Miocene to recent kinematics and exhumation of the Mur-Mürz strike-slip fault (Eastern Alps) illustrating direct interplay with surrounding lithospheric scale processes.

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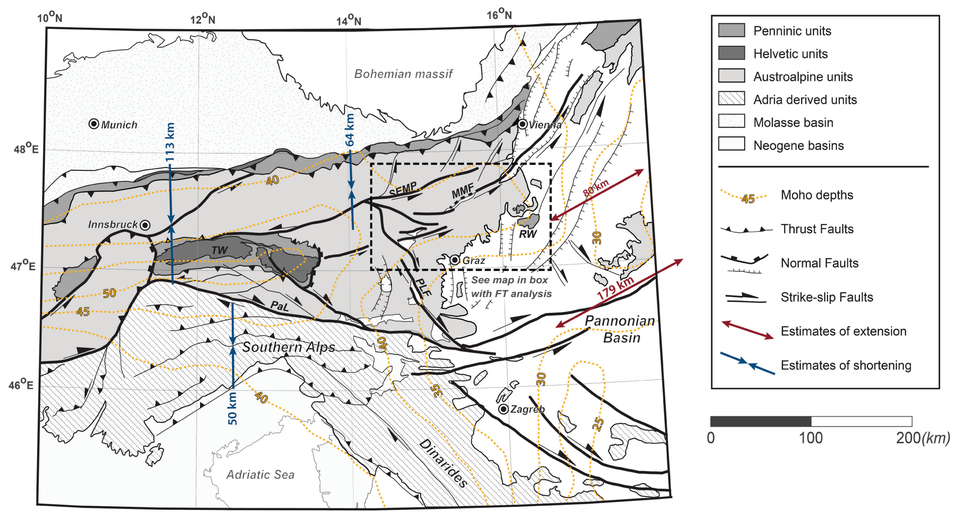
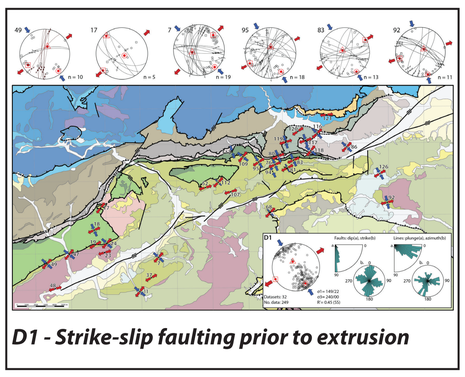
Introduction

Understanding the Miocene to recent tectonic evolution of the Eastern Alps-Pannonian Basin transition is of critical importance to comprehend the relationship with the underlying lithospheric processes. The transition is influenced by multiple tectonic processes during the Miocene to recent time interval, namely: subduction of Adria and related northward convergence, lateral extrusion of the Eastern Alps, back-arc basin formation, inversion and regional uplift. The interaction of these processes are however not well constrained along the Mur-Mürz strike-slip fault that is located at the eastern end of the Eastern Alps and terminates in the western part of the Pannonian basin, the Vienna basin to be precise. Hence, insights in the kinematics of the Mur-Mürz Fault (MMF) and associated vertical motions across the fault will provide new constraints on the Miocene to recent tectonic evolution of the Eastern Alps-Pannonian basin transition.

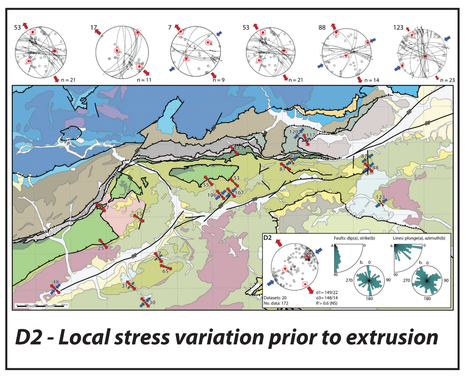
The MMF is a sinistral en-echlon strike-slip fault bounding the Styrian crustal block, including the Styrian basin. The fault facilitates extrusion to the east in response to the opening of the Pannonian back-arc basin and coeval northward motion of Adria.



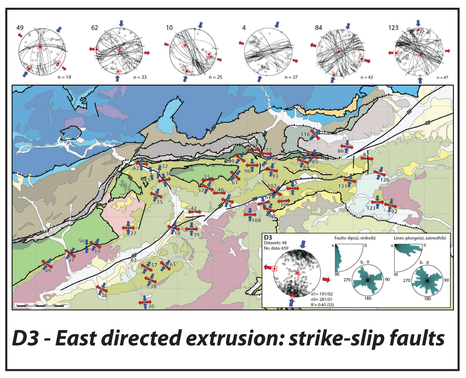
Field kinematics



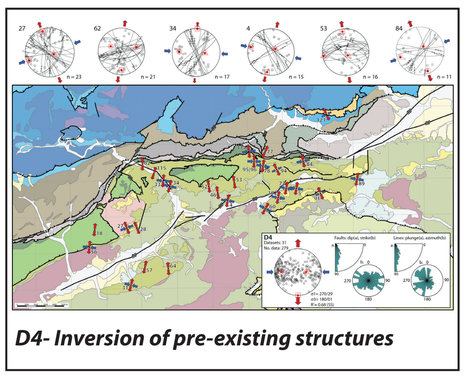
D1 - Strike-slip faulting prior to extrusion



D2 - Local stress variation prior to extrusion



D3 - East directed extrusion: strike-slip faults

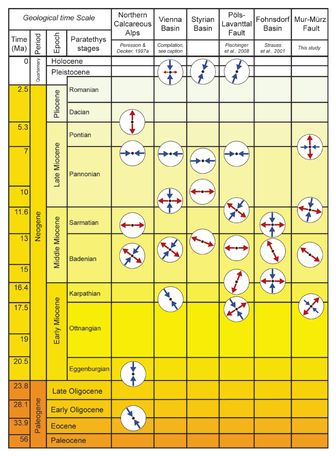


D4- Inversion of pre-existing structures

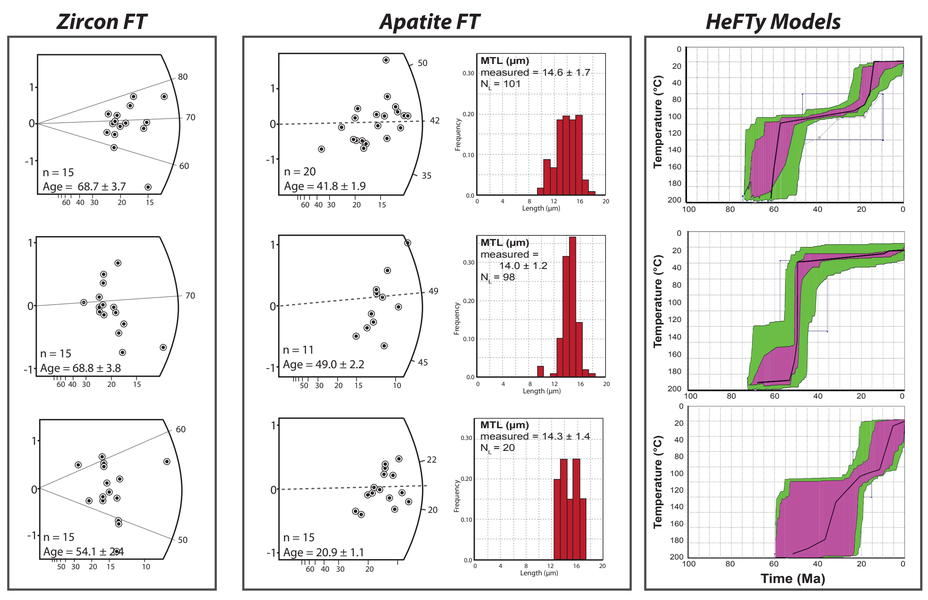
Field kinematic study was focussed at the transition to the Pannonian Basin. In this area the MMF is a strongly segmented fault where offsets and kinematics can only be obtained by collecting structural data on a regional scale.

The kinematic analysis indicates a that the MMF has asimilar tectonic evolution compared to the Vienna Basin and other strike-slip faults in the Eastern Alps. Four separate deformation phases could be distinguished. The first two phases of deformation occured prior to lateral extrusion, the third phase is related to extrusion tectonics and the forth phase reflects tectonics controlled by Pannonian Basin inversion.

Comparison to regional structures



Fission Track analysis



Zircon FT ages reflect exhumational cooling after Eo-Alpine metamorphism.

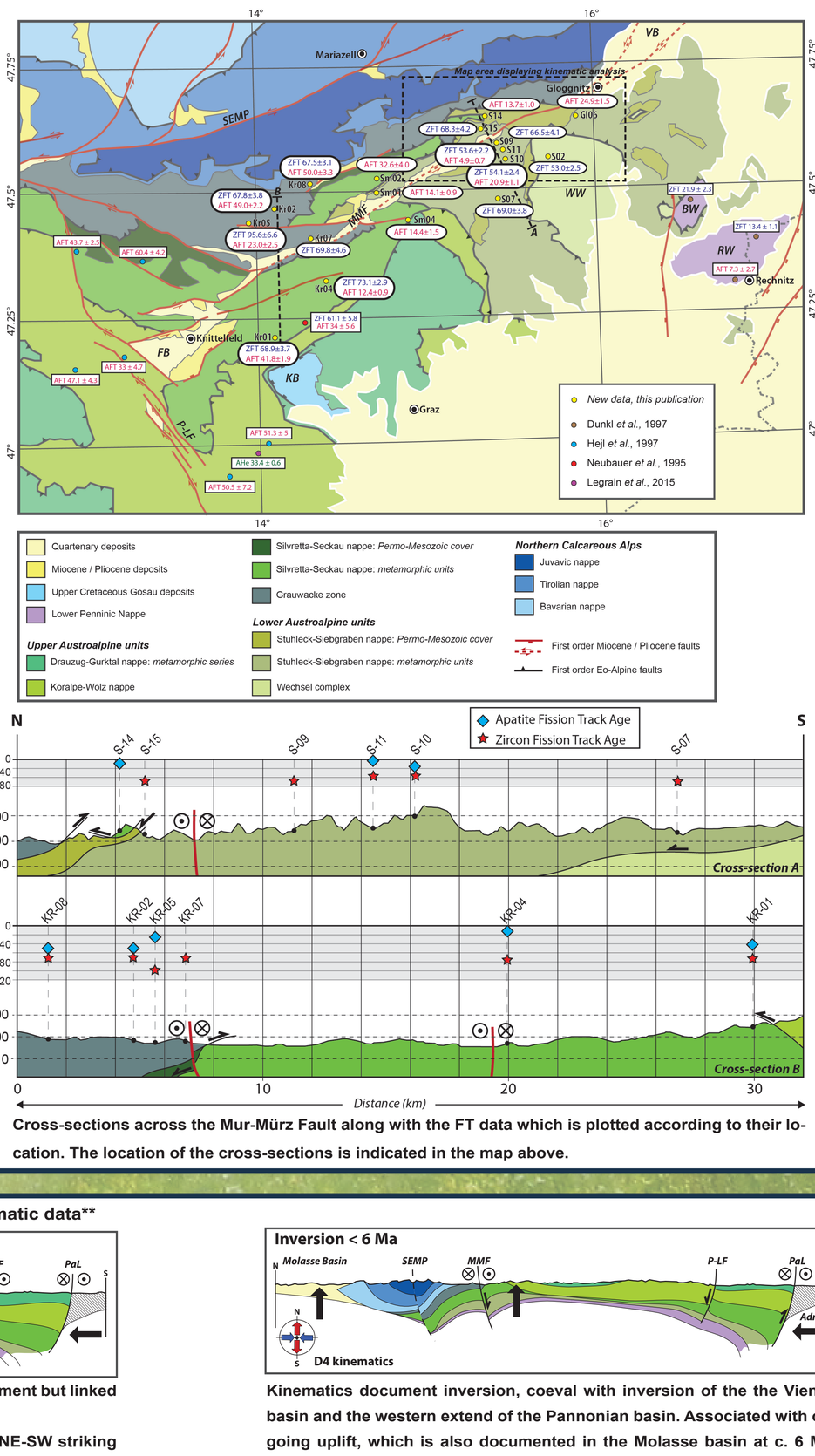
Note: the younger ZFT ages correspond to the deeper seated nappes, i.e. the Lower Austroalpine nappe.

Apatite FT ages and length measurements indicate two cooling events:

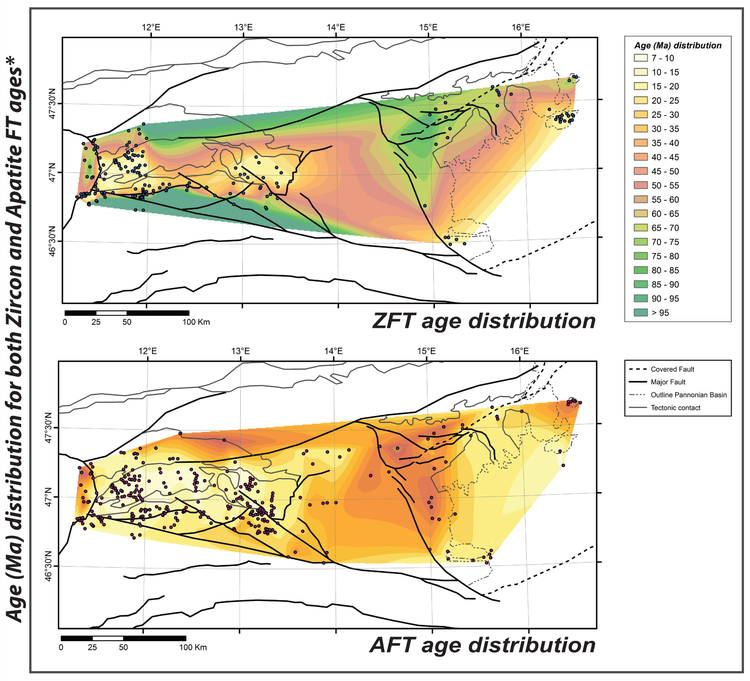
1/ ongoing post Eo-Alpine exhumational cooling

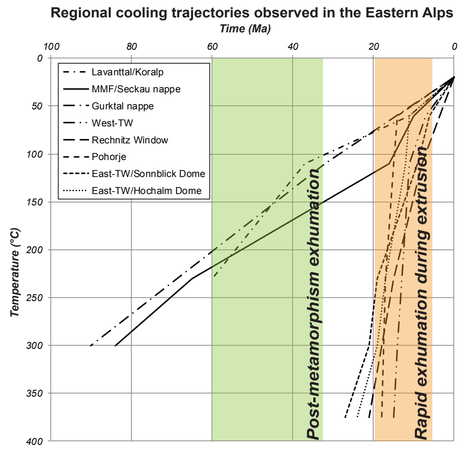
2/ increased cooling/uplift rates during Middle and Late Miocene lateral extrusion.

Overal a youngening trend to the East documented by both the zircons and apatites and no appearent influence of the MMF



Eastern Alps FT analysis





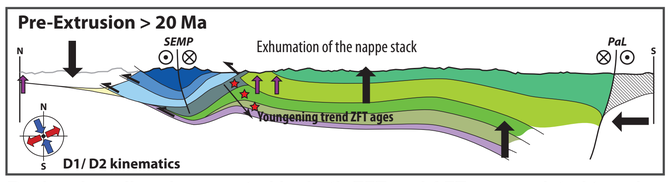
Our new apatite and zircon FT ages are combined with previously published low-temperature thermochronological data of the Eastern Alps.

The maps illustrate the Miocene 'hotspots': the Tauern window and the Eastern Alps-Pannonian Basin transition.

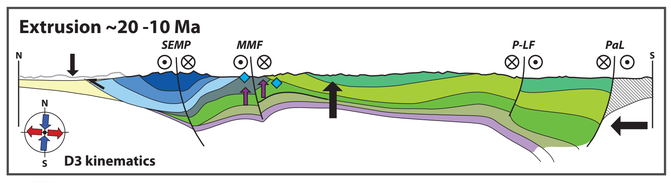
Cross-sections across the Mur-Mürz Fault along with the FT data which is plotted according to their location. The location of the cross-sections is indicated in the map above.

Conclusions

Proposed (Late) Cenozoic tectonic evolution for the eastern extend of the Eastern Alps from integrated thermochonological and kinematic data**



Regional cooling documented by both ZFT and AFT ages, related to exhumation after Eo-alpine metamorphism and Eo-alpine nappe-stacking



- AFT ages document regional uplift unrelated to fault movement but linked to possible lithospheric scale processes

- Coincides with D3 kinematics associated with dominant NE-SW striking strike-slip faults

Kinematics document inversion, coeval with inversion of the the Vienna basin and the western extend of the Pannonian basin. Associated with ongoing uplift, which is also documented in the Molasse basin at c. 6 Ma. Local youngening trend can be related to the inversion

References

* Maps created using newly published data and the database presented in: Luth and Willingshofer (2008), Mapping of the post-collisional cooling history of the Eastern Alps, Swiss J. Geosciences.

**Evolution interpreted using modified maps of: 1) Schmid et al. (2004), Tectonic map and overall architecture of the Alpine orogeny, Eclogae geol. Helv., 2) Genser et al. (2007), Late orogenic rebound and oblique Alpine convergence: New constraints from subsidence analysis of the Austrian Molasse basin, Global and Planetary Change.

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