16th Emile Argand Conference
Alpine Workshop
16-18 September 2024 - Siena, Italy

alpshop2024-27, updated on 20 Aug 2024
16th Emile Argand Conference on Alpine Geological Studies

Relation between inherited basin size and fold-and-thrust belt deformation style in crustal-scale analogue models: implications for the evolution of the European eastern Southern Alps

Anna-Katharina Sieberer[1], Ernst Willingshofer[2], Thomas Klotz[1], Hugo Ortner[1], and Hannah Pomella[1]

[1]University of Innsbruck, Geology, Innsbruck, Austria (anna-katharina.sieberer@uibk.ac.at)
[2]Utrecht University, Earth Sciences, Utrecht, Netherlands

During the Cenozoic evolution of the Alps, the Adriatic plate is traditionally considered as a rigid indenter. However, in the eastern Southern Alps (ESA) of Italy and Slovenia, significant internal deformation is observed within the northernmost part of the Adriatic plate. Predominantly Miocene shortening is accommodated within a WSW-ENE striking, SSE-vergent fold-and-thrust belt, which overprints a pre-existing platform-basin geometry formed during Jurassic extension. Jurassic basins show a remarkable bend in eastern Italy and western Slovenia (i.e., Carnic and Julian Alps, respectively), where the N-S striking Belluno basin transitions into the E-W striking Slovenian basin north of the Friuli platform. The influence of this inherited basin geometry on Miocene shortening kinematics and geometries remains a topic of ongoing debate and is the focus of this study.

In this contribution we present a new series of 12 crustal-scale analogue models designed to investigate how inherited lateral crustal heterogeneities and basin geometries affect internal deformation within the ESA. The brittle and brittle-ductile analogue experiments for inversion parallel to the axes of pre-defined basins (areas of lower mechanical strength compared to accompanied platforms) particularly focus on the northeastern basin connected orthogonally to the eastern basin. Key parameters studied include the width of the northeastern basin (5 cm vs. 10 cm). For the case of oblique inversion experiments, contraction angles of 20° and 110° to the strike of the main basins and the northeastern basin, respectively, were applied. This approach allows us to test the influence of inherited basin widths and geometries on the style and timing of deformation within the evolving fold-and-thrust belt.

Our preliminary experimental results indicate that narrow northeastern basins primarily undergo inversion and are transported piggyback, leading to the formation of numerous faults in eastern model areas. The eastern platform south of the northeastern basin tends to be incorporated into the thrust belt. Increasing the width of the northeastern basin results in the eastern platform acting more as a barrier, thereby restricting the resulting fold-and-thrust belt to a smaller N-S extent. The latter is especially pronounced in oblique inversion experiments with large northeastern basins.

To compare analogue modelling results with deformation in the ESA, structural fieldwork was conducted along major fault systems within the eastern part of the ESA, specifically east of Lozzo di Cadore. The Dof-Auda-, Pinedo-Uccea- and Barcis-Staro Selo faults are overall SSE-vergent but show variations in strike direction across platform-basin boundaries. Comparative analysis of map-view observations from the ESA and oblique analogue experiments, particularly those including large northeastern basins, emphasises the significant influence of the eastern (i.e., Friuli) platform on the deformation style of the fold-and-thrust belt.