National Research Council

Final Report of the Oceanographic Survey NextData2014

Project NEXTDATA WP–1.5

Paleoclimatic Data from Marine Sediments
(CNR-DTA, URT EvK2-CNR, INGV)

Strait of Sicily – Adriatic Sea

09 – 21 July 2014

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Introduction, objectives and short description of NextData Project (WP 1.5)

The retrieval of series of proxy data on the past climate will serve to acquire a deeper understanding of the climate system and a more accurate prediction of its future development, as a priority task for the scientific community. In particular, the analysis of climate data of the past is an essential tool for studying the dynamics of the earth's climatic system under conditions different from those of today, and irreplaceable for testing the validity of medium- and long-term forecasting models. The determination of the influence of anthropogenic impacts on the planet’s environment is predicated on a clear understanding of the natural ways in which the earth's climate responds to the complex set of external forcings. Therefore, in recent decades, many national and international research groups have focused attention on the study of the climate evolution in late-Quaternary sediments from the Mediterranean area. By virtue of its close relationship with continental masses subject to different climatic processes, the Mediterranean basin permits the documentation of climate evolution both globally and in the Northern Hemisphere. Finally, it is worth noting that shallow sea (continental shelf) areas are natural repositories for the monitoring of short-term climate change and anthropogenic impacts on the marine system. To make available information on climate history and environment yielded by marine sediments, this WP will be dedicated to analyzing and, where possible, collecting cores of marine sediments, especially those drilled in shallow sea environments, and focusing on climate dynamics in the Mediterranean over past centuries. During its course, the project will analyse and, where possible, sample marine sediment cores in continental shelf environments and in different sectors of the Mediterranean basin. Previous studies have indicated them as key sites for the identification of major short-term climate fluctuations, due to global and local forces active during the Quaternary and particularly in the past thousand years. In fact, the possibility of enriching the databases referring to this time interval (to date, still limited to the Mediterranean) will provide new working hypotheses for the implementation of numerical models that attempt simulate how the Mediterranean, in particular the marine-coastal sector, has responded to past climate dynamics (Medieval Warm Period / Little Ice Age transition, Little Ice Age, the Industrial Age, and Modern Warming). The cores obtained will be the focus of multidisciplinary studies involving national and international research groups.

Structural and Stratigraphic Framework

The Strait of Sicily

According to Maldonado and Stanley (1976) the Strait of Sicily platform occupies a geologically strategic position between the deep, fault bounded basins of the Balearic, Tyrrhenian, and Ionian seas and the emerged North African and southern European regions bounding it. Most workers envision this shallow area as a prolongation of the Tunisian-Southern Sicilian land mass and as a link between the North African Atlas chain and the Sicilian-Italian Apennine chain. The different tectonic provinces of the Strait region have been defined and mapped by Burollet (1967) and Zarudzki (1972). Seismic reflection exploration has provided both deep penetration (Flexotir records of Finetti and Morelli, 1972a, b) and shallower subbottom coverage (Woods Hole Oceanographic Institution sparker and air gun profiles, Zarudzki, 1972). Flexotir records show that this zone, separating the distinct eastern and western Mediterranean geodynamic sections, consists of thick continental crust comprising a generally thin Pliocene Quaternary unconsolidated section above a thick sequence of Triassic to Miocene rock units (Finetti and Morelli, 1972a). The reduced thickness of unconsolidated Pliocene and Quaternary sediments (except in some depressions such as the Malta Graben where these exceed 1 second, penetration two-way travel time) can be contrasted with the thick sections in the Balearic Basin west of the Strait. The underlying Upper Miocene units, correlated with limestone and dolomite sequences in cores and land sections, thicken toward Tunisia (Burollet, 1967). There is ample evidence of geologically recent (post-Miocene) structural displacement, and the different morphological-tectonic sectors of the Strait can be related to major fault patterns. Magnetic and gravity studies reveal that the main structural trends are oriented west northwest - east southeast, i.e., parallel to the major orientation of the Sicily Channel (Allan and Morelli, 1971; Morelli, 1972; Colantoni and Zarudzki, 1973; and others). A northeast-southwest trend predominates at the westernmost sector of the Strait (Auzende, 1971; Auzende et al., 1974). The largely vertical structural displacement gives rise to a complex configuration of horsts (shallow tabular-shaped banks) and grabens (narrow, deep linear basins). Seismic profiles clearly display the vertical and subvertical offset of reflectors. The intensity of structural offset and seismicity (shallow earthquake epicenters), and the concentration of volcanoes (most are submarine cones) increase in the northern sector of the Strait. The islands of Linosa and Pantelleria reflect the importance of Pliocene and Quaternary eruptions in this part of the Mediterranean. Pantelleria rises from the 1300 m deep Pantelleria Basin. The position of other volcanic deposits, including some which accumulated in historic time, are reported by Zarudzki (1972) and Finetti and Morelli (1972a); these are concentrated mostly in the northern sector of the Strait. The presence of dike swarms or narrow lava streams are also suggested on the basis of magnetic anomalies and appear aligned parallel to the principal tectonic provinces. Some Mesozoic and early Tertiary intrusions also have been penetrated by petroleum exploratory wells. In terms of regional Mediterranean-Alpine tectonics, the thick crustal sections of the platform are considered part of the African Plate, which underthrusts the Euro-Asiatic plate in the Ustica-Lipari region of Sicily (Caputo et al., 1970). Finetti and Morelli (1972b) also emphasize the role of compression but prefer to relate plate motion to subduction of the African Plate below what they define as the Mediterranean Plate. Like most geophysicists, these latter authors tend to agree that much of the Mediterranean, in particular the deep basins bounding the Strait, has undergone considerable subsidence since the end of the Miocene. Benson (1972) has proposed that the Strait platform was deeper during the Pliocene than at present. The development of vertical faults with offsets to 1000 m in the upper crust is believed to reflect isostatic adjustment following the main Alpine orogeny. Additional structural offset may also be due to alternating phases of compression and distension. Zarudzki (1972) relates the gentle folding of the more than 300 m of section in the northwest end of the Pantelleria Trough, as observed in continuous seismic profiles, to the abovecited recent, postorogenic tectonic activity. The fault development, volcanism, and seismicity of this region are not unlike those postulated in some subduction models. An interpretative diagram showing the origin of this modern rift-tension relief in the Strait and associated volcanism in relation to subduction is presented by Akal (1972). These Quaternary neotectonic factors will be emphasized in the context of sedimentary processes and sedimentation rates in the Strait region.

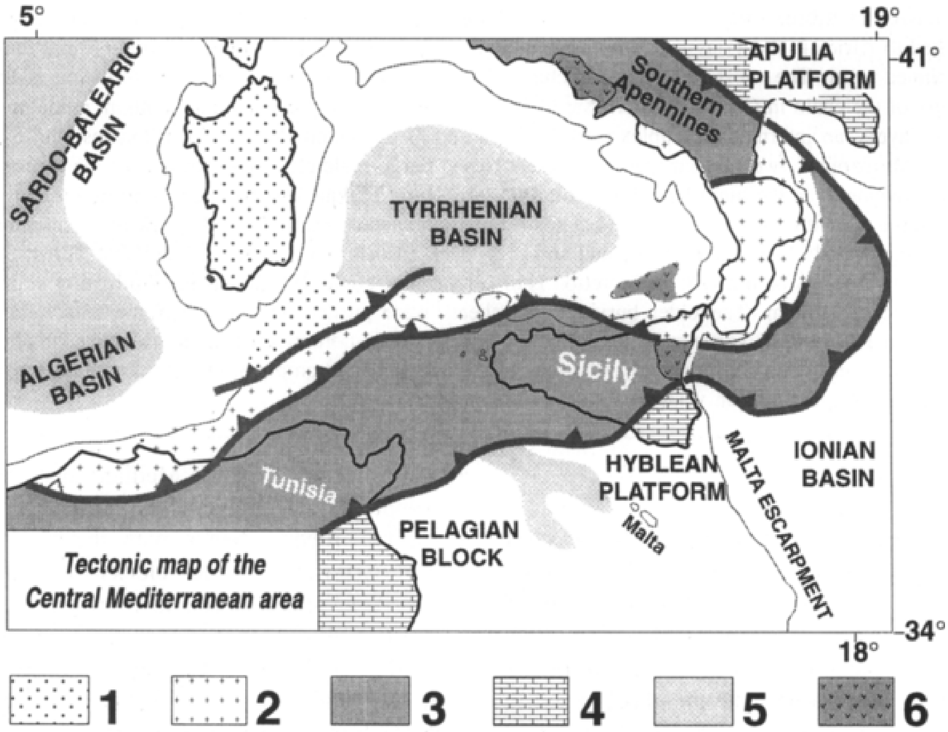

Fig. 1. Tectonic scheme of the central Mediterranean area showing: *1* = Corsica–Sardinia; *2* = Calabrian Arc, Kabylians and "Internal" Flysch sequence ophiolites; *3* = Maghrebian–Sicilian–Southern Apennine nappes and deformed foreland; *4* = foreland and mildly folded foreland (Tunisia, Hyblean plateau, Apulia); *5* = areas with superimposed extension; *6* = Plio-Quaternary volcanoes.

Fig. 1 Modified from Catalano et al., 1996

The Adriatic Sea

The Adriatic is the northernmost arm of the Mediterranean Sea, extending from the Strait of Otranto (where it connects to the Ionian Sea) to the northwest and the Po Valley. It is divided into three basins, the northern being the shallowest and the southern being the deepest, with a maximum depth of 1,233 metres. The Otranto Sill, an underwater ridge, is located at the border between the Adriatic and Ionian Seas. The prevailing currents flow counterclockwise from the Strait of Otranto, along the eastern coast and back to the strait along the western (Italian) coast. Tidal movements in the Adriatic are slight, although larger amplitudes are known to occur occasionally. The Adriatic's salinity is lower than the Mediterranean's because the Adriatic collects a third of the fresh water flowing into the Mediterranean, acting as a dilution basin. The surface water temperatures generally range from 24 °C in summer to 12 °C in winter, significantly moderating the Adriatic Basin's climate.

The Adriatic Sea sits on the Apulian or Adriatic Microplate, which separated from the African Plate in the Mesozoic era. The plate's movement contributed to the formation of the surrounding mountain chains and Apennine tectonic uplift after its collision with the Eurasian plate. In the Late Oligocene, the Apennine Peninsula first formed, separating the Adriatic Basin from the rest of the Mediterranean. All types of sediment are found in the Adriatic, with the bulk of the material transported by the Po and other rivers on the western coast. The western coast is alluvial or terraced, while the eastern coast is highly indented with pronounced karstification.

Geophysical and geological information indicate that the Adriatic Sea and the Po Valley are associated with a tectonic microplate identified as the Apulian or Adriatic Plate that separated from the African Plate during the Mesozoic era. This separation began in the Middle and Late Triassic, when limestone began to be deposited in the area. Between the Norian and Late Cretaceous, the Adriatic and Apulia Carbonate Platforms formed as a thick series of carbonate sediments (dolomites and limestones), up to 8,000 metres deep (Suricand Masa, 2005). Remnants of the former are found in the Adriatic Sea, as well as in the southern Alps and the Dinaric Alps, and remnants of the latter are seen as the Gargano Promontory and the Maiella mountain. In the Eocene and early Oligocene, the plate moved north and north-east, contributing to the Alpine orogeny (along with the African and Eurasian Plates' movements) via the tectonic uplift of the Dinarides and Alps. In the Late Oligocene, the motion was reversed and the Apennine Mountains' orogeny took place. An unbroken zone of increased seismic activity borders the Adriatic Sea, with a belt of thrust faults generally oriented in the northeast–southwest direction on the east coast and the northeast–southwest normal faults in the Apennines, indicating an Adriatic counterclockwise rotation. An active 200-kilometre fault has been identified to the northwest of Dubrovnik, adding to the Dalmatian islands as the Eurasian Plate slides over the Adriatic microplate. Furthermore, the fault causes the Apennine peninsula's southern tip to move towards the opposite shore by about 0.4 centimetres per year. If this movement continues, the seafloor will be completely consumed and the Adriatic Sea closed off in 50–70 million years. In the Northern Adriatic, the coast of the Gulf of Trieste and western Istria is gradually subsiding, having sunk about 1.5 metres in the past two thousand years (Antonioli et al., 2007). In the Middle Adriatic Basin, there is evidence of Permian volcanism in the area of Komiža on the island of Vis and the volcanic islands of Jabuka and Brusnik. Earthquakes have been observed in the region since the earliest historical records. A recent strong earthquake in the region was the 1979 Montenegro earthquake, measuring 7.0 on the Richter scale. Historical earthquakes in the area include the 1627 Gargano peninsula and the 1667 Dubrovnik earthquakes, both followed by strong tsunamis (Soloviev et al., 2000). In the last 600 years, fifteen tsunamis have occurred in the Adriatic Sea (Pasaric et al., 2012).

All types of seafloor sediments are found in the Adriatic Sea. The Northern Adriatic's comparatively shallow seabed is characterised by relict sand (from times when the water level was lower and the area was a sandy beach), while a muddy bed is typical at depths below 100 metres (Schwartz, 2005). There are five geomorphological units in the Adriatic: the Northern Adriatic (up to 100 metres deep); the North Adriatic islands area protected against sediments filling it in by outer islands (pre-Holocene karst relief); the Middle Adriatic islands area (large Dalmatian islands); the Middle Adriatic (characterized by the Middle Adriatic Depression); and the Southern Adriatic consisting of a coastal shelf and the Southern Adriatic Depression. Sediments deposited in the Adriatic Sea today generally come from the northwest coast, being carried by the Po, Reno, Adige, Brenta, Tagliamento, Piave and Soča rivers. The volume of sediments carried from the eastern shore by the Rječina, Zrmanja, Krka, Cetina, Ombla, Dragonja, Mirna, Raša and Neretva rivers is negligible, because these sediments are mostly deposited at the river mouths.

Scientific Crews

First name - Surname	Gender	Nationality	Expertise	Qualification	Role	Affiliation
1) Sergio Bonomo	M	Italian	Micropaleontology	Researcher	Co-Chief	IAMC-CNR, Naples
2) Fabrizio Lirer	M	Italian	Micropaleontology	Researcher	Project Leader	IAMC-CNR, Naples
3) Nicola Pelosi	M	Italian	Geophysics	Researcher	Chirp analysis	IAMC-CNR, Naples
4) Ludovico Albano	M	Italian	Geophysics	Student	Chirp analysis and coring	University Palermo
5) Erlisiana Anzalone	F	Italian	Stratigraphy	Researcher	Sediment sampling	IAMC-CNR, Naples
6) Mercedes Bermejo Cisneros	F	Spanish	Geochemistry	PhD	Sediment sampling	University Barcelona
7) Antonio Cascella	M	Italian	Micropaleontology	Researcher	Sediment sampling	INGV Pisa
8) Alessandro Bonfardeci	M	Italian	Micropaleontology	PhD	Sediment sampling and coring	University Palermo
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11) Serena Ferrarro	F	Italian	Micropaleontology	PhD	Coring and Sediment sampling	University Palermo
12) Irene Giliberti	F	Italian	Micropaleontology	Student	Sediment sampling	University Palermo
13) Renata Migliaccio	F	Italian	Geochemistry	Student	Sediment sampling	IAMC-CNR, Naples
14) Maria Simona Patricolo	F	Italian	Micropaleontology	Student	Sediment sampling	University Palermo
15) Stefania Sorgato	F	Italian	Micropaleontology	PhD	Sediment sampling	IAMC-CNR, Naples
16) Giulia Margaritelli	F	Italian	Micropaleontology	PhD	Sediment sampling	University Perugia
17) Mattia Vallefuoco	M	Italian	Micropaleontology	Researcher	Coring	IAMC-CNR, Naples

Sampling stations and Activities

Station	Activities	Coordinates
ND_14_T / AN97-15		(Lat/Lon: 43° 45' 12.6000" N, 13° 38' 27.6000" E)
ND_14_S / AMC99-1		(Lat/Lon: 42° 51' 48.0000" N, 14° 45' 40.2000" E)
ND_14_R		(Lat/Lon: 42° 30' 39.5407" N, 15° 28' 58.4071" E)
ND_14_P		(Lat/Lon: 42° 07' 5.7487" N, 16° 34' 23.5090" E)
ND_14_A		(Lat/Lon: 41° 32' 16.7639" N, 16° 06' 34.7265" E)
ND_14_B		(Lat/Lon: 41° 40' 17.1026" N, 16° 30' 28.9774" E)
ND_14_C		(Lat/Lon: 41° 21' 20.5265" N, 16° 34' 59.5908" E)
ND_14_D		(Lat/Lon: 41° 10' 31.0544" N, 17° 01' 36.2097" E)
ND_14_Q / MD 90_917		(Lat/Lon: 41° 17' 0.0000" N, 17° 37' 0.0000" E)
ND_14_E		(Lat/Lon: 40° 59' 8.5073" N, 17° 27' 54.7876" E)
ND_14_F		(Lat/Lon: 40° 49' 43.2261" N, 17° 50' 21.8409" E)
ND_14_G		(Lat/Lon: 40° 38' 53.7540" N, 18° 11' 36.7305" E)
ND_14_H		(Lat/Lon: 40° 27' 4.1456" N, 18° 24' 14.4479" E)
ND_14_I		(Lat/Lon: 40° 10' 49.9374" N, 18° 33' 27.7019" E)
ND_14_L		(Lat/Lon: 39° 53' 23.5657" N, 18° 37' 52.3017" E)
ND_14_M		(Lat/Lon: 39° 36' 3.2077" N, 18° 47' 41.6375" E)
ND_14_N		(Lat/Lon: 40° 11' 20.0056" N, 17° 47' 57.5137" E)
ND_14_O		(Lat/Lon: 39° 49' 53.0887" N, 17° 58' 34.9586" E)
ND11-2014		(Lat/Lon: 37° 01' 56.2800" N, 13° 10' 53.7500" E)
ND8-2014		(Lat/Lon: 38° 07' 45.4936" N, 16° 53' 49.6953" E)

Timetable and activities developed during NextData2014 survey

1st day: 09th of July (Messina).

The earlier morning was dedicated to the procedures to board the human resources and the equipment and to install the equipment on the R/V "Urania". At 14:00 a.m. we left the Messina harbour to the ND11-2014 station.

After a general meeting, concerning the research objectives and the survey technical aspects, we established the following working groups:

WORKING GROUPS	
1st **07:00 - 12:00** **16:00 - 20:00**	**2nd** **12:00 - 16:00** **20:00 - 24:00**
Sergio Bonomo	Mattia Vallefuoco
Fabrizio Lirer	Albano Ludovico
Alessandro Bonfardeci	Giulia Margaritelli
Erlisiana Anzalone	Stefania Sorgato
Nicola Pelosi	Cecilia Correggia
Irene Giliberti	Serena Ferraro
Mercedes Bermejo Cisneros	Maria Simona Patricolo
Antonio Cascella	Renata Migliaccio
Wanda Di Matteo	

For the planning of the course-plotting we used a GIS map previously designed and showing the positions of all the stations within the survey area. All the samples collected during the survey refer to the GIS map numbering.

At 16:15 we participated in a “general emergency” simulation, which was followed by a meeting about safety on board.

The weather and sea conditions were moderate with a weak mistral wind.

2nd day: 10th of July (Strait of Sicily)

At 13:00 we reached the ND11-2014 station and a core was performed with SW104. At 16:00 we headed towards the ND8-2014 station, rough sea persisted.

3rd day: 11th of July (Ionian Sea)

At 13:00 we reached the ND8-2014 station and a SW104 core and its replica were performed. The weather conditions improved considerably. At 16:00 we went towards the ND2 point. Weather conditions were excellent.

4th day: 12th of July (Ionian Sea)

At 11:00 we reached the ND14_M bis station and two gravity cores were recovered and three cores with the SW104. The weather conditions continued to be excellent. At 15:00 the transfer towards the ND14_L station started. At 16:00 we start Chirp line towards ND_14_Q / MD_90_917.

5th day: 13th of July (Adriatic Sea)

At 11:00 we arrived at the ND_14_Q / MD_90_917 station, and we collected two gravity cores and three SW104 cores. At 15:00 we went towards the ND_14_U station. The weather conditions continued to be excellent.

6th day: 14th of July (Adriatic Sea)
At 08:30 we arrived at the Giove5 station and we recovered two gravity cores. Thereafter we gathered two cores with the SW104. At 11:00 we headed towards the Giove4 station. At 13:00 we arrived at the Giove4 station and we recovered two gravity cores. Thereafter we gathered two cores with the SW104. At 19:00 we start Chirp line towards ND_14_D, ND_14_C, ND_14_B and RF93-30.

7th day: 15th of July (Adriatic Sea)
The weather and sea conditions were moderate with a weak mistral wind. At 13:30 we arrived at the ND14_V station and we recovered two gravity cores. Thereafter we gathered three cores with the SW104. At 15:30 we headed towards the ND14_R station. At 18:30 we arrived at the ND14_R station and we recovered two gravity cores. Thereafter we gathered three cores with the SW104. At 21:00 we headed towards the ND14_T station.

8th day: 16th of July (Adriatic Sea)
The weather and sea conditions were good with a weak mistral wind. At 08:00 we arrived at the ND14_T station and we perform a CTD acquisition, recovered two gravity cores and three cores with the SW104. At 10:30 we headed towards the ND14_S station. At 16:00 we arrived at the ND14_S station and we perform a CTD acquisition, recovered two gravity cores and two cores with the SW104. At 21:00 we start spark acquisition.

9th day: 17th of July (Adriatic Sea)
The weather and sea conditions were good with a weak mistral wind. At 02:30 we stop spark acquisition and we headed towards the ND14_R. At 05:00 we arrived at the ND14_R station and we perform a CTD acquisition. At 05:30 we headed towards the ND14_V. At 08:00 we arrived at the ND14_V station and we perform a CTD acquisition. At 08:30 we headed towards the ND14_P. At 12:00 we arrived at the ND14_P station and we perform a CTD acquisition. At 12:30 we headed towards the ND14_B. At 15:00 we arrived at the ND14_B station and we perform a CTD acquisition. At 15:30 we headed towards the ND14_C. At 17:00 we arrived at the ND14_B station and we perform a CTD acquisition. At 17:30 we headed towards the ND14_D. At 19:20 we arrived at the ND14_D station and we perform a CTD acquisition. At 20:40 we headed towards the ND14_Q. At 22:00 we arrived at the ND14_Q station and we perform a CTD acquisition. At 22:30 we headed towards the ND14_U.

10th day: 18th of July (Adriatic Sea)
At 00:30 we arrived at the ND14_U station and we perform a CTD acquisition. At 01:00 we headed towards the ND14_E. At 02:00 we arrived at the ND14_E station and we perform a CTD acquisition. At 02:20 we headed towards the Giove_5. At 03:30 we arrived at the Giove_5 station and we perform a CTD acquisition. At 04:00 we headed towards the Giove_4. At 06:00 we arrived at the Giove_4 station and we perform a CTD acquisition. At 07:00 we headed towards the ND14_H. At 10:00 we arrived at the ND14_H station and we perform a CTD acquisition. At 10:30 we headed towards the ND14_L. At 13:00 we arrived at the ND14_L station and we perform a CTD acquisition. At 13:30 we headed towards the ND14_M. At 15:30 we arrived at the ND14_M station and we perform a CTD acquisition. At 16:00 we headed towards the ND14_O. At 19:30 we arrived at the ND14_O station and we perform a CTD acquisition and recovered two SW104 cores. At 21:00 we finished all activity and we headed towards Palermo arbour.

11th day: 19th of July (Ionian-Tyrrhenian Sea)
Transfer to Palermo arbour.

12th day: 20th of July (Tyrrhenian Sea)
Transfer to Palermo arbour.

13th day: 21th of July (Tyrrhenian Sea)
Arrive at Palermo arbour.
Survey end

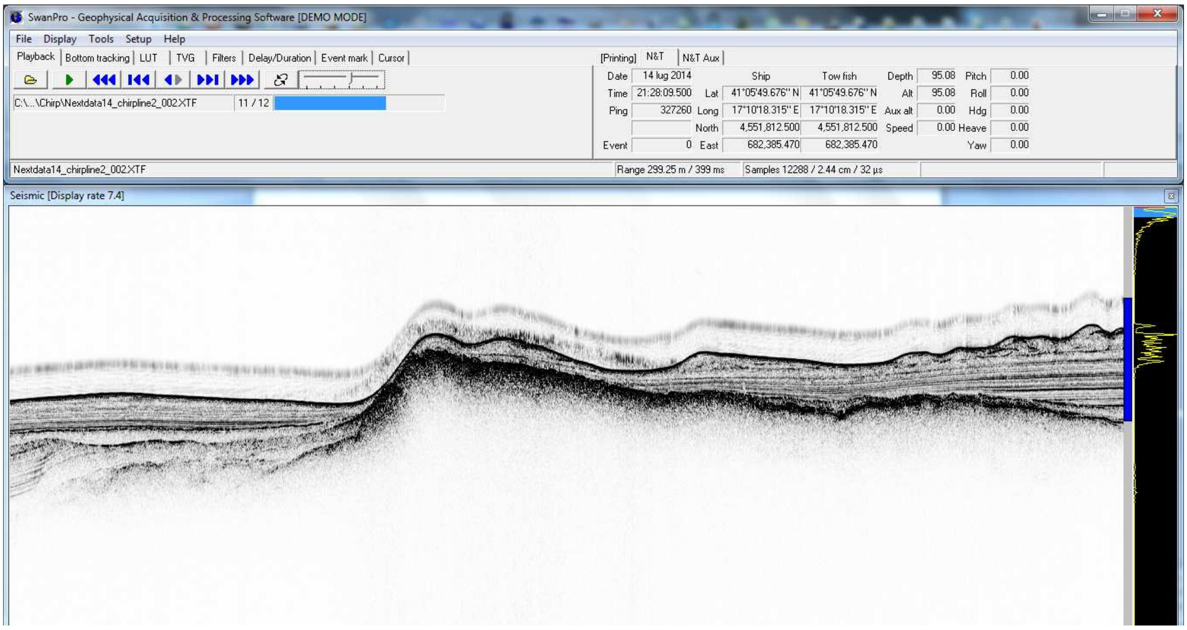
Co-Chief:
Dr. Sergio Bonomo

Scientific and Technical activities

During the NextData2014 survey we have carried out the following scientific and technical activities:

- Sub Bottom Profiler (Chirp): a tool to determination of the depth and the trend of substrate buried by recent sedimentary cover.

Before coring bottom sediments, through gravity coring system and SW104 corer, we have performed some seismic profiles whit the Datasonics CHIRP III Acoustic Profiling System (Benthos, Inc.), parallel and perpendicular to the coastline, to verify the sediments thickness and the presence of tectonic disturbances. All data were converted into a SEG-Y format and analysed aboard with SeiSee (Rev 2.22.1).



- Sediment sampling by gravity corer:

We used a gravity corer composed of the following three main parts:

1. *the head:* a cylindrical mass of 1,200 kg, capable of imparting the energy needed to penetrate the core bit through the sedimentary layers of the seabed.
2. *the tube core barrel:* a galvanized iron pipe of 105 mm (outside diameter), whose length may vary from 6 to 9 meters. Inside the tube there is a PVC liner housing (outer diameter of 90 mm, inner diameter of 84 mm), which has the function of core housing.
3. *the nose:* a full closure and tip system constituted by a stainless steel cylindrical body, which is coupled to the lower core barrel and has the function of creating the carrot. A triangular shape device, composed of four palettes and hinged in a suitable seat, represents the closure of the nose, necessary to restrain the core during the core barrel ascent. The blades closing is controlled by the same liner at the beginning of the extraction from the bottom. After bringing aboard the core barrel, the liner is extracted and divided into sections of one meter. For each section the station, the top and the bottom of the care and the section are commonly annotated.

- Gravity core splitting:

For each core the sections are immediately transferred to the cutting laboratory. Here, the sections are splitted in 2 halves by the use of a circular saw and moved towards the sedimentology laboratory for a first sedimentological and stratigraphic characterization and to sample them.

- Sediment Sampling - SW104 corer.

This corer is a lightweight core barrel (100kg max. weight) specifically made to collect clay sediments, or slightly sandy sediments. It's an ideal tool for seabed studies regarding the environmental pollution, the eutrophication and the biochemical processes occurring in the surface sediments, to analyse the nutrients flows and trace metals between the sediment and the overlying water and to assess the sedimentation rate. The corer consists of five main elements: 1) the header, 2) the tube core barrel, 3) the nose with the locking system, 4) the valve-saving water and 5) the liner.

1. *The cylinder head* is similar to a pylon including switches, crossings, a closing, an upper valve which encloses the bottom water, the annular modular masses and the core barrel junction.
2. *The tube core barrel* is made of a thin stainless steel tube (diameter: 114.3 mm, thickness: 1.5 mm, length: 2008 mm).
3. *The stainless steel nose* is composed of a very sharp conical tip, to facilitate the penetration into the seabed and the creation of the core section; the nose also represents the housing of a locking system enclosing two rings depreciated by springs and a waterproof canvas diaphragm closes the nose.
4. *The valve-saving water* is located in the upper part of the liner and represents the device which encloses and retains the water sample from the bottom. It is operated by two semi-circular lunettes set in rotation by a spring loaded an instant before the starting of the core extraction from the bottom.
5. *The liner* is a tube of transparent methacrylate, allowing us to visualize the collected core immediately, or of opaque PVC. The inner diameter is of 104 mm with a length of 1346 mm.

- Aboard Sediment Sampling:

The sediments sampling was carried out on board in all sites, taking samples with an equidistance of one centimetre in the gravity core and in the SW104 core. In particular the gravity core was sampled only in the half liner, while the SW104 core was extruded and sampled entirely. In both the cases, each one centimetre interval was divided into four sub-samples to study benthic and planktonic foraminifera, calcareous nannofossils, dinoflagellates and pollens.

- Magnetic Susceptibility analyses.

Measurement of bulk magnetic susceptibility is a well-established technique for quick characterization of variations in mineralogy. In marine sediment cores, high-resolution measurement of downcore variation in magnetic susceptibility is also frequently used to correlate cores drilled at different sites. Appealing features of the technique include its speed (usually under five seconds per measurement) and the compactness of the required equipment; these factors make it practical, as in this study, to make preliminary shipboard measurements as soon as a core has been retrieved and split.

When using magnetic susceptibility purely as a stratigraphic calibration tool, it is not necessary to consider the mineralogical origin of the variations in the signal: the signals from two cores are simply correlated by expansion or contraction to produce the best possible match between the curves. When the mineralogy itself is considered, magnetic susceptibility measurements can provide further data. One compelling application is in tephrastratigraphy: tephra minerals have vastly greater susceptibilities than normal marine sediments, and tephra layers are thus very easy to detect in a magnetic susceptibility record, even in cases where the layer is difficult or impossible to discern by eye. More generally, terrigenous input to a site of sedimentary deposition tends to be positively correlated with magnetic susceptibility; variations in magnetic susceptibility can thus reflect past changes in sediment provenance and supply at a coring site.

For the cores retrieved using the 9-metre corer, magnetic susceptibility was measured on split core faces at 1cm intervals shortly after retrieval, using a Bartington MS-3 magnetic susceptibility meter coupled with a handheld M2F surface probe. (For the cores obtained using the SW-104 corer, susceptibility was measured using the same equipment on individually bagged 1-centimetre slices of sediment). The MS-3 unit interfaces directly to a laboratory computer, allowing the data to be analysed immediately after its acquisition. The shipboard measurements will be repeated and confirmed at the INGV palaeomagnetic laboratory in Rome on u-channels subsampled from the cores, using a 2G Enterprises sample handler and Bartington MS-2 susceptibility meter with MS2C loop sensor.

Acknowledgments

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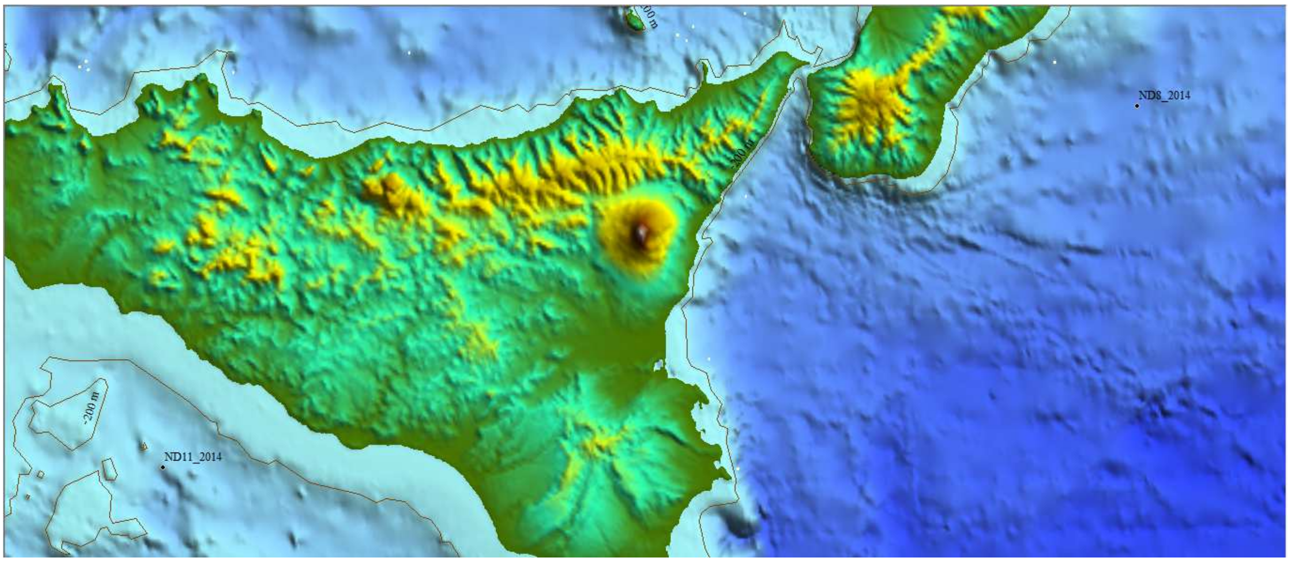
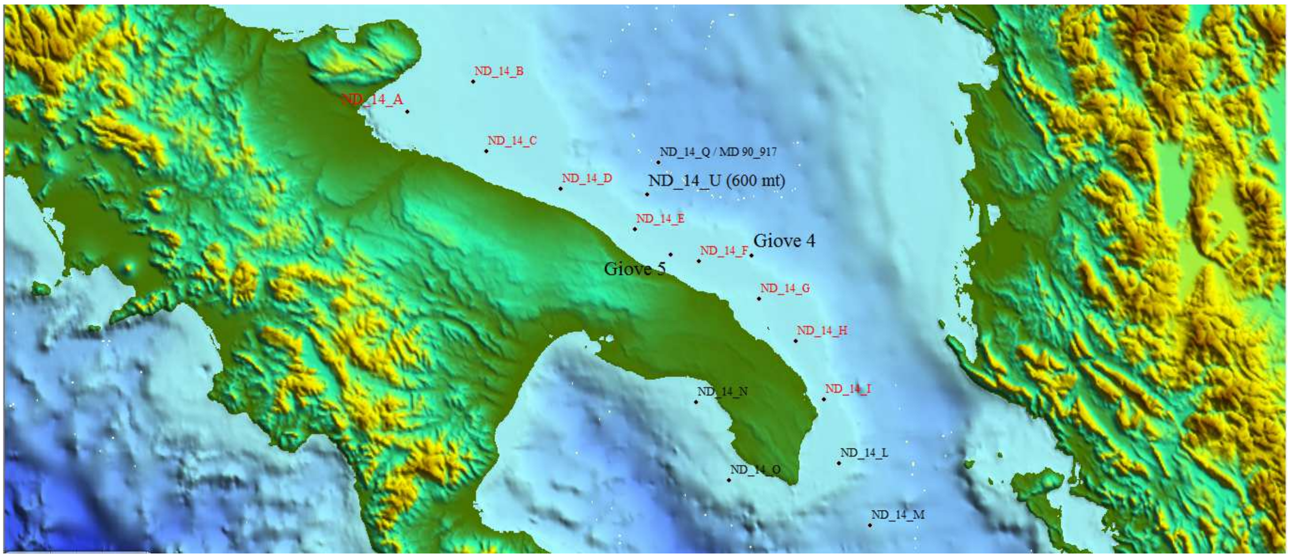
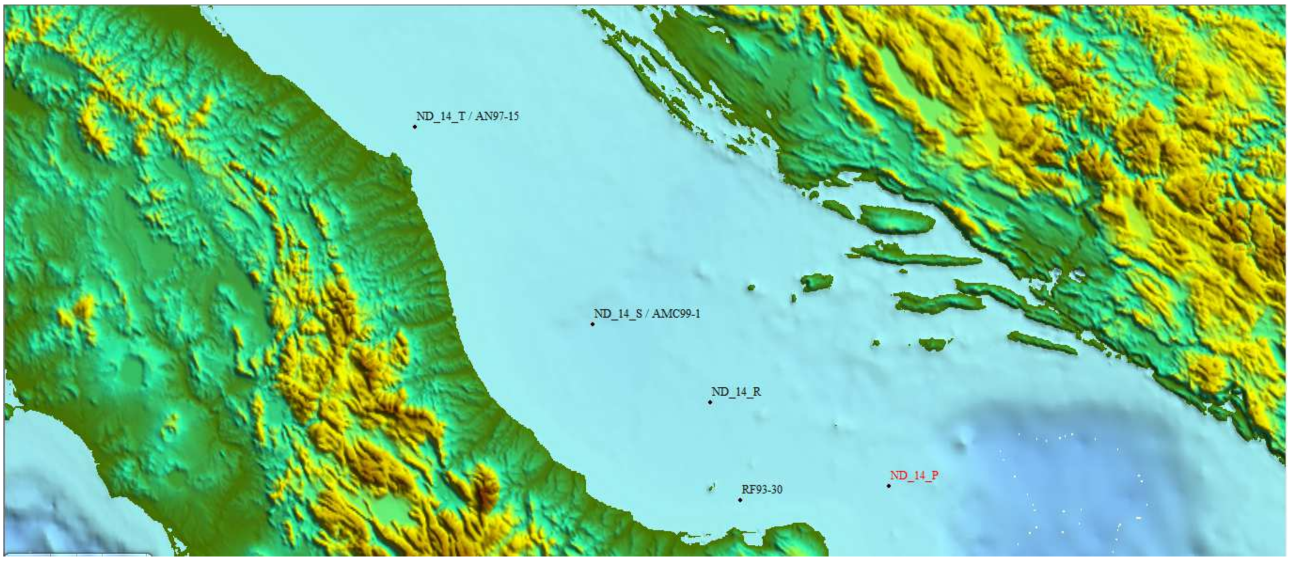
We would like to thank the Chief and the crew also for the availability, interest and attention shown during the NextData2014 survey.

Survey Maps


ND8_2014
-200 m
ND11_2014


ND_14_B
ND_14_A
ND_14_C
ND_14_Q / MD 90_917
ND_14_D
ND_14_U (600 mt)
ND_14_E
ND_14_F
Giove 4
Giove 5
ND_14_G
ND_14_H
ND_14_N
ND_14_I
ND_14_L
ND_14_O
ND_14_M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ND_14_S / AMC99-1
ND_14_R
RF93-30
ND_14_P