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Evidence for activity of the Calabrian arc system and implications for historical seismicity in Eastern Sicily

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The Wadati-Benioff zone under Calabria and the Tyrrhenian Sea is located in the centre of the Mediterranean Sea, a region characterized by complex tectonics. The presence of deep earthquakes under the Tyrrhenian Sea to a depth of 500 km, depicting an Ionian slab dipping about 70° towards the NW (Selvaggi and Chiarabba, 95), related with an active volcanic arc (the Aeolian Islands).

The Calabrian peninsula is among the most seismically active regions in the Mediterranean area. Several historical seismic events, such as 1169 and 1693 earthquakes, reached MCS intensities of XI and are associated with destructive tsunami (Piatanesi and Tinti, 1998). The source of these two strongest earthquakes has still not been identified with certainty. The 1693 earthquake struck Eastern Sicily (60000 people killed) and generated a 5-10 m high tsunami (Piatanesi and Tinti, 1998). The 1169 earthquake had similar intensities and a comparable isoseismal pattern, suggesting an equivalent source. Because of the tsunami generated in 1693 and because the isoseismals are open to the sea, the source region appears to be offshore. The subduction fault plane would then be a good candidate for the 1693 event. However, a lack of instrumentally recorded thrust earthquakes, characteristic of active subduction zone, suggests that if subduction is active, the fault plane may be locked since the instrumental period.

Reported recent GPS motions suggest that the subduction of the Ionian lithosphere beneath the Tyrrhenian basin plays an minor role in controlling the active deformation of the Eurasia-Nubia plate boundary, but may be locally still active in particular in the Calabrian arc (D'Agostino et al., 08). Moreover the offshore accretionary wedge is known to include compressional anticlines and ongoing hydrological activity (mud volcanoes).

We present preliminary results from reprocessed 96-channels seismic reflection profiles acquired during the French "Archimede" cruise (1997) crossing the Calabrian prism, the Ionian Abyssal Plain and the Mediterranean Ridge. A more recent Italian seismic cruise "Calamare" investigated the lateral boundaries of the Calabrian prism. The joint interpretation of these datasets will allow us to seek evidence of continuous tectonic activity of the system, in particular of the Malta-Hyblean escarpment which is also proposed as a candidate source for great earthquakes offshore Sicily (Bianca et al., 99). Additional work is in progress, including a CIRCEE cruise proposal (an OBS + MCS seismic survey, with sediment coring and heat-flow measurements). The objectives are : 1/ to image the deep structure of this subduction zone, 2/ to characterize its thermal state, 3) to determine a geometry of the seismogenic part of the plate interface and 4) to address the recurrence interval for large earthquakes.