

AGU Fall Meeting 2019
09.-13.12.2019
San Francisco, USA
Poster: T33F-0426

Extremely thinned continental crust underneath the Ligurian Basin?

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Abstract

The Ligurian Basin is situated at the transition from the western Alpine orogeny to the Apennine system, an area where a change in subduction polarity is observed. The back-arc basin was generated by the southeast trench retreat of the Apennines-Calabrian subduction zone. The opening took place from late Oligocene to Miocene. While the extension led to continental thinning and subsidence, oceanic spreading with unroofing of mantle material was proposed for the late opening period, 21-16 Ma.

To shed light on the present day crustal and lithospheric architecture of the Ligurian Basin, active and passive seismic data have been recorded on ocean bottom seismometers of a long-term network consisting of 29 broad-band stations, installed from June 2017 to February 2018 in the framework of SPP2017 4D-MB, the German component of AlpArray. Two refraction seismic profiles were shot to serve two aspects: (1) Determine the orientation of the horizontal components of the long-term instruments and (2) estimate the velocity distribution of the upper lithosphere, to provide a velocity model for the passive seismic data analysis.

Good quality data have been recorded, regional and teleseismic events as well as active shots could be detected by the network stations. The majority of the refraction seismic data show mantle phases at offsets up to 70 km and a very prominent wide-angle reflection originating at the crust mantle boundary. Its features share a number of characteristics (i.e. offset range, continuity) generally associated with continental settings rather than mimicking seafloor spreading lithosphere emplaced in back-arc basins. Based on traveltimes tomography along the refraction lines, the crust-mantle boundary is determined at ~9.5 km depth below seafloor. The acoustic basement is difficult to map seismically. The transition to the crystalline basement is indicated at a depth of ~6.5 km below seafloor. The absolute seismic velocities can be interpreted as hyper-extended continental crust or serpentinised mantle. The thick sedimentary coverage allows for long lasting extension of the crust. The crustal portion interpreted from the seismic velocities thickens towards the north which is in good agreement with the anti-clockwise rotation of the Corsica-Sardinia block and an associated gradual opening of the Ligurian Basin.

