



Seismicity Observations in the Hellenic Fore-Arc with an amphibian Network

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The active continental margin of the Hellenic Subduction Zone in the area of Crete is located in the Libyan Sea and approaches the passive African margin with a relative velocity of approximately 3.5 - 4 cm/a resulting in the incipient continent- continent collision south of western Crete. While the relative motion between the Aegean and African plate in the west between Crete and the Poleponnesus is normal with respect to the active continental margin the high curvature of this margin leads to an increasingly oblique subduction towards the east south of central and eastern Crete. It is believed that this oblique subduction in conjunction with the southward migration of the active continental margin led to the creation of transtensional structures within the overriding Aegean plate. These left lateral structures have their bathymetric expressions in the Ptolemy and Pliny trenches south of Crete while the transtensional Messara basin in southern central Crete is an on-shore example for the expression of the current stress regime in the eastern fore-arc. The Strabo trench further to the south is interpreted as backstop where sediments are thrust onto the Aegean crust. Despite the high seismic activity in the eastern fore-arc of the Hellenic Subduction Zone known from previous microseismic investigations and global and regional catalogs a precise determination of the southern termination of the seismogenic zone was not possible due to the lack of recording stations in the Libyan Sea. Also the seismic activity of the offshore trenches and the dip angle of the top of the slab are only poorly constrained by former studies of (micro-)seismicity in the area. From July 2003 to June 2004 five deployments of ocean bottom seismometers (OBS) each with a recording period of 2 months were conducted south of Crete spanning the region of the eastern off-shore trench system. From up to six OBS stations simultaneous recordings were recovered that were complemented by a small short period network installed in the southern

coastal Messara area on-shore Crete. Furthermore, permanent broad-band stations operated by the GEOFON project, the National Observatory of Athens and MEDNET were included in the data analysis. During the observation period more than 2500 local and regional events with magnitudes up to 4.5 were detected and localized. On-shore activity was mostly limited to the Messara basin and the NNE-SSW trending Ierapetra graben while the large majority of events was located off-shore. The observed southern limit of the seismogenic zone coincides with the Strabo trench while the inter-plate seismicity in the north terminates at the southern Cretan shore thus creating a roughly 100 km wide seismogenic zone at the plate contact. Apart from the abundant seismic activity on nearly vertically dipping structures in the region of the Ptolemy trench also the Pliny trench exhibited some intra-crustal seismic activity during the observation period. In the region between the two trenches most seismicity located at depths compatible with the presumed plate contact suggesting that relative motion between the blocks is concentrated at the trenches while the blocks show little internal activity. The inter-plate seismicity terminates at the south coast of Crete at depths of approximately 40 km pointing to a change in the properties of the plate contact further north. Below the Pliny trench the plate contact is found at depths of about 20 km hinting at a dip angle of the African slab of 15-18 degrees in the region south of eastern Crete