

Structural thermochronology along geophysical transects through the Alps

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Main Goal

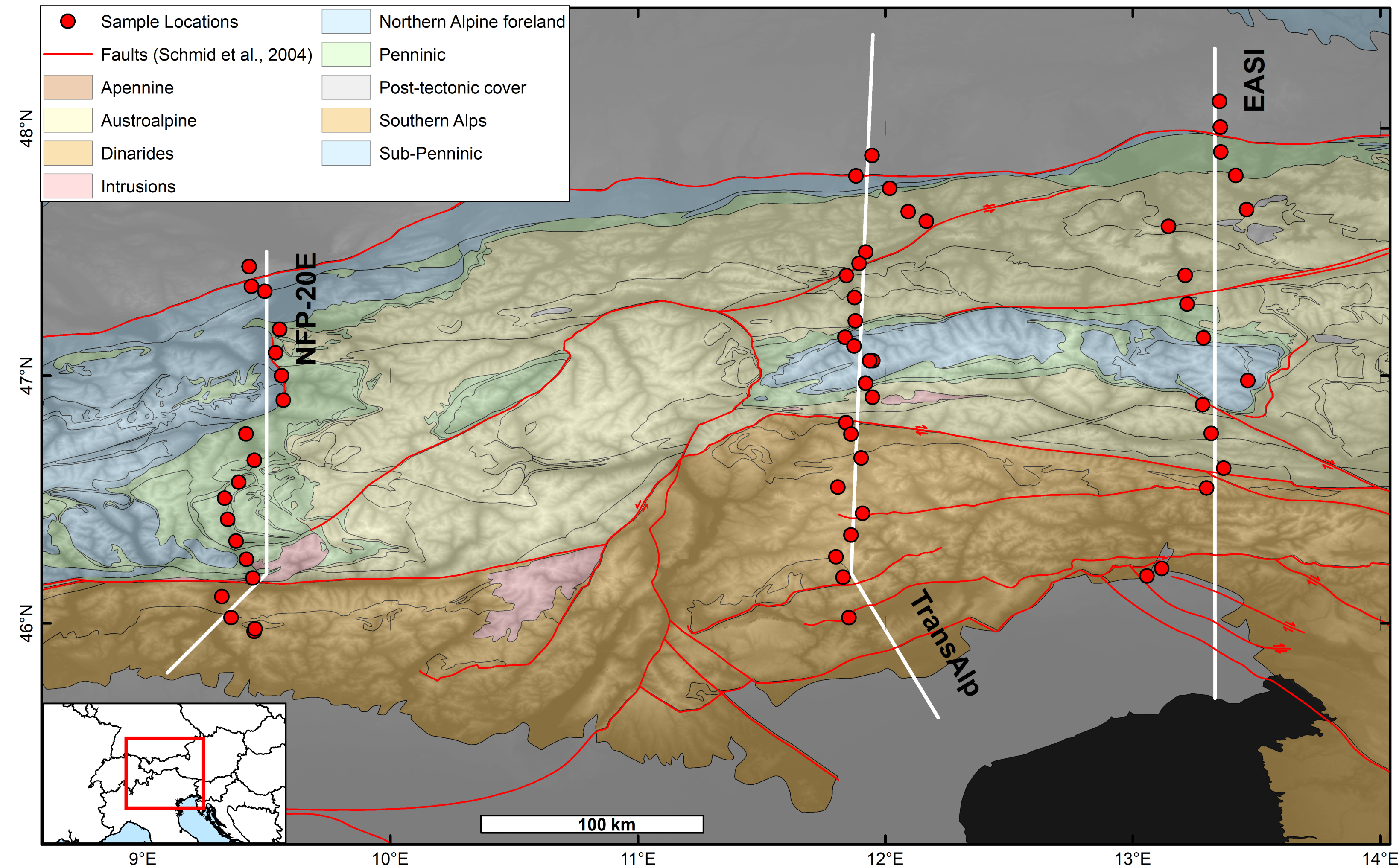
- Reconstruct the tectonic evolution of the Alps with thermochronology and balanced cross sections
- Relate the observed tectonic and exhumation history of the Alps to changes in the deep lithosphere (e.g. slab break-off or switch in subduction polarity)

Approach

Use thermal-kinematic modeling to test tectonic scenarios that do explain observed thermochronological data:

1. Thermochronological dating with apatite and zircon (U-Th)/He (AHe, ZHe) and apatite and zircon fission track (AFT, ZFT)
2. reconstruct the tectonic evolution with MOVE
3. Extract kinematic field
4. Model thermal evolution with kinematic field and thermochronological ages with PECUBE
5. Iterate through 1-3 to find scenarios that fit structural and thermochronological data

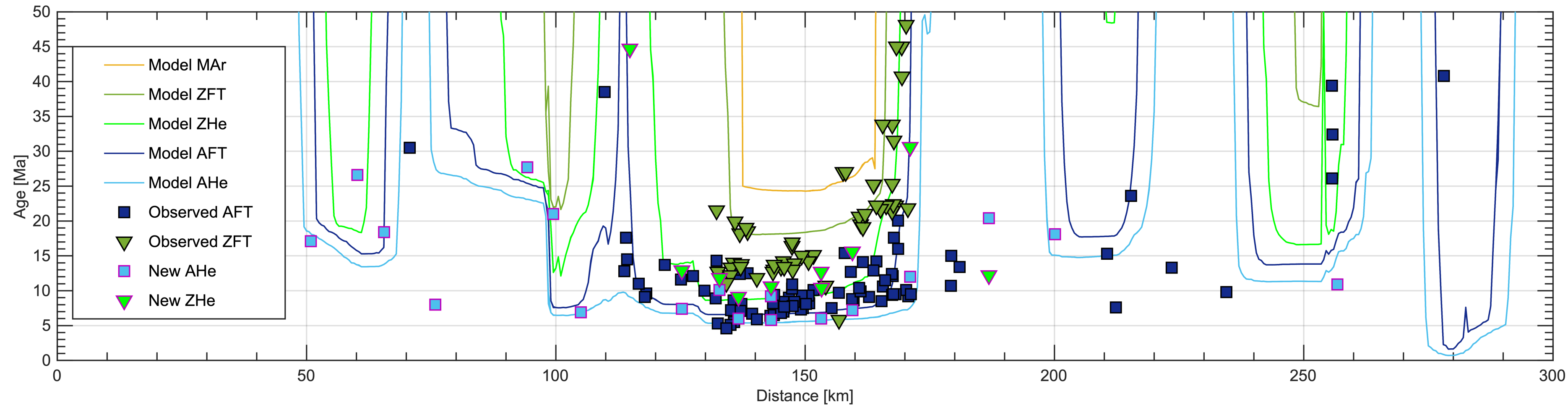
Study Area



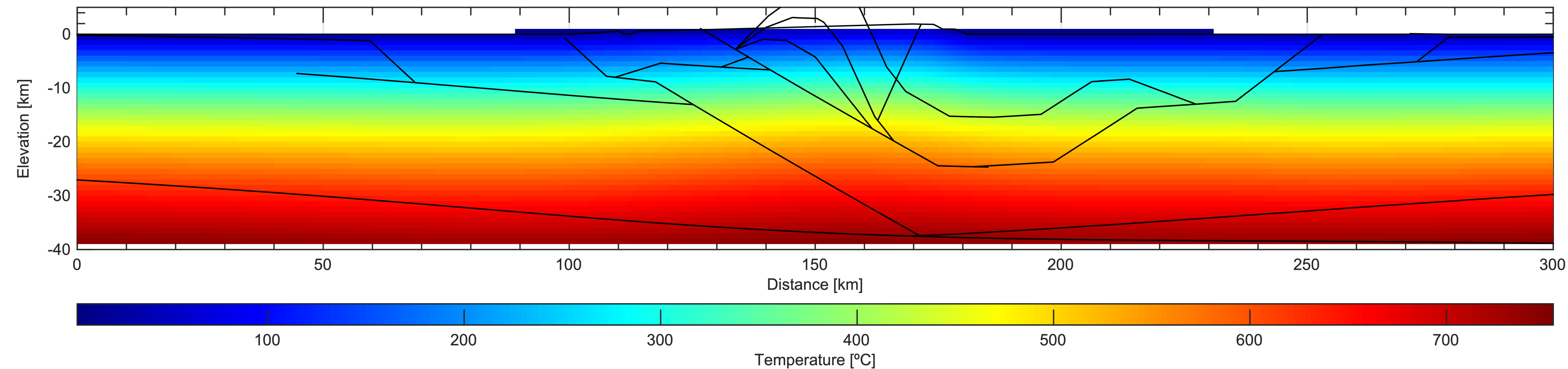
- Central and Eastern Alps
- NFP-20E, TransAlp and EASI geophysical profiles
- Roughly 60 new samples dated mainly with the apatite and zircon (U-Th)/He method

TransAlp

Thermochronological dating
and MOVE-PECUBE
modeling completed:

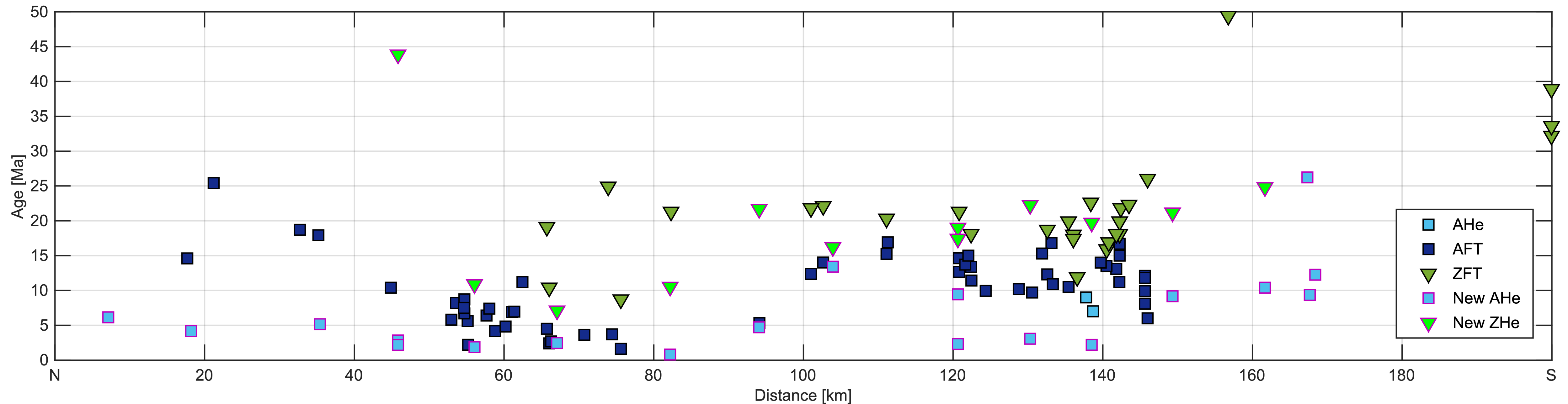


- **U-shaped pattern of ages and exhumation related to tectonic movements in the Tauern Window**
- **No distinct ‘jump’ in cooling ages at the Periadriatic fault**
- **Late phase of deformation is concentrated in the Southern Alps**
- **We suggest that the southward shift in exhumation and tectonic activity (also earthquakes) is related to a slow and ongoing subduction polarity reversal**



For details see EGU presentation of Eizenhöfer: <https://meetingorganizer.copernicus.org/EGU2020/EGU2020-9714.html>

NFP-20E



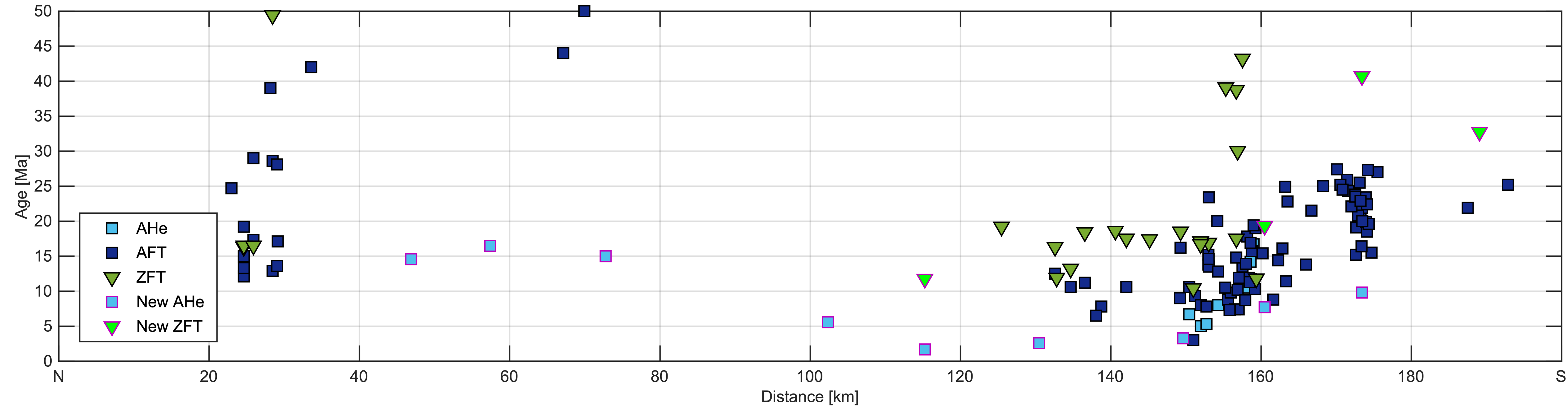
Thermochronological dating 90% completed:

- **AFT, ZHe and ZFT ages do reveal a (tectonic controlled) shift in the locus of exhumation from south (Leponine) to north (External Alps)**
- **The shift in exhumation might be related to slab rollback**
- **Very young AHe ages (<2 Ma) in the north and south are related to enhanced erosion during Quaternary glaciation (climate controlled)**

Next steps:

- **Thermal-kinematic modelling with MOVE-PECUBE**

EASI



Thermochronological dating 70% completed:

- Youngest thermochronological ages in and around the Tauern window
- Very similar ages compared to the TransAlp profile
- Resetted ZHe ages south of the Periadriatic line
- Very young AHe ages (<2 Ma) are related to enhanced erosion during Quaternary glaciation (climate controlled)

Next steps:

- Thermal-kinematic modelling with MOVE-PECUBE

Summary

- Thermochronology coupled with balanced cross section allows to independently test tectonic models
- This approach allows us to reconstruct the long-term tectonic history of the Alps
- Thermochronological data do show strong differences from West (Central Alps) to East (Eastern Alps)
- In contrast to a general shift in exhumation to the north in the Central Alps, exhumation shifted in the south in the Eastern Alps
- This shift in exhumation may be explained by an ongoing shift in the subduction polarity in the Eastern Alps