

# ACTIVE DEFORMATION AND MICROSEISMICITY OF THE MESSINIAKOS GULF, SOUTHERN GREECE, DEDUCED FROM AN ONSHORE/OFFSHORE LOCAL SEISMIC ARRAY

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## Abstract

The microseismic activity in the area of Messiniakos gulf, southern Greece, was observed by an onshore/offshore seismic array. In a period of 45 days more than 1600 events were detected and the distribution of the seismic activity confirms the existence of an active fault system of NW-SE orientation correlating with tectonic elements mapped by geological techniques. It is of particular significance that in the immediate vicinity of the city of Kalamata the distribution of epicenters delineates an NW-SE fault (F1, Fig.1) which coincides with the fault system activated during the 1986 M6.0 catastrophic earthquake. Apart from this a deep fault of NE-SW orientation was mapped in the lower part of the Messiniakos gulf (F2, Fig.1) which is associated with the subduction process below southwestern Greece.

*Keywords : active tectonics, microseismicity, southern Greece*

## Introduction

After the destructive Ms6.0 earthquake of Kalamata, southwestern Greece, of September 13, 1986, that caused significant economic damage and human losses, several investigations were initiated aiming at a more precise location of the active fault systems in order to better estimate the seismic hazard and risk of the broader Messiniakos area. In this respect particular interest was given to the study of the poorly understood submarine tectonic elements of the Messinian bay and their connection to the onshore tectonics (1). In an attempt to better locate the offshore active faults of this region, a combined onshore/offshore microseismicity survey of 30 seismic stations was carried out in the Messiniakos Gulf, by the above mentioned Institutes. The correlation of microseismicity with regional tectonics is discussed in the present study.

## Microseismicity

We deployed 20 stand alone seismic units onshore that recorded continuously for 45 days three seismic channels at a sampling rate of 8 msec (2). Data were stored on hard disk and the timing and position were obtained by an integrated GPS system. 10 ocean bottom seismographs (OBS) were used for the offshore observations. These systems have the same recording capacity as the land stations, are housed in a glass sphere and can be deployed to water depths over 6,000 m. Timing is obtained by a thermal stabilized quartz clock. The OBS are anchored on the sea floor by a specially designed weight and can be released from it acoustically or by a timing device (3,2).

In a period of 45 days, in Fall 1999, more than 1600 events were detected. In the immediate area of interest about 930 events were located (fig. 1) with an accuracy better than 3 Km in the epi- and hypocentral position. Their local magnitudes calibrated by records of the National Seismograph Network of Greece ranged between ML1.2 and 4.0.

## Discussion and conclusions

The distribution of the foci delineated mainly two active fault zones in the Messiniakos basin and one onshore the northern coastal area, and particularly the city of Kalamata. The main offshore active tectonic element strikes NE-SW and terminates in the area of Kardamili. This part of the Taigetos peninsula is truncated by a NW-SE major tectonic fault which is also characterized by high seismic activity. More important however is the identification of an active fault zone, south of the city of Kalamata. Its proximity to this densely populated urban center creates a hazardous situation that has to be considered in any major urban planning and construction. A dense distribution of deeper events in the lower part of the Messiniakos gulf is associated with the subduction process which takes part in southwestern Greece, at an approximately 50 km distance from the study area. The western coast of the Messinian bay is less affected by seismic activity and only at the southernmost part of the peninsula an NS striking active fault system has been identified. A large number of seismic events were located outside the local network. Their accuracy, particularly that of the hypocentral depth, is smaller than that within the array. In spite of this shortcoming, the strong Athens ML5.9 earthquake of September 7, 1999, has been recorded including all the foreshock and part of its aftershock activity. The larger events identified two active zones. One is striking E-W with the Athens main shock at its center, having a length of approximately 20 Km. The second one, striking NE-SW, extends all the way from the Parnis mountain over the island of Salamina to the eastern coast of Peloponnese. The Saronic bay is trun-

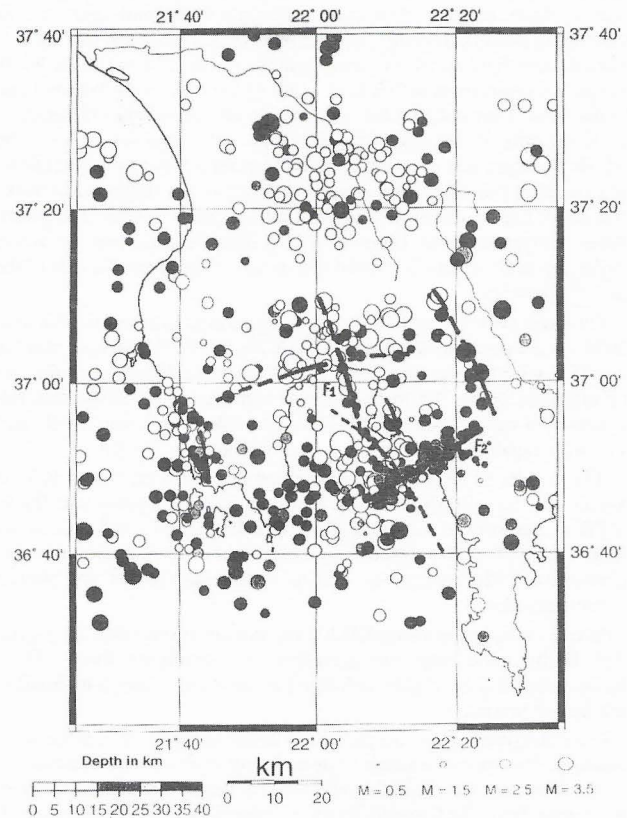


Fig. 1. Microseismicity of Kalamata 99 (number of events : 1458)

cated along this line by an active fault. A new research program was recently initiated aiming at the more precise location of the seismic activity of the Saronic area.

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