European Cooperation in the field of Scientific and Technical Research - COST -

Secretariat

Brussels, 11 June 2009

COST 245/09

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action TD0902: Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf

Delegations will find attached the Memorandum of Understanding for COST Action TD0902 as approved by the COST Committee of Senior Officials (CSO) at its 174th meeting on 26-27 May 2009.

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST Action TD0902

SUBMERGED PREHISTORIC ARCHAEOLOGY AND LANDSCAPES OF THE CONTINENTAL SHELF

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 270/07 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to im promote research on the archaeology, climate and environment of the drowned landscapes of the continental shelf, created during periods of lower sea level, which form a major part of the European cultural heritage.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 100 million in 2009 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter V of the document referred to in Point 1 above.

A. ABSTRACT AND KEYWORDS

Throughout the Ice Ages that dominated the human history of Europe over the past one million years, sea levels were mostly lower than present by as much as 150m, creating extensive coastal landscapes attractive to human settlement. Between 16,000 and 6000 years ago, most of this territory was drowned by sea level rise following the last Ice Age, transforming the geographical and environmental context of human development. This drowned landscape preserves valuable sedimentary archives of long-term environmental and climatic changes, and an increasing number of submerged archaeological remains that document human response to this rapidly changing environment. With intensification of commercial activity on the seabed and improved research technology, the evidence is increasing rapidly. So too are the threats of destruction. This Action will improve methods of investigating, interpreting and managing underwater evidence relating to human settlement on the continental shelf when it was exposed as dry land during periods of lower sea level. It will create a structure for the development of new interdisciplinary and international research collaboration, and provide guidance to archaeologists, environmental and marine scientists, heritage professionals, government agencies, commercial organisations, policy makers and a wider public.

Keywords: Climate Change, Sea-level Change, Underwater Cultural Heritage, Heritage Management, Prehistoric Societies

B. BACKGROUND

B.1 General background

Europe is a strongly maritime continent, dominated by peninsulas, coastal regions, and archipelagos that have powerfully shaped its history and changing identity. These maritime regions have often been centres of human settlement, high population density and cultural innovation in recent millennia, regions with concentrations of fertile resources and good water supplies on land, access to intertidal molluscs, rich fisheries and other marine and aquatic resources at the shore edge, and opportunities for waterborne movement, cultural contact, trade and migration. These advantages are likely to have applied throughout the whole time depth of human occupation in Europe. However, before about 6000 years ago, when modern sea level was established, relatively little is known about the role of these now-submerged coastlines and landscapes, because they were mostly drowned by sea level rise at the end of the Last Ice Age.

The expansion of the continental ice sheets during the Ice Ages caused sea level to oscillate around a depth of about 50m below present, reaching a maximum lowering of 150m, exposing up to 3.2 million square kilometres of the European continental shelf as potentially attractive cultural landscapes - adding 40% to the present landmass. These regions were probably even more important for human settlement during the Ice Ages because the European hinterlands would have been colder, more arid and less attractive to human settlement than is the case under modern climatic conditions. These now submerged regions provided a crucial arena for the survival and dispersal of Europe's earliest inhabitants during the Stone Age, the extinction of the last Neanderthals and their replacement by modern humans originating from Africa, the early development of prehistoric societies, the earliest experiments in fishing and seafaring, the initial spread of agriculture from the Near East, and the foundations for the earliest civilizations. All of these developments took root during the many thousands of years of the last Ice Age (some perhaps much earlier) or during the first few millennia of the Postglacial period (the Mesolithic and early Neolithic period of the Stone Age between about 10,000 and 6000 years ago). The key evidence relating to these early developments now lies buried on the sea floor.

Most archaeologists have ignored this huge gap in our knowledge in the belief that it is too difficult to deal with and that any surviving evidence would make little difference to the conventional narrative of European and World prehistory. However, sufficient discoveries have now been made to demonstrate that prehistoric archaeological sites many thousands of years old can survive inundation. Artefacts, structures, human burials and whole cultural landscapes can be preserved underwater. Preservation of cultural materials can be exceptional because of waterlogged conditions and constant burial temperatures, including bone and wooden artefacts, nets, boats, fibres, plant materials and biomolecular information such as ancient DNA and carbon and nitrogen isotopes capable of providing rich sources of data on ancient genetics, population migrations and palaoediet.

Nevertheless, there remains a considerable reluctance to pursue this underwater theme in a systematic way. Underwater work is slow, expensive, technically and technologically demanding, often dangerous, and intellectually high-risk because of the uncertainty that anything new will be discovered. Most work has been conducted in a depth range of 0-20m, well within range of efficient

SCUBA diving, but deep-diving techniques and other technologies for exploration at greater depth are beginning to be used down to maximum depths of 150m. However, archaeologists usually lack access to equipment such as ships, ROVs (Remotely Operated Vehicles), submersibles, and acoustic survey devices, or the technical skills or interdisciplinary partners to apply them. The underwater research that has been carried out in pursuit of archaeological goals has often been fragmented, conducted outside the academic and scientific mainstream, or by employees of museums, national parks and heritage organisations. Despite increasing recognition of the social and cultural impact of sea level change and prehistoric occupation of now-submerged landscapes, relatively few are doing the underwater archaeological exploration necessary to advance the field, although that number is beginning to grow. Conversely, palaeoenvironmental specialists and marine geologists and geophysicists have produced many detailed studies of underwater features relating to sea-level change, coastal sediment dynamics and palaeoclimate across the full depth range of potentially habitable landscapes on the continental shelf, but rarely with archaeological goals and issues of prehistoric social change in view, though there is now increasing interest in collaboration with archaeologists.

The focus of this Action will therefore be on coordinating research activities and interests across the full depth-range of land exposed as terrestrial territory by sea level change, primarily in the time range from about 120,000 to 6000 years ago, the period of lowered sea levels of the last Ice Age.

This Action provides the ideal framework to address this issue. It will:

- Bring together specialists from different archaeological and scientific disciplines and the commercial, industrial and heritage sectors - who can bring different sorts of expertise to bear on the identification of optimum conditions and methods for discovery, retrieval and protection of archaeological information
- Bring together specialists from different countries and over the widest possible range of marine sectors from the Baltic to the Aegean, and the Black Sea to the Northeast Atlantic
- Create a critical mass of specialists that will help to develop this field of research as a new and coherent field of inquiry
- Create a forum for the development of common understandings, skills, and technical resources that can lay the intellectual and scientific groundwork for future projects and foster the interdisciplinary and international partnerships necessary for their implementation
- Help to consolidate Europe's leading role in this new and globally developing research field

B.2 Current state of knowledge

Danish and German teams have led the way in developing expertise in the shallow waters of the western Baltic over the past 25 years. This has demonstrated the large numbers of surviving underwater Mesolithic and early Neolithic sites (date range 10,000-6000 years ago), the extraordinary quality and detail of evidence preserved in anaerobic underwater sediments, and high resolution data on human response to palaeoclimate and sea level changes of interest to policy makers concerned with present and future sea-level trends. Large quantities of Ice Age terrestrial fauna and some Palaeolithic artefacts (date range older than 10,000 years ago) dredged up by fishing trawlers from the bed of the southern North Sea are beginning to attract systematic investigation by the Dutch, while a British project, funded by the UK Government through a tax on companies extracting gravels and other minerals (The Aggregates Levy Sustainability Fund) has applied powerful computing techniques to geophysical survey records from the North Sea hydrocarbon industry to reconstruct different stages in the evolution of the terrestrial landscape in the Late Glacial and Early Postglacial period (date range 16,000- 6000 years) before final inundation at the end of the last Ice Age.

Underwater excavations and discoveries of prehistoric sites have also been carried out elsewhere in European inshore waters, often resulting from chance exposures of archaeological material or accidental finds, including Middle Palaeolithic sites in the French sector of the English Channel (60-40,000 years), the Upper Palaeolithic cave paintings of Grotte Cosquer (30-20,000 years) whose only entrance is now deeply submerged at 40m depth, the Mesolithic site of Bouldnor Cliff in the Solent (southern England) and the early Neolithic village of Atlit Yam on the coast of Israel (10-8000 years). More isolated or scattered work has been carried out elsewhere, the most notable being the work of a Canadian team who have created landscape reconstructions and discovered artefacts working on the deeply submerged shelf off the coast of British Columbia to investigate the hypothesis that the earliest human entry into North America from Siberia followed a coastal route when sea levels were far below the present level. Substantial palaeoenvironmental information has also been generated by natural scientists from underwater sediments in many regions, while new archaeological material is being produced incidentally as a by-product of underwater commercial activity, and is often not recognised as such, ignored, thrown away or buried in local and regional museum archives. In short, there is an increasing volume of underwater work but it needs to be organised more systematically and focussed more effectively on archaeological issues and the discovery and interpretation of underwater archaeological material on the seabed.

What is novel and timely about this Action is that it will:

- Coordinate and integrate skills and expertise from across a wide range of disciplines and focus them on the technical and intellectual challenges of exploring and recovering underwater Stone Age archaeology
- Put the currently known and somewhat disparate mix of systematically recorded and randomly discovered archaeological sites and finds into proper spatial and temporal context, identify gaps in knowledge and develop effective strategies for future investigation over a wider range of geographical regions and in deeper areas of the shelf
- Provide transnational coordination of research efforts that have been largely conducted until now in disparate areas and at regional or national level, enabling the articulation of a comparative and strategic overview of the European shelf as a whole
- Bring concerted research activity to bear on issues of current concern, notably the ever expanding threat of destruction of data by commercial and industrial activity on the seabed, a matter of increasing urgency, and the impact of sea level and climate change on the present and future prosperity of European society

B.3 Reasons for the Action

The stimulus to the development of this Action comes from:

- Recent expansion of archaeological interest and exploratory research that is seeking to exploit new avenues of investigation opened up by new technologies of remote sensing, deep diving, geophysical survey, and digital analysis
- New responsibilities on legislative authorities to include the prehistoric underwater heritage within their remit following the ratification by a growing number of European States in recent years of the Valetta Convention (the European Convention for the Protection of the Archaeological Heritage), which includes an explicit reference to underwater heritage
- Heightened current awareness of the potential impact of modern and projected sea level change on human societies, and corresponding interest in the potential of combined archaeological, geological and palaeoenvironmental studies to provide a longer-term perspective on present and future climate change and its social impact

- Growing worldwide awareness of the value of such data archives on the continental shelf, and the increasing threat of destruction from human activity, pollution and erosion
- Growing interest in the coastal theme in human prehistory, and a growing realisation that the absence of systematic investigation of submerged underwater landscapes is perpetuating a seriously distorted view of European and World prehistory.
- A large public appetite for the exploration of this hidden underwater realm of human prehistory

The benefits of the Action will therefore be advances in scientific understanding, and new knowledge of relevance to European economic and societal needs, including:

- An improved basis for understanding and researching the varied ways in which the coastal regions of Europe have changed in response to long-term environmental and sociocultural changes, and the wider implications for anticipating future adaptation and sustainability
- Improved management and monitoring of the underwater cultural heritage in the face of expanding commercial and industrial exploitation of the seabed
- Advancement of an integrated science-humanities discipline that focuses on the human-environment interface in the context of the submerged landscape
- An improved basis for addressing the big questions of European prehistory

B.4 Complementarity with other research programmes

SINCOS (Sinking Coasts) is a national-scale project, funded by the German Research Council, on archaeology and environmental change in the western Baltic in the past 10,000 years. SLAN (Submerged Landscape Archaeology Network) working with the Joint Irish Bathymetric Survey with funding from INTERREG IIIA is producing comprehensive bathymetric maps and landscape reconstructions around the Irish coastline, and IGCP (International Geological Correlation Programme) 521 on the 'Black Sea-Mediterranean Corridor over the Past 30 ky: Sea Level Change and Human Adaptation' is a transnational network bringing together landscape and palaeoenvironmental reconstructions on the Black Sea shelf. NSPRMF 'North Sea Prehistory and Management Framework' is a research network of about 20 specialists from the UK and the Netherlands, who are addressing similar issues. These regional-scale programmes are addressing to

some degree the human implications of changes in the character and extent of the submerged shelf, and SINCOS is combining this with actual survey and excavation of underwater archaeological sites. Also, Strategic Environmental Assessment reports commissioned by the UK Government, and available on their BERR (Department of Business Enterprise and Regulatory Reform) website, exemplify the types of information currently sought after for environmental impact assessments. COST Action ES0701, 'Improved Constraints on Models of Glacial Isostatic Adjustment', is providing some complementary information on sea level and coastal change in the Baltic region. This COST Action will add significant value to the above research activities by facilitating coordination and larger scale comparison and strategic overview across the whole of the European shelf, encouraging development of uniform concepts and methods, and focussing on developing archaeologically informed research strategies applicable over larger areas of the shelf and at all depth ranges.

C. OBJECTIVES AND BENEFITS

C.1 Main/primary objectives

The main objective of this Action is to promote research on the investigation, interpretation and management of the drowned landscapes of the continental shelf, which form a major but hidden part of the European cultural heritage, to create a structure for the development of new interdisciplinary and international research collaboration, and to provide guidance to archaeologists, environmental and marine scientists, heritage professionals, government agencies, commercial organisations, policy makers and a wider public.

C.2 Secondary objectives

Achievements

The Action will aim for the following specific achievements:

1. To audit and categorise the current state of knowledge about the existence, location, and chronological range of prehistoric (Stone Age) archaeological finds on the European continental shelf.
2. To evaluate conditions for the survival and visibility of prehistoric archaeological materials in different types of geological and oceanographic conditions and in different geographical regions of the shelf

3. To create an infrastructure of knowledge about the types of information available or needed from the natural sciences about the environmental and topographic character of the terrestrial landscape when sea level was lower than the present
4. To identify centres of expertise, laboratories, skills, equipment, technical support, and training opportunities, and to facilitate inter-institutional, interdisciplinary and international collaboration in planning the large-scale research programmes necessary to undertake exploration, especially at depths in the 50 -130m range, which are likely to make really significant advances in knowledge.
5. To establish channels of cooperation and collaboration with commercial and industrial organisations in sharing and monitoring of data
6. To evaluate the potential significance of such data in illuminating key developments in the early history of human settlement and society in Europe before the establishment of modern sea level about 6000 years ago, with recommendations for future projects.
7. To bring this longer term perspective to bear on present and future problems of sea-level change and their social impact

These objectives do NOT include information and research activity relating to shipwrecks from more recent periods (broadly speaking from the Bronze Age onwards over the past three millennia), or other underwater cultural data relating to harbour installations or coastal settlements of this period that have been partially or totally submerged because of minor recent changes in relative sea level. This Action recognizes that this is a major part of the underwater cultural heritage, and the preoccupation of many specialists and other interested parties. However, this area of knowledge is already well catered for. This Action will not replicate or expand on this area, but will cooperate where appropriate with specialists in this field, especially where there is an overlap of interests in technologies of underwater exploration and in the geological processes of underwater site preservation or destruction. This point is important to understand because shipwreck archaeology dominates the lay person's conception of what constitutes underwater archaeology, and the conception of many archaeologists and scientists. The emphasis of this Action is on Stone Age archaeological material from much earlier periods that was deposited on the sea floor when it was formerly dry land during periods of low sea level.

Deliverables

Establish the field as a recognised research theme in FP7

Establish a range of fundable research projects with some prioritisation based on intellectual significance, feasibility, urgency, and availability of research partners

Facilitate at least one major FP7 funding application

Facilitate at least two other major funding applications to national or international funding bodies

Produce guidance and a set of recommendations about the potential for occurrence, preservation and discovery of submerged prehistoric archaeology, of use to all relevant parties including specialists, National and State regulatory authorities, and heritage professionals

Produce a directory of skills, expertise, institutes, and equipment that can be used in research planning

Produce a directory of international expertise and academic advice that can be used by regulatory authorities concerned with commissioning, licensing and monitoring the impact of offshore commercial operations.

Produce a guide to contacts with industry and availability of archived data produced by commercial operations

Produce at least four technical reports providing a strategic overview of research potential in different sectors of the European shelf and at least one report synthesising results across the whole of Europe with an assessment of current levels of knowledge and expertise, intellectual problems to be solved, and research strategies to solve them

Produce at least four publications in international refereed journals

Produce at least one major edited book to be published by an academic publishing house

Develop at least two cooperative ventures with industrial and commercial companies

Establish at least one Training School and possibly one Marie Curie Early Stage Training Centre in an appropriate institution, subject to guidance from Early Stage Researchers who are members of the Action about what they believe would be most useful, and subject to positive responses from potential

Change the perceptions of a wider public enshrined in the popular media either that Stone Age sites once existed on the seabed but are impossible to recover, or that they comprise lost civilizations much older than those known about on land. Difficult to measure except by the production of new media aimed at a popular audience.

C.3 How will the objectives be achieved?

The primary means are the ideas, efforts and experience of the members of the Management Committee and the Working Groups, Workshops that will be open to a wider constituency of interested individuals, at least one major Conference open to a wide range of academic, scientific and heritage professionals and students, site visits in the form of STSMs, and at least one Training School. The MC will need to ensure that some members of the Action have specific skills and aptitudes in scouring the literature, accessing data archives and compiling databases of information, with the option of payment at a modest level.

C.4 Benefits of the Action

- Raise the profile of this area of knowledge amongst the archaeological and scientific community and promote the importance to government agencies, commercial organisations and a wider public of the archaeology of the submerged shelf as a key aspect of the European cultural heritage, and the need for international collaboration and coordination in researching, interpreting and managing this resource

- Improve mutual understanding between archaeologists and other scientists about appropriate methods of investigation and a wider recognition of the need for true interdisciplinary integration
- Create an accessible body of knowledge, skills, laboratories and specialists that can inform the archaeological, scientific and wider communities about existing results, opportunities and constraints of research on the archaeology of the continental shelf and the monitoring of archaeological material in the face of every-expanding industrial and commercial activity on the shelf
- Improve channels of communication and collaboration between researchers and commercial organisations engaged in exploitation of the resources on the seabed or the construction of underwater installations, who are capable both of destroying but also of revealing and monitoring the existence of underwater archaeological material.
- Develop well-focussed, well-informed and well-resourced large-scale research proposals that can produce new research findings
- Highlight and inform a range of research questions about the role of ancient coastlines and now- submerged landscapes in the deeper history of European development
- Highlight and inform a range of research questions about the role of large-scale environmental and palaeogeographical change resulting from climatic and sea-level change in the early history of human settlement and socio-economic development in Europe, the nature of the relationship between long-term changes in socio-cultural and natural systems, and the value of a long-term perspective in predicting and adapting to future such changes.
- Develop a resource of knowledge and experience that can help to guide regulatory agencies, licensing authorities, and commercial companies regarding their obligations in pre-disturbance surveys, site protection, and monitoring of the impact of exploitation on the seabed prehistoric heritage.

C.5 Target groups/end users

The results of the Action are expected to reach out to a wide range of end users: in the academic and research communities, archaeologists, historians, geographers, marine geologists, geophysicists, environmental scientists and palaeoclimatologists; commercial and industrial enterprises involved in exploitation of the submerged shelf; government agencies concerned with the management and monitoring of the underwater cultural heritage and the licensing of environmental impact assessments conducted in advance of potentially destructive commercial activity; policy makers interested in the nature and effects of future sea level change; and a wider public interested in the deeper roots of their own history and identity and fascinated by the archaeological enterprise of revealing a hidden underwater world that has been lost beneath the rising waters of major postglacial sea level rise.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The primary research tasks are:

1. To audit and categorise the current state of knowledge on the existence, location, and chronological range of Stone Age archaeological finds on the European continental shelf.

   This information is likely to be of variable quality and quantity in different European regions, and scattered through a variety of sources including scientific and academic publications, minor regional reports and museum leaflets, government reports, 'grey' literature produced by consultants working on environmental impact assessments, and word-of-mouth knowledge. The data may range from isolated artefacts dredged up accidentally by divers, fishing boats or other commercial underwater operations to systematic survey and excavation of underwater settlements by teams of archaeological specialists. The primary goal is the production of a general map and data base with associated commentary indicating the nature and level of coverage in different areas of the European shelf - the broad quality of material and sources of information available, where there is detailed data available, where there are gaps, which areas have sufficient finds to suggest a promising

focus for future investigation, where there are teams of specialists already looking at this type of assessment (for example in the southern basin of the North Sea), and so on. Depending on the volume and quality of data available, this part of the Action may produce more detailed reports or higher resolution databases for wider dissemination, but it is not possible to predict the feasibility of this in advance, and the primary goal is an audit of information that can be a useful foundation for planning future investigations.

2. To evaluate conditions for the survival, visibility and discovery of archaeological materials in different types of geological and oceanographic conditions and in different marine sectors of the European shelf.

One of the paradoxes in the preservation and discovery of drowned archaeological sites is that the best preserved material is likely to be hidden from immediate view by a thick protective covering of marine sediments, while artefacts and palaeo-terrestrial sediments that are easy to find on the seabed are detectable precisely because they are in the process of being disturbed and eroded and are therefore on the way to being degraded with final destruction of all but the most resistant materials such as stone artefacts. Many archaeological sites are likely to have been seriously disturbed but not necessarily completely destroyed by wave action in the surf zone during the course of inundation by sea level rise, especially on exposed coastlines with a large oceanic fetch and tidal range. Other possibilities for survival are in sheltered bays, inlets and river estuaries, in topography with very shallow gradients, where material is protected from the full force of wave action during sea level rise, and in caves and rockshelters. On coastlines adjacent to large rivers that are disgorging huge volumes of sediment into the inshore environment, terrestrial surfaces and archaeological data are likely to be deeply buried under thick layers of overlying marine sediments. The potentials in shallow tideless basins like the Baltic and the Black Sea, for example, are likely to be different from the open shorelines of the Mediterranean or the more exposed and high-energy coastlines of the Atlantic. General conditions on this geographical scale are likely to be further moderated by local variations in coastal topography and sedimentary regimes, and these in their turn may have differed at different

positions of the sea level on a given coastline. Some of these conditions are already known from existing case studies, and there is a great deal of useful knowledge with those specialist institutions studying coastal geodynamics. This research task will work from known case studies to general principles, compare conditions in different types of marine basins, and assess areas of ignorance that can be illuminated by new research.

3. To create an infrastructure of knowledge about the types of information available or needed from the natural sciences about the environmental and topographic character of the terrestrial landscape when sea level was lower than the present.

The primary archaeological requirement here is data on the topographic and palaeogeographical character of the submerged terrestrial landscape at different sea level positions, for example data on the position and character of coastlines, river valleys, lake basins, cliff lines and other topographic features. Such information can help in the prediction of locations where archaeological sites are likely to have occurred and can be searched for. It can also aid in reconstructing the ecological character of the landscape and the types of plant and animal resources available for human exploitation, and help to build up a picture of the of the terrestrial landscape as it would have existed at the time when people were living in it, the ways in which it has changed with changing climate and sea level, and thus the relationship between environmental conditions and human responses to them.

A very large body of data has already been collected on underwater sediments and geology by palaeoclimatologists, sedimentologists, and marine geologists. Many of these data are potentially useful or relevant for discovery of archaeological material and landscape reconstruction purposes, but some are not, especially where they are concerned with solid rocks hundreds of metres below the seabed. The main goal of this research task is, therefore, to take a critical look at what techniques and sources of information are available, their potential usefulness, what new information needs to be collected, and what new strategies of investigation are required to achieve this.

This research task is at the heart of the interdisciplinary aspirations of this Action, and exemplifies the importance of distinguishing between an interdisciplinary approach, where the participating specialists have to adjust their thinking, concepts and methods in the light of a new set of objectives, essentially archaeological ones in this case, ultimately resulting in the birth of a new discipline, as opposed to a multidisciplinary approach where specialists continue to work in their own disciplinary compartments and generate data relevant to their pre-existing intellectual agendas with limited understanding of or communication with specialists in other disciplines.

For example, sediment cores recovered from forcing a core barrel into the sediments of the shelf are usually aimed at producing evidence of palaeoclimatic change in the form of variations in pollen, diatoms, foraminifera and isotope composition. The extent to which such data are useful for archaeological purposes depends on how far they can inform on local palaeoclimatic conditions and palaeovegetation on the now-submerged terrestrial landscapes available or used for human habitation.

There is also a very large body of knowledge about sea-level change with the emphasis on assessing relative sea level variation as a proxy climate indicator. Some of these studies produce theoretical models based on geodynamic and isostatic principles, some are based on dates and depths of submerged peats, some on a mixture of both approaches aimed at calibrating the models with ground-truthed observations and dates. The results of these different approaches are often in conflict. Some of these results can be of general usefulness for archaeological objectives. For example they can be combined with bathymetric data, which may range from very general depths obtained from navigational charts to specially designed and detailed bathymetric surveys, to map the approximate width and topography of the exposed shelf at different time periods. However, such maps have a relatively low chronological or spatial resolution and, while they are suitable for some general archaeological deductions, they fall short of the next level of information that archaeologists want to know about, which is the actual position of the palaeoshoreline on the seabed and its topographic and ecological character at different periods of the sea level cycle, together with

inferences about currents, wind directions and fertility of inshore waters that may have affected the possibilities of fishing and seafaring. It is worth noting that more detailed studies of this sort, when carried out in response to archaeological objectives, can generate high-resolution data capable of refining the calibration of theoretical models of sea level variation, with important implications for the prediction of future climate and sea-level change.

Marine geologists are primarily interested in hydrocarbon reservoirs and the dynamics of crustal movement and deformation in response to plate motions and other earth processes and the evolution of continental and marine basins. Much of these data refer to timescales well outside the range of human prehistory, but some of them can generate archaeologically useful information on changing topography and hydrology at a more local scale and the changing landscapes available for past human activity. Also, the geological research associated with foundation engineering for offshore structures and pipelines is focused on the top ten or so metres of the sediments, and this can be exactly the stratigraphic level that interests archaeologists

As with the first research task the results of this evaluation can take several different forms, beginning with a simple audit of what is available and moving to a more detailed compilation and evaluation of data sources within the constraints of the Action and according to the level of information currently available.

4. To identify centres of expertise, laboratories, skills, equipment, technical support, and training opportunities, and to facilitate inter-institutional, interdisciplinary and international collaboration.

Many established and new technologies are available to assist in underwater exploration, many of them developed by the hydrocarbon industry. These include drilling and coring, acoustic survey, mixed-gas diving for work at depths greater than 30m, the use of ROVs (Remotely Operated Vehicles) with cameras and robotic equipment for collecting samples), AUVs (Autonomous Underwater Vehicles), and manned submersibles. Acoustic survey

includes the use of multi-beam recording for 3D bathymetric reconstruction, sub-bottom profiling (used for looking at the depth and character of sediments and rock formations beneath the surface of the seabed), and side-scan sonar (for highlighting surface features and irregularities). Many of the techniques and technologies are already well known to the underwater archaeological community. However, much of the equipment is either very expensive or dedicated to other purposes. The main goal here is to establish where the centres of expertise are, which institutions and organisations have ships and other sorts of equipment suitable and available for archaeological purposes, which ones are willing to engage in collaborative research, where the divers and dive-training facilities are, the existence of divers trained in the requirements of archaeological underwater survey, what the costs of mounting research collaborations might involve, what new equipment is coming on line from the manufacturers that might be especially appropriate for archaeological survey, and which institutions might provide appropriate provision for training

5. To encourage and develop cooperation and collaboration with commercial and industrial organisations in sharing and monitoring of data and to explore wider outreach activities

Much of the data that might be useful for archaeological purposes is routinely collected by commercial organisations during or in advance of underwater construction or other activities, including acoustic survey data, sediment cores, and sometimes actual finds of artefacts such as those brought up in fishing nets. A great deal of this activity is taking place or has recently taken place in many areas of the shelf, including gas and oil exploration, laying of pipelines, tunnels and bridge foundations, construction of offshore windfarms or other offshore facilities, and dredging and trawling of the seabed. Sediments from marine cores are often kept in cold-store for a period of decades, and acoustic survey data are archived. Some of this information may be commercially sensitive, but much is not. The hydrocarbon industry, for example, is primarily interested in the deep rock formations under the seabed and while their explorations have often produced material and acoustic data from the soft-sediment overburden, they have little interest in these records. Yet these are precisely the records of archaeological interest. Other forms of monitoring activity can be

carried out relatively cheaply or with little or no additional cost to the commercial companies themselves, for example through attaching video cameras to beam trawls, or filtering dredge spoil for Stone Age artefacts and fauna. Moreover, large companies are sometimes willing to fund research activities as part of their public relations and public outreach activities.

The goal of this research task is to identify the existence and availability of all these possibilities through contacts with relevant industries and their representatives and to explore the potential for enlisting their cooperation both in making available existing data and in collecting or monitoring the existence of new data.

6. To develop a communication strategy for outreach to the public sector including heritage agencies, the governmental sector and a wider public

Because of the wide range of organisations beyond the immediate academic and scientific communities that can benefit from the results of the Action and in many cases contribute to it, an active communication strategy needs to be developed that will ensure targeting of a wide range of audiences and methods of communication and dissemination that will expand those envisaged at the outset of the Action.

7. To evaluate the potential significance of such data in illuminating key stages in the early history and development of human settlement and society in Europe before the establishment of modern sea level about 6000 years ago.

The goal of this research task is to evaluate the significance of the developing underwater record on the hidden 40% of the European landmass, to refine the problems that can be illuminated by improved knowledge and understanding, to establish what sorts of new knowledge can or have been obtained, and how that will change our understanding of the big problems in European prehistory in relation to such issues as the dispersal and migration of human populations, the development of skills and interests in the exploitation of marine resources and coastal adaptations more broadly, the early development of seafaring, the roles of coastlines and marine resources in the re-population of Northwest Europe after the maximum of the last Ice Age, and in the early development and dispersal of agriculture, and the impact of sea level change.

D.2 Scientific work plan – methods and means

Research tasks will be distributed amongst 4 Working Groups

WG 1. Archaeological Data and Interpretations
Research tasks 1, 2 and 7

WG2. Environmental Data and Reconstructions
Research task 3

WG3. Technology, Technical Resources and Training
Research task 4

WG4. Commercial Collaboration and Outreach
Research tasks 5 and 6

Each Working Group will consist of an appropriate number of individuals with relevant skills and interests, with the option of co-opting additional members as appropriate. The composition of the work groups will aim for representation from a varied range of marine geographical areas to ensure that the results encompass a wide range of environmental conditions, field experience and intellectual traditions of study, in order to realise the benefits of a comparative approach and ensure the wide dissemination of ideas and scientific working practices. Each WG will have the task of collating and compiling information according to the objectives defined in their research tasks, refining the research tasks as appropriate, and feeding the resulting information into the wider network to ensure cross-fertilisation between Working Groups and between different geographical areas. Working Groups will need to spend time gathering and discussing information and results amongst themselves both in formal meetings and through remote communication. WG3 and WG4 will play a key role in forging links with organisations in the wider public sector and in helping to shape the programme of STSMs and Training Schools as the Action develops.

E. ORGANISATION

E.1 Coordination and organisation

The Management Committee (MC) will be the main body responsible for overall management and organisation. The MC may be large. If all currently interested Parties participate, it may be as large as 50 individuals, more if additional Parties wish to participate. The Action will therefore establish a smaller number of individuals to constitute a Steering Group. The role of the Steering Group will be to review membership of the WGs, to receive or make suggestions for new members, to review progress with respect to milestones and future plans, to prepare a report on each year's activities, and to make recommendations to the MC.

Annual milestones will be identified at the MC meeting at the beginning of each year and will be specified in accordance with the provisional timetable and list of deliverables, subject to any modification as the Action progresses. Key milestones are the production of reports and publications, initially in preliminary or draft form and subsequently towards the end of the Action in final form according to the overall dissemination plan, the establishment of inter-institutional links for information exchange and/or research collaboration, the communication of results to organisations in the wider non-scientific and public sector, and the achievement of targets for recruitment of ESRs and improvement of gender balance.

The coordination of national and regional research will be organised by careful attention to the size and composition of WGs, by a programme of STSMs, and by workshops at appropriate intervals involving the full membership of the MC and WGs, to ensure cross-fertilisation of ideas, methods and research strategies between WGs, between disciplinary specialisms and between different geographical areas of the continental shelf.

A website will be established which will provide a vehicle for the posting of information, documents and reports, including a secure area for material that the Action may wish to keep within a restricted membership. The content and operation of the website will be reviewed on an annual basis by the Steering Group and the MC.

E.2 Working Groups

There will be four WGs as the main foci for carrying out specific research tasks. There are two keys to the successful operation and organisation of these WGs.

The first is that the WGs should be sufficiently large and have a sufficiently diverse membership that each WG is able to cover the main geographical regions of interest across Europe, especially for WGs 1 and 2, which are dealing with the key research tasks relating to underwater data of different kinds. The principal areas are the Black Sea, the Mediterranean (probably divisible into at least 3 further areas, the Aegean, the Adriatic, and the western Mediterranean), the Baltic, the North Sea, and the Atlantic coasts of Britain and Norway. That suggests a target size of each group of at least 7-8, with a maximum size that may be larger according to the work and expertise required and the available participants.

The second key is that the organisation of the Action should facilitate interaction and cross-fertilisation between the WGs. There is an obvious relationship between WG1 and WG2, and again a close relationship between WG3 and WG4, although four-way interaction is also important. Much of this interaction will occur naturally because of the range of interests of particular individuals, but the Action will facilitate this process in the following ways:

1. By organising joint meetings of WGs, provisionally WG1 and WG2 in Year 1, and WG3 and WG4 in Year 2, each WG meeting separately in back-to-back meetings and then jointly within the framework of a larger workshop on the same occasion, with wider meetings in Years 3 and 4

2. By providing a common area for exchange of ideas and information on a secure website

3. By ensuring that each WG has on its agenda a standing item to consider inter-relations with the other WGs, with positive reinforcement from the WG leader

E.3 Liaison and interaction with other research programmes

This Action will establish links in two ways, first and primarily through cross-membership - IGCP, NSPRMF, SINCOS and SLAN all have members who are on the list of individuals who have expressed interest in this COST Action and are likely to be involved as members either of the MC or of one or other of the WGs. COST will also explore the possibilities of joint workshops in discussion with these individuals. Links will also be explored with potentially relevant research being conducted by the oceanographical sections of FP7.

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its agendas. The Action will also be committed to considerable involvement of early-stage researchers. This item will also be placed as a standard item on all MC agendas.

In addition this item will go on the agendas of Working Groups with a view to positive action in recruitment. ESRs are crucial to the development of this research field, not only for social and intellectual reasons but because they are often the key group who combine intellectual aspiration with training, skills and expertise as active divers. WGs, STSMs and Training Schools offer important opportunities to engage and expand this community.

F. TIMETABLE

The Action will extend over a period of 4 years

Year 1

Meeting 1
First meeting of MC
Review overall plan of Action
Decisions taken on provisional membership of Steering Group, WG leaders, membership of WGs and plan for first year's STSMs
STSMs. At least two to be organised between Meetings 1 and 2, with two more during the year

Meeting 2

Meetings of WGs 1 and 2

Combine with workshop emphasising recruitment and participation of ESRs

Possibly combine this with 1 STSM and field excursion, ideally one involving ship time on an existing offshore project, if feasible

Combine with meeting of Steering Group to evaluate progress

End of Year 1

Steering Group meeting to evaluate membership, progress, budget, recruitment, plans for dissemination, and plans for activities for Year 2, to prepare a report on the Year 1 activities, and formulate recommendations for the MC at the first meeting of Year 2

Year 2

Meeting 1

Meeting of MC

Review progress, membership, dissemination and plans for activities for Year 2, including most appropriate means of communication with complementary research programmes

Consider plans for STSMs during course of Year 2 and feasibility and timing of possible Training School

At least 4 STSMs to take place during course of year

Possible Training School during course of year

Meeting 2

Meetings of Working Groups 3 and 4 to review progress

Combine with Workshop involving wider Membership to review and compare progress between all four Working Groups and between geographical regions

Possibly combine with STSM as in Year 1 depending on feasibility and budget

Review progress on formulation of plans and proposals for future research collaborations and research projects

End of Year 2

Steering Group meting to evaluate membership, progress, budget, recruitment, plans for dissemination, and plans for activities for Year 3, to prepare a report on Year 2 activities, and formulate recommendations for the MC at the first meeting of Year 3

Year 3

Meeting 1

Meeting of Management Committee to review plans and progress

At least 4 STSMs to take place during course of year

At least 1 Training School to be organised

Meeting 2

Major conference to be organised in an appropriate location, open to all comers

Combine with meetings of WGs as appropriate

End of Year 3

Steering Group meeting to evaluate progress, budget, recruitment, plans for dissemination, and plans for activities for Year 3, to prepare a report on Year 3 activities, and formulate recommendations for the MC at the first meeting of Year 4

Year 4

Meeting 1

Meeting of MC to review plans and progress, with particular attention to dissemination achievements and plans and proposals for future research

At least 4 STSMs to be organised during the course of the year

At least 1 Training School to be organised if feasible and appropriate

Meeting 2

A full meeting of the MC and all 4 WGs to review progress and results of the Action, plans for dissemination and proposals for future research.

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: BG, HR, CY, DK, EE, FI, FR, DE, GR, IE, IL, IT, LV, LT, LU, NL, NO, PL, PT, RO, SI, ES, SE, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 100 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

Target audiences include:

1. A world audience of specialists interested in researching the prehistoric archaeology of the underwater landscape

2. The archaeological community at large at regional, national and international level, including those concerned with heritage management and education

3. Heritage managers and organisations involved in conducting impact assessments, investigation of underwater archaeology and mitigation work in advance of commercial or industrial work

4. A large swathe of the scientific community, particularly those concerned with various aspects of the environmental and earth sciences and long-term processes of environmental and climate change

5. Commercial and industrial organisations operating on the continental shelf

6. Government agencies at national and sub-national level concerned with management and protection of the underwater cultural heritage and licensing and monitoring of environmental impact assessments

7. Policy makers at national and European level

8. The wider public

H.2 What?

Papers and reports in international refereed journals (Audiences 1, 2, 3 and 4)
Papers and reports in national and local journals (Audiences 2 and 3 and some of 4 interested in particular areas or regions)
At least one book with an academic publisher (Audiences 1, 2, 3 and 4, and some of 5-8)
Progress reports (Primarily audience 1)
Technical reports (Primarily audiences 1 and 3)
Databases of information (Primarily audience 1)
More general reports (Audiences 1-7)
Directories of information and expertise (audiences 3, 5, 6 and 7)
Short and well illustrated pamphlets and websites (primarily audience 8, but also audiences 3, 5, 6 and 7)

H.3 How?

For international journals this Action will take advantage of the knowledge and contacts of members of the Action, aiming in particular at journals such as:

Antiquity (primary journal of World Archaeology, edited in York, which has a widely disseminated web gallery as well as text

Internet Archaeology. This is also hosted by ADS in York and is a peer-reviewed journal that specialises in publication of papers and reports that require and benefit from integration of text and complex arrays of digital supporting material in the form of data tables, databases, colour illustrations, etc.

Journal of Island and Coastal Archaeology (which publishes short notes and reports of research activities as well as articles) (Bailey is on the editorial board)

Journal of Maritime Archaeology (Dix is on the editorial board)

Journal of Nautical Archaeology

Marine Geology

Proceedings of the Geological Association (Bailey is on the editorial board)

Quaternary Science Reviews

Quaternary International

Major book or books will use high quality academic publishers with a global distribution and high visibility (such as Elsevier or one of the major University Presses)

Web dissemination of information and reports will take advantage of the web expertise available through the official Action website to reach the archaeological and scientific community and a wider constituency beyond that, using all forms of media including 3D visual reconstructions of landscapes

Development of interactive databases will be explored as a means of coordinating and disseminating information

This Action will also explore how best to take advantage of existing web networks, for example Machu <http://www.machuproject.eu/> 'Managing Cultural Heritage Underwater' and Herein <http://www.european-heritage.net/sdx/herein/>

Journals of professional associations will also be used for dissemination, such as the UK Institute of Field Archaeologists and comparable journals in other European States

For wider public outreach and publicity the Action will take advantage of the expertise of those of its members who work in public organisations such as Museums, for whom public outreach is a major priority and who have well developed publicity Departments and expertise in production of attractive material suitable for a wide audience, including distribution of educational material suitable for use in schools.