Source mechanisms of earthquakes in S. Italy and their relations to tectonic structures

by

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Seismograms from earthquakes in Southern Italy were used to study source mechanisms and crustal structure. The results may be summarized : Shallow shocks within the earth's crust in Sicily and Calabria lead to the assumption of two prevailing fault systems, one with East-West, left lateral strike-slip faulting, the other one with dip-slip faulting extending in an approximate NNE to NE direction. The earthquakes with dip-slip mechanism concentrate along the geological known fault line Comiso- Messina -S. Eufemia and two well known shocks of this category are the earthquake of Monteleone (1905) and the earthquake of Messina (1908). The latter earthquake clearly shows normal faulting with tensional stress in a horizontal plane perpendicular to the Strait of Messina. Geodetic measurements made by COSTANZI before and after the Messina earthquake together with a tsunami analysis indicate a downsucking or down-pressing of material in the Strait, similar to the formation of a graben structure. This leads to the assumption, that the superposed NE-SW striking compressional field acting approximately in the direction of the Comiso- S. Eufemia fault is opening this zone of weakness in a direction perpendicular to the strike direction of the fault. This opening could well coincide with the feeding fissure of the volcano Etna.

Furthermore, Etna is situated on a crossing point between two seismic active faults, one of the a.m. EW strike-slip faults and the normal faulting earthquakes along the Comiso line. There is a remarkable difference between the stress-drop accompanied with earthquakes along the Comiso- S.E. line. The stress-drop for shocks in E. Sicily is significantly lower than for shocks in Calabria. In regard to stress-drop, the Messina earthquake from 1908 belongs to the group of the Calabrian shocks.

The deep-focus earthquakes below the Tyrrhenian sea are clearly separated in focal depth from the crustal earthquakes in Sicily and Calabria. There exists an aseismic zone between the crust-mantle boundary and a depth of at least 200 km. With the word aseismic we mean, that with available and useful seismograms of S. Italian earthquakes no hypocenters in this zone were located.

There is one exception : some earthquakes with their epicenters in the Gulf of Squillace show focal depths between 40 km and about 70 km.

Only few reliable fault plane solutions exist for the deep earthquakes in the Tyrrhenian. One reason for this is the complicated form of the P-wave group from these sources. The f.p.s. of the deep foci agree in the assumption of a N-S striking vertical fault, with a vertical dislocation of upward movement on the western side. The shallow shocks in the Tyrrhenian sea concentrate around the Eolian islands. The earthquake near Ustica of MAR 16, 41, shows a remarkable similarity in the f.p.s. comparing it with the normal faulting shocks in E. Sicily.

In addition to the study of source mechanisms, the seismograms were analysed for group travel times of fundamental RAYLEIGH and LOVE surface wave modes. Concerned wave paths were from W. Sici-

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ly, E. Sicily, the Gulf of Squillace and the Gulf of Taranto to the WWSSN station in l'Aquila. The measured grouptravel times were compared with theoretical models based on the results from refraction measurements, as given by GIESE and MORELLI. The data by GIESE and MORELLI are compatible with these surface wave data for wave paths in the S. Italian main land. However, their models are not in full agreement with surface wave data along wave paths from W. Sicily to l'Aquila. The section within the Tyrrhenian indicates a somewhat larger MOHO-depth than given by GIESE and MORELLI, and an assumed smallest MOHO-depth of approximately 20 km on this wave-path would fit to the dispersion measurements.

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Discussion

M. Flores : Did you find any evidence that the comiso-Messina (S. Eufemia) fault alignement has a transcurrent component?

Les auteurs répondent : No, we were working on the idea. No any sismic evidence.

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