

Local Seismicity indicates basin inversion in the Ligurian Sea

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The Ligurian Basin & AlpArray OBS network

Geographic and tectonic overview map

- The Western Mediterranean consists of several basins formed between 30 Ma and present (e.g. Burrus, 1984; Rehault et al., 1984).
- Retreating subduction zones in Apennines, Calabria and Gibraltar lead to the ~23° CCW rotation (red arrow in Fig. 1) of the Corsica-Sardinia block during Miocene times (Speranza et al., 2002).
- Seismicity observed in the Ligurian Sea is low, increasing in rate towards the alpine deformation front. Events are poorly detected and located in the center of the Ligurian Sea.

Aims:

- What is the state of the **seismicity** in the Ligurians Sea?
- What is the **properties of the mantle** below the Ligurian Sea?
- Are the indications for the **future evolution** of the Ligurian Basin?

AlpArray OBS network

- consist of 24 ocean bottom seismometer (OBS) from France and Germany (Fig. 1)
- Duration: June 2017 till February 2018
- combined with land stations in France and Italy.

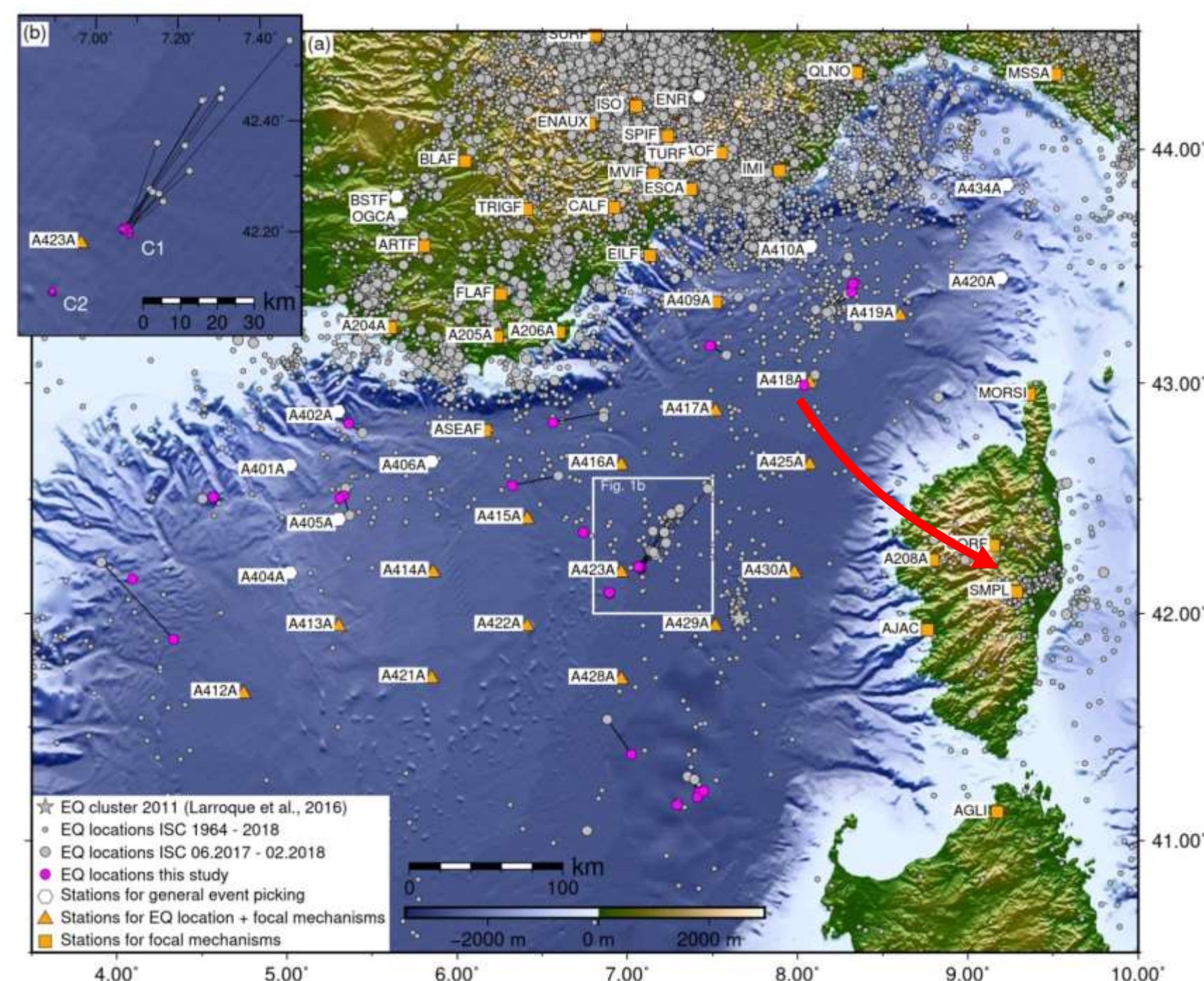


Fig.1: Event locations of ISC (Storchak et al., 2017) and this study (magenta). Black lines connect different location of the same event. Red arrow indicates rotation of the Corsica during Miocene.

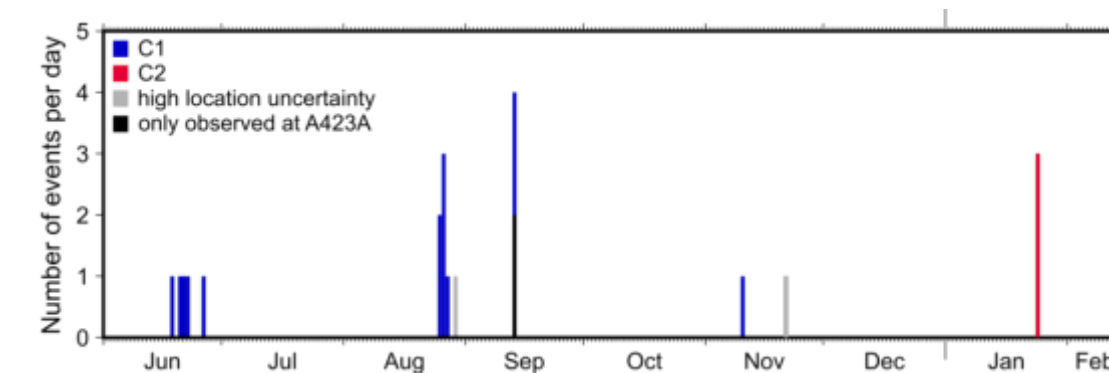
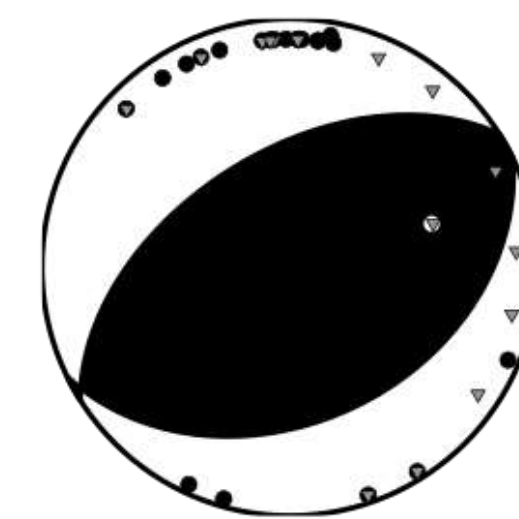
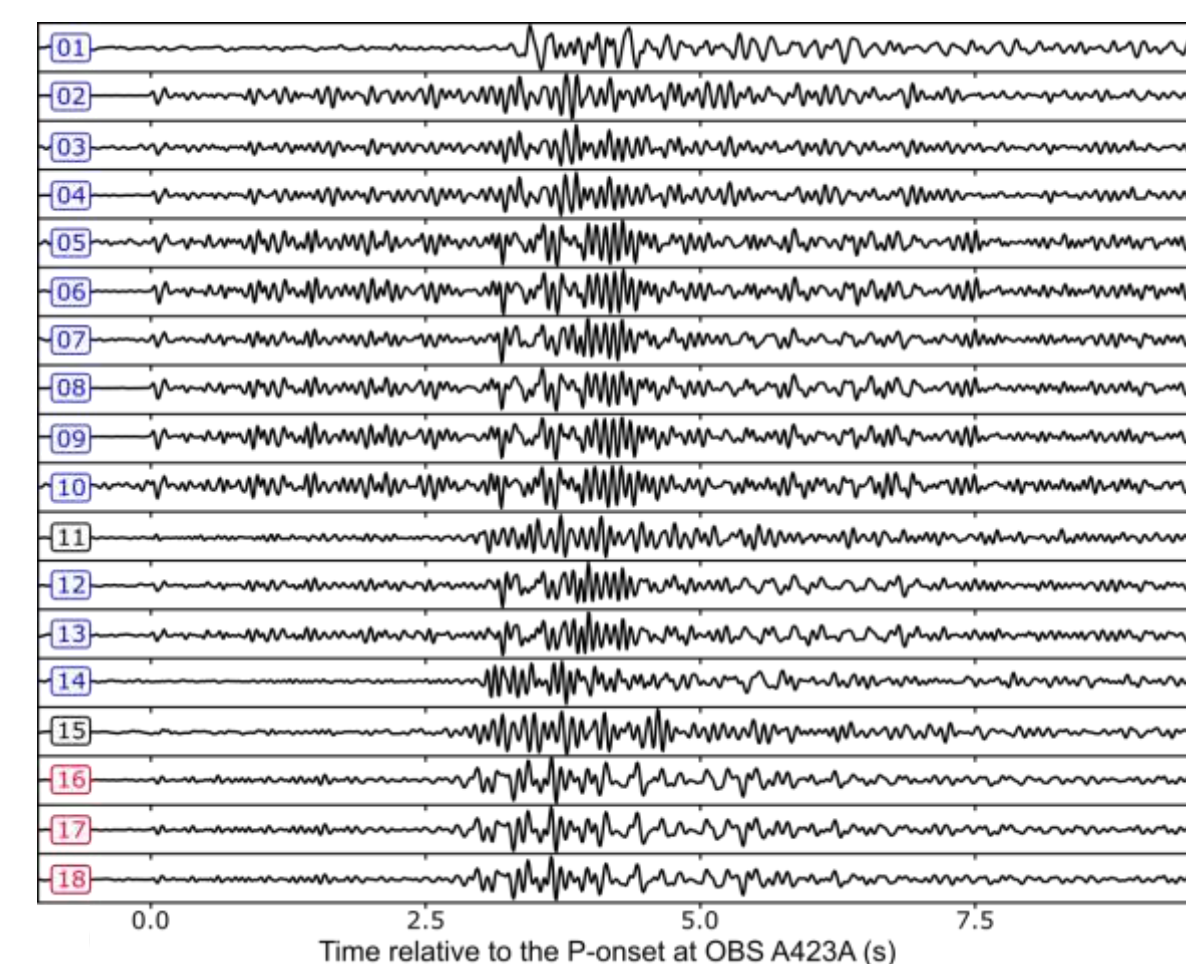


Fig.2: Timing of the events

Fig.3: left: Vertical component of cluster events on A423A
right: fault plane solution of event 2



Event clusters

- 2 earthquake cluster are observed: C1 northeast and C2 southwest of OBS A423A.
- Event location was performed using a velocity model derived from a seismic refraction line (Dannowski et al., 2020; Fig. 4e). See also vPICO EGU21-2822.
- The events of each cluster occur in a 3x3x3 km³ big volume
- Magnitudes between 1.1 and 2.5 are observed.

Cluster C1

- was active in June, August, September 2017,
- consists of minimum 2 families with coherency > 0.8,
- is located in the mantle at 14-16 km depth.
- Fault plane solution of 4 events show a thrust faulting and are rotated compared to solutions closer to Corsica (Larroque et al., 2016) resembling the orientation of the Miocene rift structures.

Cluster C2 was active in Jan. 2018 and is located in the crust.

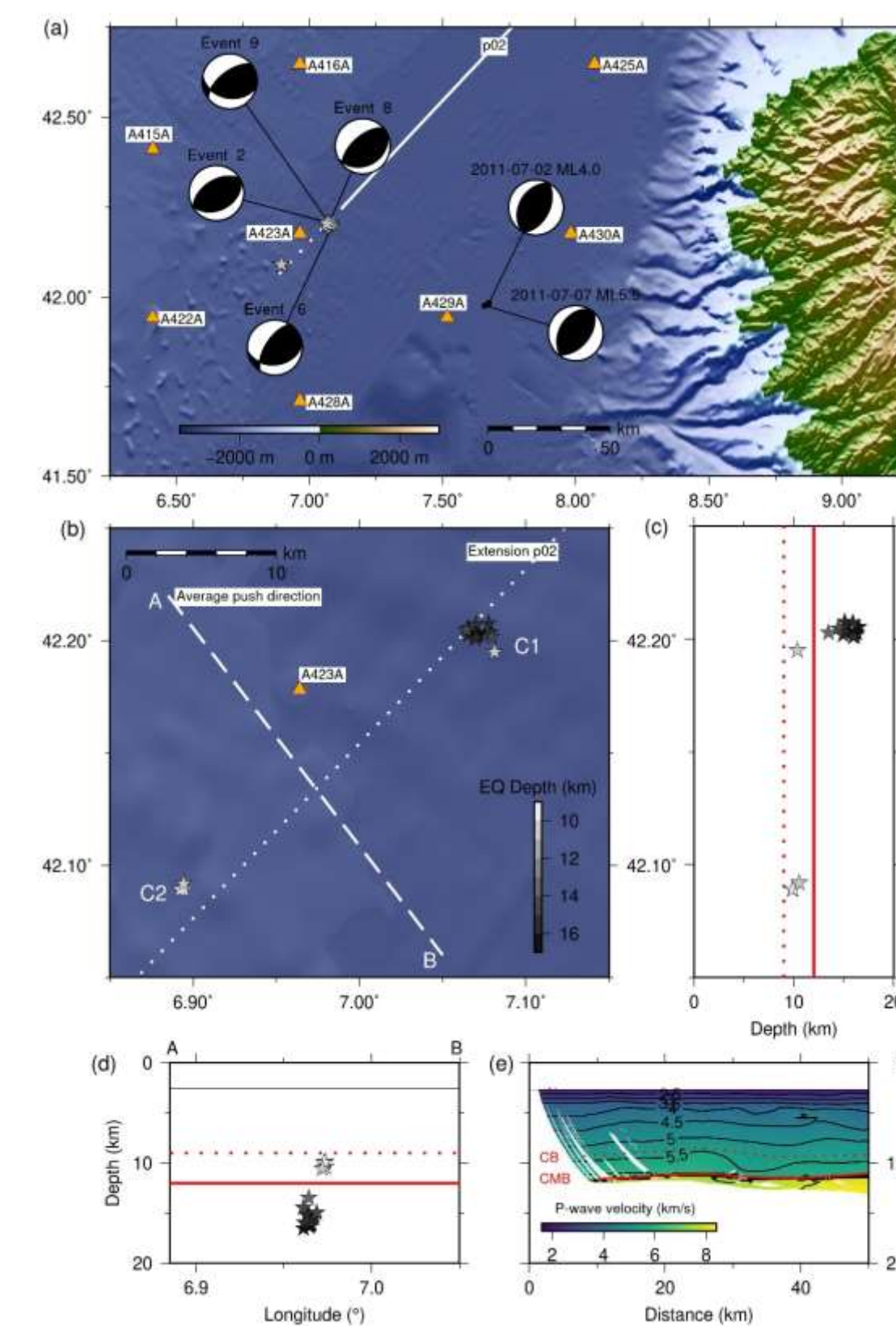


Fig.4: Location and fault plane solutions.

Mantle Properties

- Mantle Phases Pn and Sn are observed with apparent velocity of 8.1 km/s and 4.7 km/s. ⇒ vp/vs=1.72
- Indication of a stronger and more brittle mantle
- Maybe caused by uplifted and cooled mantle material.

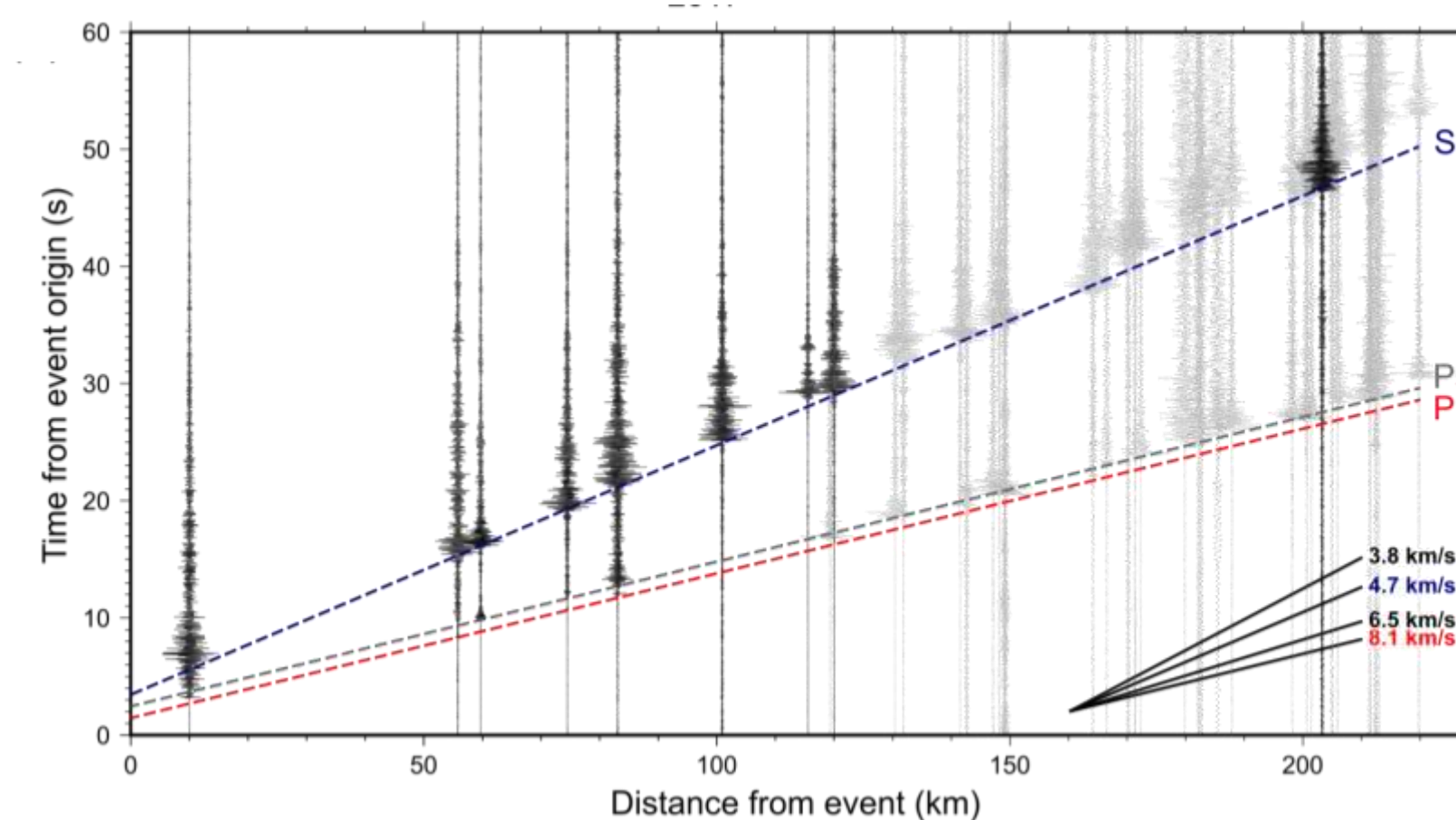


Fig.5: record section of the M2.5 event on 20.06.2017

Conclusion

- The upper most mantle is stronger and more brittle.
- Fault plane solutions indicate reactivation of Miocene rift structures
- Compressional regime suggests an inversion of the Ligurian Basin

This work is under review (<https://se.copernicus.org/preprints/se-2021-9>). OBS were provided by the DEPAS pool, GEOMAR, and IGP-INSU pool. Figures were produced with ObsPy (Beyreuther, M. et al., 2010) and GMT (Wessel, P., et al., 2013). GMRT (Ryan et al, 2009) data were used as background topography. The deployment of the German component of the AlpArray seismic network (AASN) was funded by the LOBSTER project that is part of the German Priority Programme SPP2017 4D-MB by the Deutsche Forschungsgemeinschaft (DFG), grant no. TH_2440/1-1, KO_2961/6-1, 280 and LA_2970/4-1. The deployment of the French component of the AASN was funded by the AlpArray-FR project of the Agence Nationale de la Recherche (contract ANR-15-CE31-0015). We also thank the AlpArray Seismic Network Team (<http://www.alparray.ethz.ch>) and the permanent seismic networks used in this study (FR, IV, and MN).

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