SHALLOW FAULT DISTRIBUTION AND DEFORMATION PATTERN IN THE STRAIT OF MESSINA, SOUTHERN ITALY

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Abstract
Newly collected high-resolution seismic data allowed mapping fault patterns in the Strait of Messina. Several transtensional faults were identified in the inner Strait but these faults seem to be too short for generating large earthquakes, such as the Messina earthquake of Dec. 28, 1908 (Mw=7.1). A prominent E-W-trending transtensional fault zone was identified in the outer Strait. It is the only fault system with a clear surface expression. We consider this fault zone as potential source for tsunamis.

Keywords: Geophysics, Messina Strait, Geohazards

The continental margins of southern Italy are located along converging plate boundaries, which are affected by intense seismicity and volcanic activity. Most of the coastal areas experienced severe earthquakes, landslides, and tsunamis in historical and/or modern times. The most prominent example is the Messina earthquake of Dec. 28, 1908 (Mw=7.1; 80,000 casualties), which was characterized by the worst tsunami Italy experienced in historical times (~2000 casualties). However, no general agreement has been archived on the seismogenic/tsunamigenic faults, mainly because the tectonics of the Messina Strait is still unclear.

New hydroacoustic and high-resolution 2D-reflection seismic data were collected during RV Meteor Cruise M86/2 in the Strait of Messina in Dec 2011/Jan 2012 in order to investigate the fault pattern in the Strait of Messina. The data suggest that the inner Messina Strait is a triangular graben. Surface faults in the graben strike in N-S and E-W directions. The N-S-trending surface faults are right-lateral transtensional faults distributed along the Messina Canyon and the coastline off southern Calabria, dipping toward the Messina Canyon. E-W-trending surface faults are left-lateral transtensional faults and located in the northern inner Messina Strait off Calabria. Most of them dip toward the south. Several surface faults fit to the suggested focal mechanisms of the 1908 Messina earthquake, but we were not able to identify the master fault of this event because the superficial expression of all mapped faults was too short for generation a magnitude 7.1 earthquake.

A prominent fault zone has been discovered in the outer Strait (Fig. 1), which is located in the area supposed to be the source of the 1908 Messina tsunami. It is a 30 km long E-W-trending left-lateral transtensional fault zone. The master fault of this system has a clear surface expression, which is marked by a 60 m-high morphological step (SF21 in Fig. 1). We consider this fault as being active. Tsunami modelling showed that this fault would produce significant tsunamis with assumed vertical slip rates of 5 m. A vertical slip of up to 15 m could generate a tsunami comparable to the 1908 Messina tsunami, but we discard this fault zone as a source for the 1908 Messina tsunami, because an E-W-trending fault is not in agreement with levelling and microseismic data of the 1908 Messina earthquake; moreover a 15 m slip event is highly unlikely. However, we still consider this fault as a hazard source in Southern Italy, because it shows the most obvious vertical displacement in the entire Messina Strait and seems to be active.

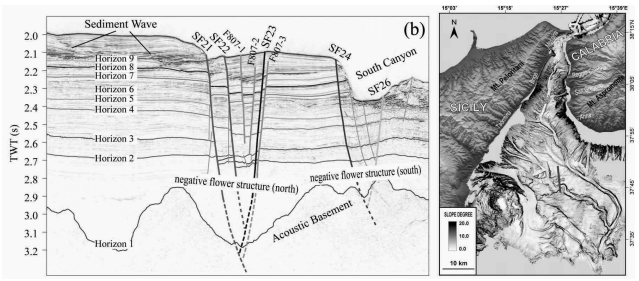

Fig. 1. Seismic profile almost perpendicular to the described fault zone in the outer Strait of Messina. SF21 is the master fault showing a clear surface expression. Map shows location of profile

References
1 - No references