



## **Project of Strategic Interest NEXTDATA**

Scientific Report for the reference period **01/01/2012-31/12/2012**

### **Unit CNR-IAMC**

Partners: CNR-DTA, URT Ev-K2-CNR, INGV

#### **WP 1.5: Paleoclimate data from marine sediments**

##### **1. Planned activities and expected results**

Identification of potential key sites in the Mediterranean Basin on the basis of a bibliographic survey, mainly in continental shelf areas, which preserve marine records for the last millennium in a sedimentary facies suitable for the high resolution paleoclimatic studies. The identification of key sites will be preceded by a careful phase of specific data collection (in collaboration with WP 2.4) in order to obtain the best possible identification of drilling sites, also in view of the optimization of the available economic resources.

Priority will be given to sites which contain levels of tephra (the continental shelf areas close to the volcanic districts), which represent a first order stratigraphic marker, and provide an added value for the dating of paleoclimatic events.

In the first year of activities the ODP-IODP databases will be explored to detect, and if appropriate analyze, key sites suitable for multidisciplinary high resolution studies, in areas outside the Mediterranean Basin (in this first phase, sites located in the Atlantic Ocean near the Strait of Gibraltar), with particular interest on the last millennium and on the key sites which may provide potential correlations with Mediterranean sites. After the identification of these sites of interest, we will proceed with the request for materials available from the core repositories.

M1.5.1 (PM12): Identification of potential key sites suitable for the high resolution studies in the Mediterranean Basin. Identification of the data available in national and/or international archives in selected sectors outside the Mediterranean Basin.

##### **2. Deliverables expected for the reference period**

D1.5.1 (PM12): Report on the definition of the available measurements and of the key sites for new drilling activities.

D1.5.2 (PM12): Report on sedimentary cores available from the repository core, transmission of information to the archives and to the General Portal.

### **3. Activities actually carried out during the reference period**

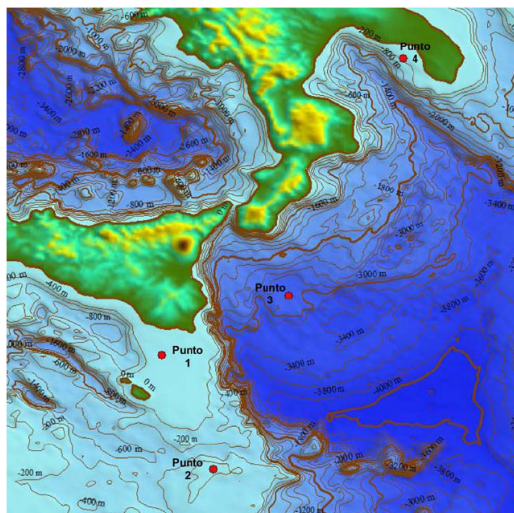
#### **3.1 Research activities**

The WP 1.5 research activities carried out in the first year (01/01/2012-30/06/2012) were focused on (1) the analysis, for the Mediterranean Basin, of a large amount of bibliographic data in order to detect keysites for the recovery of marine sediments, which could contain the Holocene record and in particular records from the last millennia (c.a. 2000 years), and (2) the analysis of cores recovered from a site of interest (southern-eastern Tyrrhenian Sea, Gulf of Salerno) and stored at CNR-IAMC. The choice to study this time interval (last 2000 years) is due to the possibility of comparing the fossil marine datasets with information retrieved from historical documents. These latter represent important information to calibrate the paleoclimatic events recognizable in the last 2000 years. In fact, the possibility to compare the recognized climatic events recorded in marine records, throughout the integration of biotic and abiotic proxies, with the succession of archeological periods, represents an important approach for studying past climatic changes. In addition, during this time interval the anthropogenic pressure began to have an impact on the marine ecosystem. Within this framework, the Mediterranean basin represents a natural laboratory for this type of research. The occurrence of high sedimentation rates (useful for secular to decadal studies of past climatic changes) mainly in continental platform environments, makes this basin a key site for studying the past climate and for producing new information useful to calibrate climatic models.

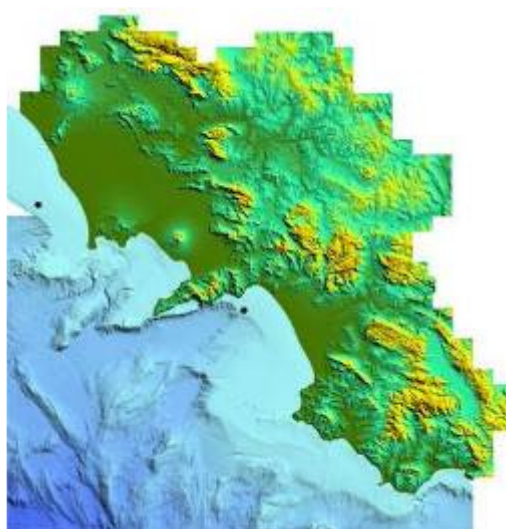
This survey and study of the literature data was conducted in close collaboration with the WP 2.4 research team.

This study allowed us to identify, in the first six months of the project, different key areas located in the Southern Mediterranean basin, in the Central-Southern Tyrrhenian Sea, and in the Ionian Sea; for these areas, the national and international scientific literature provided useful information to recover continuous and undisturbed marine records, and consequently to conduct geochronological, paleoclimatic and paleoceanographic studies. These sites, moreover, potentially contain tephra layers, which could be used as independent chronological markers.

The study of the literature data led us to identify the following sites of interest, shown in Figs. 1 and 2: 1) the Gulf of Gaeta (Central-Southern Tyrrhenian Sea); ii) the Gulf of Salerno (Central-Southern Tyrrhenian Sea); Malta continental shelf (area between Sicily and Malta); Malta continental shelf (area south of Malta); the Gulf of Taranto (southern Ionian Sea); the southern Ionian Sea (area south of Messina).



**Figure 1.** Location of the sites of interest in the Central-Southern Mediterranean Sea.

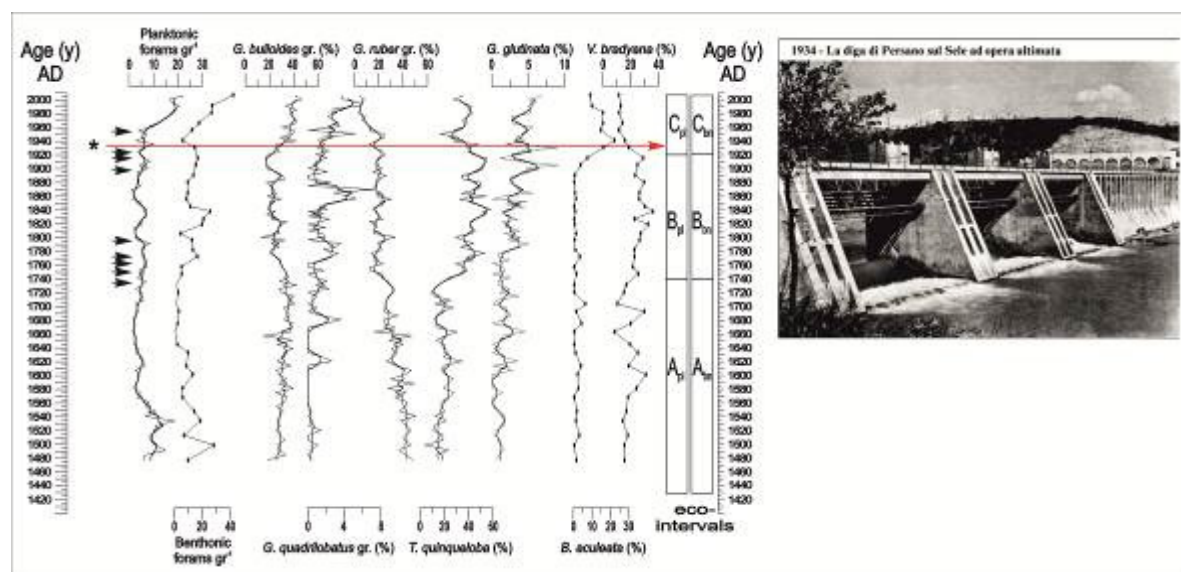


**Figure 2.** Location of the sites of interest in the Central-Southern Tyrrhenian Sea (the Gulf of Salerno and the Gulf of Gaeta).

At the beginning of the second half of 2012, the request for two new oceanographic cruises aboard the R/V Urania of CNR was forwarded to the CNR (one oceanographic cruise is directly associated with the NEXTDATA Project and the other is associated with the PON I-AMICA project). Priority will be given to the recovery of gravity cores through the SW104 core system (which allows to recover the undisturbed sedimentary record at the water-sediment interface), in the sites of interest already identified in the first semester of 2012. Both requests were accepted and allocated in the ship-time calendar of R/V Urania of the CNR.

In particular, a first oceanographic cruise was scheduled from January, 29 to February, 11 2013 in the Gulf of Gaeta. This oceanographic cruise will be also carried out under the aegis of the project PON\_03 I-AMICA (Infrastructure High-tech for the Integrated Monitoring Climate-Environment), which looks into the Gulf of Gaeta as a site of interest. In this site, two cores logging will be carried out in a water depth of 200m and of 100m, respectively. The high-resolution geophysical data available at CNR-IAMC indicated the presence of sedimentary facies suitable for paleoclimatic studies. The second request for ship time was scheduled for the period from September 12 to 19 2013, and this cruise will be aimed at the recovery of marine sediments in the sites of

the southern Mediterranean Basin (Malta Continental Shelf, the area between Sicily and Malta, Malta Continental Shelf, the area south of Malta), of the Ionian Sea and of the Gulf of Taranto. As for the Gulf of Salerno, a core (C90-1m) of 1.20 m length, was already collected at the depth of -103m in 2006 (N / O Tethis CNR) within the national project VECTOR (Vulnerability of Coasts and ecosystems Italian marine climate change and their role in the carbon cycle of the Mediterranean). This core, available for analysis in the framework of the NEXTDATA project, is currently stored at the CNR-IAMC core repository, in Naples. In the future, half of the core archive will be transferred to the new Core Repository of Naples, provided within the WP 2.4 activities, and it will be made available to the scientific community. The first paleoenvironmental studies conducted on the sedimentary record of this core (C90-1m), started under the auspices of the national project VECTOR and then continued within the NEXTDATA project, have shown the validity of this sedimentary record of the Tyrrhenian continental shelf as a natural laboratory for the monitoring of short-term climatic oscillations of the last 500 years (*Rend. Fis. Acc. Lincei* - DOI 10.1007/s12210-011-0154-0). Some results are published by Vallefuoco et al. (2012), who showed a clear impact of human activities on the marine ecosystem, providing an additional control point on the chronology with radionuclides ( $^{137}\text{Cs}$  and  $^{210}\text{Pb}$ ). In particular, they demonstrated that the construction of the dam on the Sele river, the largest river in the Gulf of Salerno, which occurred in 1934 (see Fig. 3), has influenced the coastal marine ecosystem. Evidence of this control is the increased abundance of the benthic foraminifera *Bulimina aculeata*, which was present with few specimens in the fossil record before 1920. The presence of this benthic foraminifer suggests an increasing organic matter at the sea bottom, likely due to a change in the input of continental sediments (terrigenous materials).



**Figure 3.** Comparison between biotic and abiotic proxies. The arrows show the position of flood events related to extreme rain events and the star symbol indicates the construction of the dam on the Sele River (1934 AD). On the right site a picture of the Sele river is reported. From Vallefuoco et al. (2012).

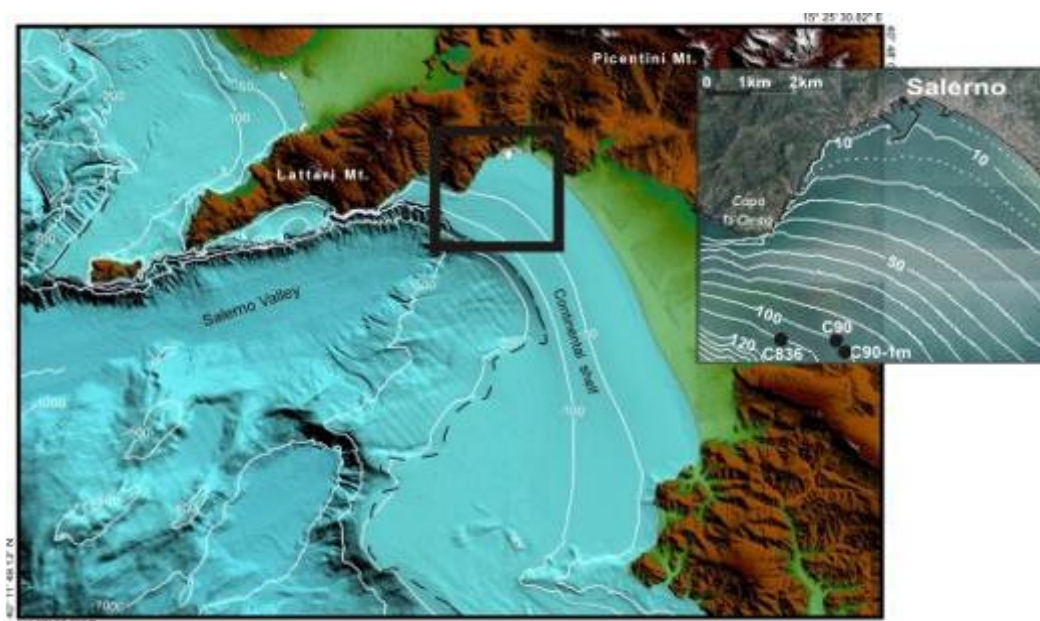
The analyses on the C90-1m core to study the secular variations of the Earth's magnetic field and the environmental magnetism are currently underway at the INGV Laboratory of Paleomagnetism, in Rome, in collaboration with Dr. Fabio Florindo.

The integration between the radiometric chronology ( $^{137}\text{Cs}$  and  $^{210}\text{Pb}$ , published in Vallefuoco et al., 2012; Lirer et al., 2012) and the paleomagnetic one (also comparable with instrumental data) should provide a detailed chronology of the last 500 years. This high-resolution age model represents the starting point for a better chronology of the major climatic fluctuations detected in the central-southern Tyrrhenian Sea. These

oscillations can be compared with the major ones surveyed at a global scale (compared with  $\Delta^{14}\text{C}$ , TSI and Sun spot numbers) and may provide useful information for the calibration and the implementation of global and regional climate models (these activities will be performed in conjunction with other WPs), which will be used to simulate how the coastal marine area of the Mediterranean Basin (western Mediterranean) responded to past climatic and/or anthropogenic dynamics (Medieval Warm Period, Little Ice Age, Industrial Revolution, Modern Warming). In spite of the difficulty of comparing the fossil records with climate models, due to their different resolution, we think that the integrated study of the marine sedimentary archives of the continental shelf may provide new information on the response time of the Mediterranean Basin to global climate dynamics. We also believe that the acquisition of historical data series aimed at a deeper understanding of the Earth's climate system and at a better prediction of its future evolution, is one of the current priority tasks of the scientific community.

Although there are different opinions about the reliability of the palaeoclimatic "proxies" and the outputs of the models for past climate reconstruction, the study of the historical time series is the only tool to analyze the dynamics of the system Earth's climate under conditions different from the current ones, and it has a remarkable value to test the validity of medium and long term predictive models.

In 1998, in the framework of the CARG project (Campania Region), two cores - C90 (4.87 m) and C836 (5.70 m) - were collected at a depth of 103 m in the same site of interest (Gulf of Salerno, see Fig. 4).



**Figure 4.** The position of the cores in the Gulf of Salerno; modified from Lirer et al. (2012).

These two cores, integrated with the core C90-1M collected with the SW104 core system in 2006, have led to a complete composite record for the last 10,000 years. After an integrated stratigraphic study carried out in 2012, a third article was published (Lirer et al., 2012). This work presented for the first time a detailed chronology for the last 10,000 years through the integration of the radionuclide, the AMS $^{14}\text{C}$  dating and tephrostratigraphy. This study also published a new high resolution isotope dataset ( $\delta^{18}\text{O}$  *G. ruber*), which allowed for the identification of the time interval related to the deposition of sapropel S1 in the eastern Mediterranean Basin (the recognition of this event, sapropel S1-like, will play a key support for the correlations with new sites of interest that will be drilled in 2013 in the central-western Mediterranean and with the

other ones already drilled in the eastern Mediterranean). While the lithological marking of this anoxic event (level rich in organic matter, sometimes laminated) is not recognizable in the western Mediterranean, its isotope signature and the micro-paleontological pattern (calcareous plankton) are clearly visible. Other climate oscillations of the last 2,000 years were also recognized (Lirer et al., 2012, and Section 3.5 of this document), allowing for a very detailed temporal scanning. This study represents the starting point for subsequent data processing, aimed at the identification of climatic fluctuations of the last millennium at decadal and centennial scales. This objective is achievable thanks to the high sedimentation rates of the central-southern Tyrrhenian Sea area, at least for the last 2,000-3,000 years (Lirer et al., 2012; Vallefucio et al., 2012). It is currently under preparation a fourth article, aimed at the identification of paleoclimatic oscillations at a century-scale and recognizable in the last 10,000 years; it will be submitted to the *Integrative Zoology* journal.

In addition to the above identified areas of the Mediterranean basin, we focused our attention on some paleolakes that have great potential in terms of continuous records of changes in paleoclimate and paleoenvironment during the last 10,000 years. Among them, the Giuturna Lake (lat 41.73° latitude, 12.62° longitude), located in the Alban Hills south-east of Rome, is particularly promising.

### **3.2 Applicative, technological and information developments**

None during the reference period.

### **3.3 Training activities**

None during the reference period.

### **3.4 Dissemination**

The NEXTDATA project has been included in the ongoing RCMNS Projects of the 2013 RCMNS Bulletin (Regional Committee on Mediterranean Neogene Stratigraphy Newsletter, edited by the Museum of Natural History of Vienna).

In addition, CNR-IAMC, with the support of the NEXTDATA Project, will organize the AIQUA 2013 Congress (Fig. 5), which will be held in Naples (19-20-21 June 2013) at the Pathenope University. In particular, two scientific sessions (Climate and Paleoclimate and Oceanography coastal and offshore) will be strictly related to the activities of WP 1.5 and WP 1.3.

**Organizzatori del congresso:**  
 Fabrizio Lirer - [fabrizio.lirer@iamc.org.it](mailto:fabrizio.lirer@iamc.org.it)  
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**IAIQUA**  
 Istituto per l'Ambiente Marino Costiero

**Consiglio Nazionale delle Ricerche**

**L'Ambiente Marino Costiero del Mediterraneo oggi e nel recente passato geologico conoscere per comprendere**

**Napoli 19-20-21 Giugno 2013**

L'ambiente costiero, interfaccia instabile fra il dominio marino e quello continentale, possiede una dinamica geologica rilevante: questo modello ha ricadute significative su molti settori dell'attività umana, anche se finora si è legato soltanto alla continua evoluzione dell'ambiente; giungendo oggi ad analizzare, anche a livello globale, non questi mutamenti.

Questi problemi richiedono una conoscenza scientifica. È più possibile di carattere multidisciplinare, per apprezzare *Disturbi e Vulnerabilità* per la *Previsione e Mitigazione* del rischio, per giungere anche per le zone costiere a proposte di gestione integrata.

Il Mediterraneo, per il suo stato insulare rispetto agli oceani e per la sua storia geologica recente, può essere considerato per molti aspetti un modello a scala intermedia, per comprendere le attuali condizioni degli ecosistemi e degli ambienti fisici, onde poter meglio prevedere le vicende del prossimo futuro.

L'urgenza di tali questioni ha suggerito alle Istituzioni promotrici di organizzare un convegno che, nel quadro delle finalità scientifiche della Associazione Italiana per lo Studio del Quaternario (AIQUA), faccia il punto su una serie di problemi relativi alla evoluzione del la fascia costiera del Mediterraneo, vista attraverso l'analisi dei processi geologici del recente passato e in di quelli ancora in corso. È infatti chiaro che solo un esame attento di questo vicinale può consentirci di prevedere in modo appropriato il futuro prossimo della vasta area peri-medioadriatica da una, direttamente o indirettamente, dipende il futuro sostanziale di milioni di persone.

In relazione a tutto ciò il convegno, che si terrà a Napoli il 19, 20 e 21 giugno del 2013, presso la Stazione Marittima, intende fare il punto sulle problematiche che riguardano i rapporti terra-mare e le relative ricadute socio-economiche, con particolare attenzione al controllo ambientale dei cambiamenti climatici, derivanti dalle variazioni del livello di mare e dagli altri fattori che la causa le metodologie analitiche che vanno dalla biostratigrafia alla geocronologia, dalle nuove tecnologie a quelle tradizionali.

Altri temi, come sarà più ampiamente sottolineato con la prima tavola, riguarderanno la pericolosità dei processi naturali, con particolare riguardo all'impatto di processi "transitorici", di dinamica geologica recente (sismicità, vulcanismo, tsunami, ecc.) in un'impetuosa e in tempi brevi variazioni climatiche e loro implicazioni su ambienti ed ecosistemi, trattamento delle acque di mare, ecc. I e senza trascurare argomenti di grande interesse sociale quali la valutazione delle risorse energetiche e di quelle demersali.

**Principali tematiche scientifiche:**  
 Oceanografia costiera e di mare aperto.  
 Risorse e usi oggi del litorale marino costiero.  
 Clima e paleoclima.  
 Cartografia geologica e correlazioni terra-mare.  
 Evoluzione geologica e paleogeografia del margine continentale.  
 Aree di instabilità recente e moderna (coseismicità, tsunami).  
 Interazioni natura del mare e suo impatto sulla morfologia costiera.  
 Geochimica del mare costiero.  
 Pericolosità sismica e vulcanica.

**Segreteria Scientifica del congresso:**  
 Cristina Anzalone - [cristina.anzalone@iamc.org.it](mailto:cristina.anzalone@iamc.org.it)  
 Laura Giordano - [laura.giordano@iamc.org.it](mailto:laura.giordano@iamc.org.it)  
 Sofia Tamburino - [sofia.tamburino@iamc.org.it](mailto:sofia.tamburino@iamc.org.it)  
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<http://www.aiqua.it>

**Date importanti:**  
 - 2 gennaio 2013: prima circolare e sessioni scientifiche  
 - 31 marzo 2013: submission abstracts e pagamenti quote iscrizione

Figure 5. AIQUA 2013 poster.

### 3.5 Participation in conferences

AIQUA CONGRESS 2012 – The transition from natural to anthropogenic-dominated environmental change in Italy and surrounding regions since the Neolithic. Pisa 15-17 Febbraio 2012:

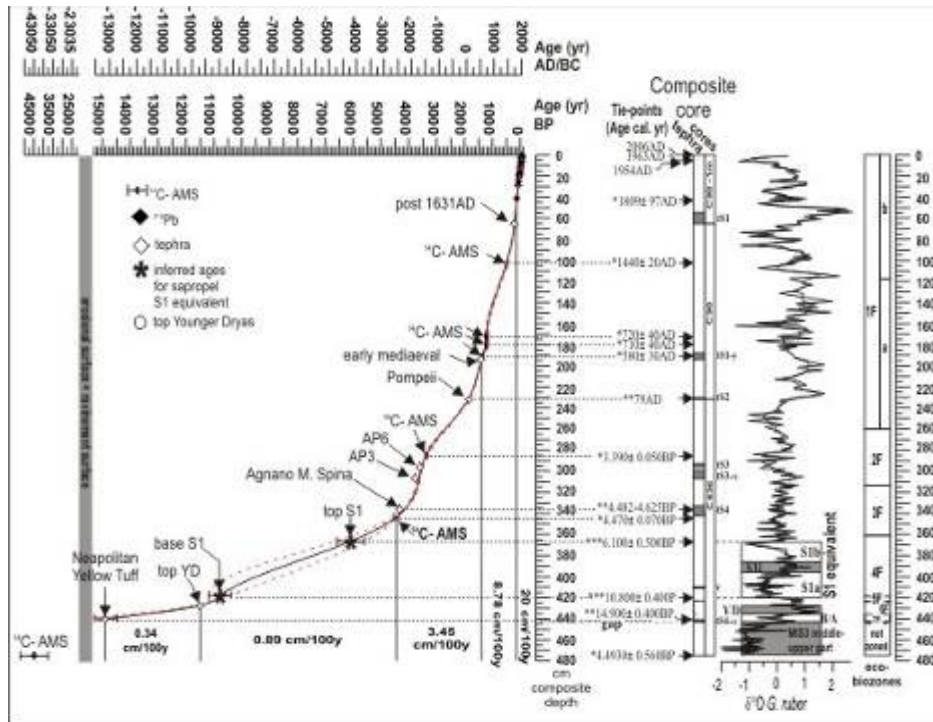
- Oral presentation: Budillon F., Senatore M., Ferraro L., Insinga D.D., Iorio M., Lirer F., Lubritto C.: (2012) The inner shelf stratigraphic record in the Salerno gulf (southern Tyrrhenian sea): an archive of the environmental changes along the coast over the last 3 KY. Abstract, pag. 15, Congresso AIQUA 2012 – Pisa.
- Poster presentation: Lirer, F., Sprovieri, M., Vallefucio, M., Ferraro, L., Cascella, A., Capotondi, L. (2012). Holocene climatic phases recorded in the shallow water southern-east Tyrrhenian Sea marine sediments. Abstract, pag. 16, Congresso AIQUA 2012 – Pisa.
- Poster Presentation: Lirer F., Sprovieri M., L. Ferraro, M. Vallefucio, Capotondi L., Cascella A., (2012), High resolution Holocene paleoclimatic events from the Southern-eastern Tyrrhenian Sea (Salerno Gulf), to ' AGU Fall Meeting 2012, 3-7 December 2012 in San Francisco (USA).

## 4. Results obtained during the reference period

### 4.1 Specific results (databases, measurements results, models output, etc)

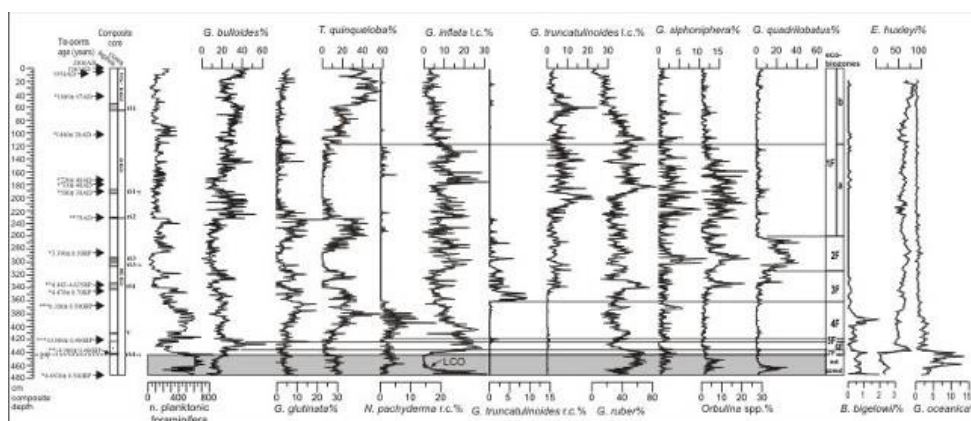
- ◆ A large number of scientific papers related to the Mediterranean Basin and focused on Holocene paleoclimatic studies have been collected and critically examined. This bibliographic dataset has been integrated with the recent Elsevier book related to the MedClivar project (The Climate of the Mediterranean Region: from the past to the future, Edited by Piero Lionello, 2012);
  
- ◆ Studies on three high-resolution cores (C90\_1m-C90-C836) collected in 1998 and 2006 on the continental shelf of the Gulf of Salerno (south-central Tyrrhenian Sea) at the depth of 103 meters by the research vessels R/V Urania and N/O Tethis have been completed. The integrated chronostratigraphic study of the three cores has been published in Lirer et al. (2012). This integrated study conducted on the composite core C90\_1m-C90-C836, which was analyzed to obtain:
  - Quantitative analysis of planktonic foraminifera (468 samples).
  - Quantitative analysis of calcareous nannofossils (187 samples).
  - Study on carbon and oxygen stable isotopes (468 samples) on the planktonic foraminifer species: *Globigerinoides ruber*.
  - Tephrostratigraphic study (petrochemical analysis) on 8 levels of tephra;
  - 8 AMS14C datings and  $^{210}\text{Pb}$  e  $^{137}\text{Cs}$  radionuclides dating of the first 40 cm of core.
  - also using the integrated age model, a very accurate estimation of the sedimentation rates relating to the last 10,000 years (see Fig. 6), revealing the great potentials of this site to develop more detailed studies at a scale from decadal to secular.





**Figure 6.** construction of the age model and assessment of the sedimentation rates (modified from Lirer et al., 2012)

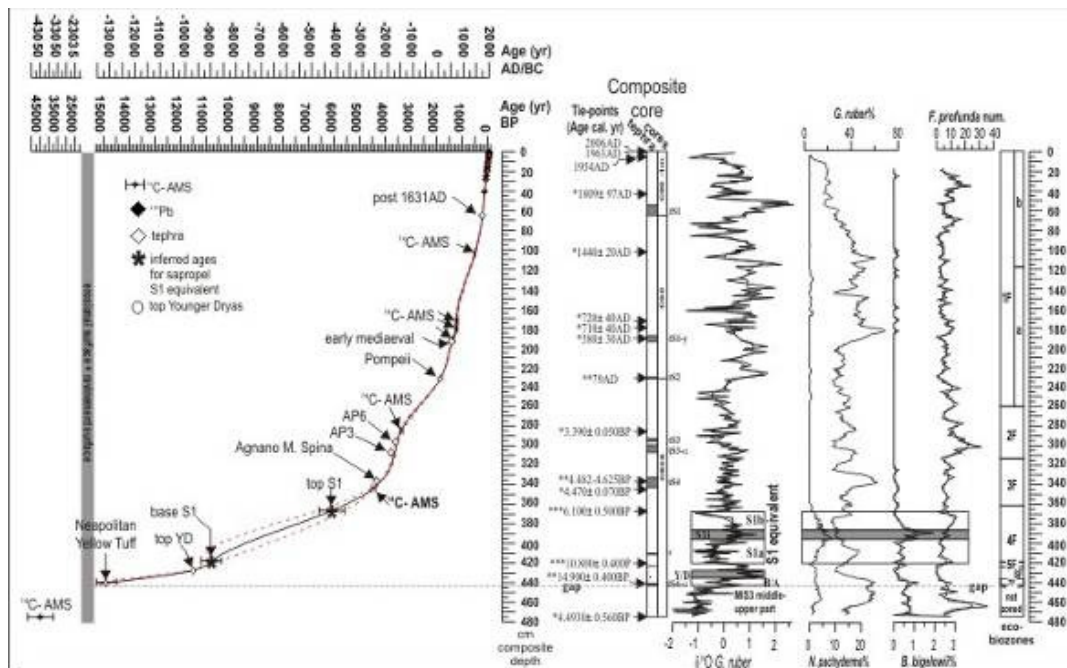
- The studies published in 2012 helped us to improve and calibrate the eco-biostratigraphic scheme suitable for the western Mediterranean (Fig. 7), identifying major and minor events which are useful for determining intra-Mediterranean correlations. A whole tephrostratigraphic study of the tephra detected in the Gulf of Salerno, associated with the major volcanic events characterizing the Holocene, has been published.



**Figure 7.** Eco-biostratigraphy of the last 10,000 years (Lirer et al., 2012).

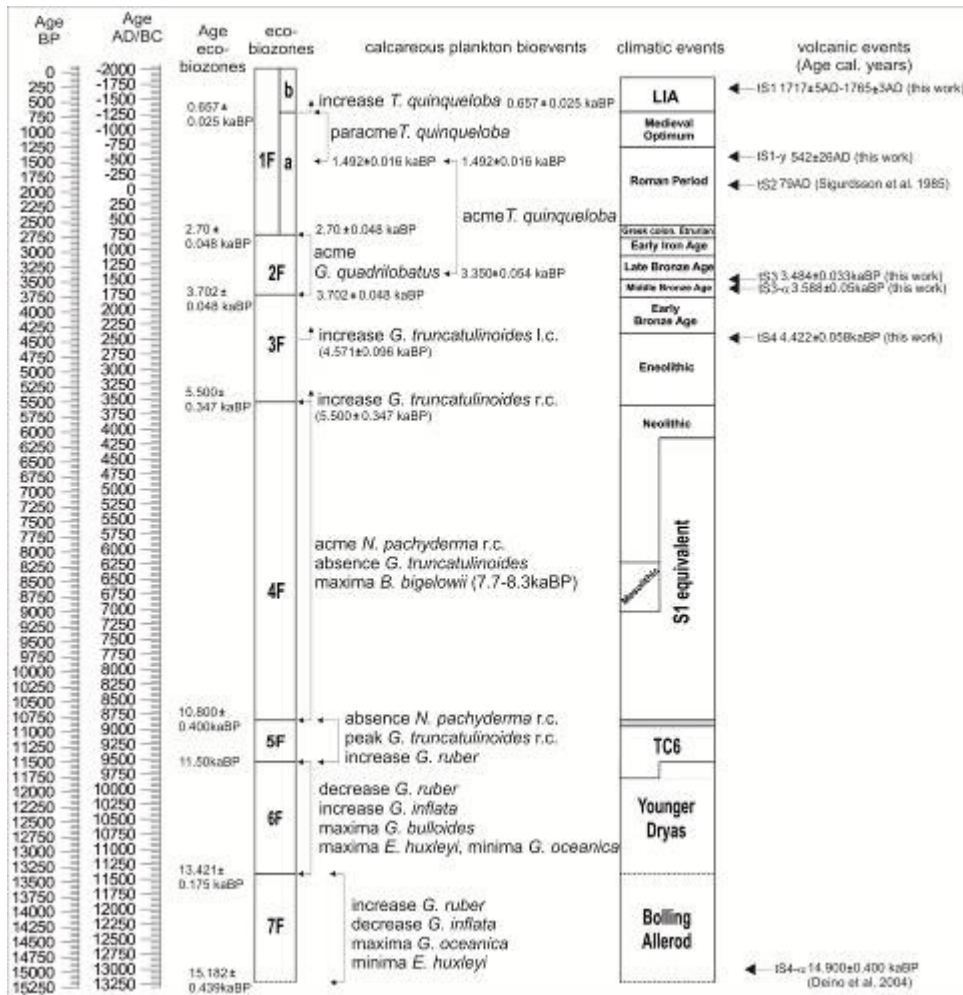
- The event time associated with the deposition of sapropel S1 in the eastern Mediterranean (Fig. 8) has been recognized and characterized by the geochemical ( $\delta^{18}O$  *G. ruber*) and micropaleontological (planktonic foraminifera and calcareous nannofossils) points of view. This climatic event is characterized by three phases: S1a, S1b and S1I. In particular, the S1I phase is marked by a pronounced cooling ( $\delta^{18}O_{G.ruber}$  positive values) and by abundance peaks of *N. pachyderma* dx and *B. bigelowi*;

conversely, the S1a and S1b phases are characterized by a heating ( $\delta^{18}\text{O}_{G.ruber}$  negative values) and by two abundance peaks of *G. ruber* and of *F. profunda*. This pattern is similar to the one detected in the Strait of Sicily (Central Mediterranean) by Sprovieri et al. (2003).



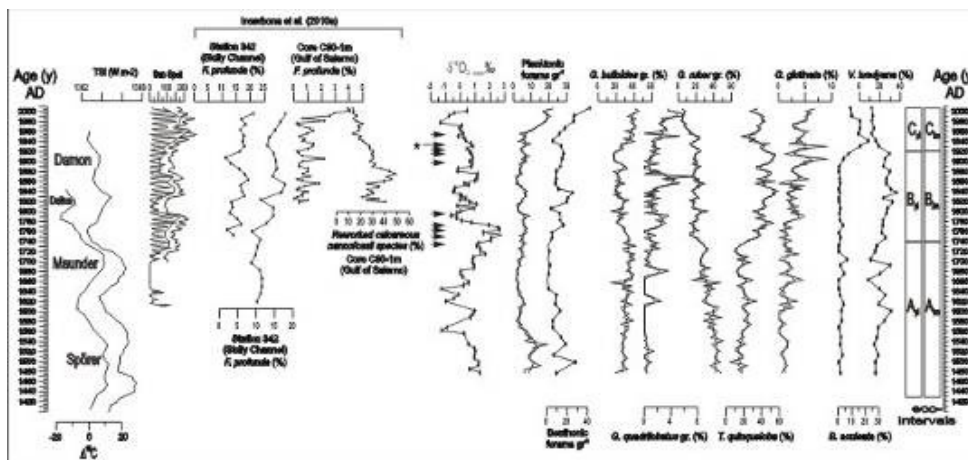
**Figure 8.** Position of the sapropel S1- like (modified from Lirer et al., 2012)

- This work has allowed us to correlate the eco-biostratigraphy pattern of the western Mediterranean Basin with the Mediterranean geoarchaeological plans proposed by Roberts et al. (2001). This preliminary correlation has revealed that the planktonic foraminiferal assemblages, characterizing the various eco-biozones, indicate paleoenvironmental changes; the latter also find their counterpart in the continental sector (Fig. 9).



**Figure 9.** Temporal comparison between the western Mediterranean eco-biozones, the geo-archaeological plans and the climatic events (Lirer et al., 2012)

- A detailed paleoenvironmental and paleoclimatic reconstruction of the last 500 years in the central-southern Tyrrhenian Sea and comparing the planktonic foraminifera, the benthic foraminifera and the calcareous nanofossils quantitative data, has been proposed (Fig. 10).



**Figure 10.** Comparison of several biotic and abiotic proxies. The arrows indicate the dates of extreme events and floods from the continent, and the star marks the date (1934) of the construction of the dam on the Sele River (Vallefuoco et al., 2012).

- All quantitative data (planktonic foraminifera, benthic foraminifera, calcareous nannofossils,  $\delta^{18}\text{O}_{\text{G.ruber}}$ , petrochemistry of tephra, radiometric dating) will be uploaded on the NEXTDATA General Portal.
- Measurements of the carbon and oxygen stable isotopes have been made on the planktonic foraminifera *Globorotalia inflata*. These analyses, together with the ones carried out on the planktonic foraminifera *G. ruber* (published in Lirer et al., 2012) will be used for detailed studies on the Sea Surface Temperature (SST) of the central-southern Tyrrhenian Sea.

## 4.2 Publications

Vallefuoco M, Lirer F, Ferraro L, Pelosi N, Capotondi L, Sprovieri M, Incarbona A, (2012). Climatic variability and anthropogenic signatures in the Gulf of Salerno (southern-eastern Tyrrhenian Sea) during the last half millennium. *Rend. Fis. Acc. Lincei*, 23 (1), 13-23. DOI 10.1007/s12210-011-0154-0.

Budillon F., Senatore M., Ferraro L., Insinga D.D., Iorio M., Lirer. F., Lubritto C.: (2012) The inner shelf stratigraphic record in the Salerno gulf (southern Tyrrhenian sea): an archive of the environmental changes along the coast over the last 3 KY. Abstract, pag. 15, Congresso AIQUA 2012 – Pisa.

Lirer, F., Sprovieri, M., Vallefuoco, M., Ferraro, L., Cascella, A., Capotondi, L. (2012). Holocene climatic phases recorded in the shallow water southern-east Tyrrhenian Sea marine sediments. Abstract, pag. 16, Congresso AIQUA 2012 – Pisa.

Lirer F., Sprovieri M., Ferraro L., Vallefuoco M., Capotondi L., Cascella A., Petrosino P., Insinga D.D., Pelosi N., Tamburrino S., Lubritto C., (2012). Integrated stratigraphy for the Late Quaternary in the eastern Tyrrhenian Sea. *Quaternary International*, <http://dx.doi.org/10.1016/j.quaint.2012.08.2055>.

Lirer F., Sprovieri M., Ferraro L., Vallefuoco M., Capotondi L., Cascella A., (2012), High resolution Holocene paleoclimatic events from the Southern-eastern Tyrrhenian Sea (Salerno Gulf)- Abstract AGU Fall Meeting 2012, 3-7 Dicembre , San Francisco (USA).

## 4.3 Availability of data and modeling output (format, support, etc.)

- Quantitative data on the distribution of planktonic foraminifera and calcareous nannofossils during the last 15 kyr (excel file). These data will be uploaded on the General Portal;
- $\delta^{18}\text{O}$  e  $\delta^{13}\text{C}$  measurements data on the *Globigerinoides ruber* during the last 15 kyr (excel file). These data will be uploaded on the General Portal;
- Quantitative data on the distribution of the benthic foraminifera during the last 500 years (excel file). These data will be uploaded on the General Portal;

- Petrochemical analysis of the 8 levels of tephra recognized in the C90\_1m-C90-C836 composite core published in Lirer et al. (2012). These data will be uploaded on the General Portal;
- Photographs and stratigraphies of the three analyzed cores. These data will be uploaded on the General Portal.

#### 4.4 Completed deliverables

D1.5.1: Despite the large number of sites drilled in the Mediterranean basin, there are very few scientific studies reporting the presence of sedimentary records of the last two millennia and above all exposing the presence of the marine record of the last 200 years (note that only the use of the SW104 core barrel allows the operator to preserve the water-sediment interface intact). Even in the recent Elsevier volume of the 2012 MedClivar project dealing with the evolution of the Mediterranean climate (in particular in the paper "A Review of 2000 Years of Paleoclimatic Evidence in the Mediterranean" by Luterbacher et al., 2012), there is clear evidence that the only available sedimentary record for the Mediterranean marine sector is the one retrieved at the Gulf of Taranto (Taricco et al., 2009; Versteegh et al., 2007). This site will be drilled again in the September 2013 oceanographic campaign to perform a stratigraphic integrated study aiming at the identification of the major climatic oscillations. The research activities carried out in the first year of the NEXTDATA project also indicate that the Gulf of Salerno, in the central-southern Tyrrhenian Sea, is an excellent laboratory for the SST reconstruction of the last 2000 years. Therefore, based on the data by Lirer et al. (2012), Vallefucio et al. (2011), Incarbona et al. (2010), Sprovieri et al. (2003), Taricco et al., (2009), Versteegh et al. (2007), along with the data produced by the CNR-IAMC Campania CARG project (on the Gulf of Gaeta) and the PON\_03 I-AMICA project, we have identified the following sites of interest where new drilling activities will take place: the Gulf of Gaeta (central-southern Tyrrhenian Sea), Malta Continental shelf (area between Sicily and Malta), Malta Continental Shelf (area south of Malta), the Gulf of Taranto (Ionian Sea), southern Ionian Sea (south of Messina). Previous geophysical data (Subbottom Chirp) and recently acquired data (Subbottom Chirp) have shown that these new drilling sites, in the continental shelf areas and in basinal areas, have thick Holocene sedimentary covers, and therefore they are potentially suitable for the high-resolution paleoclimatic studies. Furthermore, these sites of interest may contain levels of tephra that could be used as stratigraphic markers.

We believe it is necessary to calibrate and / or verify the reliability of the outputs of climate models applied to the reconstruction of past climate (in collaboration with others NEXTDATA WPs) using the temporal series representative of several sectors of the Western Mediterranean.

D1.5.2: Currently the C90\_1m core (Gulf of Salerno) and the ST137 50 cm core (the continental shelf between southern Sicily and Malta) are stored at the CNR-IAMC core

repository in Naples, and they are available for paleoclimatic studies in the framework of the NEXTDATA project.

These cores are kept at a temperature of 5 °C. The C90\_1m core has been collected through the SW104 gravity core system, aboard the research vessel R/V Tethys CNR, while the ST137 core has been collected by a boxcore. There are also the C90 and C836 cores samples available, drilled in the Gulf of Salerno, (washing residues > 90 microns), aboard the research vessel R/V Urania of the CNR. At the moment, a census of sites drilled in the Mediterranean has been obtained in collaboration with WP2.4.

## **5. Comment on any discrepancies between activities / results / deliverables planned and actually realized**

The literature survey for the Mediterranean, in close collaboration with WP 2.4, has been completed. This study has allowed us to identify the sites of priority interest, in the continental shelf areas of the western and central Mediterranean. The choice of these marine sites was made according to following criteria: i) high sedimentation rates to allow for paleoclimatic studies at decadal and century scales, ii) sedimentary facies suitable for quantitative studies on calcareous plankton, and iii) the presence of tephra levels to be used as chronological markers.

The identification of other sites of interest (for the last millennium) outside the Mediterranean area, to be obtained through a detailed analysis of the ODP-IODP database or partnerships with other international research groups, was delayed.. Though a preliminary identification of sites potentially useful for the correlations with the Mediterranean basin records has been done based on the MedClivar 2012 book database (Elsevier), we have focused more on the Mediterranean than extra-Mediterranean sites because of the large amount of literature data, still to be analyzed, available for the former area. However, we believe that this deviation will have little influence on the accomplishment of the activities planned for this WP, also owing to the fact that other tasks foreseen for the second year have been anticipated and already started in the first project year. We refer for instance to the integrated study of sedimentary cores collected in the Mediterranean Basin (Milestone M2), and specifically, to the analysis of three cores collected by IAMC-CNR (CNR-DTA Unit) in the Gulf of Salerno in 1998 and 2006.

Part of the data and results for the last 500 years have been published (Vallefuoco et al. 2012). In addition, a detailed chronostratigraphic study has been published in Lirer et al. (2012). Finally, a detailed reconstruction of the Mediterranean paleoclimatic evolution of the past 10,000 years has been presented (Lirer et al., 2012) during the 2013 AGU Congress in San Francisco, 3-7 December 2012.

## **6. Planned activities for the following period**

The planned activities for the next year will be focused on the organization and achievement of the first oceanographic cruise aboard the Urania CNR ship, that will be held from 29 January 2013 to 11 February 2013 in the Gulf of Gaeta. This oceanographic cruise will include 19 researchers (from several Italian universities and

research institutes), differently involved in the NEXTDATA project. During this oceanographic cruise the high resolution seismic profiles will be performed, in order to correctly assess the position of the cores to be drilled. For each drilling site we will collect two cores, one of these through a classic piston gravity corer and the other one through the ISMAR SW104-CNR core system (CNR-Bologna).

Furthermore, the cores will be opened, described and sampled on board. This immediate sampling phase will speed up the analysis procedures in the subsequent months.

After the oceanographic cruise, secular variation measurements of the geomagnetic field on all the cores will be performed at the INGV Paleomagnetism Laboratory in Rome, in collaboration with Dr. Fabio Florindo. We will start the quantitative analysis on the calcareous plankton (planktonic foraminifera and calcareous nannofossils), on the pollen (in collaboration with the La Sapienza University of Rome) and on the dinoflagellates (in collaboration with the Utrecht University), and the petrochemical analyses on the eventually recognized tephra layers, in collaboration with the researchers at the University "Federico II", Naples.

In addition, we will carry out a seismic and magnetic geophysical survey of the Giuturna Lake aimed at identifying the best site for drilling.

Finally, Dr. Fabio Florindo (INGV, Rome) will continue the investigation of the aggradational sequences of the Paleo-Tiber River in the area of Rome, in order to better understand the relationship among climate, sea-level forcing, tectonics and sedimentary processes during the past 800 kyrs.

We will also start a new data collection phase for the Mediterranean area and the Atlantic Ocean area near the Strait of Gibraltar, in order to monitor the inflow of Atlantic waters in the Mediterranean Basin.

We will organize a workshop addressed to the researchers and specialists on paleodata (planktonic foraminifera, calcareous nannofossils, pollens, dinoflagellates, stable isotope, paleomagnetism) and climate modeling, to be held in Rome (CNR) on January 15, 2013. The workshop aims at understanding and/or identifying the ways of interaction between these two areas.

In addition, we will contribute to the organization of the 2013 AIQUA Congress which will be held in Naples on 19, 20 and 21 June 2013, supported by the NEXTDATA project. The second drilling campaign will be organized in September 2013.