

Structure of the Sardinia Channel: crustal thinning and tardi-orogenic extension in the Apenninic-Maghrebian orogen; results of the Cyana submersible survey (SARCYA and SARTUCYA) in the western Mediterranean

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Abstract

The Sardinia Channel is located in a 400 km-long submerged section of the Apennine-Maghrebian branch of the Alpine chain. The Sardinia Channel connects the Algerian-Ligurian-Provençal to the Tyrrhenian oceanic basins. The structure of this region results from the superposition of two tectonic regimes: an earlier crustal thickening and a later crustal thinning.

The crustal thickening is the consequence of the shortening which occurred in the late Oligocene–early Miocene during the build up of the Apennine-Maghrebian Orogen. This thickening is coeval with the rotation of the Corsican-Sardinian block and the opening of the Provençal-Algerian back-arc basin. All of these structures, as well as the magmatic arcs in Sardinia and Tunisia, *i.e.* the Galite Archipelago, are connected to the subduction of the Tethyan Ocean.

The crustal thinning is associated with the rifting of the Tyrrhenian Basin, which occurred just before the Messinian salinity crisis and was accompanied by significant erosion throughout the region. This erosion was followed by a period of thermal subsidence linked to the opening

of the Tyrrhenian oceanic basin in the Plio-Quaternary, interspersed with minor episodes of compression.

On the Sardinian margin, the dives led to the discovery of a submarine volcano, dated at 12.6 Ma, and composed of shoshonitic andesites with lamprophyre inclusions, and to the characterization of the nature and structure of the underlying basement, consisting of tilted blocks of Hercynian metamorphic and granitic rocks and their sedimentary cover. The sea floor morphology reflects this structure.

The other areas of the Sardinia Channel explored, *i.e.* its southern margin and central ridge, belong to the Calabrian-Peloritanian-Kabylian group (CPK). They are composed of a metamorphic and granitic Hercynian basement deformed during the Alpine orogeny, which is stratigraphically overlain by an Oligo-Miocene detrital cover of Peloritanian or Kabylian type, and tectonically overlain by the so-called “flysch nappe”. Throughout the CPK domain these formations were subjected during the Oligo-Miocene, at ca. 23 Ma ago, to a first denudation event, and during the Tortonian, ca. 10-8 Ma ago, to a second denudation, which has been connected to the opening of the Tyrrhenian basin. Structures, microstructures and thermochronological data indicate relatively low P-T conditions for the extensional deformations: this suggests that these units remained at shallow depths in the Apennine-Maghrebian Orogen, and were relatively preserved from the Messinian erosion. The age (12.5 Ma) and nature of the volcanic sequence in the Sorelles is closely comparable with the calc-alkaline suite of the Galite Archipelago, Tunisia.

Thus, the data gathered during the dives in the Sardinia Channel give new constraints to the reconstruction of the kinematic evolution not only of the region, but also to the entire western Mediterranean.