Resolving the Eastern Alpine puzzle: Illumination of crustal structure with receiver functions and ambient noise autocorrelations

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The tectonic structure of the Eastern Alps is heavily debated with successive geophysical studies that are unable to resolve areas of ambiguity (e.g., the presence of a switch in subduction polarity and differing crustal models). In order to better understand this area, we produce a high resolution Moho map of the Eastern Alps based on a dense seismic broadband array deployment (SWATH-D). Moho depths were derived from joint analysis of receiver function images of direct conversions and multiple reflections for both the SV (radial) and SH (transverse) components, which enables us to map overlapping and inclined discontinuities. Autocorrelations, derived from ambient noise, recover zero-offset reflections for a subset of stations located in the Bohemian Massif (part of the EASI transect) and provide an independent measurement of Moho depth and corroborate the receiver function results. Autocorrelations also give potential for a combined analysis to better constrain crustal average P velocities. Furthermore, an associated petrological study informs us on the implications of the eclogitisation of crustal rocks for these imaging techniques (see poster John et al "The effect of eclogitization of crustal rocks on the seismic properties on variable scales"). We observe the European Moho to be underlying the Adriatic Moho from the west up to the eastern edge of the Tauern Window. East of the Tauern Window, a sharp transition from underthrusting European to a flat and thinned crust associated with Pannonian extension tectonics occurs, which is underthrust by both European crust in the north and by Adriatic crust in the south. The Adriatic lithosphere underthrusts northward below the Southern Alps for a short distance of a few tens of km at most, and becomes steeper and deeper towards the Dinarides where it dips towards the north-east. Our results suggest that the steep high velocity region in the mantle below the Eastern Alps, observed in tomographic studies, is likely to be of European origin.

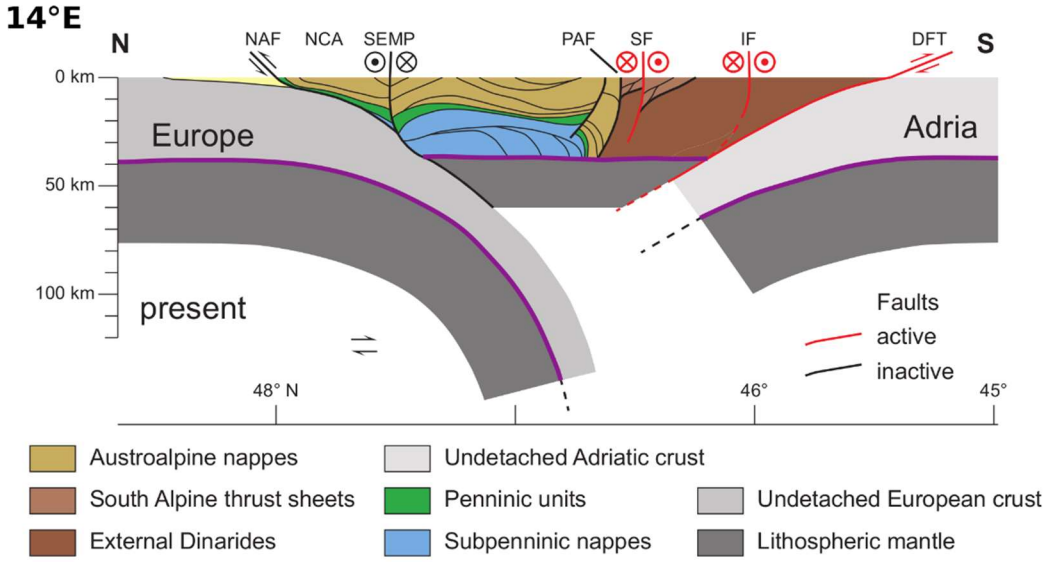

Figure 1: The north-south transition from European to Adriatic crust, through the central Pannonian domain, is captured in the schematic cross section (present day) through the Alps at 14°E based on Moho depths derived from receiver functions.