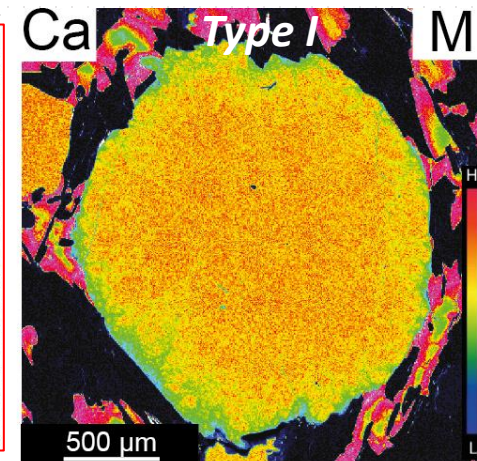
Mineral assemblage:  
 $Pl + Grt + Bt + Ms \pm$   
 $Ky \pm Qtz$

Corona microstructure  
 $Mnz \rightarrow Aln \rightarrow Czo$

## EBSD map



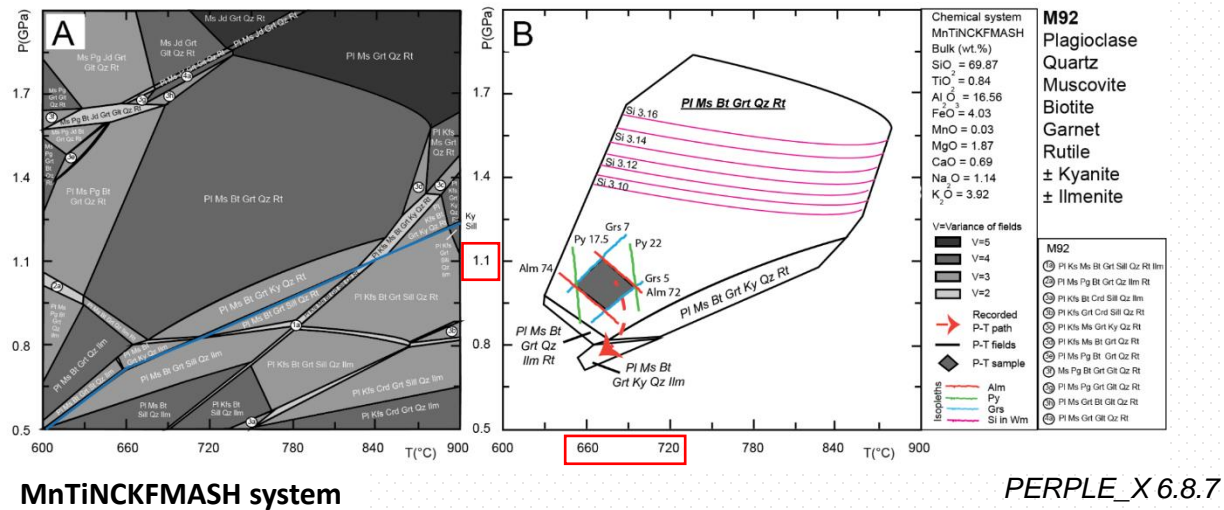
## Garnet





# Results: Heterogeneous features in metasediments

## Country rocks

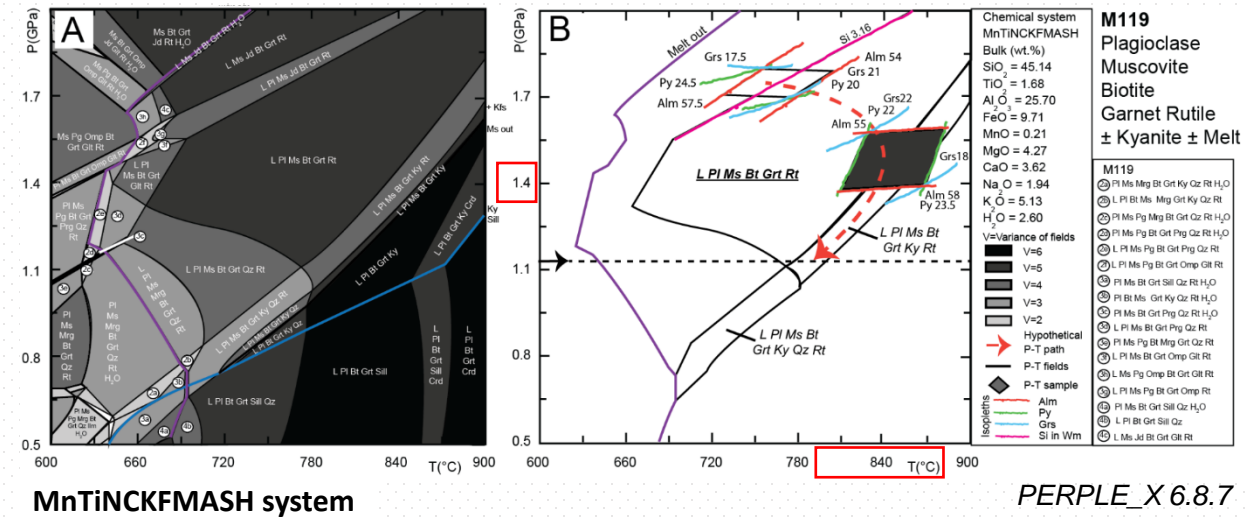


## Middle PT peak conditions

T: 650–720 °C

P: 1.0–1.2 GPa

## Halos



## High PT peak conditions

T: 720–770 °C and 800–850 °C

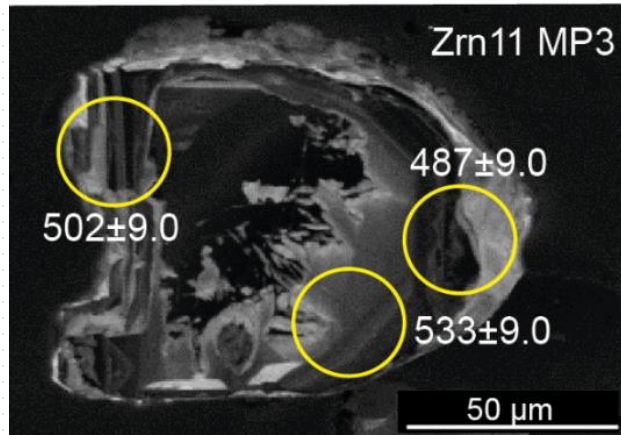
P: 1.3–1.7 GPa



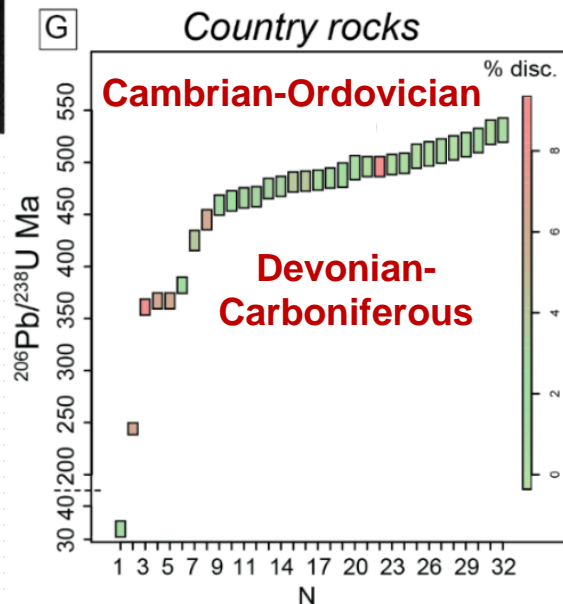
# Results: Heterogeneous features in metasediments

## Country rocks

### U-Pb zircon

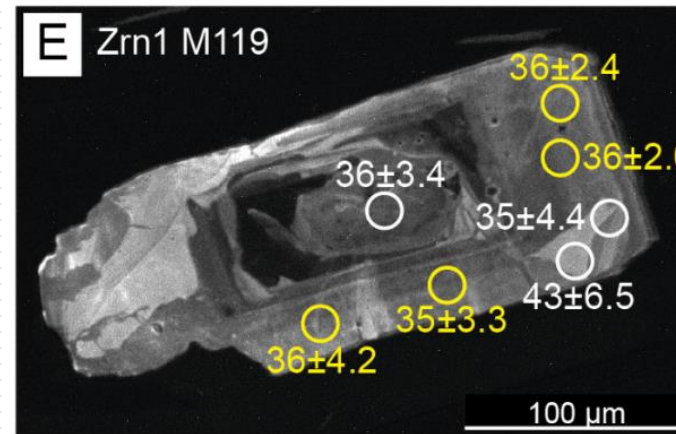


**Country rocks** records  
pre-Alpine ages

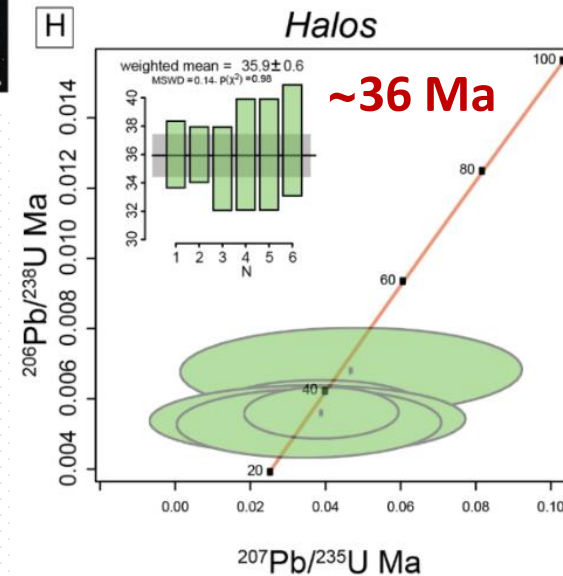


## Halos

### U-Pb zircon



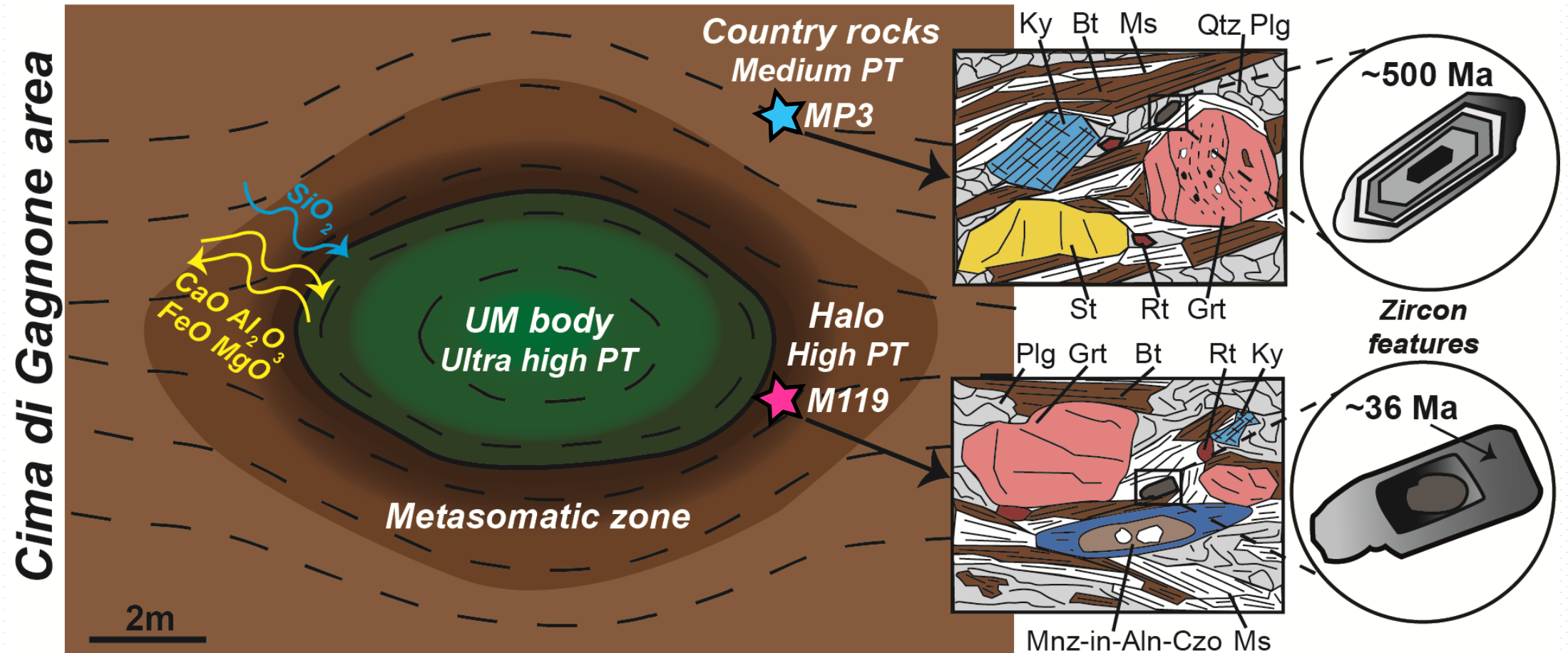
Zircon grains from **Halos** show full re-equilibrated **thick rim** during the early stage of the Alpine exhumation (**~36 Ma**)





# Interferences between UM and Host rocks

Fluid-rock interaction processes were **strongly localized at the interface** between UM and the host rocks, allowing **locally assemblage equilibrium** during **HT** phase.



Corvò et al., (2021) - Lithos



# *P-T-t-D path*

Even though metasediments and UM share the same structural evolution, **metasediments** record different *P-T* conditions as a function of the distance to the UM bodies

## *Country rocks*

*T*: 650–720 °C

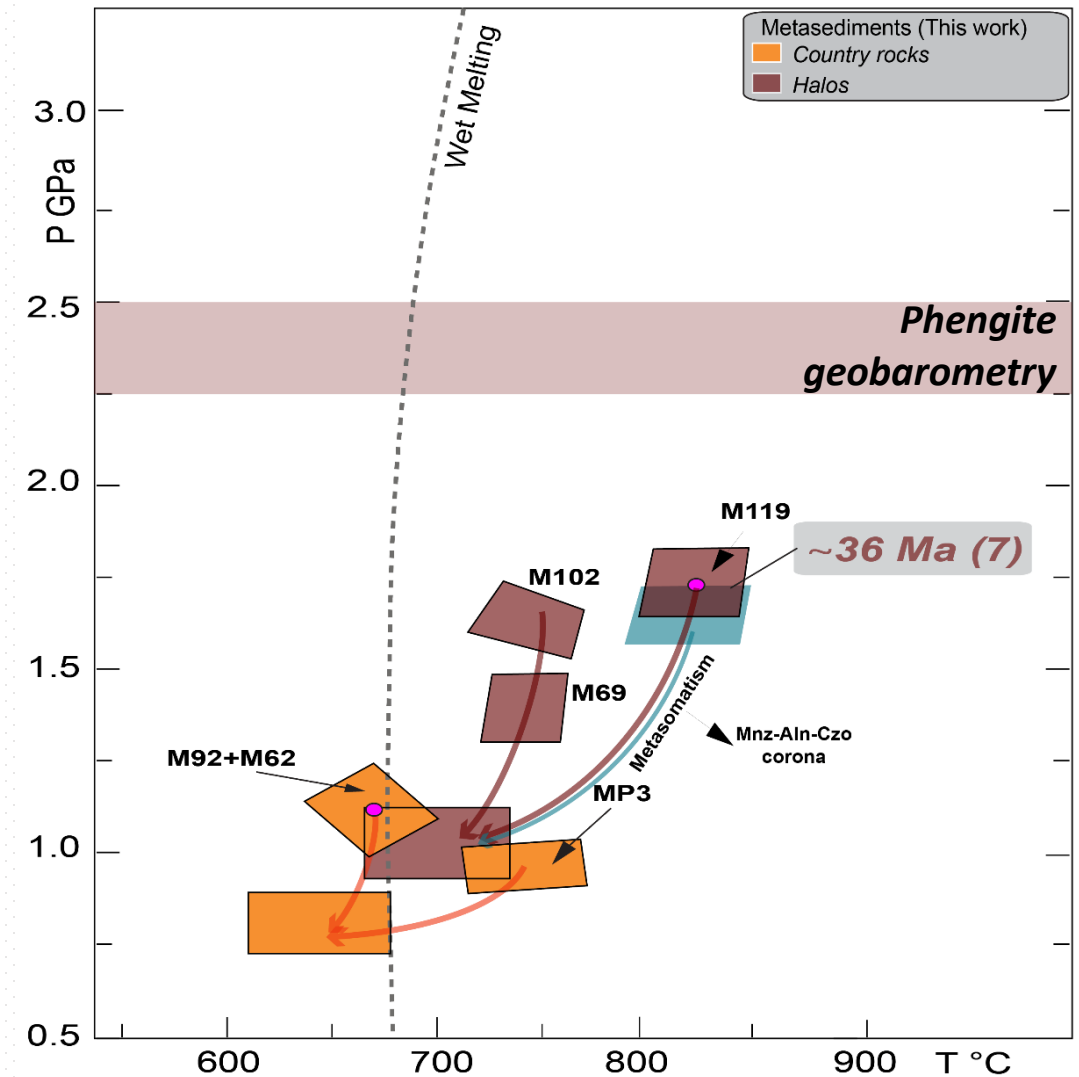
*P*: 1.0–1.2 GPa

## *Halos*

*T*: 720–770 °C and 800–850 °C

*P*: 1.3–1.7 GPa

Phengite geobarometry up to 2.5 GPa





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## Country rocks

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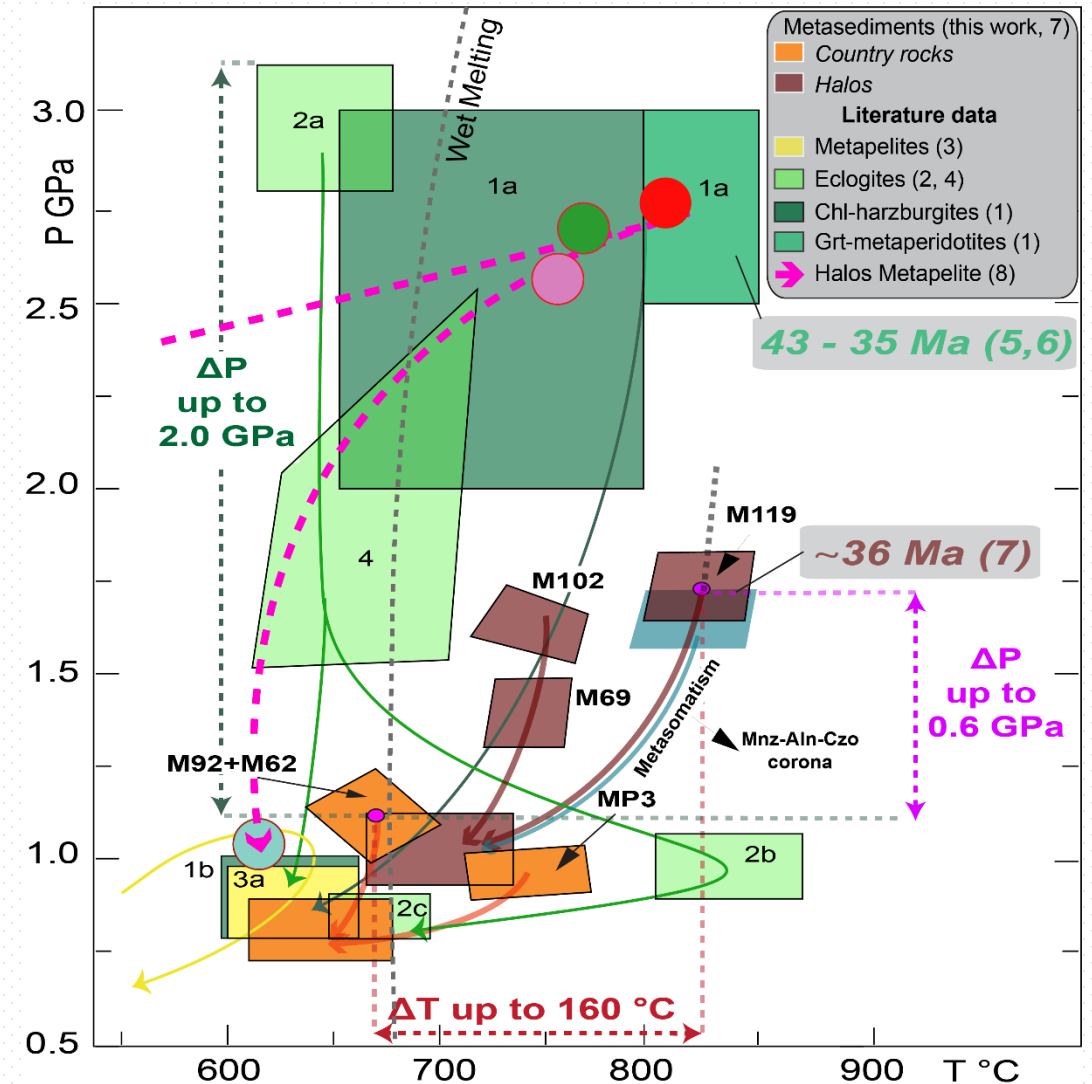
Phengite geobarometry up to 2.5 GPa

## UM

*T*: 650–850 °C

*P*: 2.0–3.0 GPa

$\Delta P = 2.0 \text{ GPa}$ ;  $\Delta T = 160 \text{ °C}$

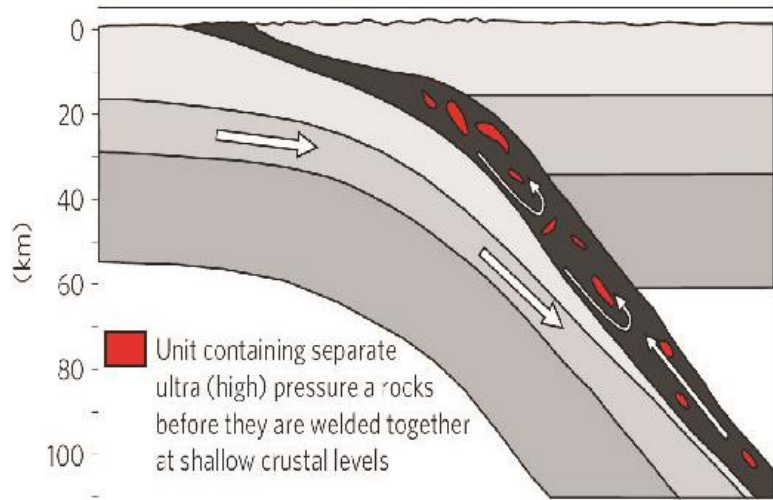


1 – Nimis and Trommsdorff (2001) and Scambelluri et al. (2014); 2 – Brower et al. (2005); 3 – Grond et al. (1995); 4 – Heinrich (1986). 5 – Gebauer (1996, 1999); 6 – Becker et al. (1993). 8 – P-T paths for metapelite studied in Piccoli et al., (2021).



# *Inferences on the exhumation of Cima-Lunga nappe*

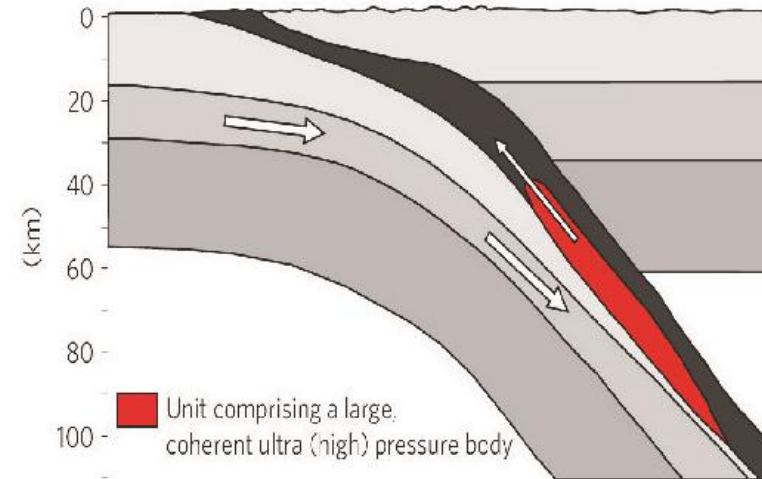
## 1. Channel flow



from Herwartz et al., 2011

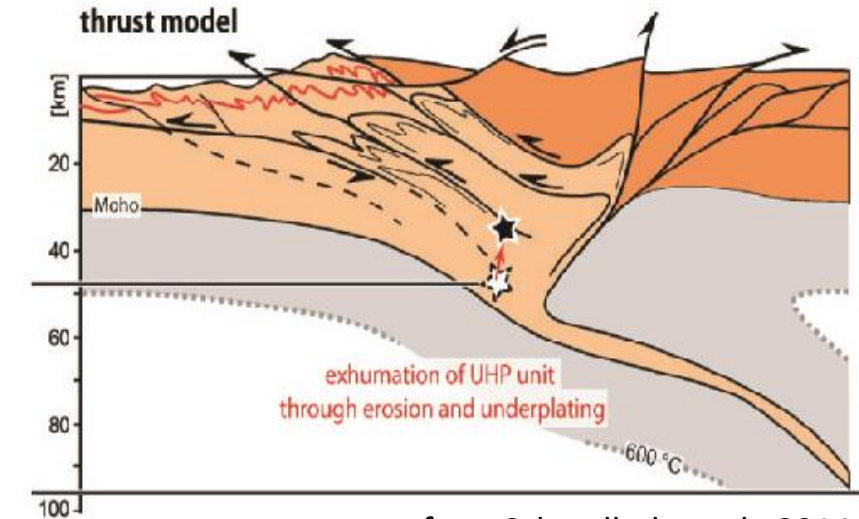
These findings open new scenarios for geodynamic interpretation of subduction-exhumation models

## 2. Coherent unit



from Herwartz et al., 2011

## 3. Thrusting model



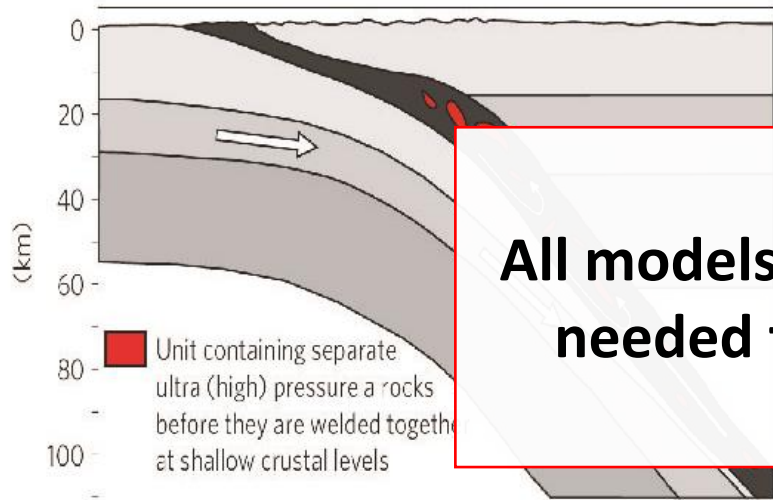
from Schmalholz et al., 2014



# *Inferences on the exhumation of Cima-Lunga nappe*

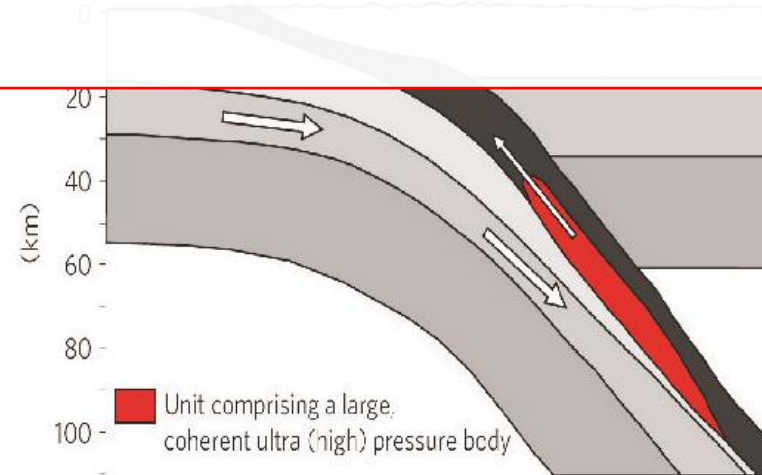
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## 1. Channel flow



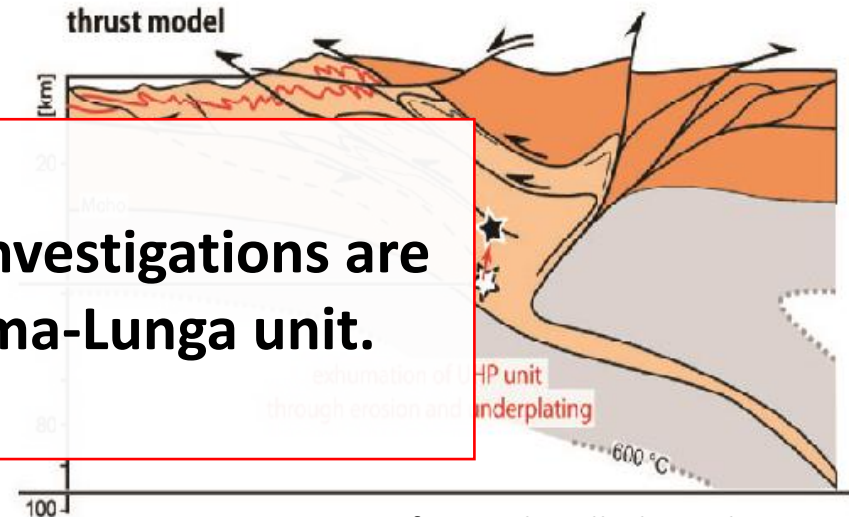
from Herwartz et al., 2011

**All models have shortcomings and further investigations are needed to explain the evolution of the Cima-Lunga unit.**



from Herwartz et al., 2011

## 3. Thrusting model



from Schmalholz et al., 2014

# ***Thanks for your attention!***



Questions?

In person here at the EGU or

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For further information →

