

Seismic wide-angle constrains on the structure of the northern Sicily margin and Vavilov Basin:

implications for the opening of the Tyrrhenian back-arc basin

Ingo Grevemeyer (1), Cesar R. Ranero (2), Nevio Zitellini (3), Manel Prada (2), and Valenti Sallares (2)

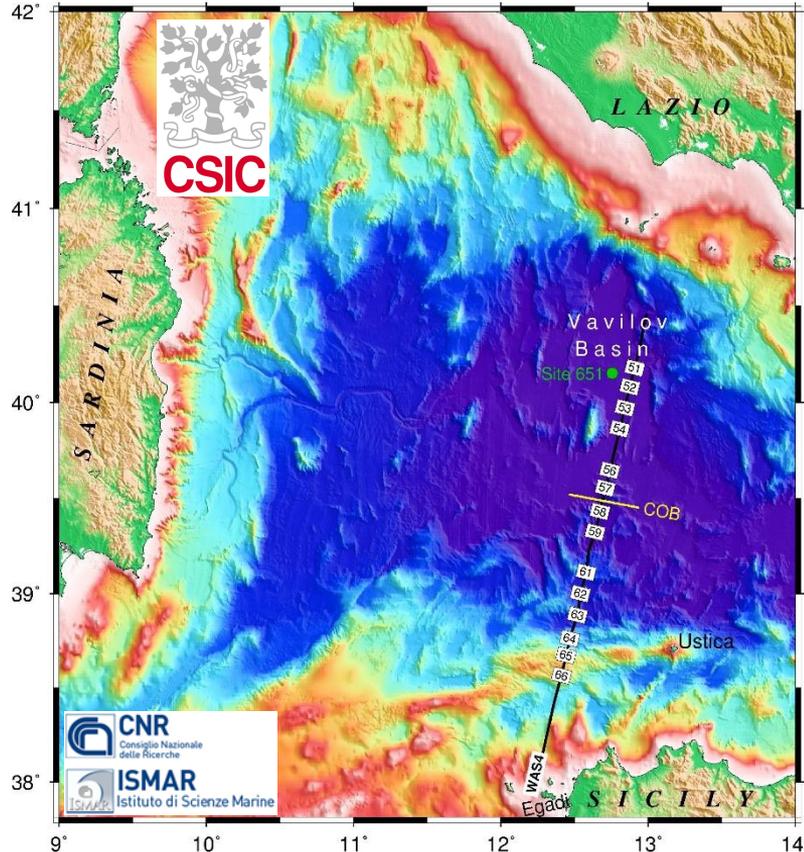
(1) GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany

(2) Instituto de Ciencias del Mar, CSIC, Barcelona, Spain

(3) Institute of Marine Science, National Research Council, Bologna, Italy



Background and Aim



The opening of the Tyrrhenian Basin in the central Mediterranean Sea was controlled by the retreating Ionian slab 6 to 2 Myr ago, hanging today under the Calabrian arc.

Yet, little is known about the structure of its southern margin off Sicily as well as back-arc extension and spreading in the southern Tyrrhenian Sea to the north of Sicily.

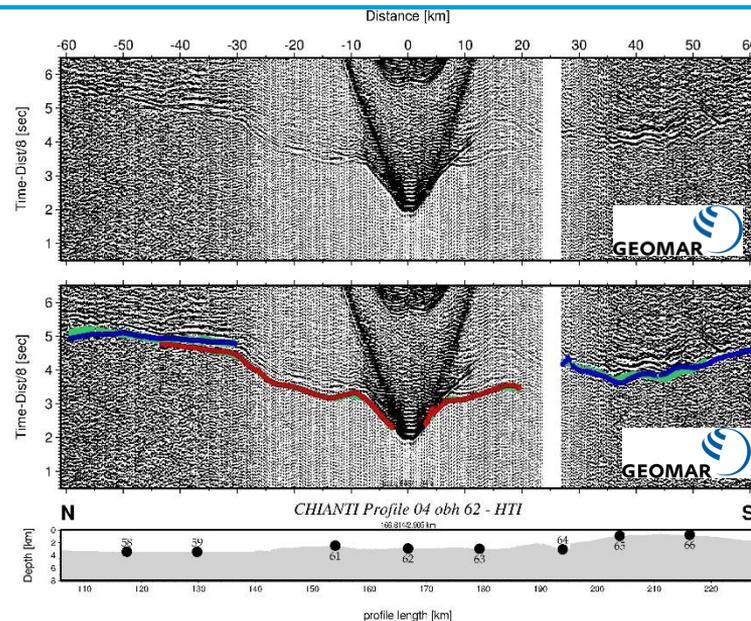
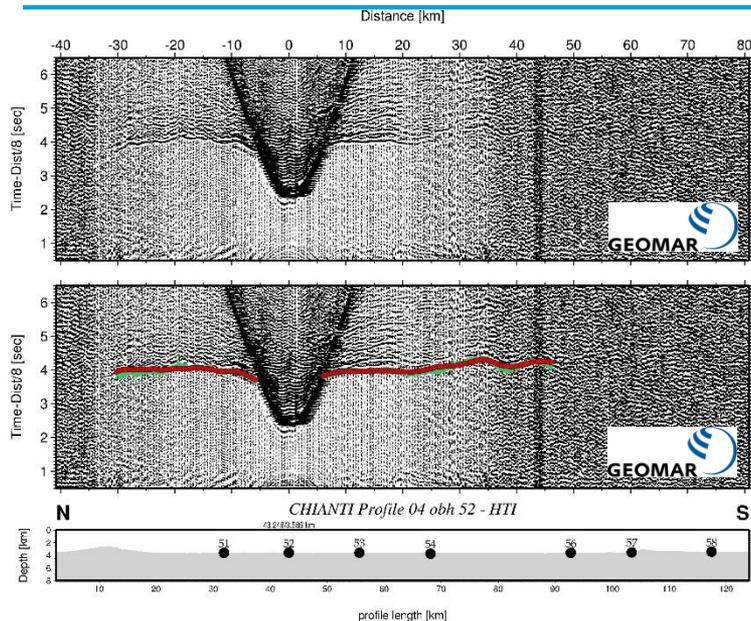
Here, we present results from an offshore seismic refraction and wide-angle line running from the centre of the Tyrrhenian Sea – the Vavilov Basin – across the margin of Sicily, terminating to the north of the Egadi Islands to the west of Sicily.

The profile WAS4 was obtained during the CHIANTI cruise aboard the Spanish research vessel Sarmiento de Gamboa.



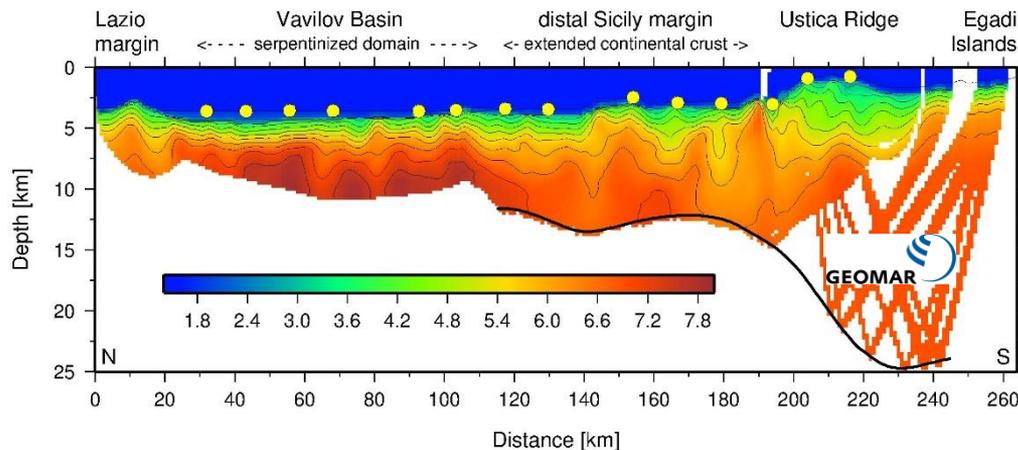
GEOMAR

Seismic data from CHANTI cruise / Sarmiento de Gamboa



Note – ocean-bottom-hydrophones (OBH) in the Vavilov Basin (left) show very fast apparent velocities at near offsets (<10 km) indicating shallow mantle. Further, OBH did not show any wide-angle arrivals. OBH in the north on the slope of Sicily (right) show crustal arrivals and a Moho reflection. Red dots are predicted travel times for first arrivals and blue dots are Moho-wide angel arrivals. Travel times were derived using seismic tomography.

Seismic velocity model from CHIANTI WAS4 and conclusions



Offshore of Sicily, a roughly 120-140 km wide domain shows seismic velocities characteristic for continental crust ($V_p \sim 4\text{-}6.7$ km/s) and a base of crust defined by a wide-angle Moho reflection. Continental crust reaches a maximum thickness of 22 km to the northwest of Sicily and is thinning to ~ 9 km to the north of the Ustica Ridge. In the Vavilov Basin, a lithosphere was sampled which shows velocity increasing continuously from ~ 3 km/s to 7.5 km/s, mimicking features attributed to serpentinized mantle and hence, supporting previous seismic observations and drilling results from Ocean Drilling Program hole 651A. The transition between both domains is rather abrupt. Thus, within a $\sim 10\text{-}20$ km wide transitional domain, continental crust with a thickness of ~ 9 km occurs adjacent to serpentinized mantle.