SEISMIC WIDE-ANGLE REFLECTION AND REFRACTION STUDY IN THE IONIAN SEA

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Abstract
The collision between Africa and Eurasia resulted in a complex tectonic setting in the Mediterranean. In the area of the Ionian Sea, subduction is still active, and there is an ongoing debate among scientists about the nature of the crust. Seismic wide-angle reflection and refraction data were used to construct a velocity model of the structure of the sub-seafloor.

Keywords: Active margins, Ionian Sea

The complex tectonic setting of the Mediterranean is the result of the collision between the African and the Eurasian plate. This collision slowed down Africa's northward movement and the system changed from subduction-dominated to collision-dominated. Subduction still continues below a large part of the Mediterranean, e.g. the Ionian Sea. It is unresolved to date if the crust in this area is of oceanic origin, as the Mediterranean is a remnant of the Tethys ocean, or if thinned continental crust is subducted. Locked between the Malta escarpment and the Apulia escarpment, the Calabrian wedge is build by sediments that are scraped off the subducting plate, and sediments are also piled up by Calabria's movement to the SE. The development of the wedge was influenced by the Messinian Salinity Crisis (MSC), and the wedge can be divided into a pre- and post-Messinian part. During the MSC, evaporites were deposited in the Mediterranean and these were detected in the Ionian Sea (e.g. Polonia et al. (2011)). R/V Meteor cruise M111 (funded by the Deutsche Forschungsgemeinschaft (DFG)) was the first time a modern ocean bottom seismometer (OBS) survey was undertaken to investigate the deep structure of the Ionian Sea subduction zone. Five seismic refraction and wide-angle reflection profiles cover the area of the Calabrian accretionary wedge and the Ionian Abyssal Plain (IAP). This presentation focuses on profile DY-P04 that crosses the wedge from the IAP to the coast of Sicily. The aim of this profile is to shed light on the debate about the nature of the crust and to image the sub-seafloor structure. A G-gun array was used as source with a total volume of 84 l to shoot with 190 bar with an interval of 60 s. The resulting shot spacing was ~110 m. A multichannel streamer (65 m) was used to resolve the shallow part beneath the seafloor. Wide-angle reflection and refraction data were recorded by 62 ocean bottom hydrophones (OBH) and OBS in a dense spacing of 5 km. The model for profile DY-P04 was constructed by using forward and inverse traveltime modelling (Zelt et al., 1999 and Korenaga et al., 2000). The seafloor consists of a thin layer of Plio-Quaternary sediments (Gallais et al., 2012). In the southern part of the profile, these sediments overlay a layer of salt that is resolved in the OBH data. While its velocities are highest in the IAP, they decrease slowly up the wedge. This indicates a mixture of Messinian evaporites with sediments along the wedge. Another indication for this is the base of the evaporitic layer, which is manifested as a reversed polarised reflector in the IAP. This implies a negative velocity contrast underneath the salt layer. This phase reversal disappears towards the North. The OBS/H data show a second strong reflector within the sediments, indicating an increase in the seismic P-wave velocities. To fit the reflected phases of the basement, a thin layer of ~1.5 km above the basement was introduced. The basement is located at a depth of ~10 km beneath the IAP. Its depth increases along the profile to about 17 km (Dellong, 2015) at the northern end. Seismic energy from the deeper crust, the Moho discontinuity, and the upper mantle was observed on most of the stations. The depth of the Moho was determined at 15 km in the IAP, deepening towards the NW to 21 km beneath the upper slope of the wedge in the centre of the profile. At the northern end of DY-P04, the crust-mantle boundary has a depth of 28 km (Dellong, 2015).

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