A CRUSTAL SECTION ACROSS THE CENTRAL TYRRHENIAN SEA (SARDINIA MARGIN, VAVILOV PLAIN, CAMPANIA MARGIN)

G. Carrara[1], M. Magaldi[2], P. Mussoni[1], R. Sartori[2]*, L. Torelli[1], and N. Zitellini[3]

[1] Dip.to di Scienze della Terra, Univ. Parma, Italy
[2] Dip.to di Scienze della Terra e Geol.-Ambientali, Univ.Bologna, Italy - sartori@geomin.unibo.it
[3] Istituto per la Geologia Marina, CNR Bologna, Italy

Abstract

The reprocessing of a deep penetration MCS line shot across the whole central Tyrrhenian Basin, tied to available geophysical and geological data collected in its vicinity, allows an interpretation of the crustal characters and structures of the area. The main results are:a) a marked asymmetry between the two continental margins facing the Vavilov plain; b) a very wide COT across the lower Sardinia margin, characterized by widespread occurerence of magmatic and ultramafic bodies.

Key Words: Tyrrhenian Sea, crustal evolution, reflection seismics

Introduction

According to ODP Leg 107 results and to previous data (1), in the Vavilov plain oceanic crust was emplaced during Pliocene after two rifting events that affected the upper and lower Sardinian margin respectively. We analyse here a MCS reflection line running W to E across the whole Basin (Line ST08, shot in 1985 by IFREMER-CNRS-IFP and reprocessed in 2000 at IGM-CNR in Bologna), adding available geophysical and geological data collected in the vicinity of the line. The aim is to better constrain the transition from continental to oceanic crust and to elucidate the Neogene extensional processes that affected the area.

Results

Figure 1 reports the location and the line drawing of the reprocessed ST08 MCS line, together with heath flow and refraction data projected on the line (geophysical data, including magnetic anomalies, from 2, 3, 4, 5). The line and its characters will be described from W to E.

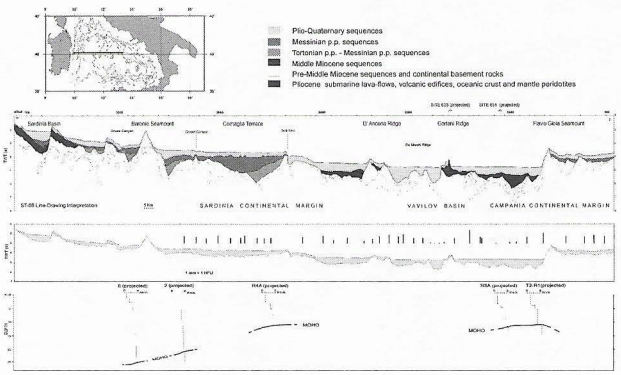

Fig. 1 MCS line ST08. Location, line drawing, Heat Flow (from 2) and refraction data (from 4,5).

Upper Sardinia margin

In this sector the line intersects at low angles a major lineament trending roughly W-E along the Orosei Canyon. As reported by Sartori *et al.* (6), this lineament separates two crustal sectors that experienced different structural evolution prior to Late Tortonian. Across the whole upper Sardinia margin (as far E as the R. Selli or Central Fault), the line shows extensional listric faults generating half grabens filled by sedimentary wedges of Late Tortonian to intra-Messinian age (1), while the Pliocene-Quaternary sequence drapes the previous units. Heath flow values are rather high and constant. Magnetic anomalies are weak. Refraction data indicate that the Moho depth is about 10 kms quite W of the R. Selli Fault, that is already under the upper Sardinia margin, and that it deepens from that area beneath Sardinia (down to 30 kms).

R. Selli Fault.

This marked feature separates the upper from the lower Sardinia margin. Along the seismic line the structure appears as pre-Messinian in age, since it separates different upper Messinian deposits and seismic facies (1). Heath flow values are markedly low in this region.

Lower Sardinia margin

From the R. Selli Fault to the Vavilov plain, crustal blocks rotated by extensional listric faults are observed, active from intra-Messinian to intra-Pliocene times (1). In several places, however, faults appear associated to magmatic bodies of Pliocene age. Magnetic anomalies are high though variable, as are the heath flow values.

Vavilov plain

Between the lower Sardinia margin and the Vavilov plain a wide Continent-Ocean Transition (COT) can be observed, spanning from the last tilted continental block (De Marchi Smt), to the W of the peridotite ridge drilled at ODP site 651 (1). Along most of the line, under a blanket of Pliocene-Quaternary sequences, a rough topography is observed that recalls an oceanic layer 2 (pillow basalts of Pliocene age have been drilled). At places, dipping reflectors occur inside the acoustic basement; they may represent either volcaniclastic bodies or faults linked to the tectonic uplift of the mantle peridotites. Heath flow values are irregular, though quite low across the sector floored by alleged oceanic crust and near the major volcanic bodies (such as the Vavilov Smt). Magnetic anomalies are high though irregular, the Moho depth is still observed at less than 10 km depth.

The Campania margin

The line does not run across the whole margin, imaging it only for some tens of kms. Contrary to the Sardinia margin, in this sector the COB is extremely narrow, because just a few kms E of the pillow lavas recovered at Site DSDP 373 (1), the F. Gioia Smt already contains continental rock units similar to those making up Calabria (7). In addition, no clear extensional listric faults are observed on Line ST08 across the Campania continental margin.

Discussion and conclusion

A very marked asymmetry is observed between the two continental margins facing the Vavilov plain. The Sardinia margin is wide, has been generated by at least two rifting events (1) and displays a complex COT, marked by Pliocene magmatism interplaying with extensional deformations. On the contrary the COB across the Campania margin is very sharp. While the domain with Moho depth of less than 10 km is quite wide, the area floored by laterally continuous layer 2 basalts is quite narrow and is limited to a small portion of the Vavilov plain.

References

1- Kastens, K.A., Mascle, J. , Auroux, C., *et al.*, 1988. Leg 107 in the Tyrrhenian Sea : insights into passive margins and back-arc basin evolution. *Geol. Soc. Am. Bull.*, 100: 1140-1156.

2 - Hutchinson, I., Von Herzen, R.P., Louden, K.E., Sclater, J.G. and Jemsek, J., 1985. Heath Flow in the Balearic and Tyrrhenian Basins, Western Mediterranean. *J. Geoph. Res.*,90: 685-701.

3 - AGIP, 1981. Italia: Carta Aeromagnetica: Anomalie del campo magnetico residuo. (Scale 1:500.000). Atti Min. Direz. Esplor. Idrocarburi, S. Donato Milanese, Milano.

4 - Recq, M., Rehault, J.P., Steinmetz, L., and Fabbri, A. (1984). Amincissement de la croute et accretion au centre du bassin Tyrrhenien d'apres la sismique refraction. *Mar. Geol.*, 55: 411-428.

5 -Duschenes, J., Sinha, M.C., and Louden, K.E., 1986. A seismic refraction experiment in the Tyrrhenian Sea. *Geoph. J.R. Astron. Soc.*, 85 : 271-289.

6 - Sartori, R., Carrara, G., Torelli., L., and Zitellini , N., 2001. Neogene evolution of the southwestern Tyrrhenian Sea (Sardinia Basin and western Bathyal Plain). *Mar. Geol.* (in press)

7 - Bigi, G., Cosentino D., Parotto, M., Sartori, R. and Scandone, P., 1991. Structural Model of Italy, Scale 1:500.000, Sheet 6, CNR P.F. Geodinamica, SELCA Florence.