CRUSTAL STRUCTURE AND VELOCITY TOMOGRAPHY OF THE NISYROS VOLCANIC AREA-EAST AEGEAN SEA

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Abstract:
Within the frame of GEOWARN project active and passive seismic studies have been performed at the volcanic area of Nisyros. Our aim is to map the crustal and velocity structure of this volcanic area and the microseismicity in order to delineate the active fault systems. In the active experiment we involved 20 land and 40 bottom seismic stations and recorded 7000 shots in 3D geometry. We identify that the island of Nisyros is occupied by apophytic intrusion of much larger volcanic structure with a caldera of 30 km diameter extending between the southern coast of Kos and southern coast of Nisyros.

Keywords: Aegean Sea, crust structure, seismic, volcanology

Within the frame of the European Community supported GEOWARN (Geo-spatial warning system Nisyros volcano (Greece). An emergency case study) investigation of the volcanic area of Nisyros active and passive seismic and seismicity studies have been performed during the last two years. Our aim is to map the crustal and velocity structure of this volcanic area and to map the microseismicity in order to delineate the active fault systems. This project was initiated out of the necessity to better understand the volcanic behavior of Nisyros. By combining geodetic, geophysical, geochemical and geological observations it is intent to correlated magma movements and changes of physical and chemical parameters of the volcanism. The existence of overheated (300 C) aquifers at shallow depth (1500 m) below the volcano cause a permanent danger for the inhabitants and tourists who visit this island. A decrease of the lithostatic pressure triggered by seismic activity could cause an explosive reaction of the aquifers and distractions of the island as already occurred in 1871 and 1873 (1). In the active experiment we involved 40 ocean bottom seismographs and 20 standalone digital seismic stations and we recorded 7000 shots in 2D and 3D geometries (Fig. 1). The evaluation of these data are now in process and the crustal structure as is presently known and referred to by (2) shows that between Rhodes in the south-east and Patmos in northwest the continental crust of east Aegean sea does not exceed 23 km in thickness (Fig 2). We could identify through the geometry of the crust and the distribution of the sediments that the island of Nisyros is occupied by apophytic intrusion of a much larger volcanic structure have a caldera of 30 km diameter extending between the southern coast of Kos and southern coast of Nisyros. By tomographic inversion of the active seismic observation we could see that the islands of Yali and Strongili arte also occupied by apophytic intrusions in a similar fashion as that of Nisyros.

We observed the microseismicity by an on- and offshore seismic array for 3 mouths in 1997-98 and for 3 month in 2000. The epicentral distributions plotted in Fig.3 delineate the geometry of caldera and it associated with shallow distribution of foci mainly triggered by hydrothermal activity and magmatic processes. A series of active faults were identified between the islands of Tilos to Nisyros and between Nisyros and Yali by the linear distribution of the foci. Other active fault seems to be east northwest oriented and truncate the caldera at different azimuths. All these active faults can trigger vertical and horizontal movements and rupture the lithological overburden thus changing the physical parameter at depth. We are now in the process of computing by the active seismic experiment new crustal and tomographic models of the area and our next step will be to integrate these data to the chemical and geodetic observation the GEOWRN team has collected.

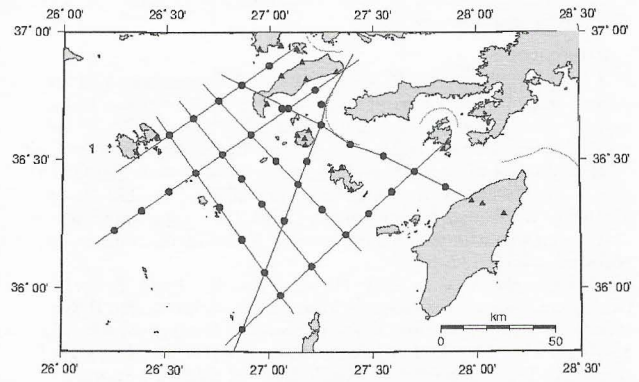

Figure 1. Locations of OBS (filled circles) and land stations (filled triangles) in Nisyros 2000 tomography project. Black lines are the airgun shooting profiles.

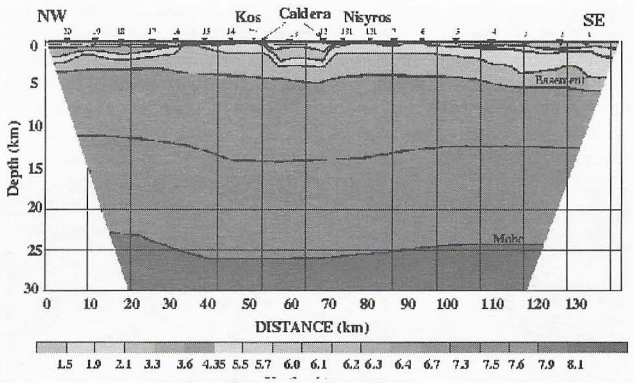

Figure 2. The P-wave velocity cross-section through Dodecanesos islands.

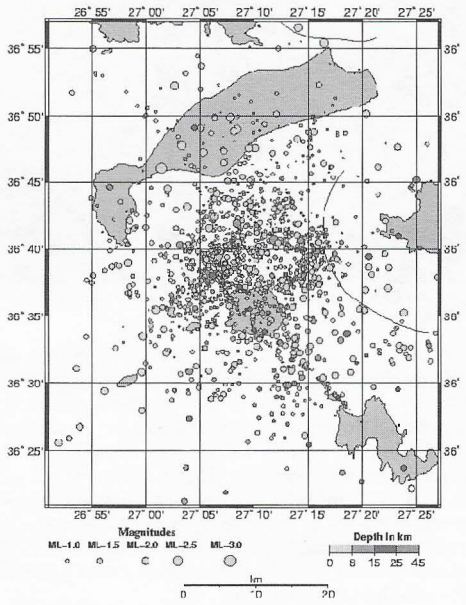

Figure 3. Microseismic observations in Nisyros area recorded in periods: 1) 11.10.97 – 02.01.98; 2) 15.07.00 – 14.09.00.

References

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