Tectonometamorphic and geochronological evolution of the metasediments of the Erzgebirge orogenic wedge (Saxothuringian Domain, Bohemian Massif)

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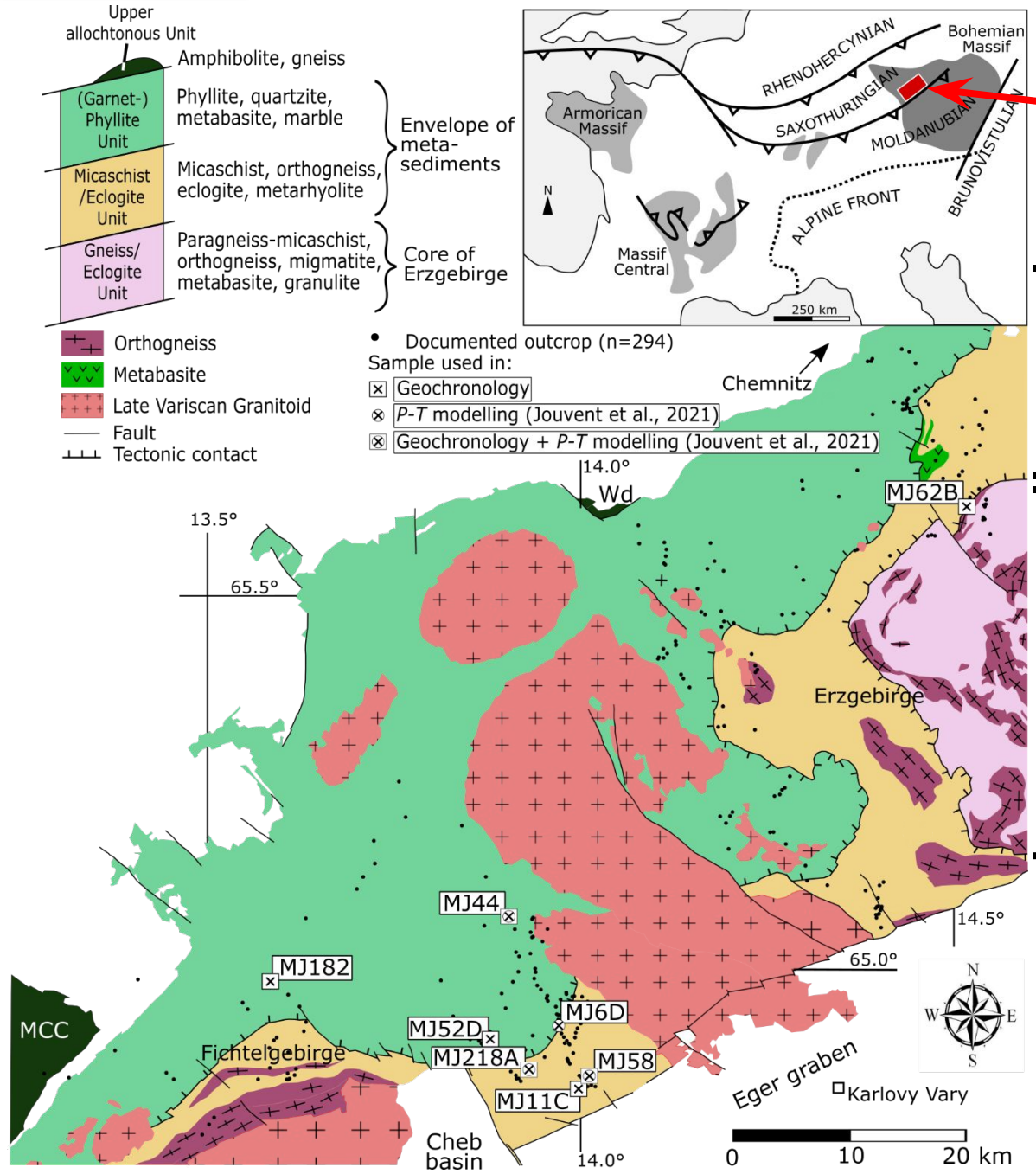
EGU conference 2022



Envelope of Erzgebirge metasediments: low-grade rocks
- Phyllites
- Micaschists

Erzgebirge core:
- High-grade rocks

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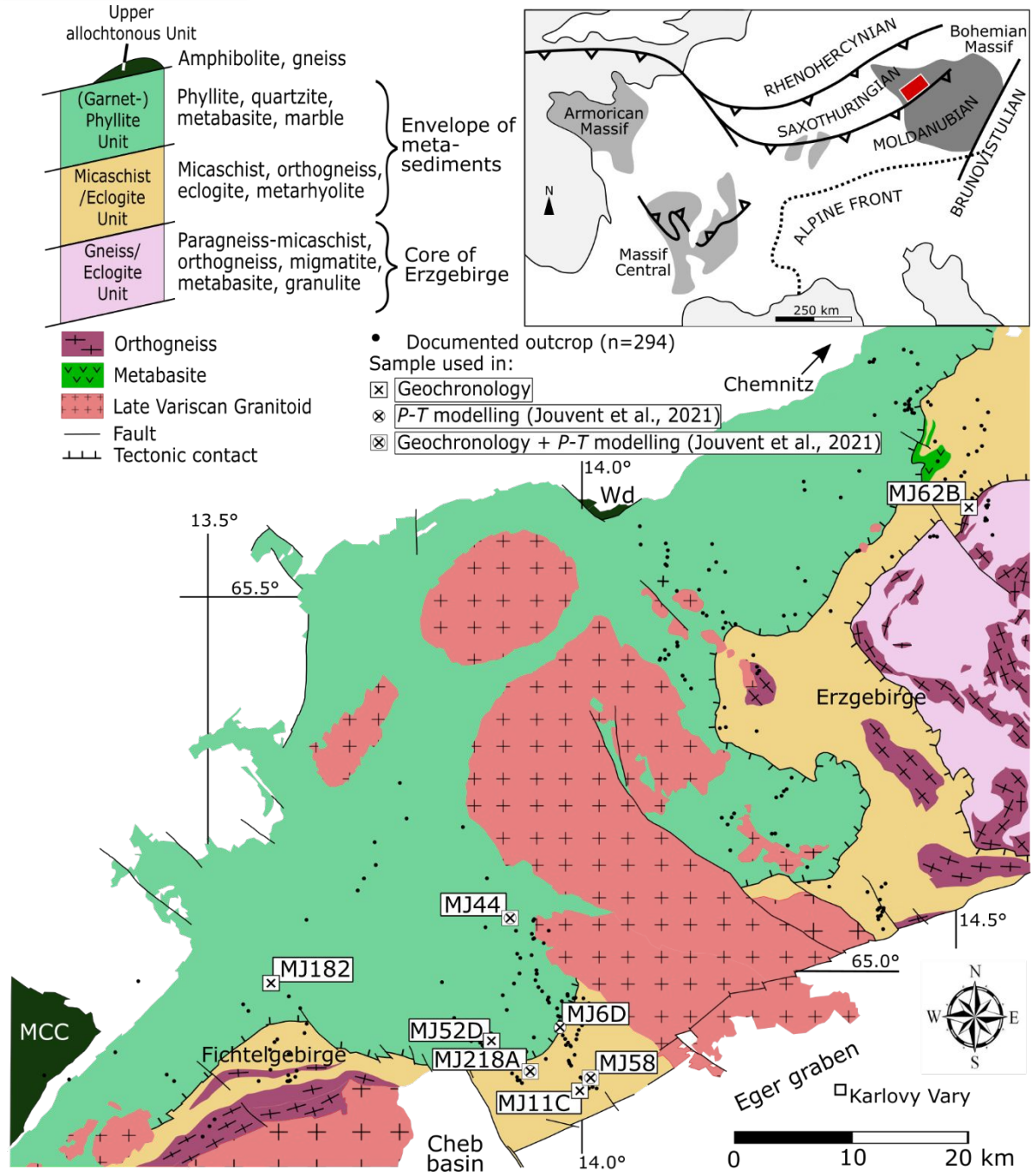


Why this study?

- Metasediments poorly studied in the past
- Why a normal metamorphism in a subduction zone?

⇒ What is the **P-T-t evolution of these metasediments**?

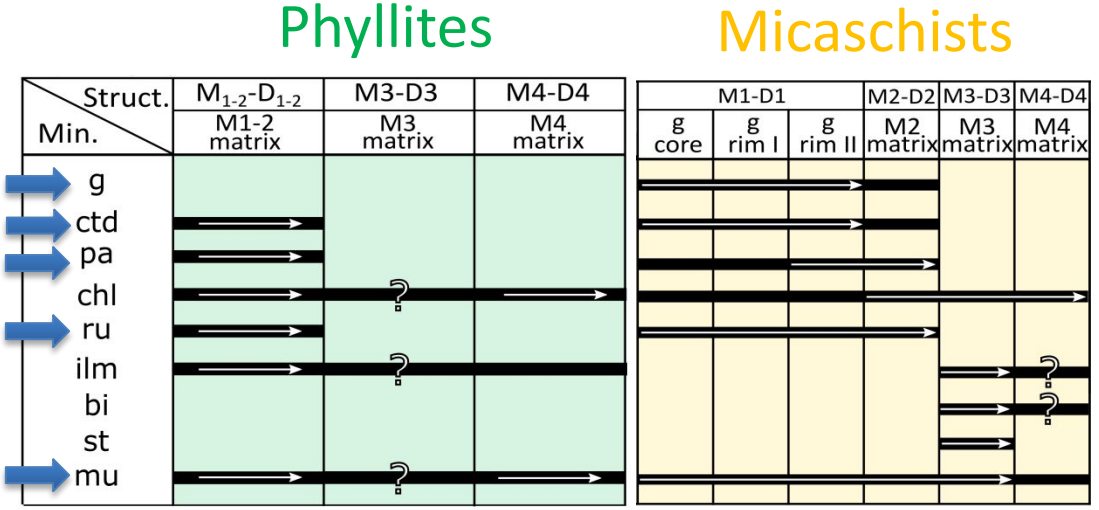
⇒ How the **whole crustal wedge was built?**

Jouvent et al., 2022

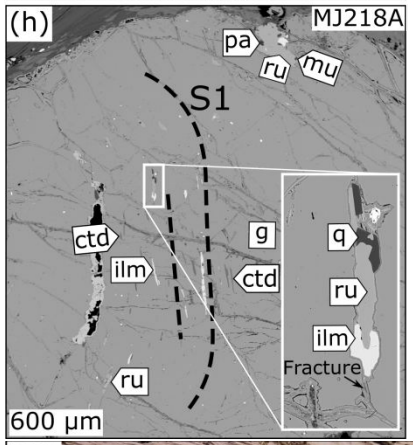
Tectono-metamorphic evolution

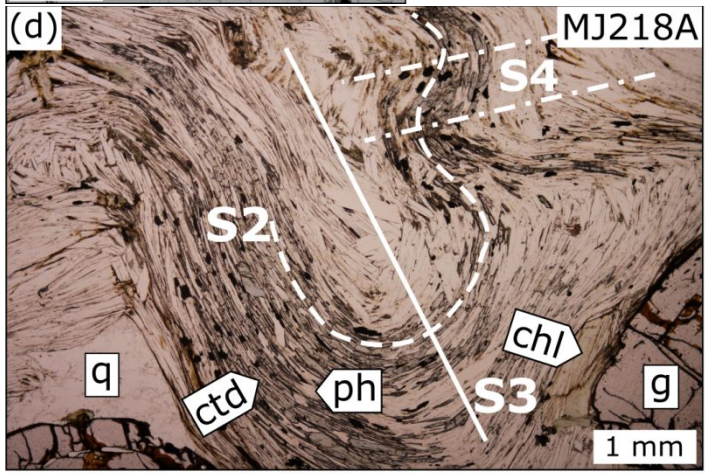
What is the structural and metamorphic record of these metasediments?

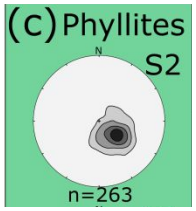
Tectono-metamorphic record

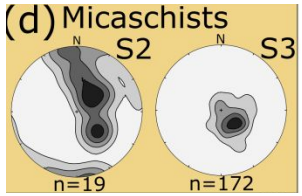


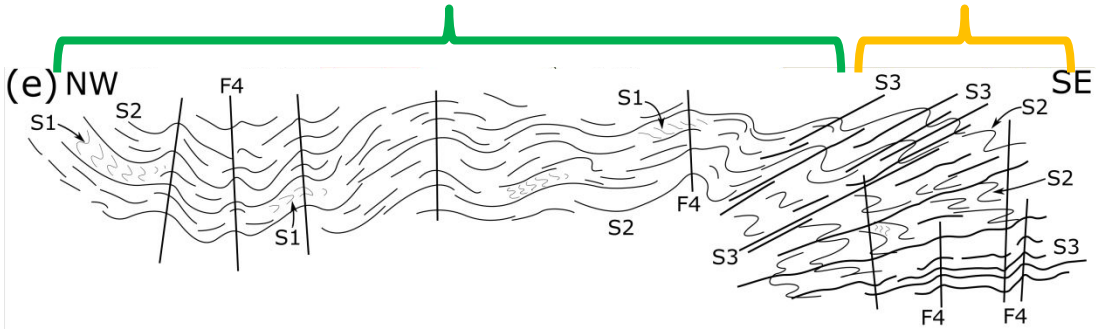
- **S1-S2**: g, ctd, ph, ru, pa => **HP-LT**











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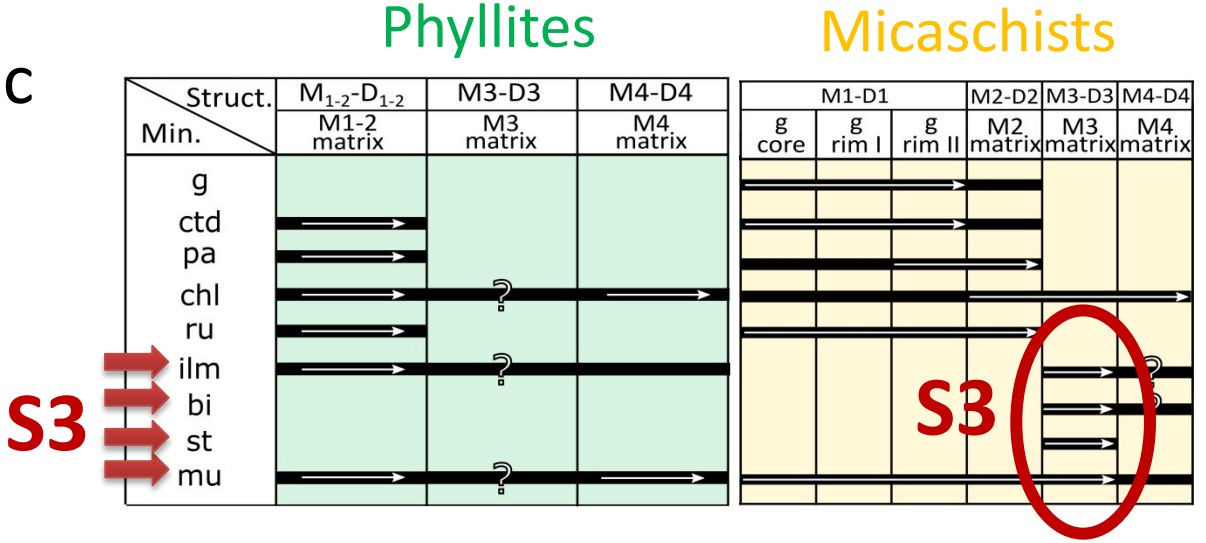
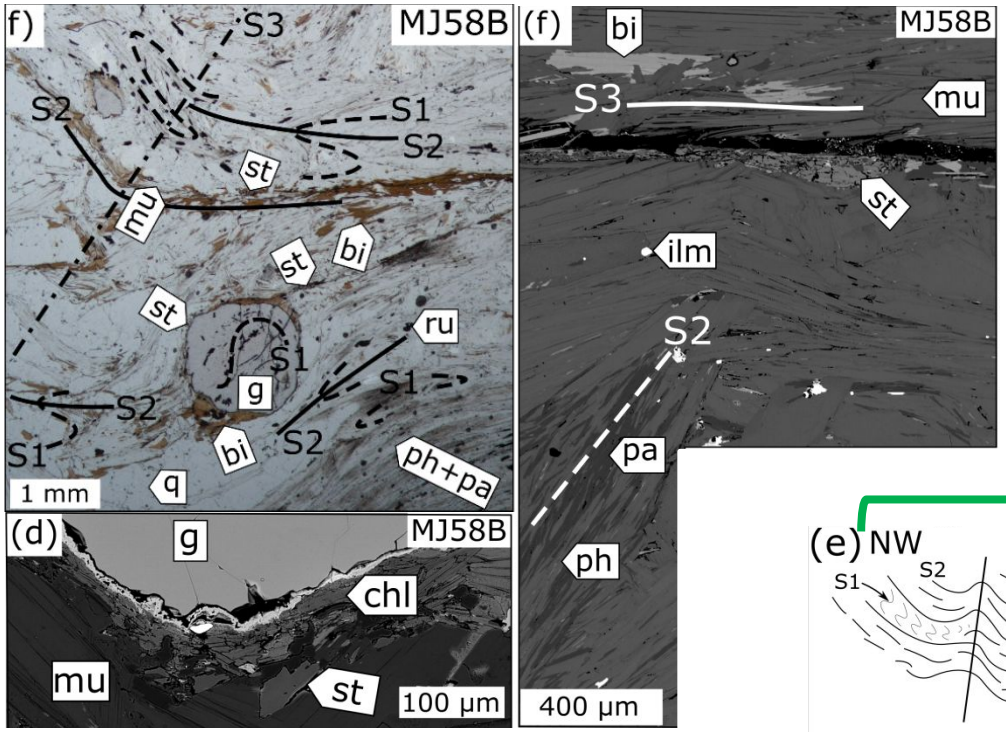
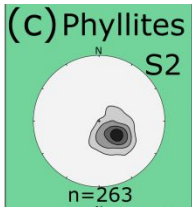
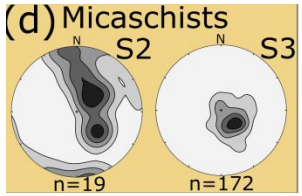
Tectono-metamorphic record

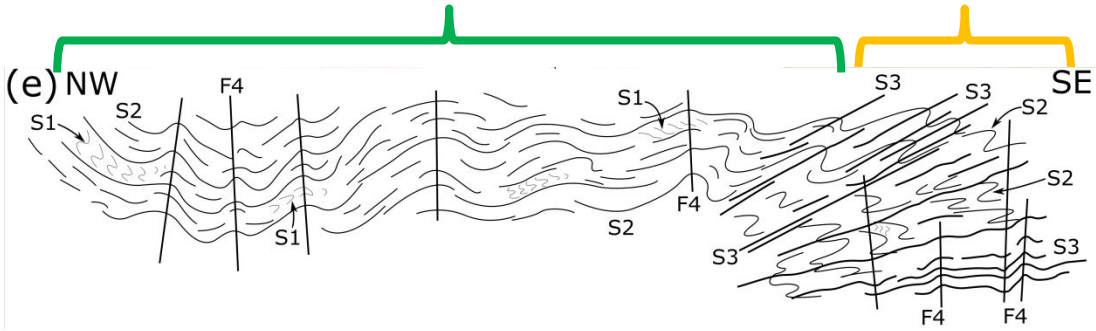




- **S1-S2**: g, ctd, ph, ru, pa => **HP-LT**
- **S3**: st, bi, ilm, mu => **MP-MT**







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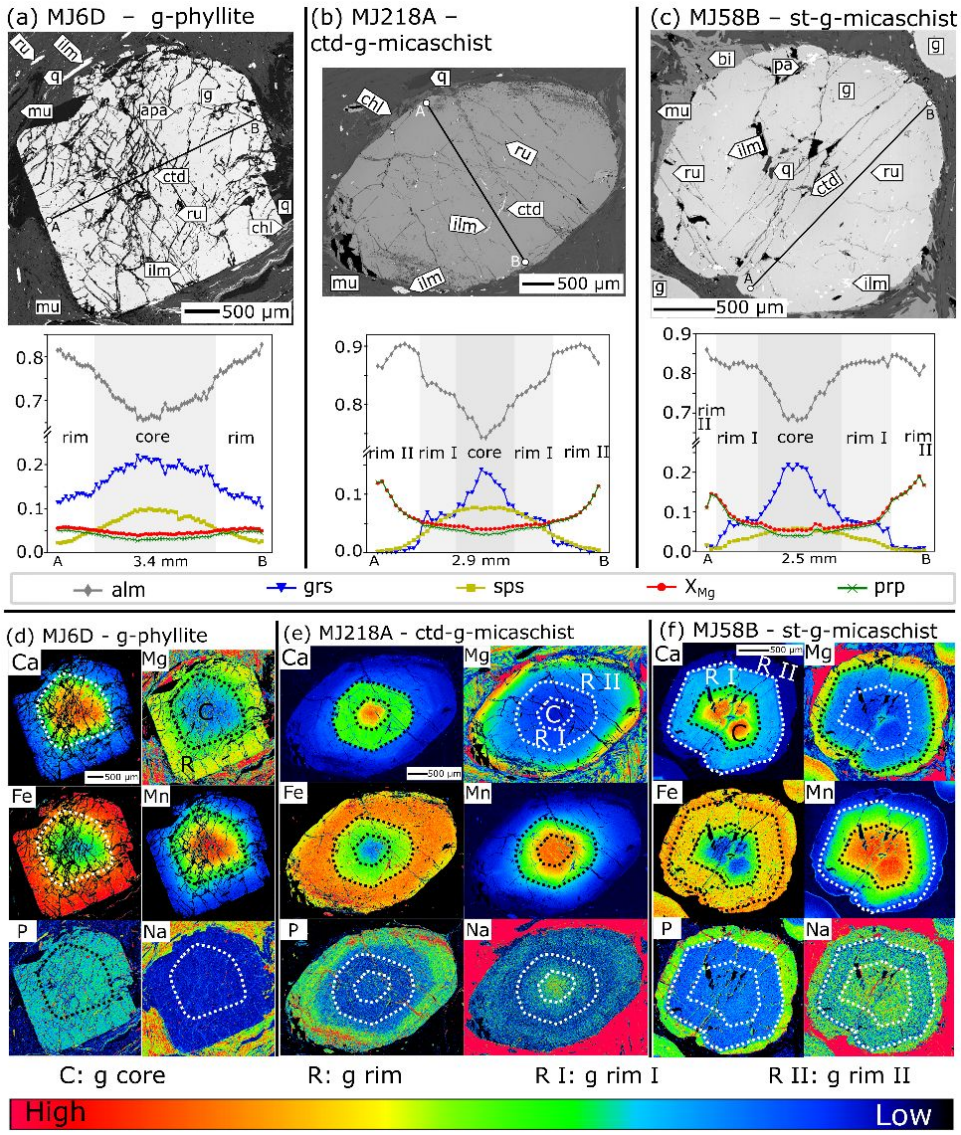
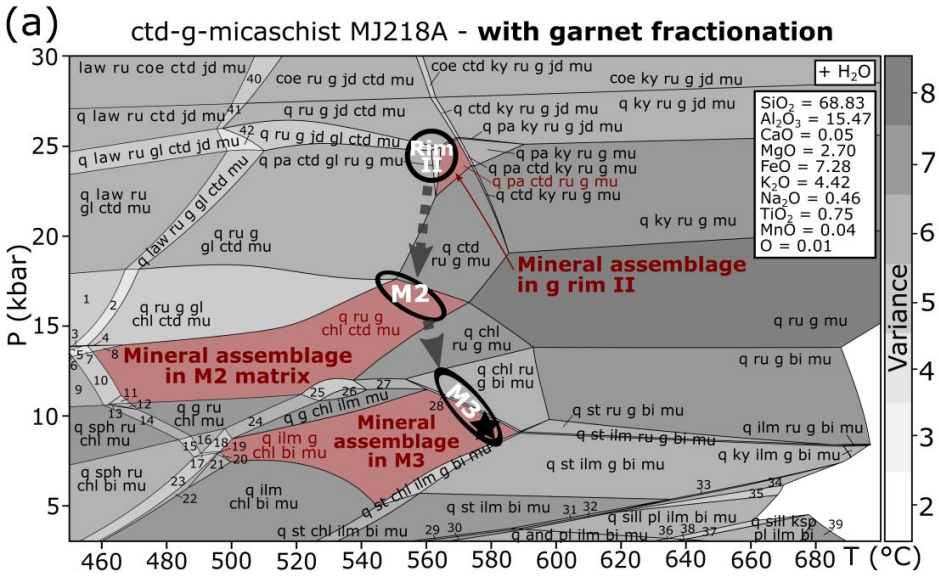
Thermodynamic modelling

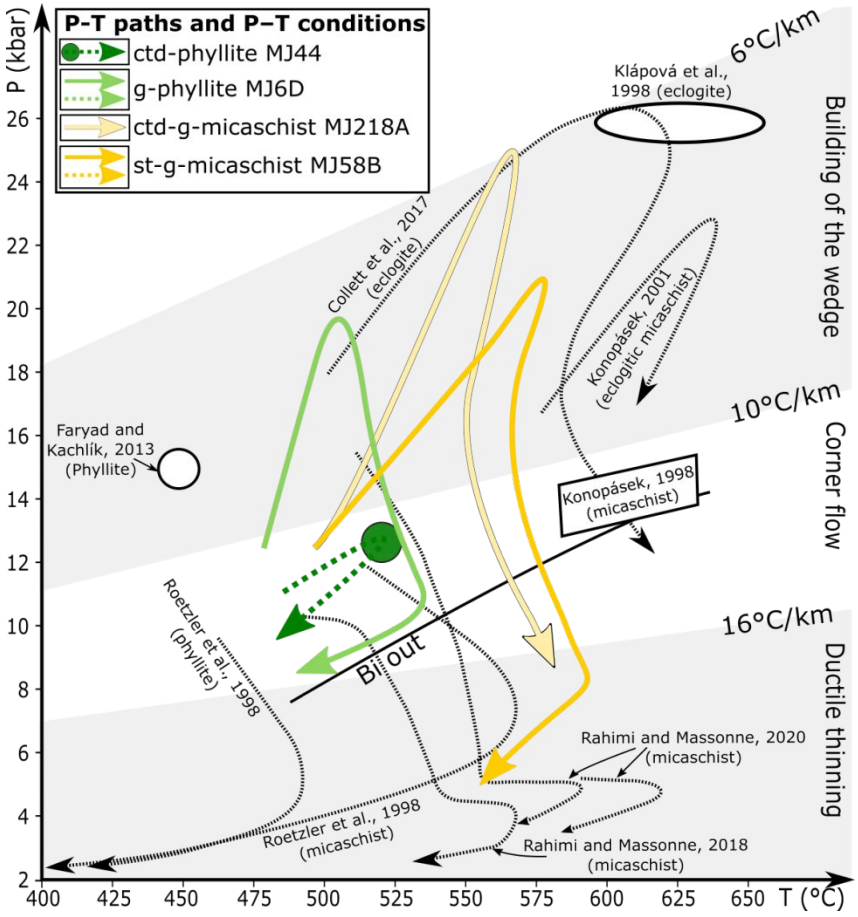


Jouvent et al., 2022

- Garnet zoning => Gt isopleths
- Isopleths of ctd, mu, ph, pa, st, bi,…

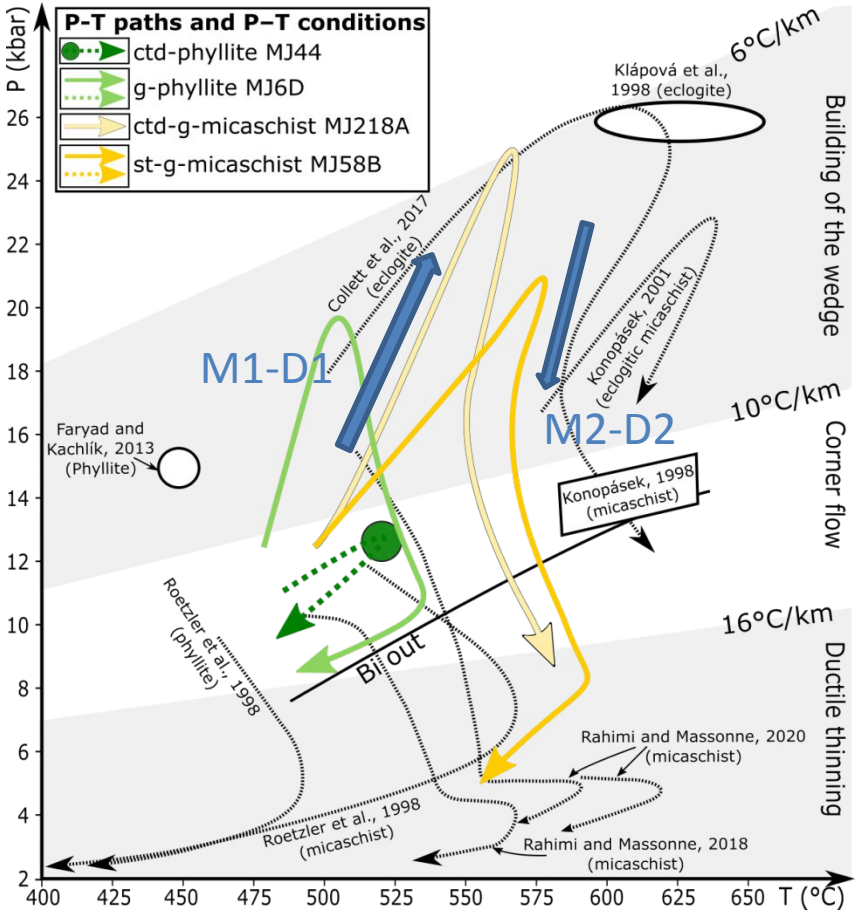


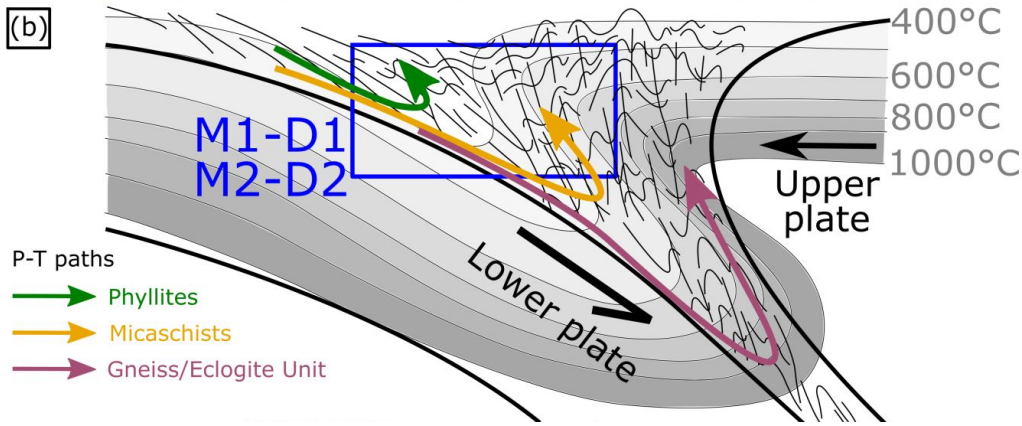
P-T summary


P-T paths and P–T conditions
ctd-phyllite MJ44
g-phyllite MJ6D
ctd-g-micaschist MJ218A
st-g-micaschist MJ58B
P (kbar)
T (°C)
6°C/km
10°C/km
16°C/km
Building of the wedge
Corner flow
Ductile thinning
Klápová et al., 1998 (eclogite)
Collett et al., 2017 (eclogite)
Konopásek, 2001 (eclogitic micaschist)
Faryad and Kachlík, 2013 (Phyllite)
Konopásek, 1998 (micaschist)
Exhumation
Roetzler et al., 1998 (phyllite)
Rahimi and Massonne, 2020 (micaschist)
Roetzler et al., 1998 (micaschist)
Rahimi and Massonne, 2018 (micaschist)

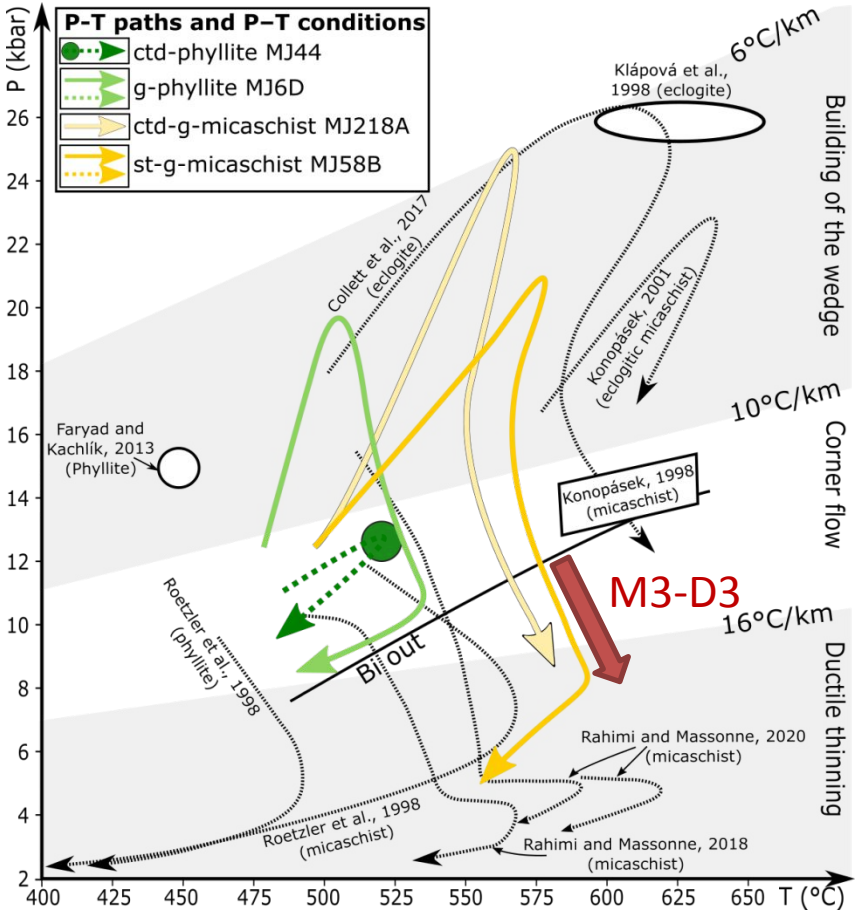
P-T summary

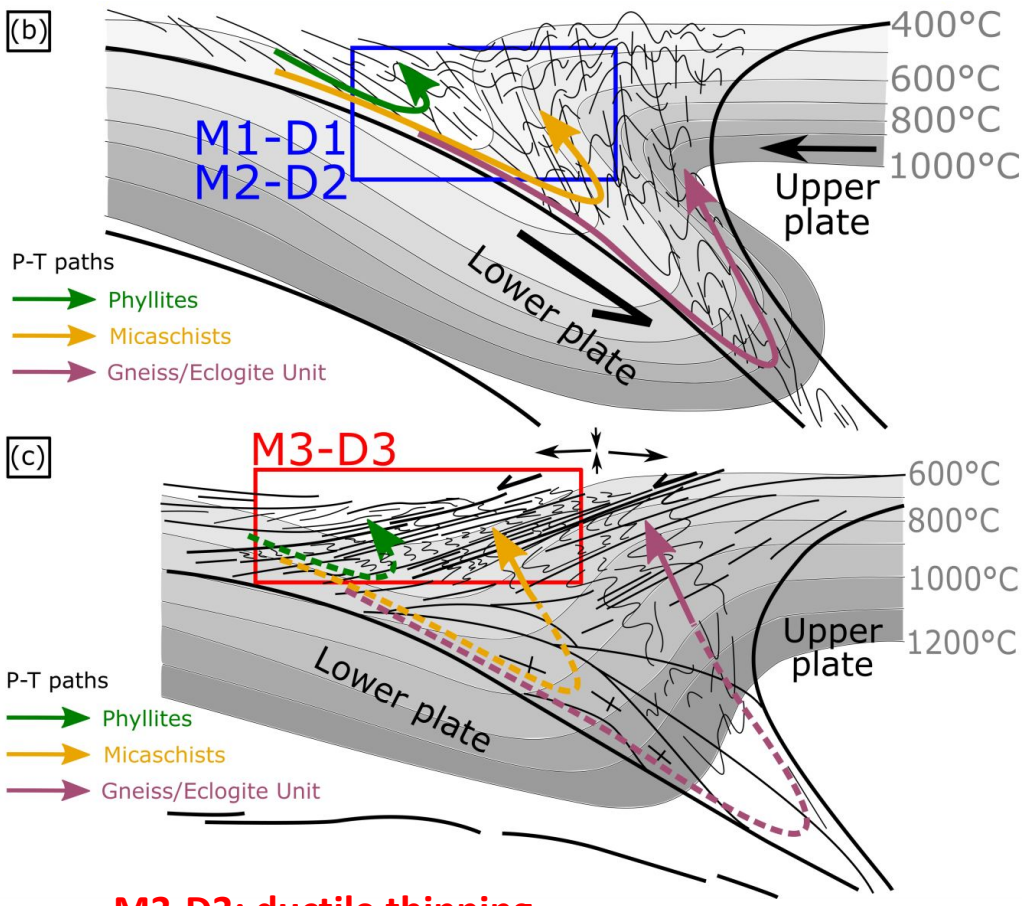
M1-D1: Prograde subduction +
M2-D2: corner flow
=> Inverse metamorphism?





P-T summary





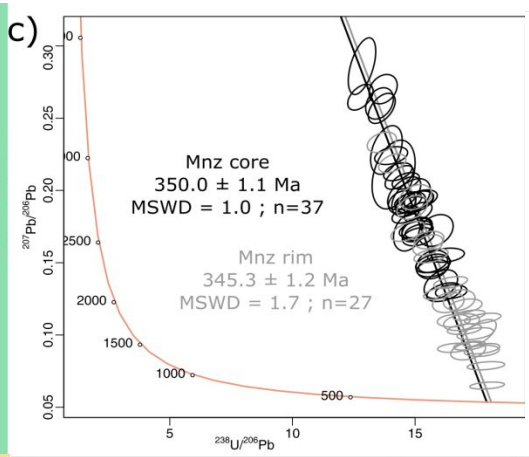
M3-D3: ductile thinning
=> Normal metamorphism

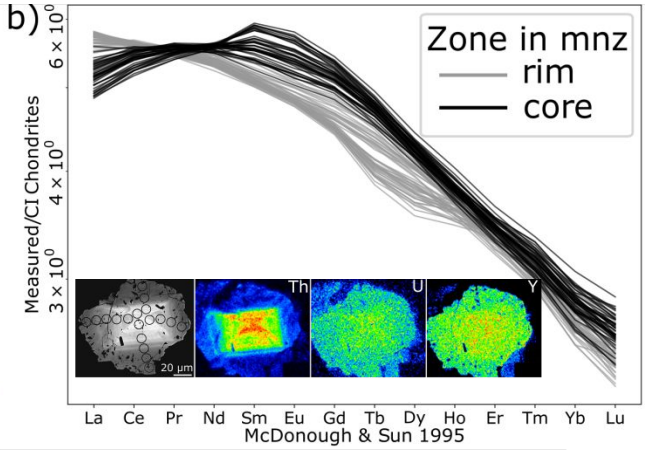
Geochronological evolution

What are the ages of the individual tectono-metamorphic events?

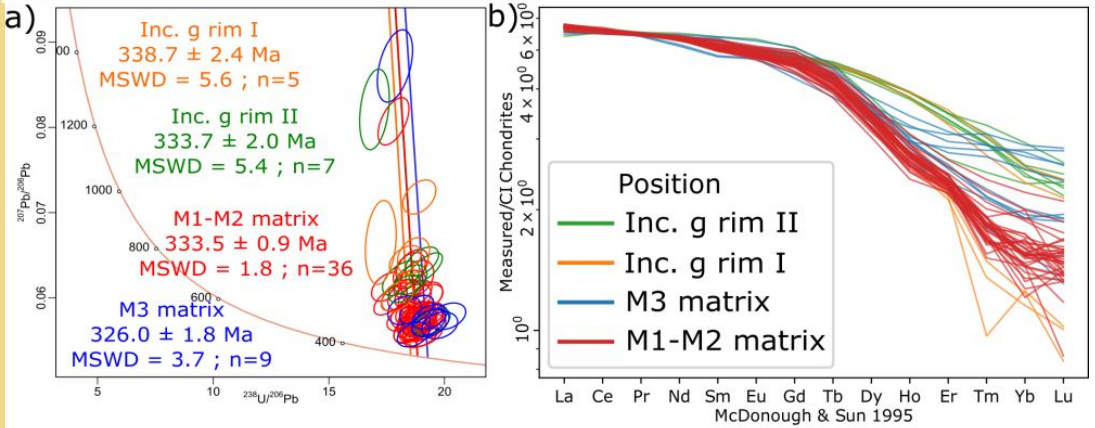
Monazite U-Pb dating

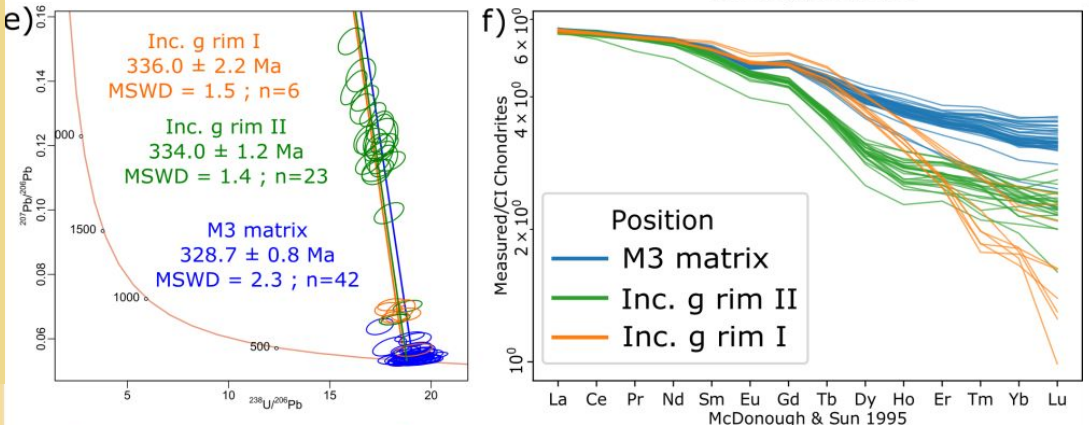
Phyllites MJ182

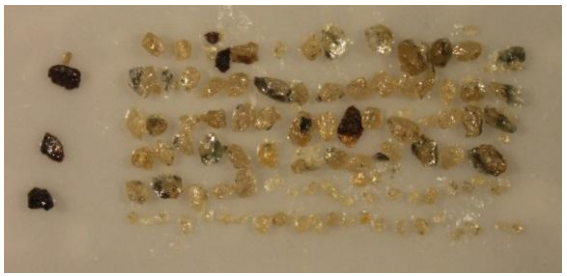




Micaschists

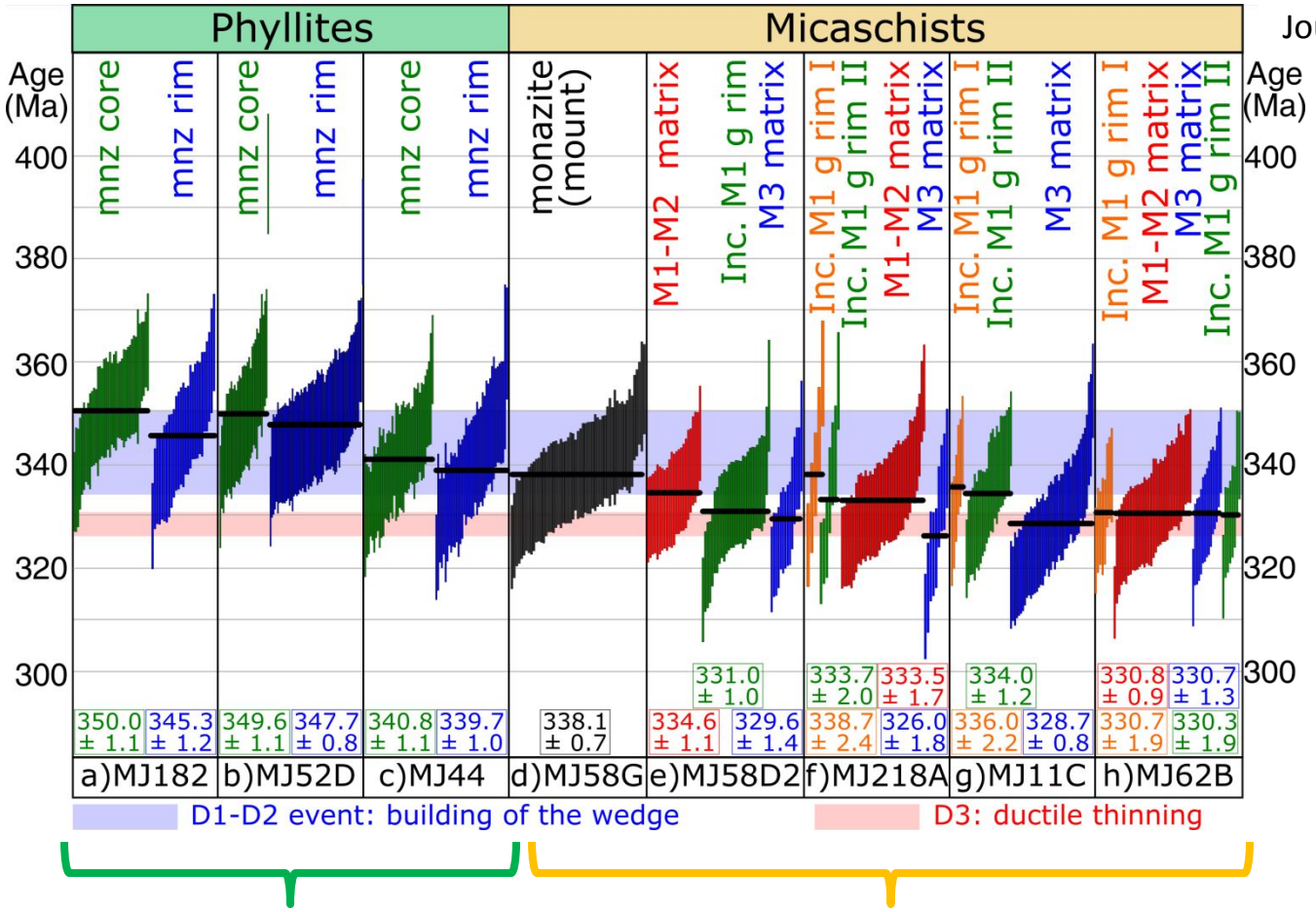






Jouvent et al., in prep.

Results monazite U-Pb dating

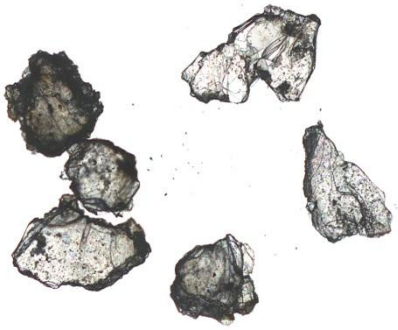


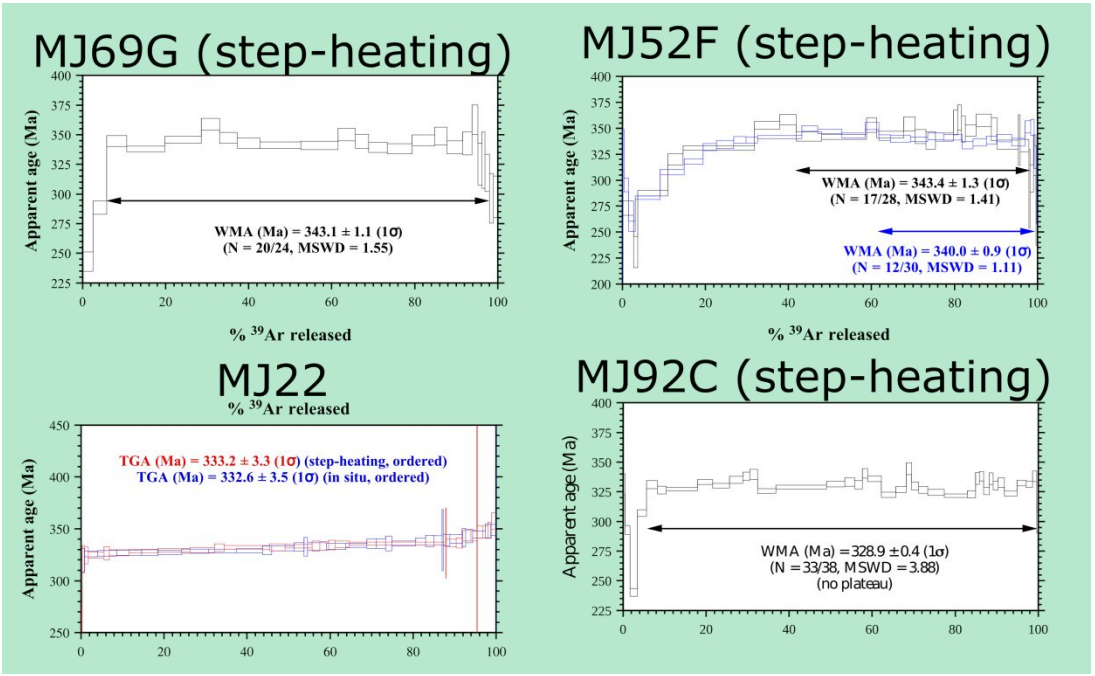
Jouvent et al., in prep.

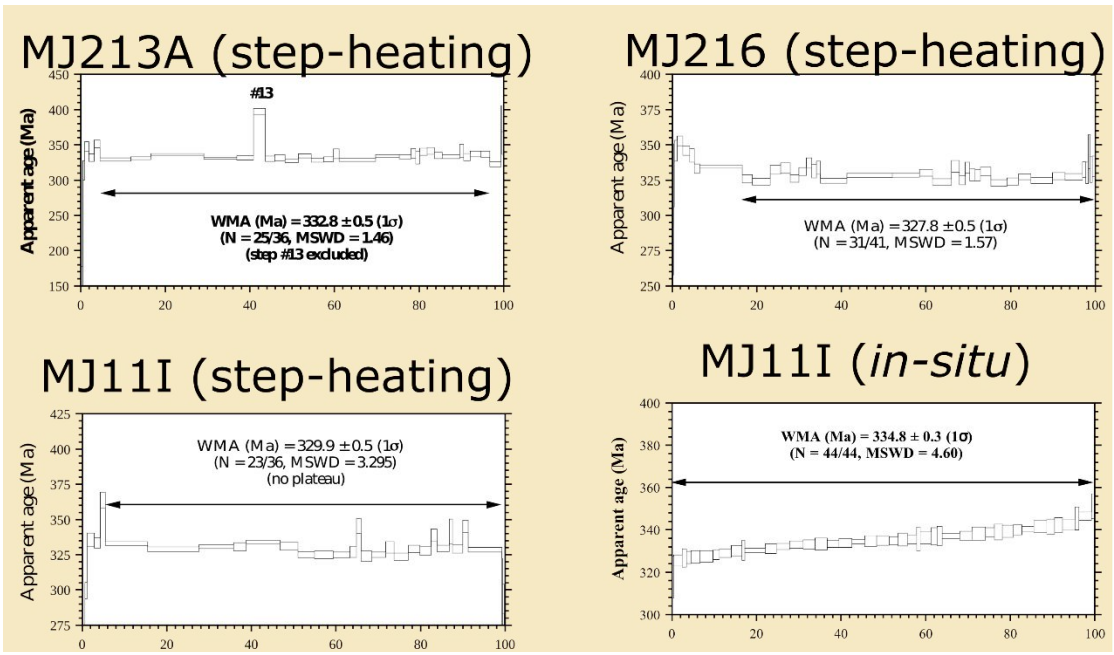
Phyllites:
Ages from **350 to 340 Ma**

Micaschists:
Ages from **340-335 to 330 Ma**

White mica Ar/Ar dating





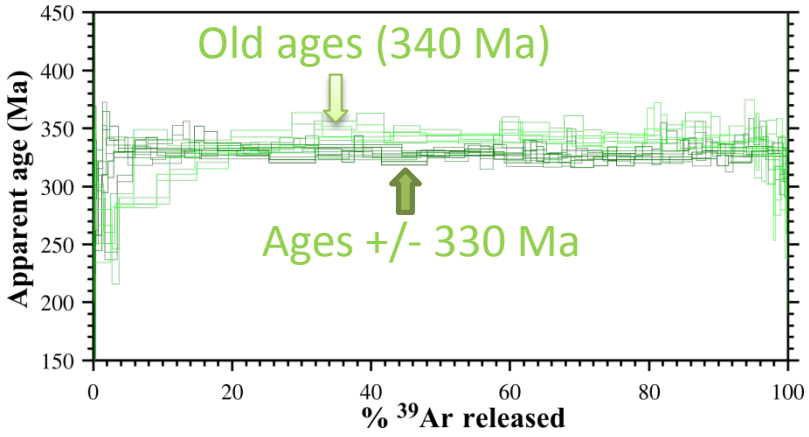


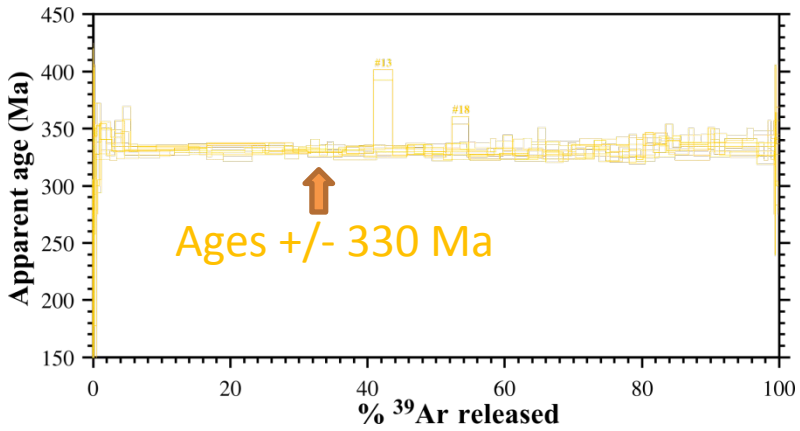
Jouvent et al., in prep.

Results white mica Ar/Ar dating

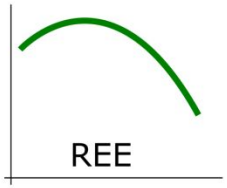
Phyllites:
- 340 Ma
- +/- 330 Ma

Micaschists:
- +/- 330 Ma

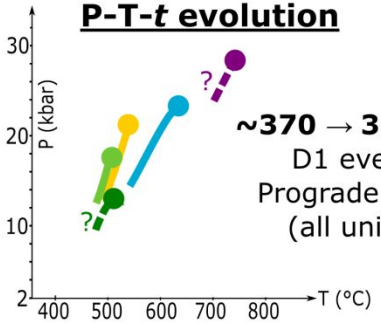




Monazite REE patterns

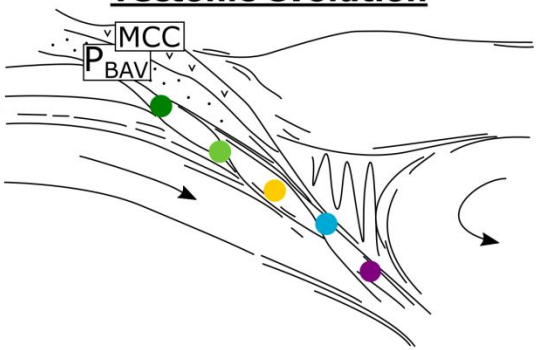


P-T-*t* evolution

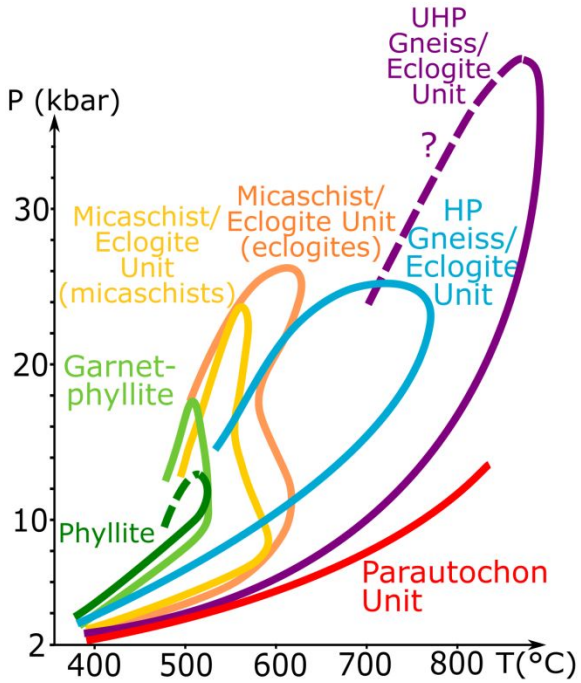


~370 → 350 Ma
D1 event
Prograde path
(all units)

Tectonic evolution

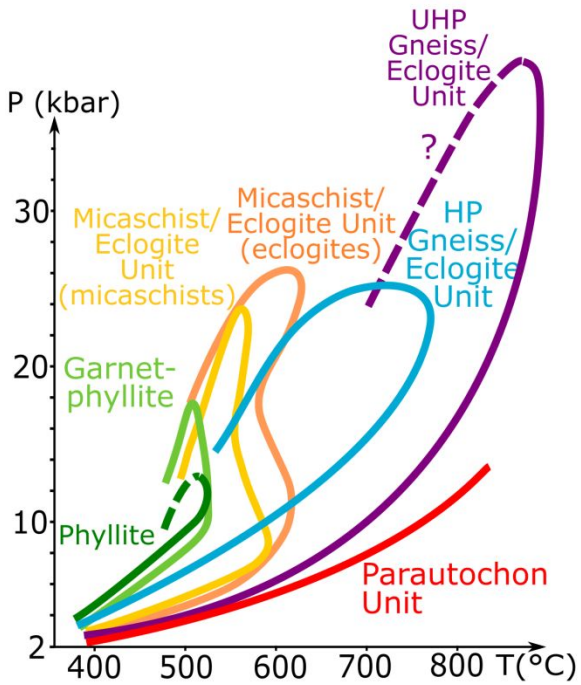


Simplified P-T paths

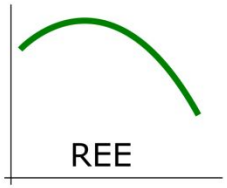


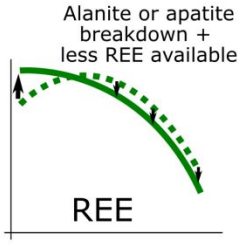
Jouvent et al., in prep.

Simplified P-T paths

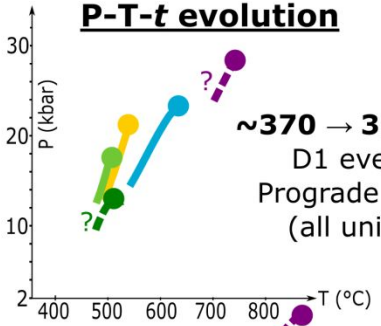


Monazite REE patterns

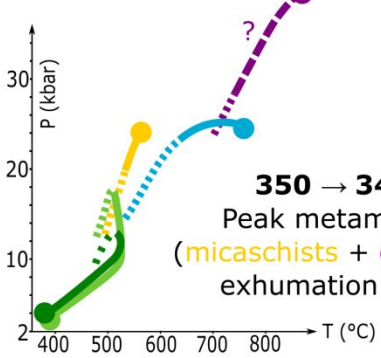




P-T-*t* evolution

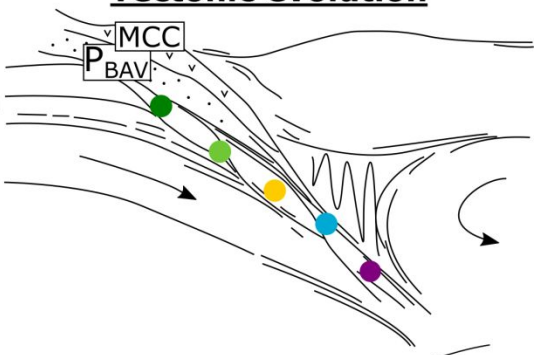


~370 → 350 Ma
D1 event
Prograde path
(all units)

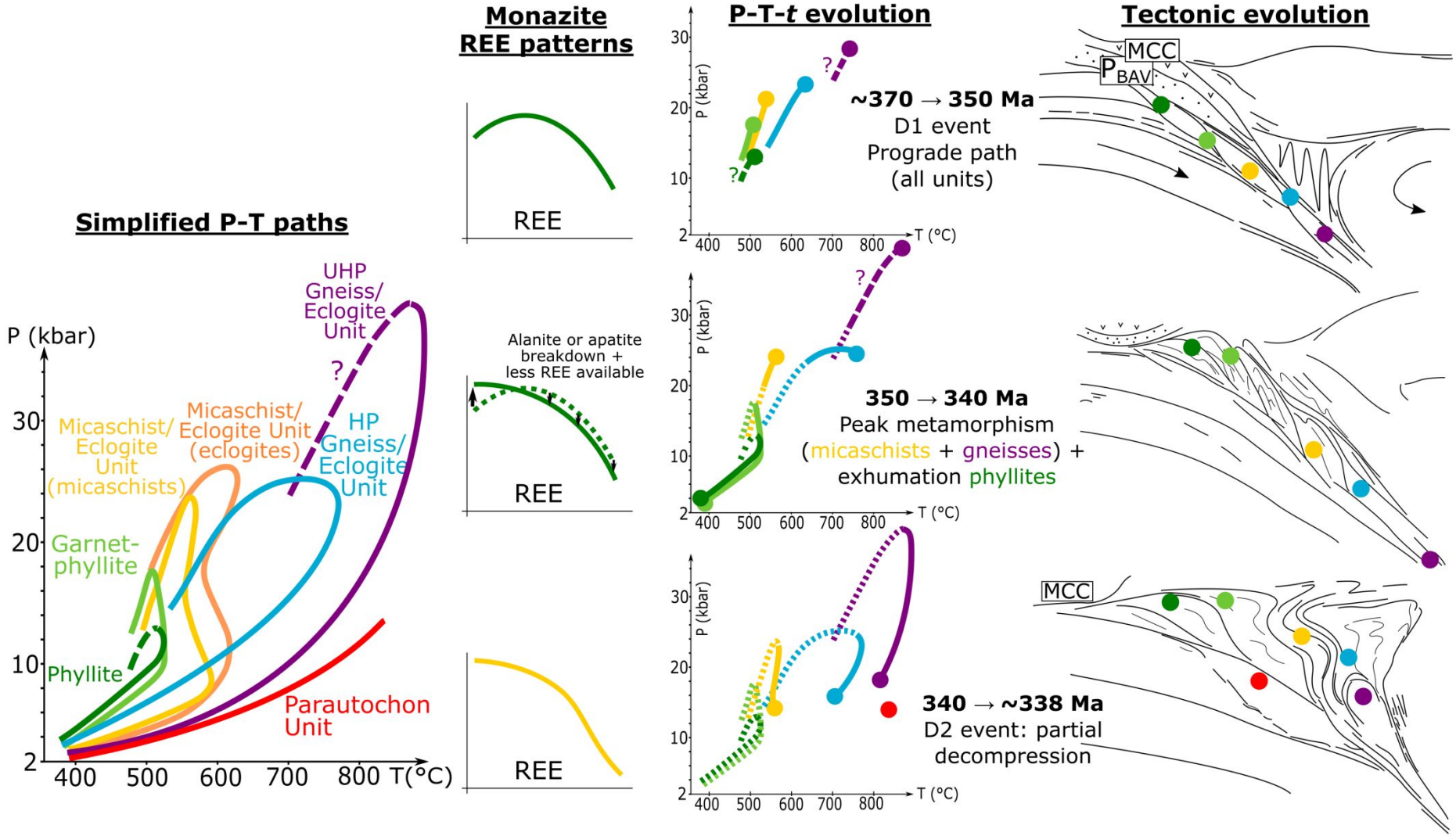


350 → 340 Ma
Peak metamorphism
(micaschists + gneisses) +
exhumation phyllites

Tectonic evolution

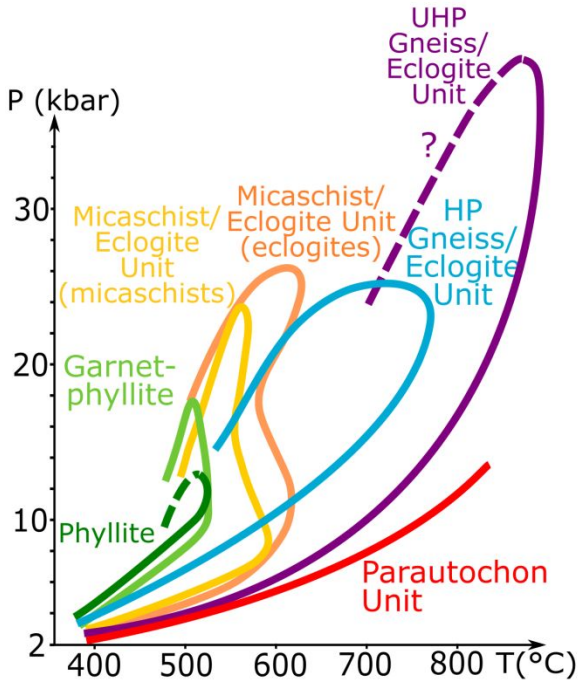


Jouvent et al., in prep.

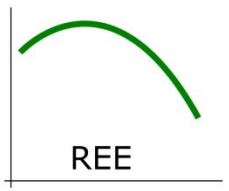


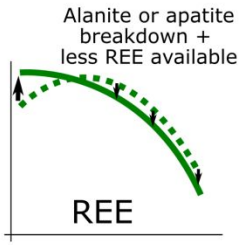
Jouvent et al., in prep.

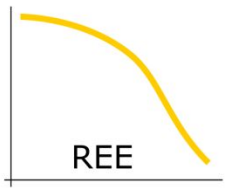
Simplified P-T paths

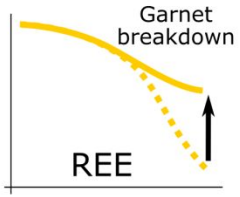


Monazite REE patterns

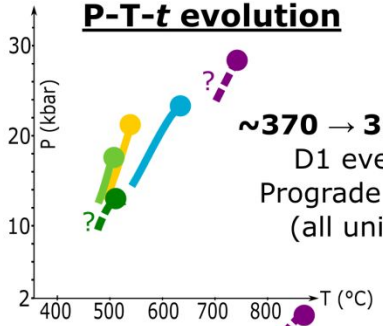




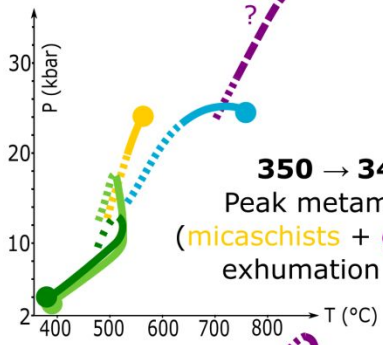




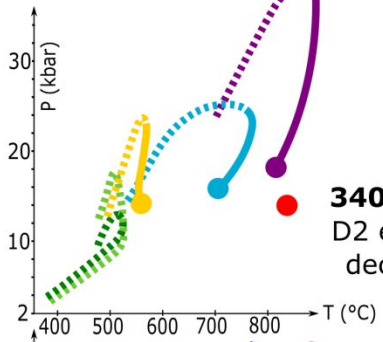
P-T-*t* evolution



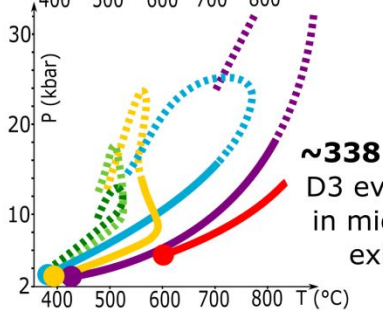
~370 → 350 Ma
D1 event
Prograde path
(all units)



350 → 340 Ma
Peak metamorphism
(micaschists + gneisses) +
exhumation phyllites

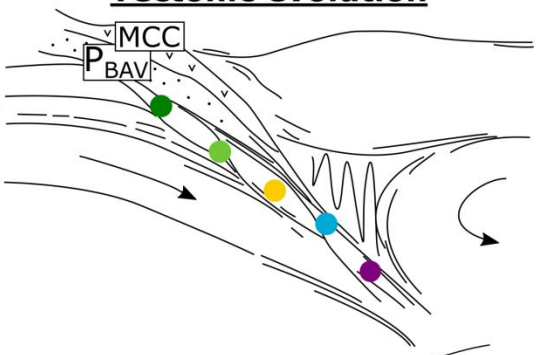


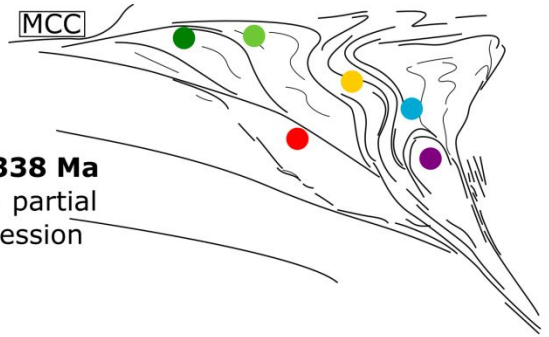
340 → ~338 Ma
D2 event: partial
decompression

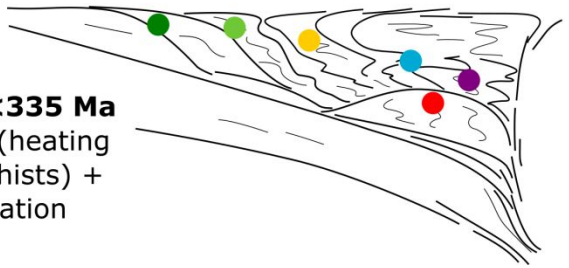


~338 → <335 Ma
D3 event (heating
in micaschists) +
exhumation

Tectonic evolution

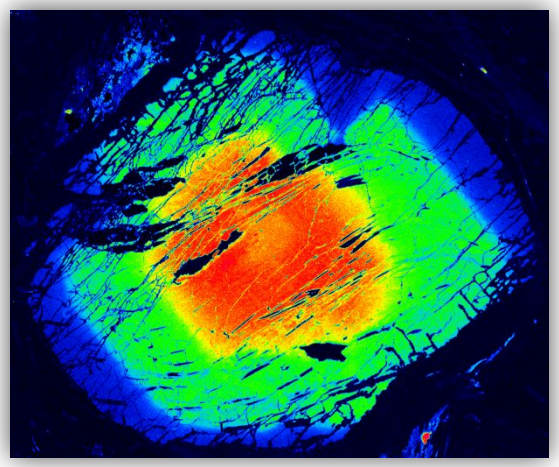






Jouvent et al., in prep.

Thank you for your attention!



Looking for a Post-doc opportunity!

Contact:
marine.jouvent@natur.cuni.cz
or Research Gate,…

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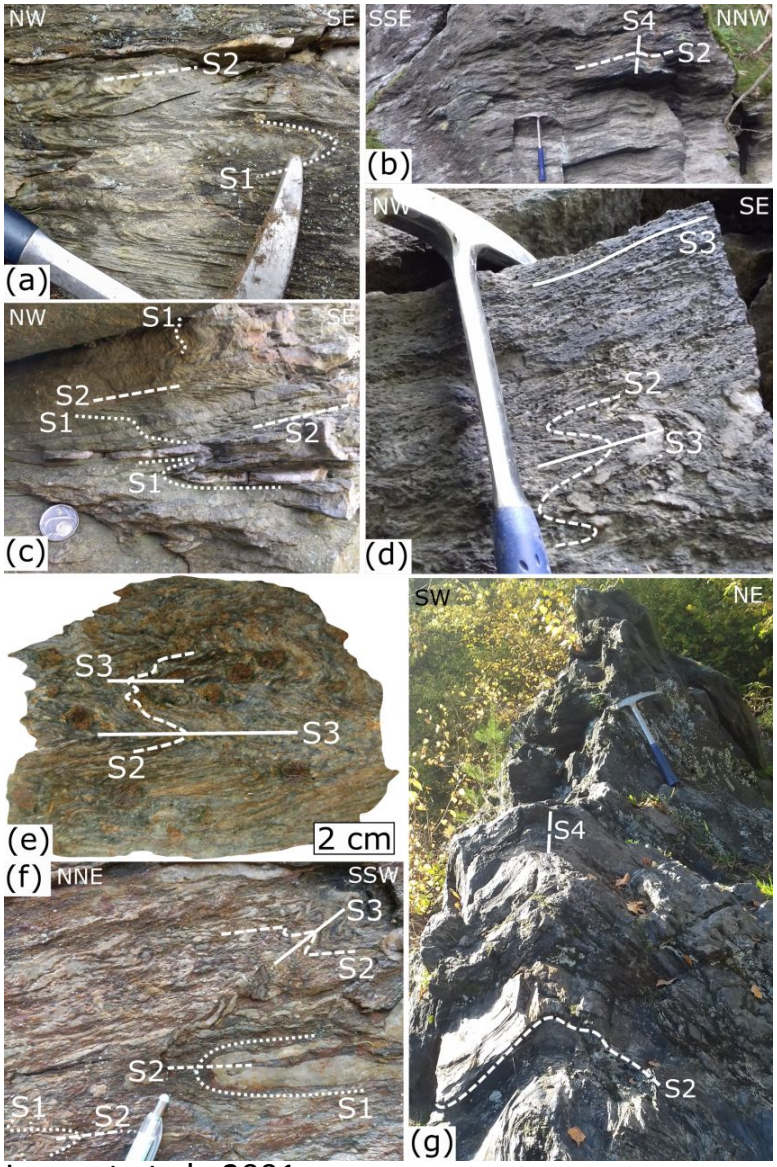
Additional material for questions

Structural evolution

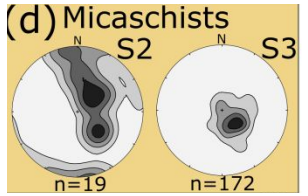
- In the field and in microstructures

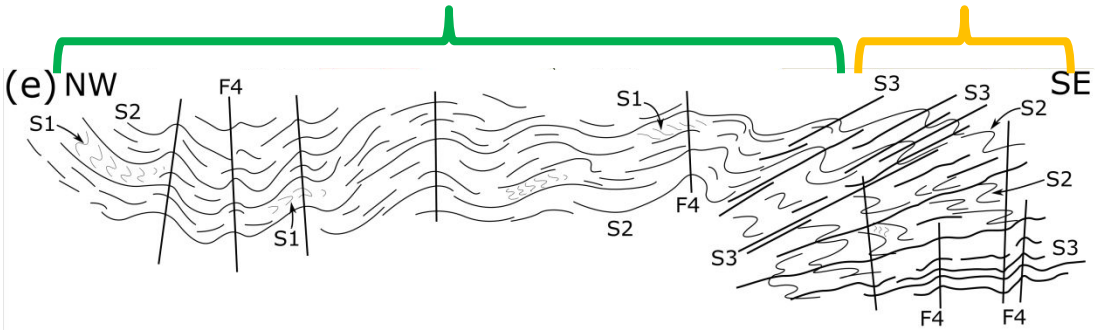


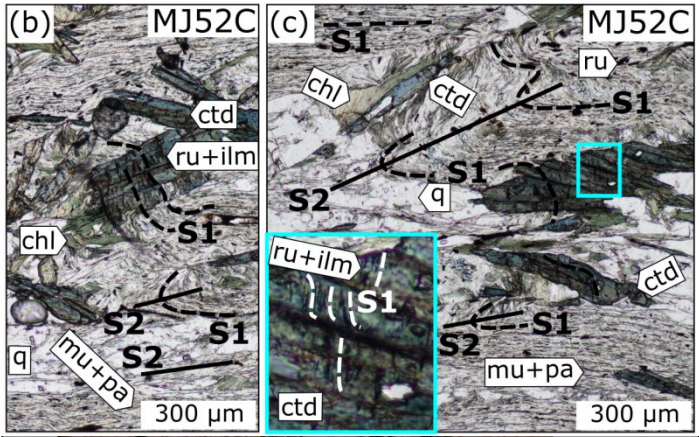
Jouvent et al., 2001

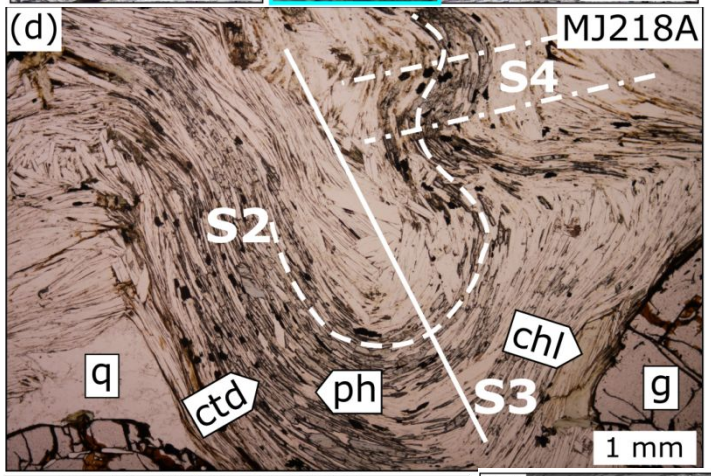
Four deformation events:

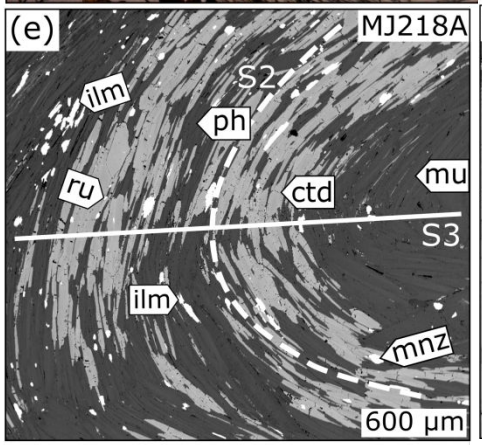
- Relics of early fabric S1 in all units
- Main flat foliation S2 in phyllites and S2 transposed to flat fabric S3 in micaschists
- Late deformation D4

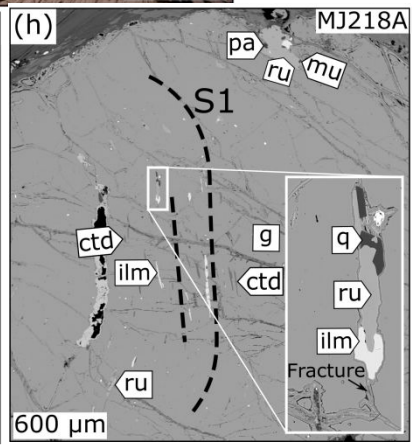












Metamorphic assemblages

Struct. / Min.	M_{1-2}-D_{1-2} M1-2 matrix	M3-D3 M3 matrix	M4-D4 M4 matrix	M1-D1 g core	M1-D1 g rim I	M1-D1 g rim II	M2-D2 M2 matrix	M3-D3 M3 matrix	M4-D4 M4 matrix
g	→			→	→	→			
ctd	→								
pa	→								
chl	→	?	→	→	→	→	→	→	→
ru	→								
ilm	→	?	→					→ ?	→ ?
bi								→	→ ?
st								→	
mu	→	?	→	→	→	→	→	→	→

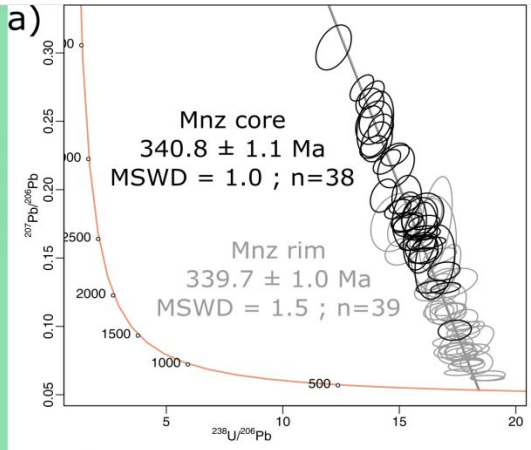
- **S1-S2**: g, ctd, ph, ru, pa => **HP-LT**

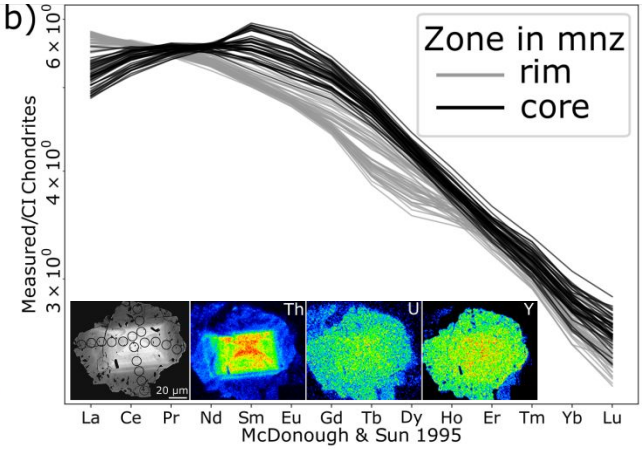
- HP event identified everywhere
- MP-MT overprint localized only in deeper unit

Jouvent et al., 2001

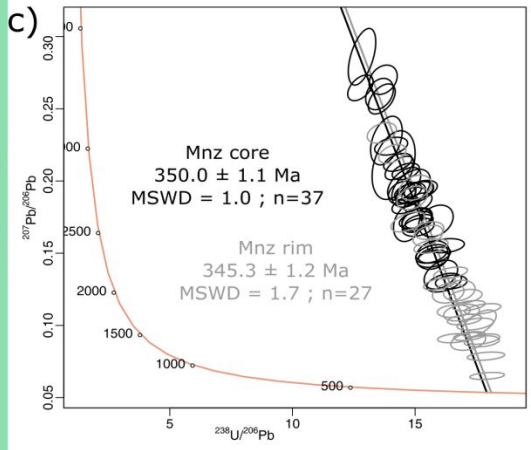
Phyllites

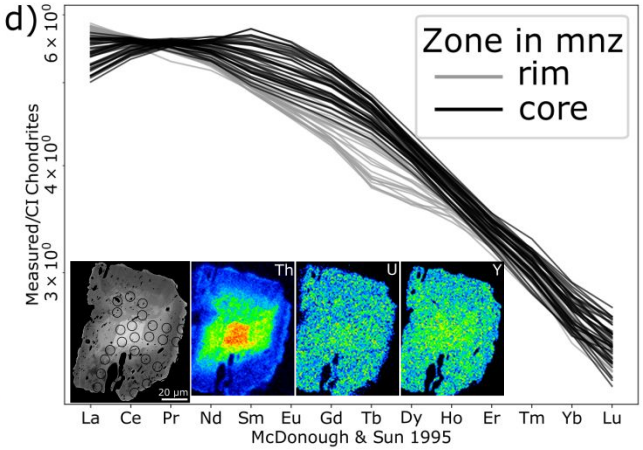
MJ44



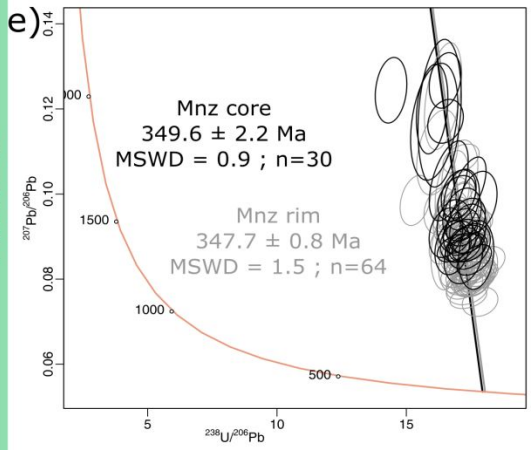


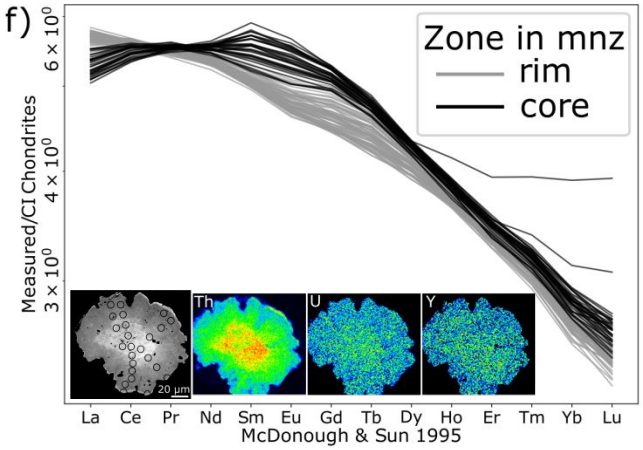
MJ182





MJ52D



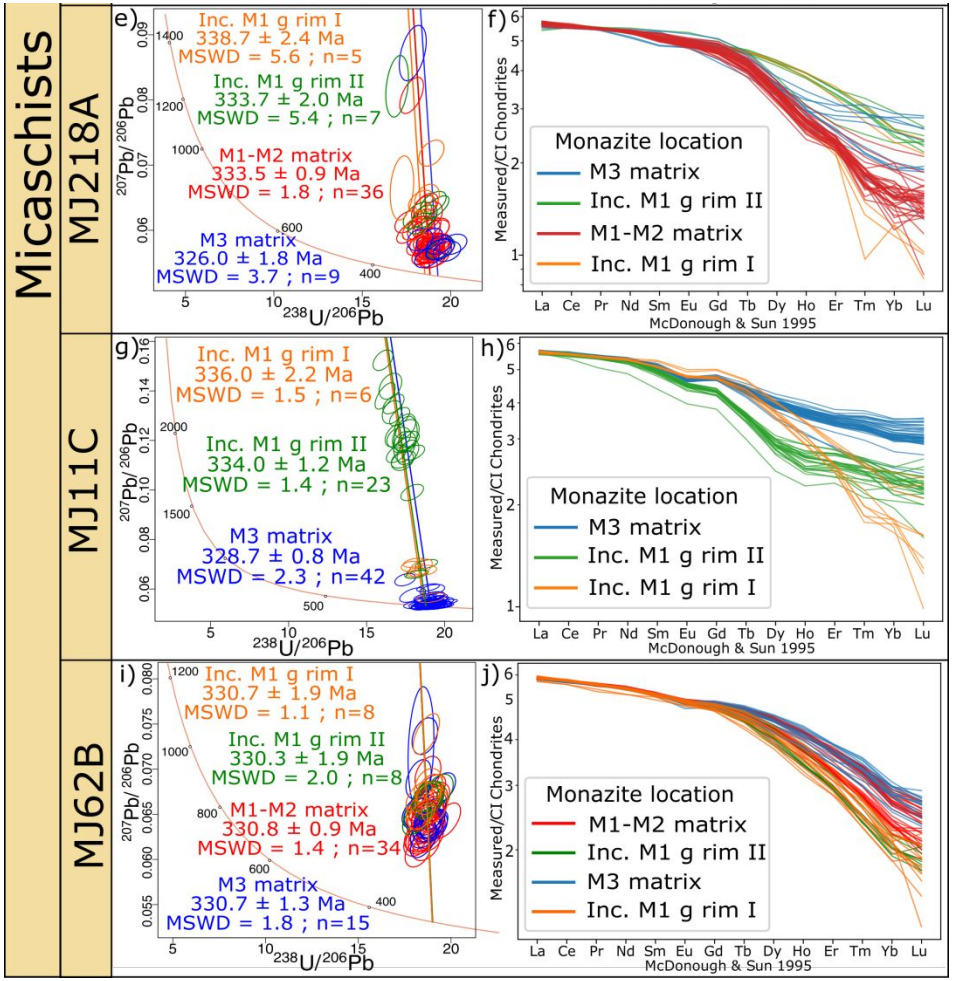


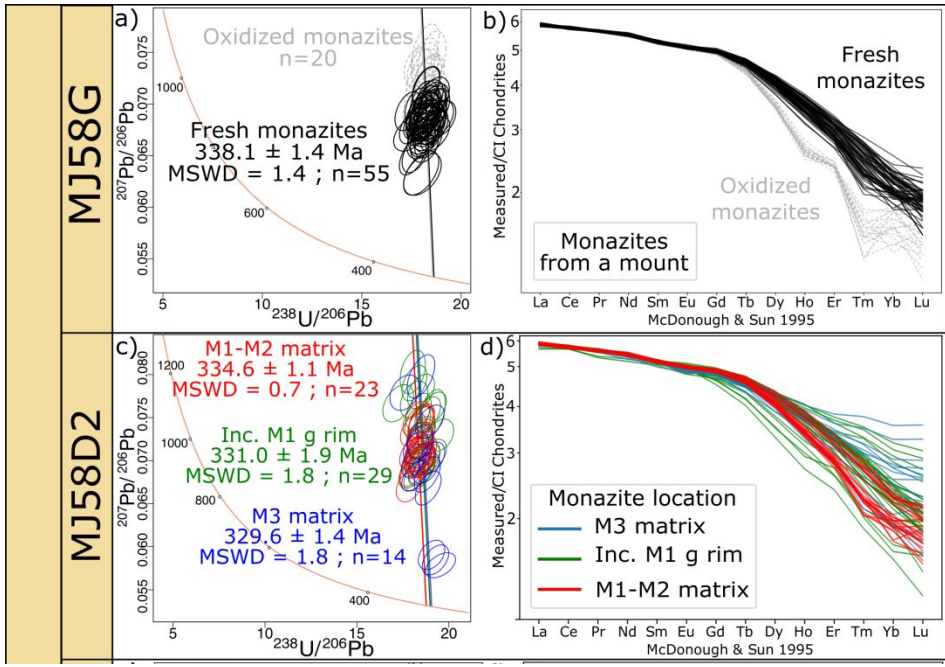
Monazite dating in phyllites

- Ages from **350 to 340 Ma**
- Core of mnz often older than rim
- Ages likely correspond to the prograde evolution (M1)

Jouvent et al., in prep.

Monazite dating in micaschists





- Ages from ~**340 to 330 Ma**
- Mnz in garnet **rim I (340-335 Ma)** older than in **M3 matrix mnz (330 Ma)**

Jouvent et al., in prep.

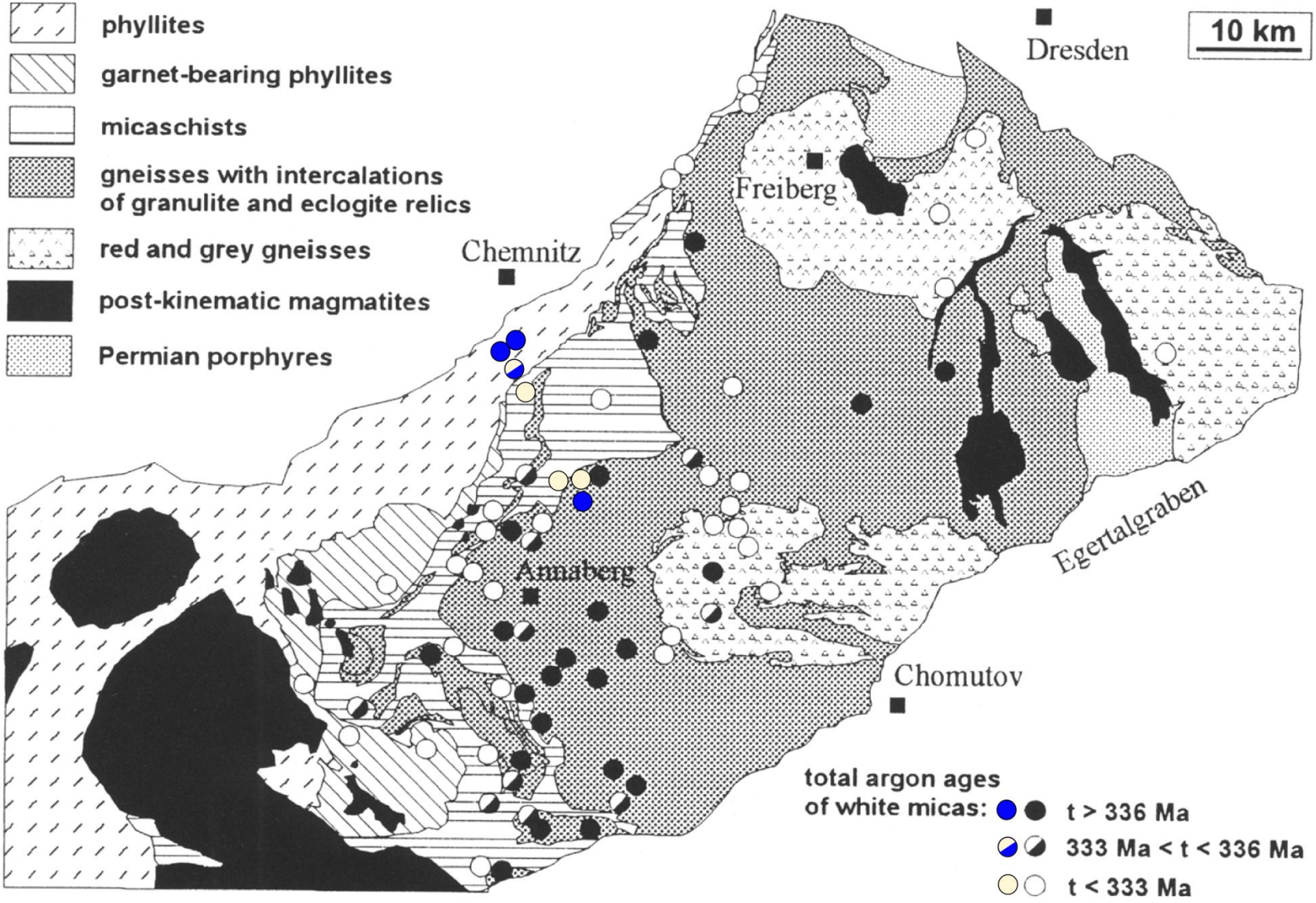


Fig. 1. Simplified geological map of the Erzgebirge: main rock units and isotopic age groups of white mica from metamorphic rocks.

Modified from Werner and Lippolt, 2000

Article available for more detail about the structural and metamoprhic evolution of the wedge: Jouvent et al., 2022 (JMG)

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ORIGINAL ARTICLE

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New constraints on the tectonometamorphic evolution of the Erzgebirge orogenic wedge (Saxothuringian Domain, Bohemian Massif)

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Abstract

In contrast to well-documented (*U*)*HP* rocks of the Erzgebirge crystalline complex (Saxothuringian Domain, Bohemian Massif), the surrounding medium- to low-grade metasediments are scarcely studied, although they provide an important link between deep subduction and mid-crustal processes. To constrain the Variscan evolution from continental subduction to orogenic wedge,