Project of Strategic Interest NEXTDATA

Deliverable D1.5.1: Report on the definition of the available measurements and of the keysites for new drilling activities

Resp: Fabrizio Lirer, CNR-IAMC

The main scientific literature available for the Mediterranean area, documents the existence of several marine sites with information and data concerning the Holocene (last 10.000 years), but unfortunately, as recently reported by Luterbacher et al. (2012) in "A Review of 2,000 Years of Paleoclimatic Evidence in the Mediterranean", there are very few scientific studies quoting the occurrence of the sedimentary records covering the last two millennia with high resolution data, and in particular the presence of the marine records over the last 200 years. In fact, in this review the only available marine sedimentary records regarding the last 2,000 years for the Mediterranean Basin are the following: one retrieved in the Gulf of Taranto (Taricco et al., 2009; Versteegh et al., 2007) and one in the Southern-Western Mediterranean Sea (Schilman et al. 2012). Recently, a new study regarding the West Algerian-Balearic Basin during the last 4,000 years has been published by Nieto-Moreno et al. (2011) and one study concerning the Gulf of Lion during the last 400 years has been reported in Fanget et al. (2012).

The goal of WP 1.5 is to find super-expanded marine records characterized by a thickness of emipelagic sediments for the last two millennia useful to perform analysis of the climatic oscillations at scales from the secular one to the decadal one. The only marine environment where this time interval is potentially preserved, with an useful thickness of late Holocene sediments, is the continental shelf. This shallow water marine environment has been investigated in the Mediterranean area by Cini Castagnoli's group [Cini Castagnoli, et al. (1993); Cini Castagnoli, et al. (1998); Cini Castagnoli, et al., (1999); Cini Castagnoli, et al. (2000); Cini Castagnoli, et al. (2002); Cini Castagnoli, et al. (2005)], and by Oldfield et al. (2003), Pena et al. (2007), Versteegh et al. (2007), Piva et al. (2008), Taricco et al. (2009), Incarbona et al. (2010), Abrantes et al., (2011), Nieto-Moreno et al. (2011), Vallefuoco et al., (2012), Lirer et al. (2012), quoting information of marine sedimentary records with high sedimentation rates, required for high resolution paleoclimatic reconstructions.

The choice to analyze the time interval of the last 2,000 years is related to the possibility to compare the acquired proxies (biotic and abiotic ones) from marine sedimentary archives with data from historical chronicles. These data represent fundamental information to calibrate the sequence of paleoclimatic events, stored in the marine records. In addition,

during this time interval the human impact has had an important rule on the marine ecosystems.

The main problems connected with performing high resolution studies for the last two millennia are as follows:

i) the thickness and the facies of the sedimentary records related to this time interval and consequently to the sedimentation rates (a sampling resolution of about 5 years for cm is needed);

ii) the need to recover the undisturbed sedimentary records at the water-sediment interface;

iii) and the fact that the generation of high resolution data (calcareous plankton, stable isotope, pollens, etc..) is time consuming.

The first problem can be solved studying the marine records in continental shallow water environments. The second one can be solved using the SW104 core system to recover the gravity cores (which allows us to recover the undisturbed sedimentary records at the water-sediment interface). Concerning the third problem, unfortunately, the generation of both geochemical and micropaleontological proxies is time consuming, but they really represent the best tools to pursue the goal (paleoclimate) of WP 1.5 of the NEXTDATA project. The geochemical (stable isotope data on planktonic and benthic foraminifera) data are useful to provide information about the temperature and the salinity while micropaleontological proxies (calcareous plankton, benthic foraminifera, pollens and dinoflagellates) give information on paleoclimate/paleoenvironments/ecological niches.

The choice of new key sites is based on the following criteria:

i) the occurrence of tephra layers, which represent the first order stratigraphic markers, and provide an added value for the dating of paleoclimatic events (sites located close to volcanic districts);

ii) undisturbed emipelagic marine sedimentary sequences, useful for quantitative analysis of calcareous plankton data;

iii) high sedimentation rates, useful for reconstructions at scales from the secular one to the decadal one

The following areas have been selected, according to geochemical, geophysical, micropaleontological, sedimentological and geochronological literature data:

i) Gulf of Salerno (southern-eastern Tyrrhenian Sea – cores C90_1m-C90, Figure 1), according to Iorio et al., (2004); Budillon et al., (2005, 2012); Sacchi et al., (2009); Vallefuoco et al., (2012); Lirer et al. (2012);

- This site presents high sedimentation rates and well preserved calcareous plankton data
- during the last 2,000 years, useful for climatic reconstructions at scales from the decadal one to the secular one.

ii) Gulf of Taranto (core point 3, Figure 2), according to Cini Castagnoli, et al. (1993); Cini Castagnoli, et al. (1998); Cini Castagnoli, et al., (1999); Cini Castagnoli, et al. (2000); Cini Castagnoli, et al. (2002); Cini Castagnoli, et al. (2005); Versteegh et al. (2007); Taricco et al. (2009);

- This site has been selected according to published geochemical data (stable isotope data on planktonic foraminifer *Globigerinoides ruber*) which suggest a centennial-scale solar forcing since 1420AD.

iii) area south-east of Malta Island (central Mediterranean Sea, core point, Figure 2), according to preliminary data from high resolution seismic profiles (Subbottom Chirp) of CNR-IAMC;

- This site has been selected according to unpublished high resolution seismic profiles (Subbottom Chirp), which show a thick sequence of Holocene marine deposits at about 100 meters water depth. In addition, a short core available at CNR-IAMC shows that the upper part of this sediment (last 30 cm) is composed of emipelagic sediments.

iv) area between Malta and Sicily (central Mediterranean Sea, core point 1, Figure 2), according to Sprovieri et al. (2003), Incarbona et al. (2010);

- This site has been selected according to micropaleontological and geochronological published data, which suggest high sedimentation rates and well preserved calcareous plankton data for the last 2,000 years, useful for reconstructions at scales from the decadal one to the centennial one.

v) Gulf of Gaeta (central southern-eastern Tyrrhenian Sea, Figure 3), according to preliminary data from high resolution seismic profiles (Subbottom Chirp) of CNR-IAMC;

- This site has been selected according to unpublished high resolution seismic profiles (Subbottom Chirp), which show a thick sequence of Holocene marine deposits at about 100 meters water depth.

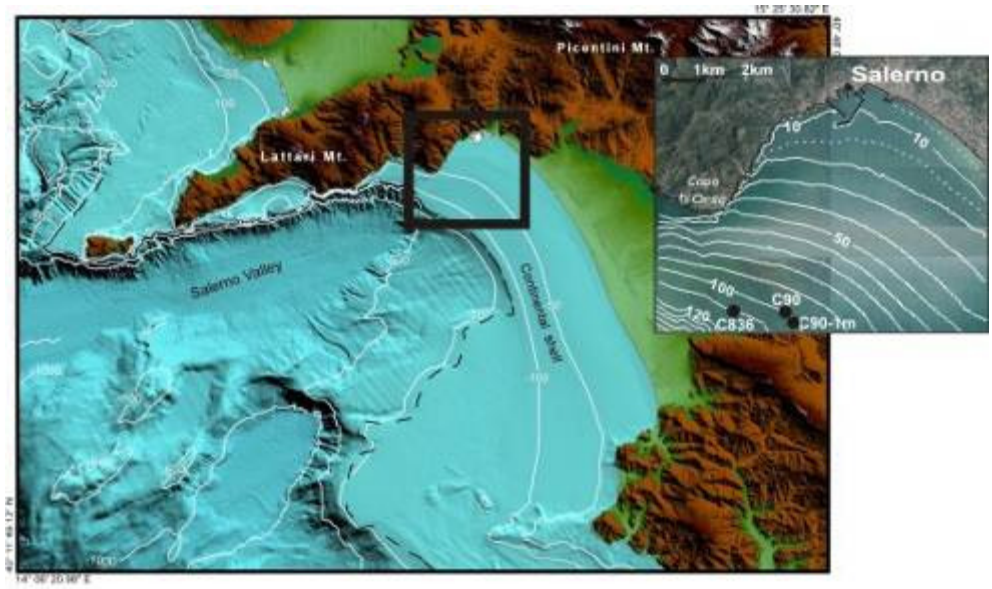

Figure 1. Location map of the sites of interest (C90_1m, C90 and C836) in the southern-eastern Tyrrhenian Sea (Gulf of Salerno).

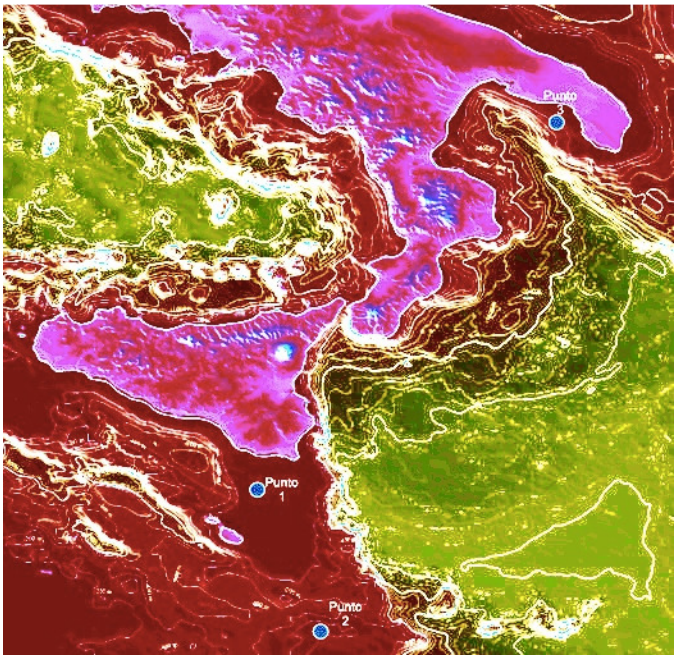

Figure 2. Location map of the sites of interest (Points 1, 2 and 3) in the Central Mediterranean Sea

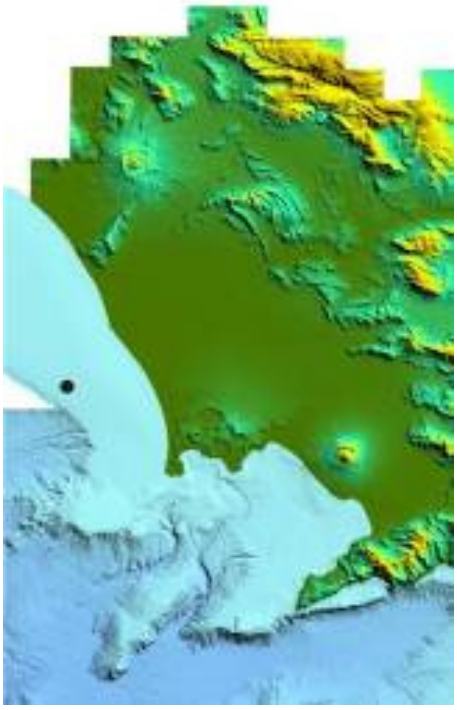

Figure 3. Location map of the site of interest in the central southern-eastern Tyrrhenian Sea (Gulf of Gaeta).