AMPHIBIOUS SEISMIC STUDY ON THE CRUSTAL STRUCTURE OF THE ADRIA

A. Dannowski [1]*, H. Kopp [1], B. Schurr [2], L. Improta [3], C. Papenberg [1], A. Krabbenhöft [1] and A. Argnani [4]
[1] GEOMAR Helmholtz Centre for Ocean Research Kiel, Wischhofstr. 1-3, 24148 Kiel, Germany - adannowski@geomar.de
[2] GFZ Helmholtz Centre for Geosciences Potsdam, Telegrafenberg, 14473 Potsdam, Germany
[3] INGV, Via di Vigna Murata 605, 00143 Rome, Italy
[4] ISMAR-CNR, Via Gobetti 101, 40129 Bologna, Italy

Abstract
The present-day structure of the southern Adriatic area is controlled by two oppositely-vergent fold-and-thrust belt systems. The Adriatic basin offers the unique opportunity to image a segment of Mesozoic crustal structure within the Mediterranean. Seismic refraction and wide-angle reflection data were acquired including stations off- and on-shore. Two different approaches of travel time tomography were applied.

Keywords: South Adriatic Sea, Seismics, Crust structure

The present-day structure of the southern Adriatic area is controlled by two oppositely-vergent fold-and-thrust belt systems (Apennine and Dinaride-Albanide). The Adriatic continental domain is one of the most enigmatic segments of the Alpine-Mediterranean collision zone. It was separated from the African plate during the Permian-Mesozoic extensional phase that led to the opening of the Ionian Sea, with carbonate sediments that were deposited throughout the Mesozoic. The maximum basin widening and deepening occurred during the Late Triassic-Liassic extension, which resulted in the formation of the southern Adriatic basin, bounded on either side by the Dinaric and Apulian shallow water carbonate platforms. A thick succession of shallow water sediments was deposited on the platforms throughout the remaining of the Mesozoic and part off the Cenozoic, whereas a thin succession of hemipelagic sediments were deposited within the basins. Following the Eocene-Oligocene collision of Adria into the European plate, and the ensuing formation of the Alps and Dinarides, clastic sediments were shed into the Adriatic domain. In the southern Adriatic basin, in particular, clastic sediments , mainly Miocene-Quaternary in age, fill the present day foredeep basin of the Dinaride-Albanide thrust-and-fold belt, reaching a thickness up to 7 km, that decreases dramatically northward, offshore Montenegro, where the foredeep basin is resting onto the shallow water Dinaric carbonate platform. Because of its present foreland position with respect to the Alpine s.l. fold-and-thrust belts, the southern Adriatic basin represents the only remain of the Tethys' southern margin and offers the unique opportunity to image a segment of Mesozoic crustal structure within the Mediterranean.

The shallow part of the Adriatic region and its sedimentary evolution in particular have been extensively studied, mostly for hydrocarbon exploration purpose; however, little is known about the deep crustal structure, the upper mantle and the shape of the plate margin. To shed light on these structures, the German research vessel Meteor (cruise M86-3 supported by the Deutsche Forschungsgemeinschaft DFG) acquired 2D seismic refraction and wide-angle reflection data during an off- and on-shore experiment. Three profiles, each consisting of up to 36 ocean bottom hydrophones (OBH) and up to 25 land stations where shot. Two of the profiles crossed Adria from the Italian Peninsula into Montenegro and Albania (P02 and P03). The third profile (P01) was shot parallel to the coastlines, extending from the southern Adriatic basin to a proposed mid-Adriatic decoupling zone. A cluster of 6 G-guns with a combined volume of 84 l was used as source to shoot with ~190 bar every 60 s. This resulted in a shot spacing of ~ 200 m over the densely spaced OBH stations. A short streamer was towed behind the vessel to resolve the shallow part beneath the seafloor.

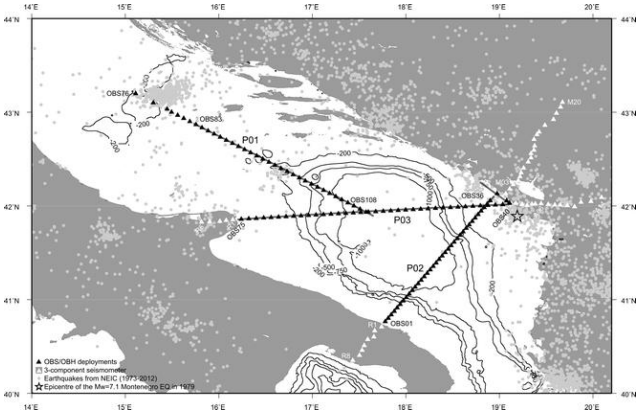

Fig. 1. Overview map of the eastern Adriatic Sea showing the experiment setup of M86-3 cruise on RV Meteor.

Two different approaches of travel time tomography are applied to the data set: A non-linear tomographic approach [*Improta et al., 2002*] is used for the shorter profile P01 that is situated in the middle of the Adriatic Sea. A well-established linear tomographic approach [*Korenaga et al., 2000*] is applied to profile P03 and allows for the integration of OBH and land stations. This profile has a length of 360 km and reaches from the Gargano Promontory into Albania. The instruments partly recorded good data quality up to large offsets. The land stations even recorded arrivals from the opposite end of the shot line. First results show a good resolution of the sedimentary part of the Adriatic region. The depth of the basement as well as the depth of the Moho discontinuity vary laterally and deepen towards the North-East.

References
1 - Improta, L, A. Zollo, A. Herrero, R. Frattini, J. Virieux, and P. Dell'Aversana, 2002. Seismic imaging of complex structures by non-linear traveltime inversion of dense wide-angle data: application to thrust-belt. Geophys. J. Int. 151, 264-278, doi:10.1046/j.1365-246X.2002.01768.x .
2 - Korenaga, J., Holbrook, S., Kent, G., Kelemen, P, Detrick, R. S., Larsen, H.-C., Hopper, J. R., and Dahl-Jensen, T., 2000. Crustal structure of the southeast Greenland margin from joint refraction and reflection seismic tomography, J. Geophys. Res., 105, doi:10.1029/2000JB900188.