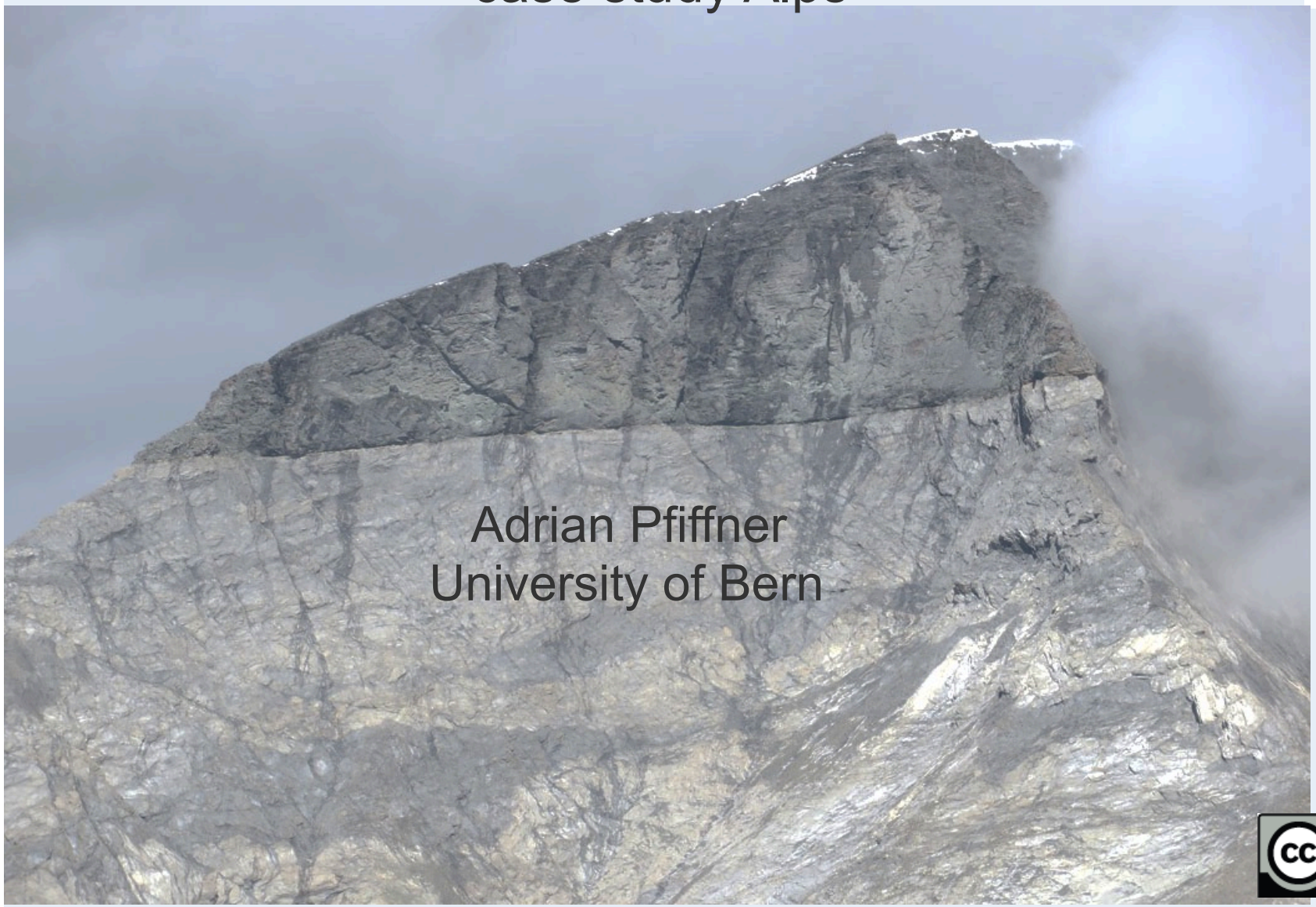
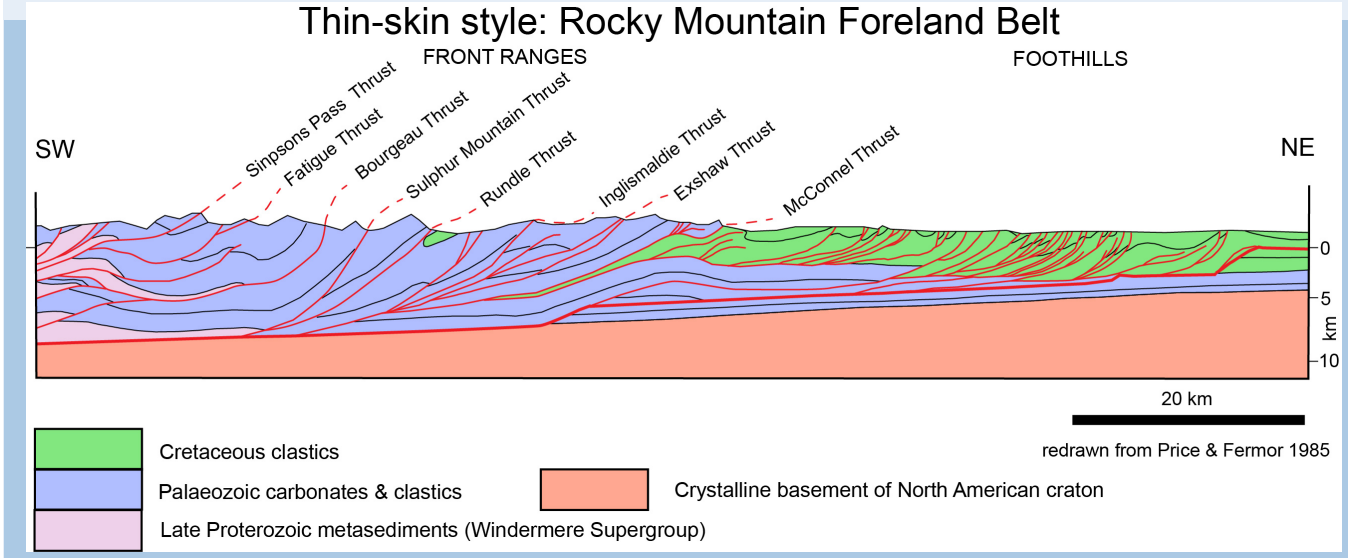
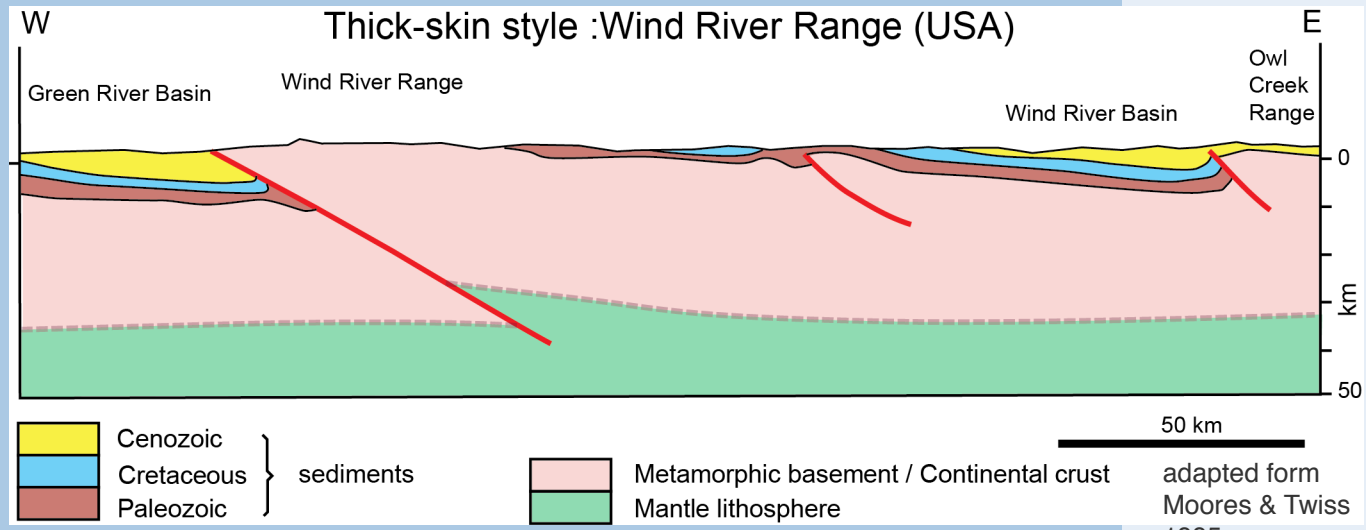
Basement-involved thin- and thick-skinned tectonics: case study Alps



Adrian Pfiffner
University of Bern

The topic: Thick-skinned ⇔Thin-skinned style





adapted form Moores & Twiss 1995

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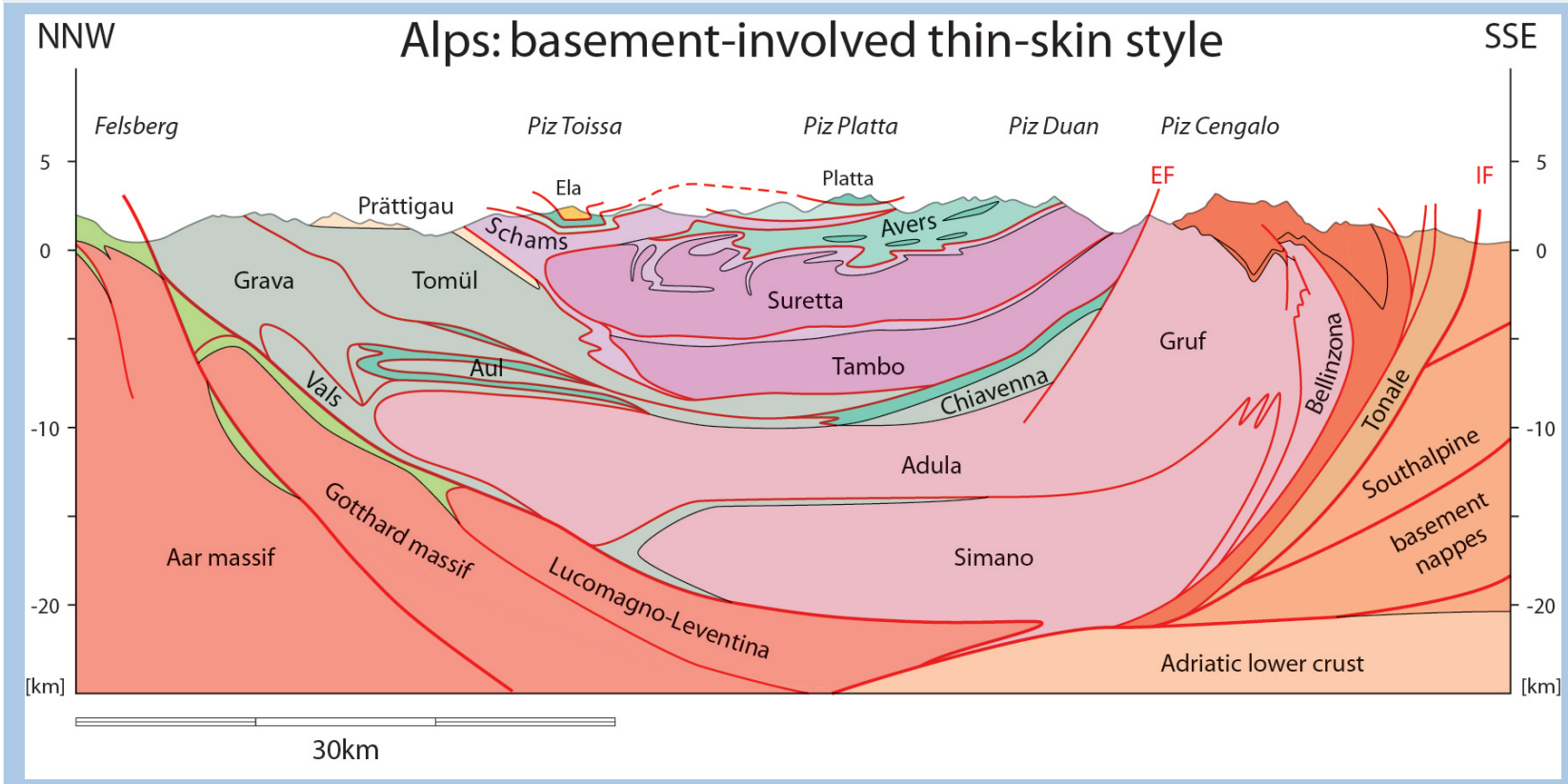
The Problem: Thin basement nappes ….



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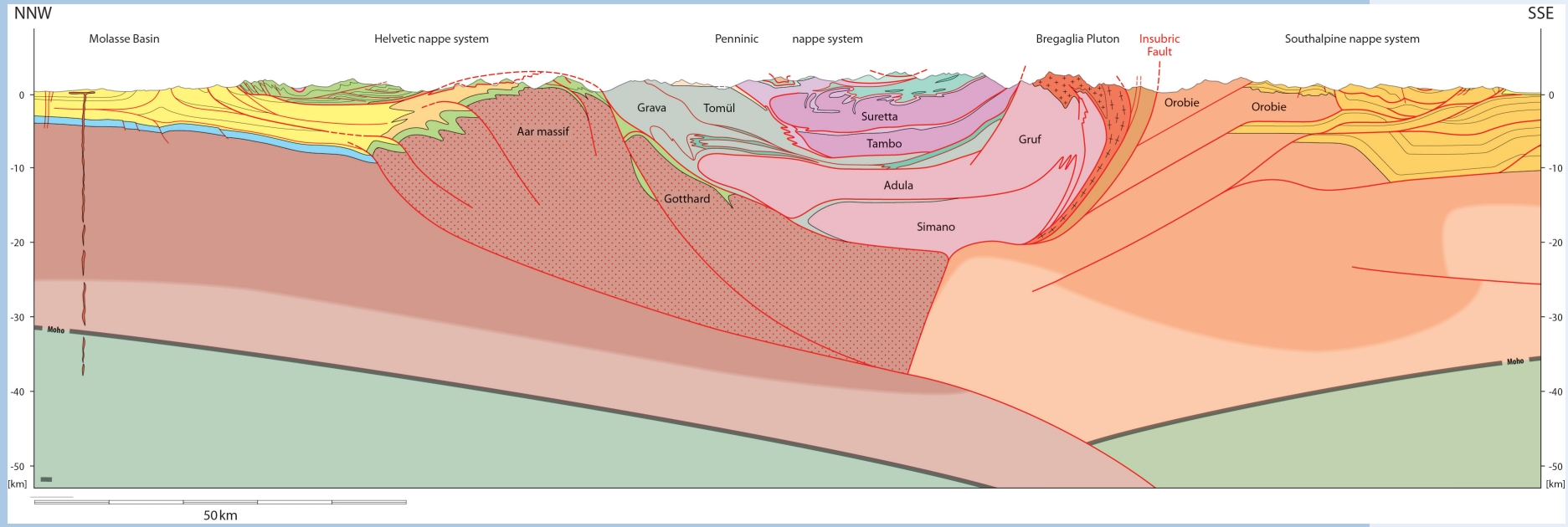
…. overlying thickened continental crust



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Replacement of cover, folded thrust faults

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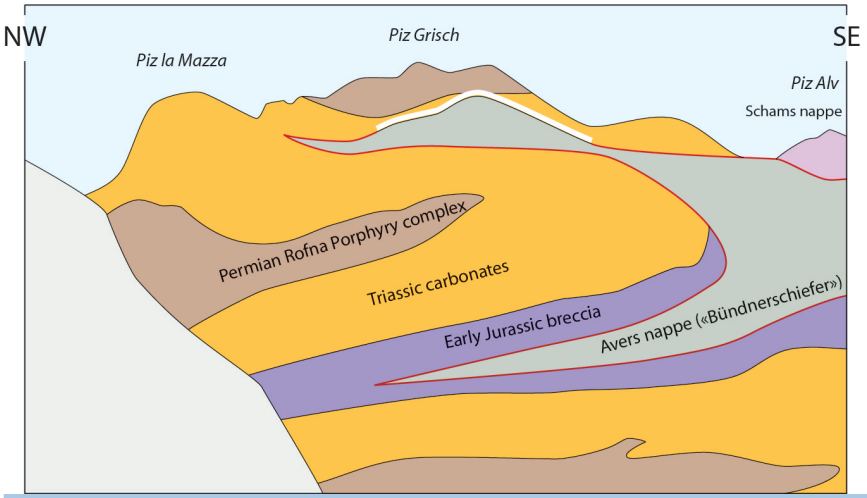

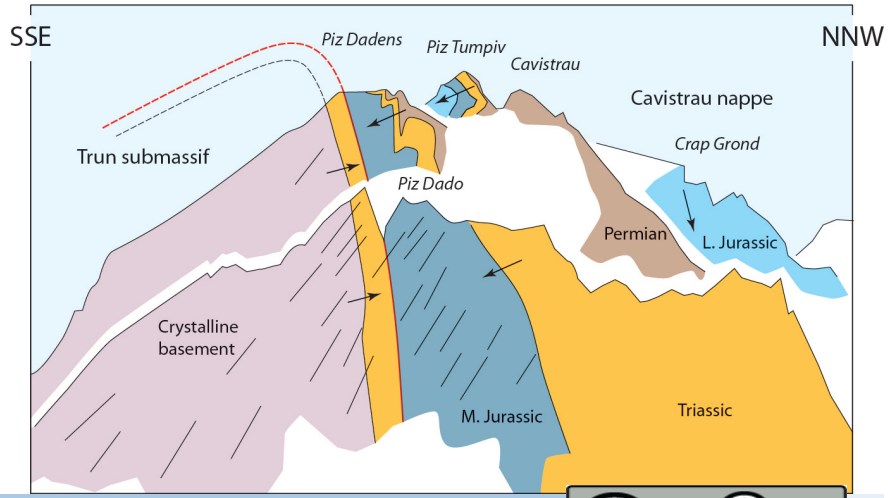

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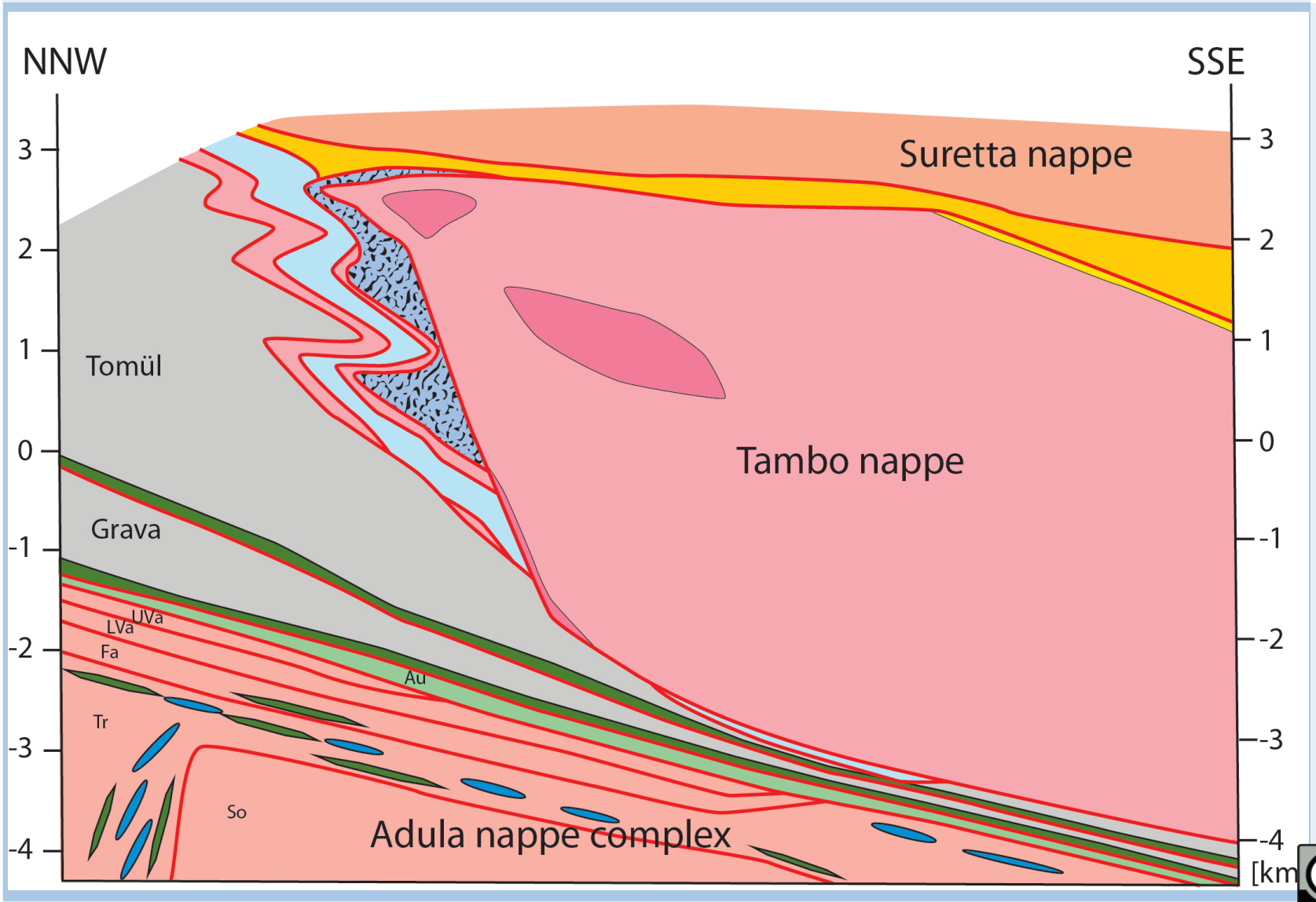
Internal deformation of basement nappes: Tambo & Adula



adapted from Mayerat-Demarne 1994

based on Berger & Mercolli 2006

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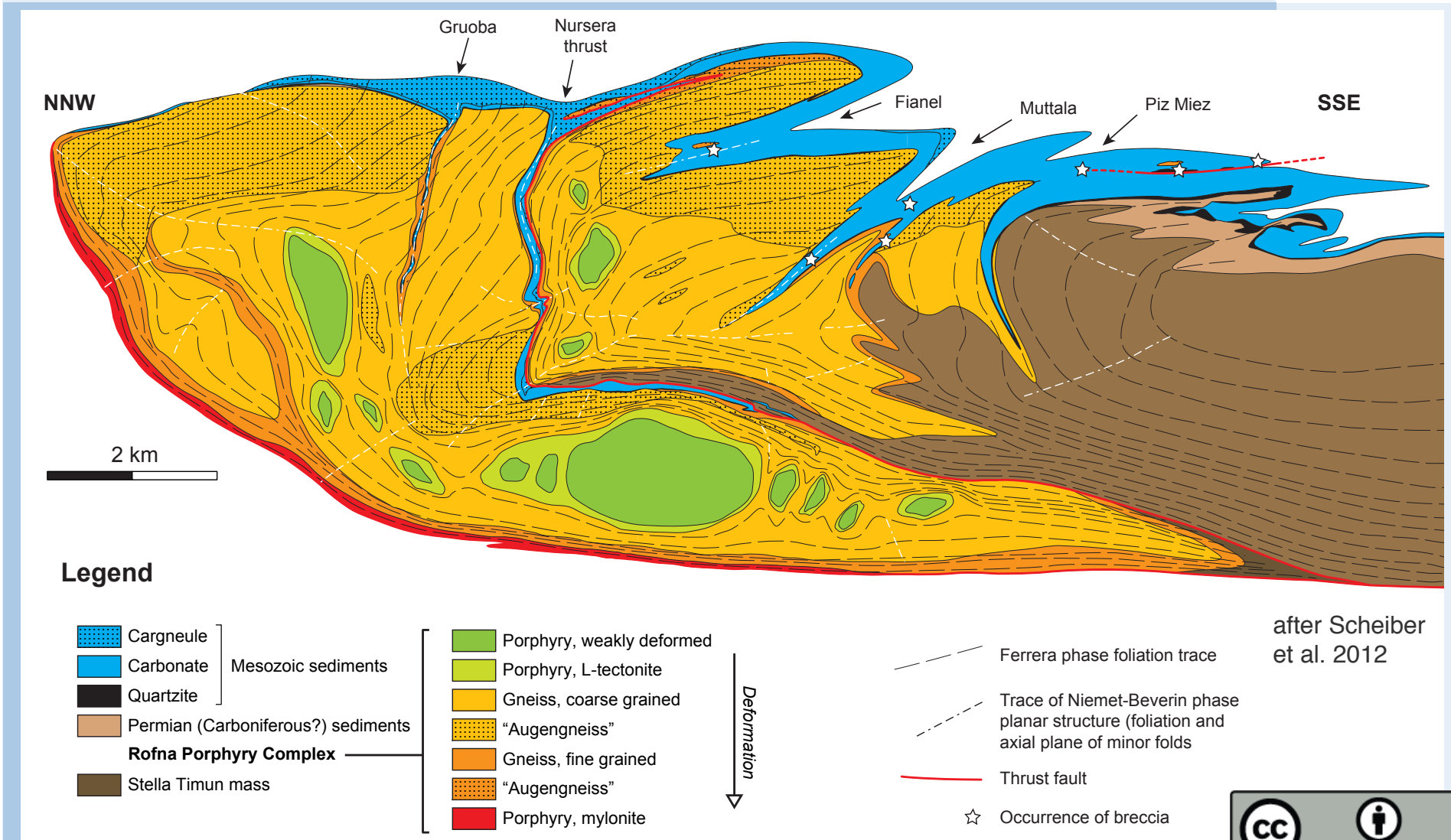
Internal deformation of basement nappes: Suretta



after Scheiber et al. 2012

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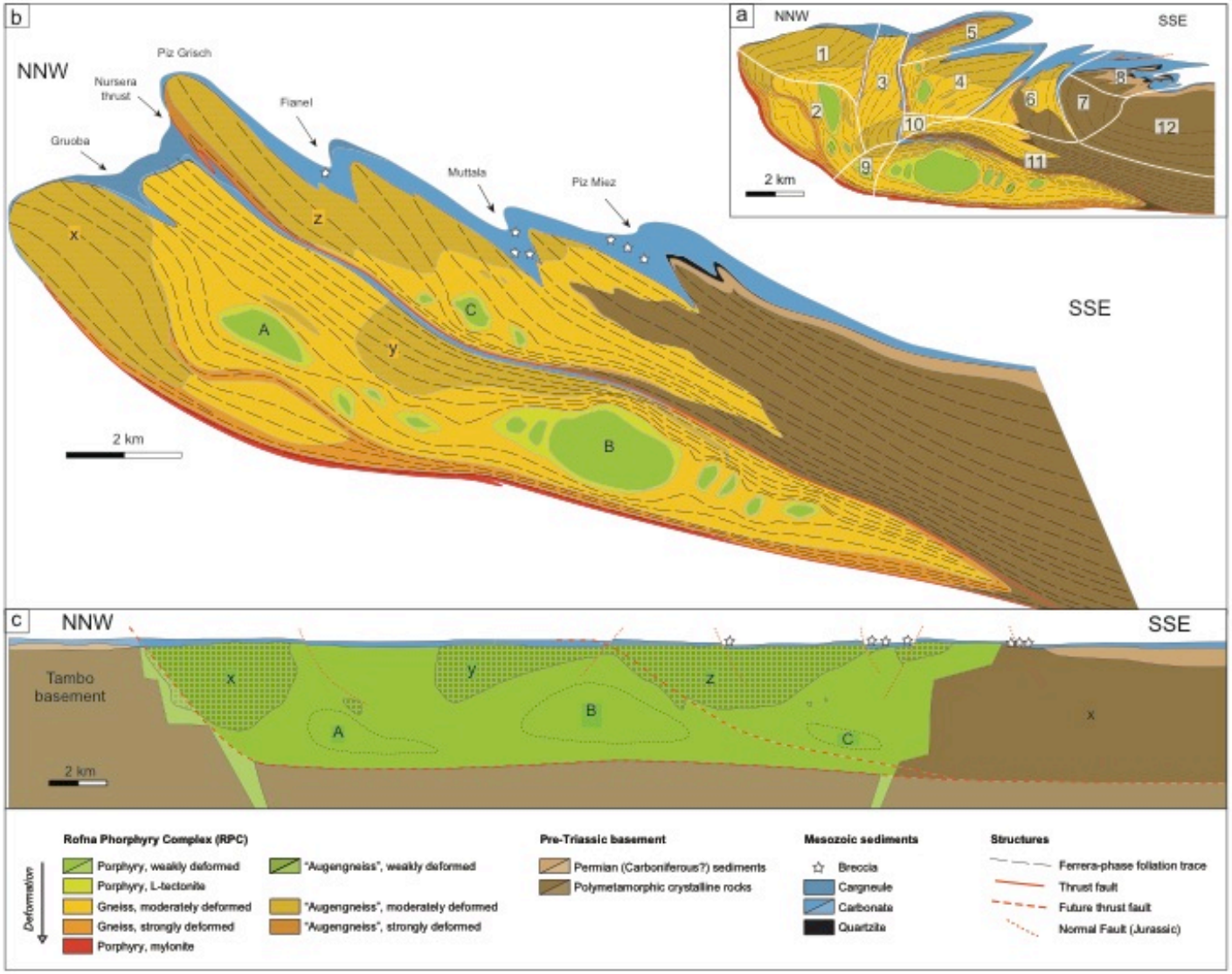
Internal deformation of basement nappes: Suretta



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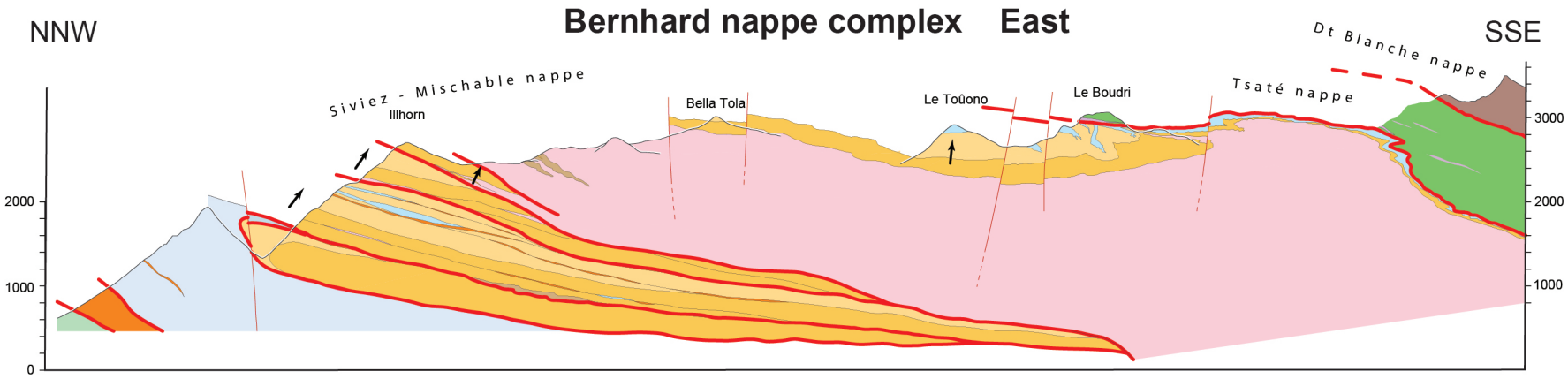
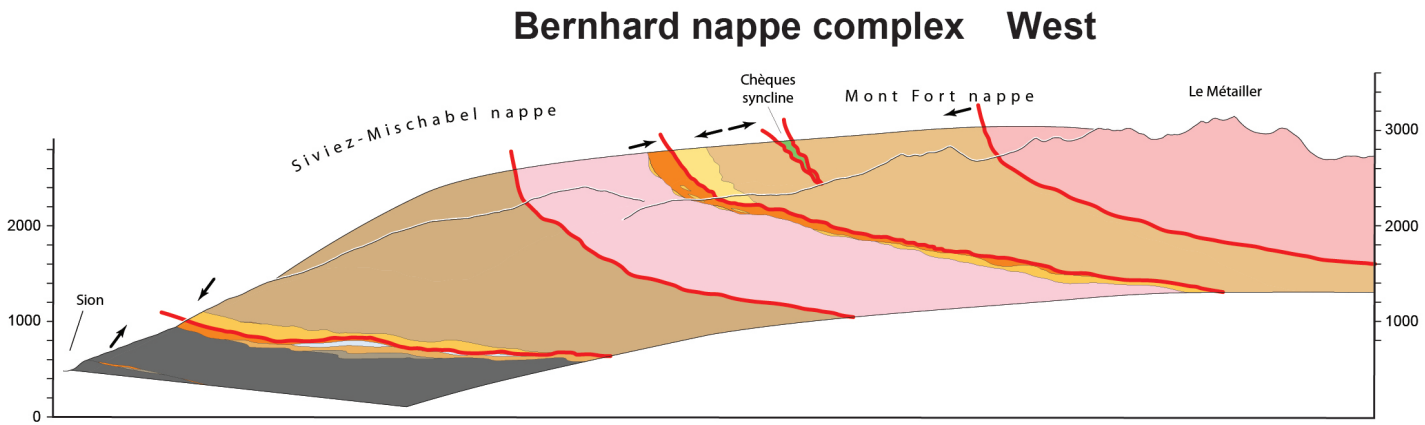
Internal deformation of basement nappes: Bernhard



after Scheiber et al. 2013



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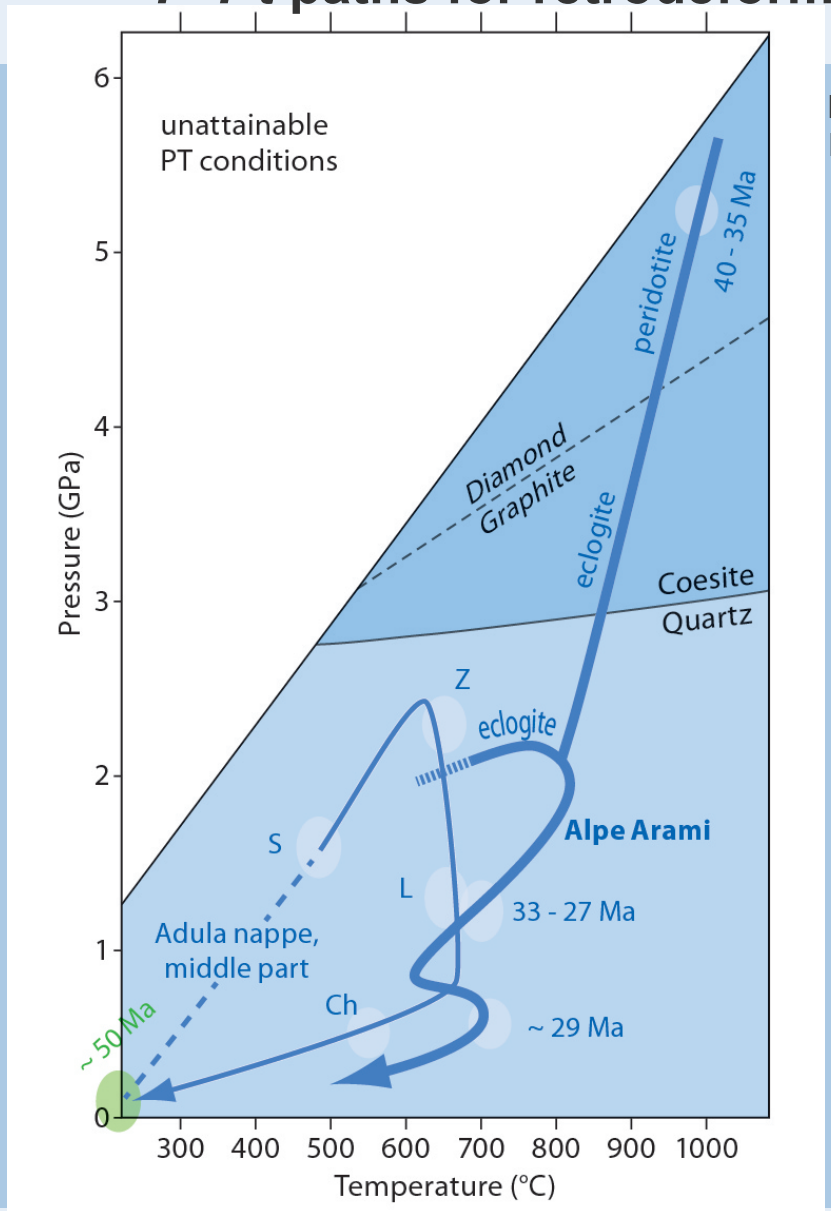
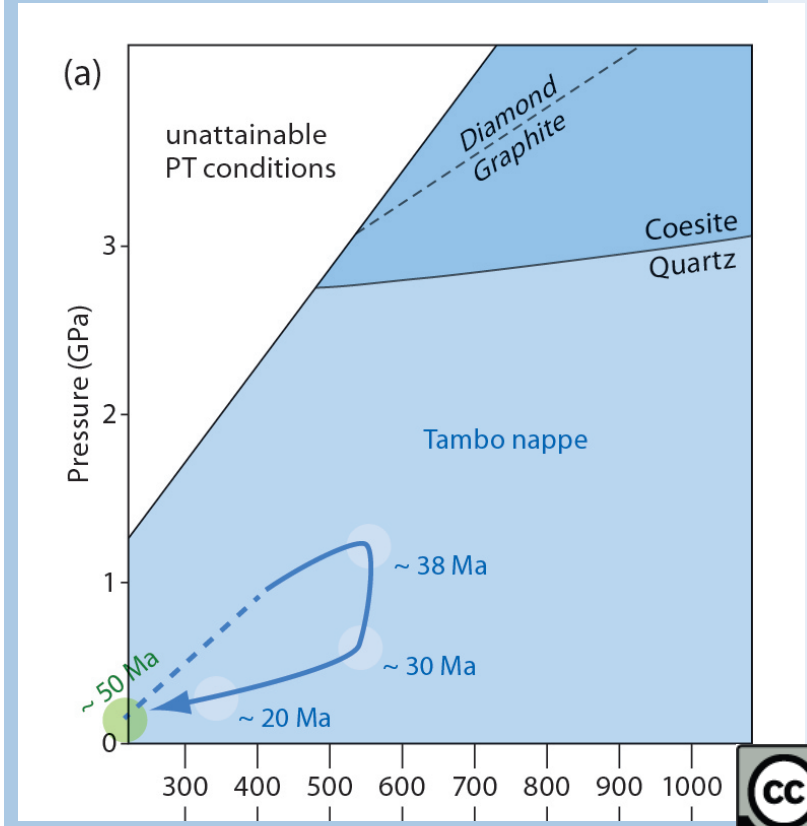
P-T-t paths for retrodeformation of cross-sections



based on compilation by
Frey & Ferreiro Mählmann 1999

after Marquer et al. 1994



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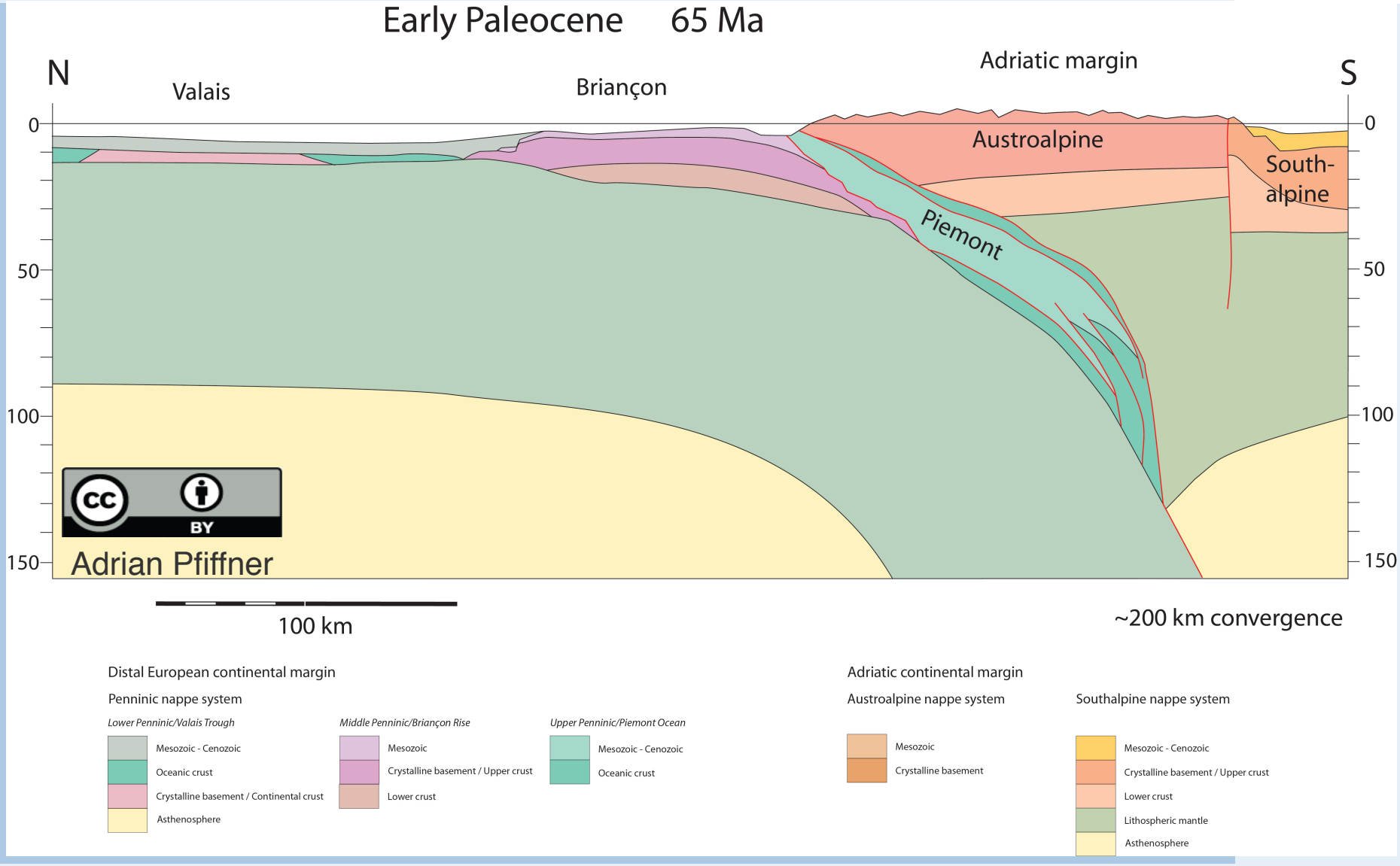
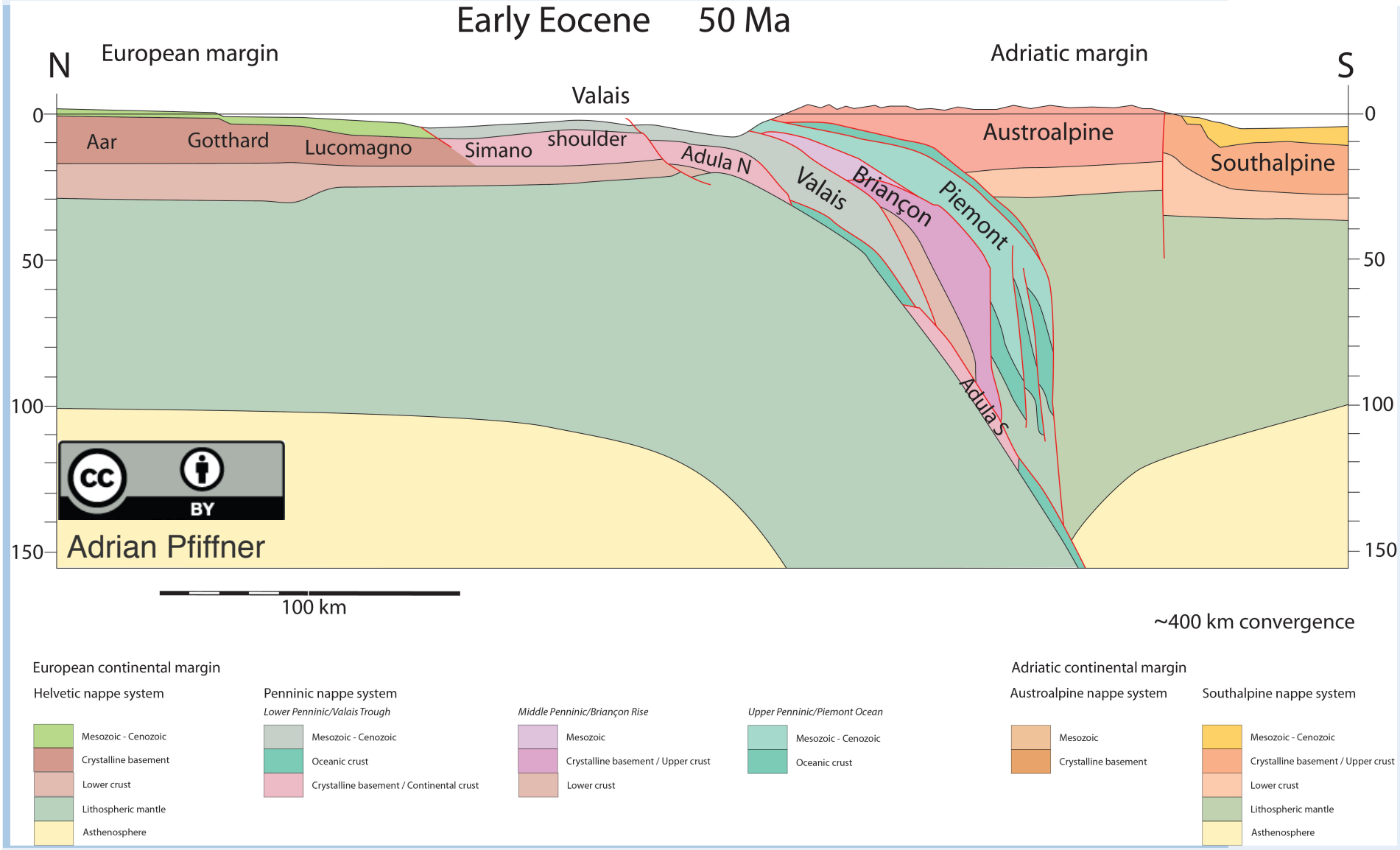
Piemont Ocean subducted, Briançon microcontinent enters



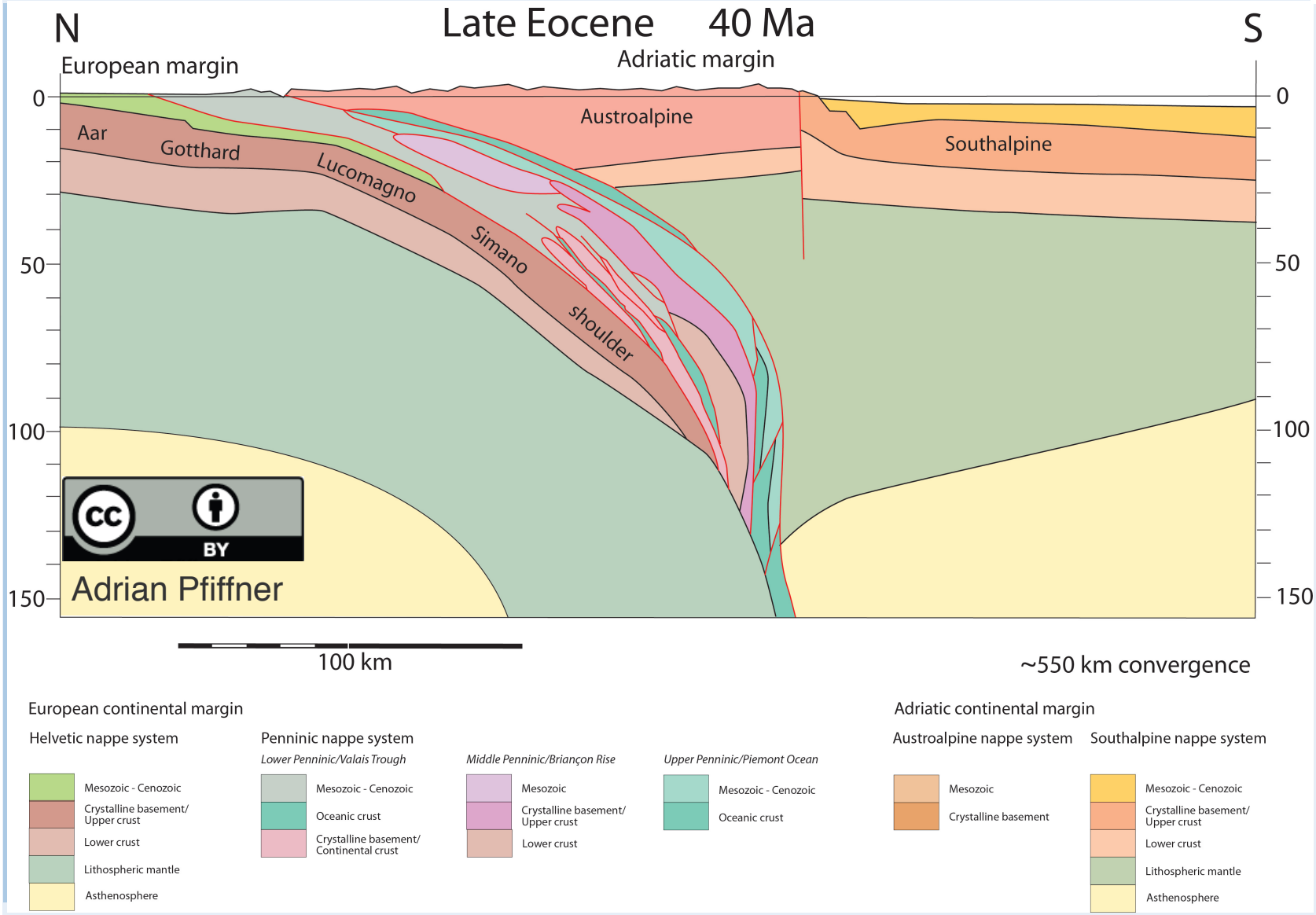
Basement-involved tectonic styles

Briançon & Valais cover detached, basement descends



Basement-involved tectonic styles

Basement nappes expelled upward



Onset of collision by entrance of thick continental crust

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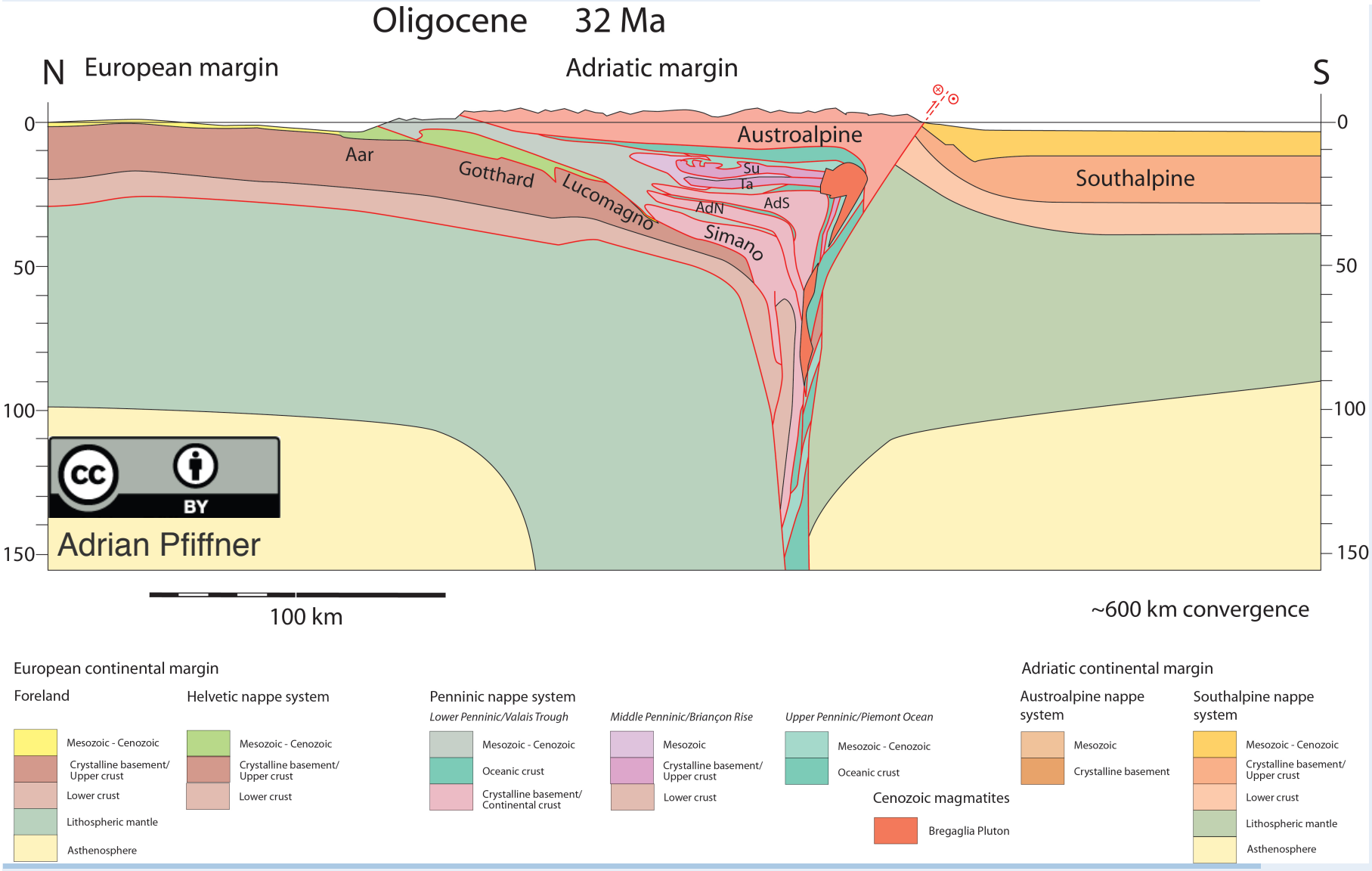
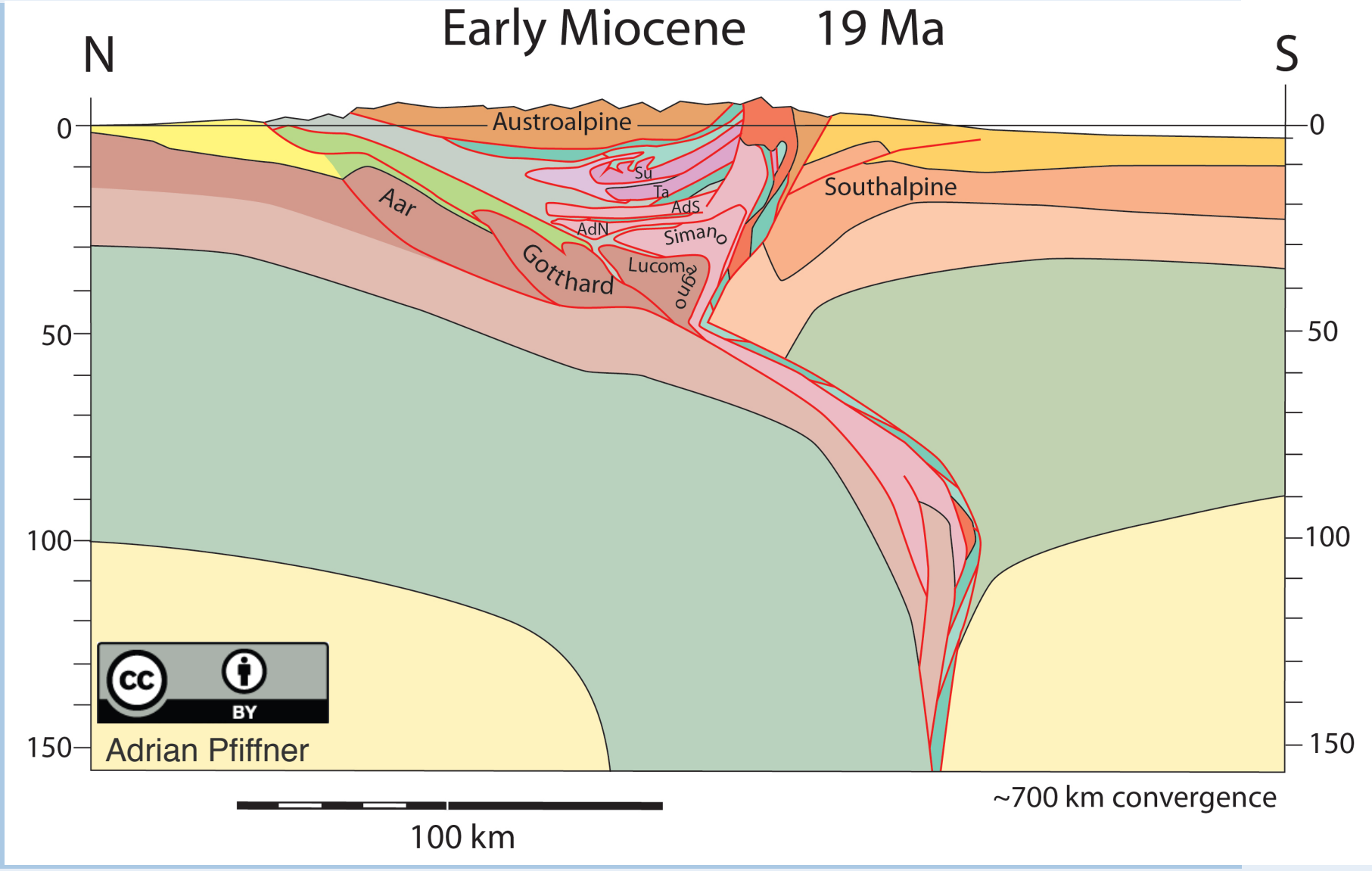
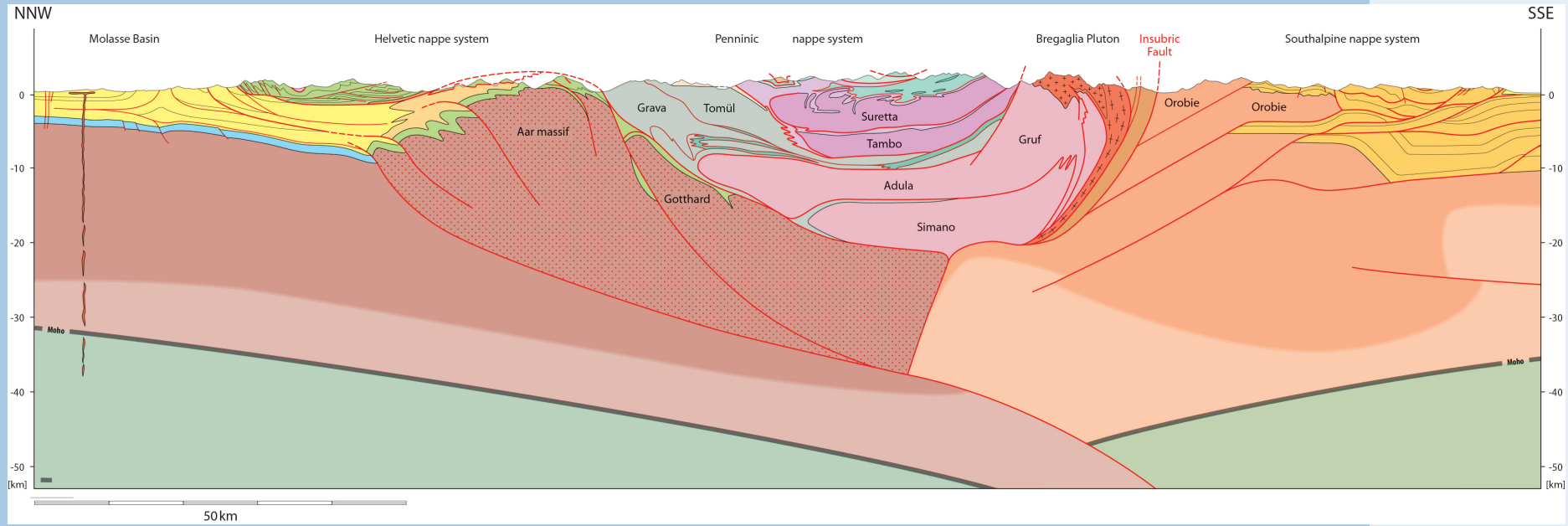


Continuing collision: backthrusting, squashing of margins



Final stage: crustal structure



Crustal structure after Waldhauser et al. 2002, Diel et al. 2009 & Wagner et al. 2012

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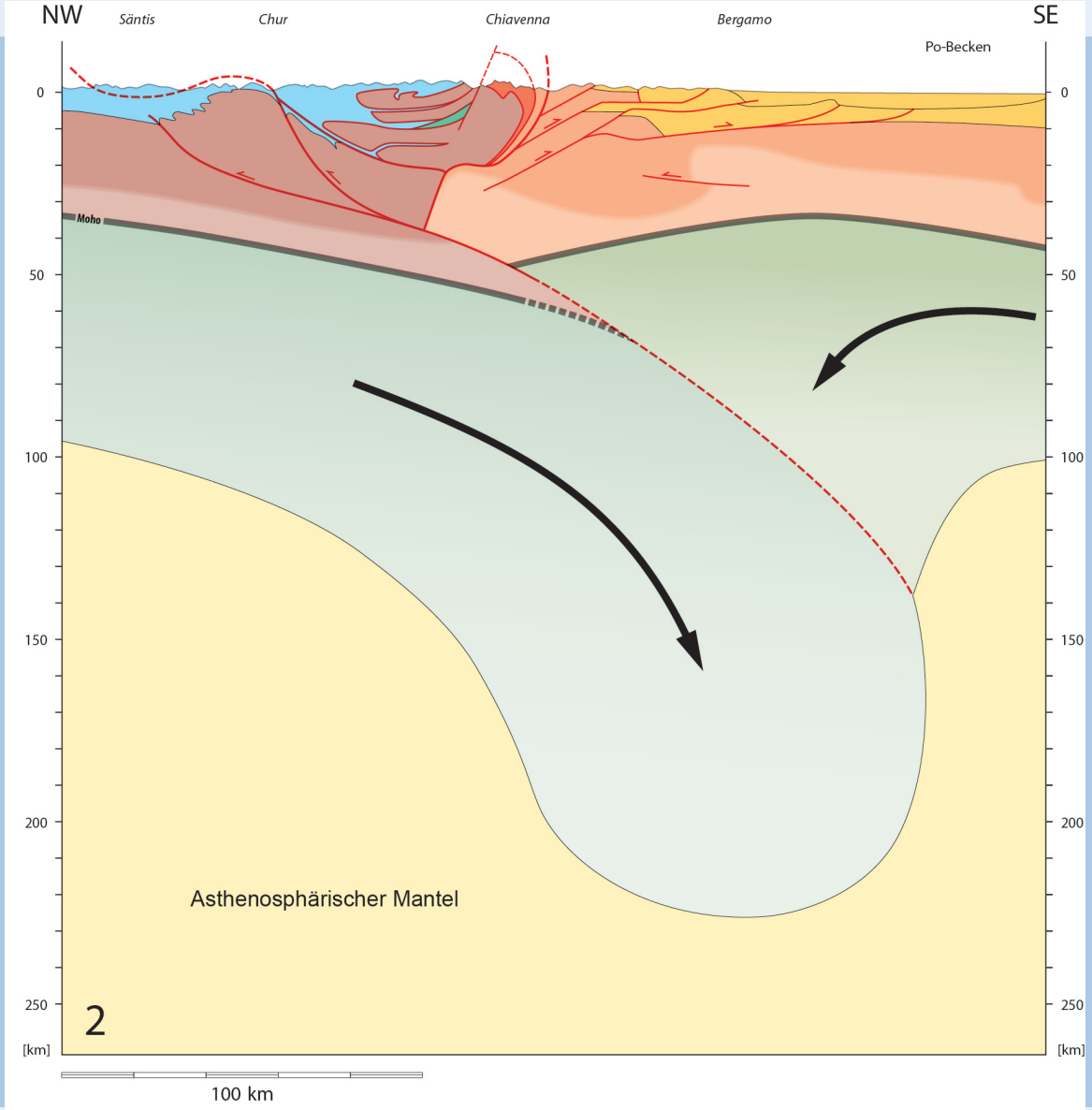
Final stage: lithosphere structure



Lithosphere structure
after Lippitsch et al. 2003

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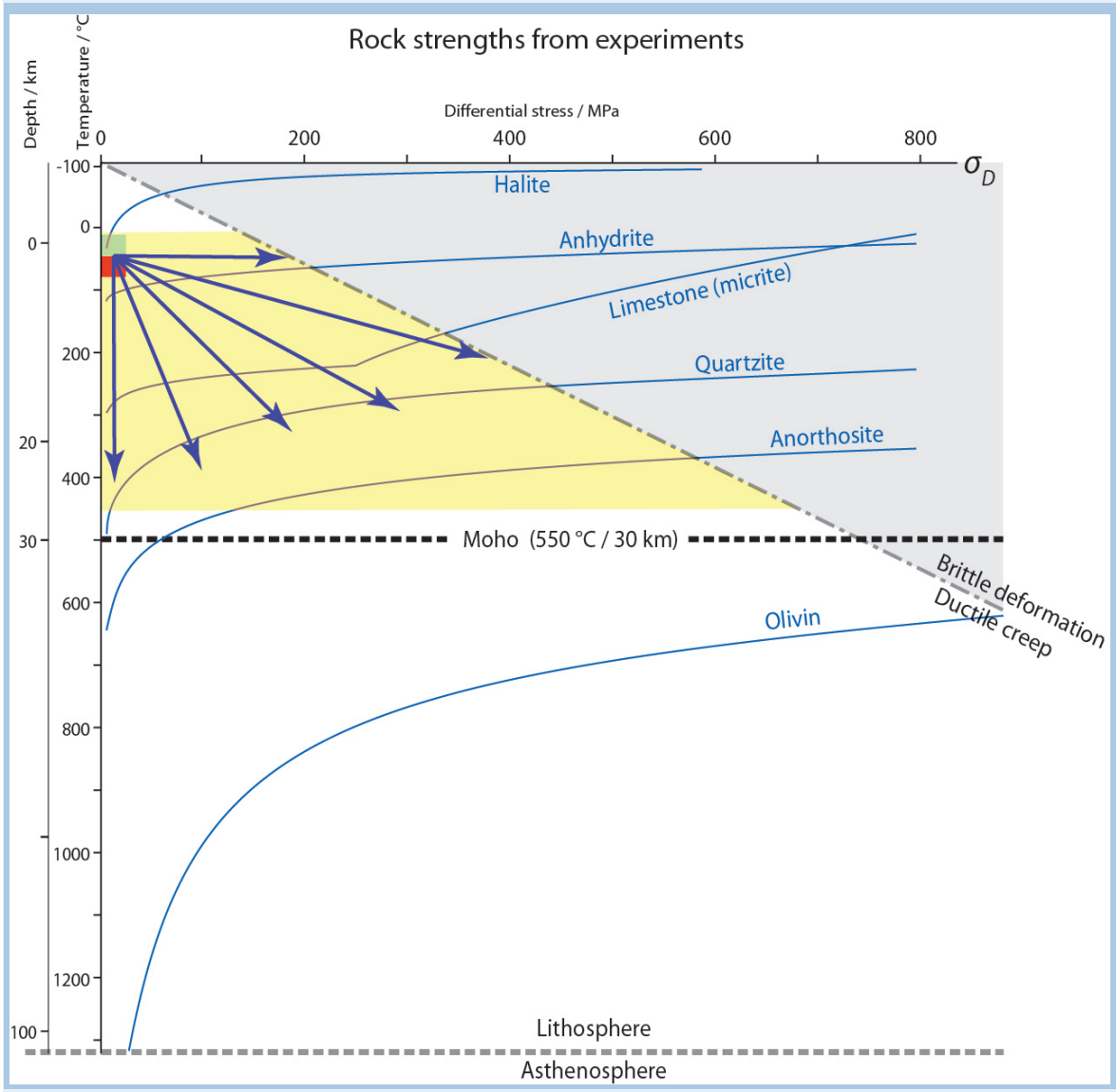
Shallow versus deep detachment



Evaporite layers allow detachment at low temperature nd shallow depth

Deformation of cristalline basement is controlled by quartz rheology, which requires higher temperatures attained at deeper levels

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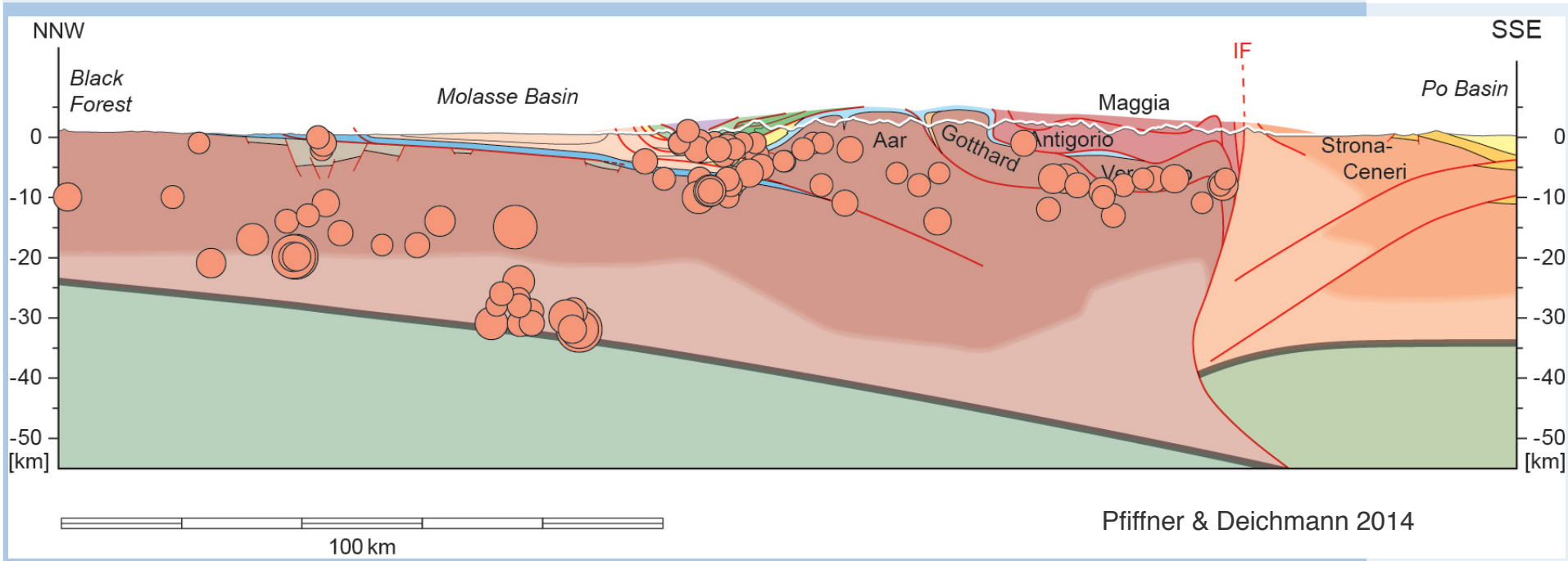
Final stage: crustal structure and seismicity



Pfiffner & Deichmann 2014

deep earthquakes in the foreland ←→ shallow earthquakes in the Alps

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