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Crustal and tectonic structure of the southern Tyrrhenian Basin

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The Tyrrhenian basin of the Mediterranean started its formation in the Early Miocene, and some processes may be still active in the eastern area. It is generally accepted that the evolution of this basin is related to the eastward migration of the subduction zone between the African plate and the European plate. The subducting plate has been rolling back towards south-east, producing stretching at the upper plate and causing the Tyrrhenian Sea opening.

To study the crustal structure, we are reprocessing selected deep multichannel seismic profiles acquired during the CROP survey in 1994. In this work we present the results from profile M28B, a 260 km long profile located at the southern part of Tyrrhenian Sea. The profile provides a cross section from the southern sector of the basin, running from the southern continental shelf of Sardinia to near the north-west margin of Sicily. The line was shot roughly parallel to the opening direction of the basin, providing an overview of the structures generated during its formation.

The seismic data were collected by the Italian Consiglio Nazionale delle Ricerche (CNR) in collaboration with Agip and ENEL, with the research vessel OGS Explora. The ship was equipped with an airgun array with a volume of 4906 cu inc., that was shot every 50 m. The seismic signal was recorded in a 4500 m. long streamer with 180 channels.

The cross section shows a crust that changes thickness and structure along the profile. We have imaged three different segments along the line. Starting from west, in the Sardinian continental margin, a 60-km-wide first segment shows a faulted continental-type crust, with a sedimentary cover with clear sin-rift and post-rift units, that reach about 1,5 km. in basin depocenters. Normal faults cut the top of the basement giving a rough topography and a progressive thinning of the crust towards the east.

The segment 2 is a 100 km long section, with fairly constant water depth, possibly indicating a fairly constant crustal thickness. In this sector, the sedimentary layer is thin: it has a maximum thickness of 400 m. This zone corresponds to the deepest basin sector. The boundary with the first segment appears abrupt possibly marked by a large normal fault. The top of the basement is smooth compared with the first segment, possibly indicating that tectonic extensional processes were not very important in this area. The internal reflectivity of the crust is more important than in segment 1.

The eastern part of the line, the segment 3, is a 100 km. long segment. It comprises the north-west margin of Sicily. It has a hight reflectivity similar to that of segment 2, but the structure seems more complex showing a rougher top of the basement and seafloor, perhaps due to faulting. However, crustal thickness doesn't seems to change much with respect to segment 2.